

BIOLOGICAL ASSESSMENT and EVALUATION FEDERALLY LISTED SPECIES

Mark Twain National Forest
Salem Ranger District
Crawford and Dent Counties, Missouri

Crooked Creek Project

INTRODUCTION

The purpose of this Biological Assessment/Evaluation (BAE) is to document the potential effects that planned management activities associated with this project may have upon federally proposed, endangered, or threatened species and their habitats within the Mark Twain National Forest. The objectives of this BAE are:

- a) to ensure that Forest Service actions do not contribute to a loss of viability or cause a trend toward federal listing of any species;
- b) to comply with the requirements of the Endangered Species Act and ensure that actions of Federal agencies do not jeopardize or adversely modify critical habitat of federally listed or proposed species;
- c) to provide a process and standard by which to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision making process;
- d) and to ensure compliance with Reasonable and Prudent Measures and associated Terms and Conditions outline in the June 23, 1999 Biological Opinion on the Impacts of Forest Management and Other Activities to the Gray Bat, Bald Eagle, Indiana Bat, and Mead's Milkweed on the Mark Twain National Forest, Missouri.

The analysis presented in the Mark Twain National Forest Programmatic Biological Assessment (September 1998) is not repeated in this BAE, however it is incorporated by reference along with the Biological Opinion on the Impacts of Forest Management and Other Activities to the Gray Bat, Bald Eagle, Indiana Bat, and Mead's Milkweed on the Mark Twain National Forest, Missouri prepared by the U.S. Fish and Wildlife (June 1999).

Effects determinations for each species are summarized at the end of this document.

PROPOSED MANAGEMENT ACTION

Summary of Proposed Action: The Salem Ranger District is proposing to improve forest health, enhance wildlife habitat, and provide additional recreational opportunities in the Crooked Creek Analysis Area. The proposed action is needed due to declining

habitat diversity, declining forest health and vigor, and to meet desired future conditions as identified in the Mark Twain National Forest Land and Resource Management plan (LRMP), also known as the Forest Plan.

Project Location: The Crooked Creek Project is located in Crawford and Dent counties Missouri on USGS Quadrangles Short Bend, Howes Mill Spring, Viburnum West and Greeley within the Meramec River drainage (Hutchins Creek, Huzzah Creek, and Crooked Creek). The center of the project is approximately 37°42'00" by 91°15'00" (See attached maps).

Project Management Prescription Area: 3.4-1, 2, 3

Project Area Size: approximately 23,217 acres of Forest Service managed lands

Land Type Associations in Project Area: Oak Hickory Hills (HM), Oak Pine Hills (HL)

The alternatives that are being considered for implementation within the Crooked Creek Analysis Area are as follows:

Alternative 1 (No Action)

This alternative would initiate no new active management within the analysis area. This alternative provides a baseline (reference point) against which to describe the environmental effects of the two action alternatives being considered. This is a viable alternative and responds to concerns of those who want no active management to occur in the analysis area beyond what is currently ongoing as the result of natural processes, routine maintenance or current management direction. Existing term grazing permits would be allowed to expire.

Alternative 2 (Proposed Action)

This alternative would utilize commercial timber harvesting as a means for achieving forest health and vigor. This alternative would allow forest stands to be treated commercially by using the final harvests, seedtree, shelterwood, sanitation/salvage cut, overstory removal, selection with groups, and thinning methods. Some temporary openings created by proposed final harvest would be greater than 40 acres where proposed final harvest occurs next to existing final harvest temporary openings that are from 0 to 20 years old. Some firewood removal would also be allowed. Natural regeneration and pine planting would occur. These methods would achieve stand conditions that would favor regeneration of desirable tree species such as shortleaf pine, white oak, post oak, and hickory.

Several forest stands, including many timber harvest units, would be burned with prescribed fire to improve wildlife habitat and reduce hazardous fuels that may increase as a result of silvicultural treatments and may occur due to the level of tree mortality, wind and ice damage, understory growth, and past fire exclusion and to encourage pine and oak regeneration. Prescribed burning would most likely occur during the spring and fall seasons. In some cases, stands may be prescribed burned more than once in order to achieve open woodland conditions and a more herbaceous understory and improve the grass, forb, and shrub components of the ground cover.

Wildlife habitat would also be improved by hand cutting and/or mowing of existing open and semi-open habitat in order to remove competing vegetation, including several small dolomite glades, and the maintenance of existing waterholes. Some of the open and semi-open habitat areas will be burned on a 3 to 4 year rotation to encourage the proliferation of native grasses and forbs. In addition, term grazing permits will be re-issued with allotment management plans (that comply with the Forest Plan) for three existing grazing allotments.

The Forest Service in partnership with Missouri Department of Conservation would continue to maintain five lakes and ponds for fisheries: Howes Mill Lake, Howes Mill Pond, Howes Mill South, Huzzah cutoff pond number 3, and Gnuse pond. The Forest Service proposes fish stocking, fish habitat improvements (including fish structures, fertilization, liming), and dam maintenance and reconstruction (including draining and deepening Howe's Mill Lake), for the five lakes and ponds managed for flat water fishing opportunities. This action will maintain existing flat water fishing opportunities for public fishing.

Some actions require other actions in order to be accomplished. These actions will be considered in the environmental analysis of this project.

Fire Lines: Existing roads and natural fire-breaks would be used whenever possible. New fire line construction would be necessary in some areas.

Proposed Road Work: There are 40 Forest Service system roads within the management areas, with a combined length of 52.5 miles. The analysis area contains approximately 36.3 square miles of National Forest System land. National Forest system roads within the analysis area vary from 0.1 miles to over 6 miles in length. The Crooked Creek project has 8.4 miles of system roads that need reconstruction before they can be used to access project activities. The other 44.1 miles of system road need routine maintenance, such as replacing surface material, surface blading, improving drainage features, removing brush from right-of-ways, and cleaning culverts. In addition to system roads, there are non-system roads on National Forest System land in the analysis area. The condition of these roads is usually fair to poor because no road improvement or maintenance work has ever been done. Approximately 55 miles of these non-system roads would be closed.

Alternative 3 (Reduced Final Harvest with Natural Regeneration Only)

This alternative would be the same as Alternative 2 except there would be 295 acres less of final harvest (reduced final harvest) and there would be no pine planting (natural regeneration only). Proposed final harvest next to existing temporary openings that would result in final harvest temporary openings greater than 40 acres are dropped in this alternative.

Table 1. Alternative Activity Comparison Table

	Alt.1	Alt.2	Alt. 3
<u>Silvicultural Methods</u>	Acres	Acres	Acres
Final Harvest	0	932	637
Seed Tree	0	26	26
Shelterwood	0	1332	1332
Uneven Aged	0	1706	1706
Over-story Removal	0	122	122
Sanitation	0	580	580
Thin	0	1206	1206
<u>Reforestation</u>	Acres	Acres	Acres
Natural Regeneration	0	2462	2167
Pine Planting	0	667	0
<u>Timber Stand Improvement</u>	Acres	Acres	Acres
Crop Tree Release	0	0	0
<u>Prescribed Fire</u>		Acres	Acres
Open woodland development	0	2445	2445
Hazardous fuel reduction	0	5956	5956
<u>Transportation</u>	Miles	Miles	Miles
Temporary	0	25	23
Reconstruction	0	8.4	8.4
<u>Soil and Water</u>	Each	Each	Each
Dump Clean-up	0	5	5
Non-system closure	0	55	55
<u>Range/Wildlife</u>	Acres	Acres	Acres
Grazing	0	345	345
Fertilize	0	345	345
Mechanical-Hand Cut, Mow, and Waterhole Maintenance	0	1375	1375
<u>Fisheries *</u>	Acres	Acres	Acres
Pond Rehab	0	16	16
Stock Fish	0	16	16

* Includes Howe's Mill Lake Deepening, Fish Structures, and Howe's Mill South Spillway

CONSULTATION HISTORY

In 1984, the Forest Service requested formal consultation with the US Fish and Wildlife Service (FWS) on the Mark Twain National Forest Land and Resource Management Plan (Forest Plan). On August 8, 1985 FWS issued a non-jeopardy biological opinion for seven federal species. In 1998, the Forest Service reinitiated programmatic consultation for continued implementation of the Forest Plan. Further consultation was needed to incorporate information gathered about federal threatened and endangered species over the past decade. A programmatic Biological Assessment (BA) that included ten federal species was submitted to FWS in September 1998. Determinations of no effect or not likely to adversely affect were made for six of the ten species. These determinations were concurred with by FWS during informal consultation. On June 23, 1999 FWS issued a non-jeopardy Biological Opinion that included the other four federal species.

SPECIES CONSIDERED AND EVALUATED

The threatened, endangered, proposed and candidate species addressed in this BE were identified in cooperation with the US Fish and Wildlife Service. Using information from field surveys and other knowledge of species distribution, species habitat requirements, reasons for species decline, limiting factors, and analysis area habitat conditions, the Mark Twain National Forest list of federally listed animals and plants in Missouri (updated 12/29/03), Forest GIS records and MO Dept. of Conservation records were reviewed for species that could potentially be affected under the action considered, including taking no action (see attached listing of MTNF Proposed, Endangered, Threatened and Candidate Species animal and plant species (PETC), (Table 2). Federally listed threatened and endangered species, species proposed for federal listing, and species proposed for federal candidate listing that may potentially be affected by this project were examined using the following existing available information:

1. Reviewing the list of PETC animal and plant species known or likely to occur on the Mark Twain National Forest, and their habitat preferences. This review included the U.S. Fish and Wildlife Service current list of endangered, threatened, proposed and proposed candidate species for the Forest.
2. Consulting element occurrence records (EOR's) for TES species as maintained by the Missouri Department of Conservation (MDC), and the Forest.
3. Consulting with individuals in the private and public sector who are knowledgeable about the area and its flora and/or fauna.
4. Reviewing Forest BE Program data for PETC species with known or potential habitat within Landtype Associations (LTAs) within analysis area.
5. Reviewing sources listed in the reference portion of this report.
6. Reviewing the results of past field surveys that may have been conducted in the area.

A “step down” process was followed to eliminate species from further analysis and focus on those species that may be affected by proposed project activities. Species not eliminated are then analyzed in greater detail. Results of this “step down” analysis process are displayed in the Occurrence Analysis Results (OAR) column of Table 2. First, the range of a species was considered. Species’ ranges on the Forest are based on county records, but are refined further when additional information is available, such as

more recent occurrences documented in scientific literature or in Natural Heritage databases. Many times range information clearly indicates a species will not occur in the analysis area due to the restricted geographic distribution of most PETC species. When the analysis area is outside a known species range, that species is eliminated from further consideration by being coded as OAR code “1”. For this project, 4 species were eliminated from further consideration because the analysis area is not within the species known range.

From existing site surveys in the analysis area, species were eliminated from further consideration because of: 1) lack of suitable habitat in the analysis area, (OAR code “2”); and 2) for aquatic species, the species or habitat is known downstream, but outside identified geographic bound of cumulative effects analysis area (OAR code “7”). For this project, 2 additional MTNF species were eliminated from further consideration because of one of the above reasons (see Table 2).

TABLE 2. MARK TWAIN NATIONAL FOREST Proposed, Endangered, Threatened and Candidate Species

Common Name-Species	Designation	Habitat	OAR*
Mammals			
Indiana bat- <i>Myotis solalis</i>	Endangered	Caves/forested areas, Forest wide, Cave Hollow Cave	6
Gray bat – <i>Myotis grisescens</i>	Endangered	Caves/riparian areas near caves, Forest wide, Cook;s cave	6
Birds			
Bald Eagle- <i>Haliaeetus leucocephalus</i>	Threatened	Near large bodies of water, Forest wide	6
Fishes			
Topeka shiner- <i>Notropis topeka</i>	Endangered	Large streams, slight to moderate current over sandy bottom, also gravel or silt. May coexist with scaly sand darter, Ouachita darter, speckled chub, or Sabine shiner, Cedar Creek Unit	1
Insects			
Hine’s emerald dragonfly- <i>Somatochlora hineana</i>	Endangered	Calcareous or limestone/dolomite wetlands and shallow, spring-fed streams draining into wet meadows and cattail marshes, Salem, Potosi, Hou/Rolla RD, Barton, Bates, Grasshopper Hollow fens	4
Clams (mussels, unionids)			
Curtis’ pearlymussel – <i>Epioblasma florentina</i>	Endangered	Large river drainages with moderate current, Doniphan, PB RD, Black, Castor, Little Black River, Cane Creek	1
Pink mucket pearlymussel – <i>Lampsilis abrupta</i>	Endangered	Large river drainages with gravelly bottoms, Don/11Pt, Potosi, PB RD, lower Big, Meramec, Osage, Little Black, St. Francis, Black	8
Scaleshell mussel – <i>Leptodea leptodon</i>	Endangered	Large rivers in mud, Hou/Rolla RD, Auxvasse Creek, Big, Gasconade, Meramec Rivers	7
Snails			
Tumbling Creek cavesnail – <i>Antrobia culveri</i>	Endangered	Cave aquatic systems, Ava RD	1
Amphibians			
Ozark hellbender - <i>Cryptobranchus allenganiensis bishopi</i>	Candidate	Large river drainages, Willow Springs Unit, Don/11Pt RD, Black and N. Fork White	1
Plants			
Running buffalo clover – <i>Trifolium stoloniferum</i>	Endangered	Open woods along streams, Forest wide introduced, Fred’town wild	3
Mead’s milkweed – <i>Asclepias meadii</i>	Threatened	Igneous, chert glades; prairies, Potosi/Fred’town RD, Bell Mnt wilderness	2

Coding for Occurrence Analysis Results (OAR)

LEGEND FOR TES LIST:

OCCURRENCE ANALYSIS RESULTS (OAR) CODES:

- 1 = Project located out of known species range.
- 2 = Lack of suitable habitat for species in analysis area.
- 3 = Habitat present, species was searched for during field survey, but not found.
- 4 = Species occurs in analysis area, but outside of activity area.
- 5 = Field survey located species in activity area.
- 6 = Species not seen during field survey, but possibly occurs in activity area based on habitat observed or field survey not conducted when species is recognizable.
- 7 = Aquatic species or habitat known or suspected downstream of project/activity area, but outside identified geographic bounds of water resource cumulative effects analysis area (defined as point below which sediment amounts are unquantifiable).
- 8 = Aquatic species or habitat known or suspected downstream of project/activity area, but inside identified geographic bounds of water resource cumulative effects analysis area.

The “analysis area” is defined as the area in which activities associated with one or more of the alternatives could potentially have a direct, indirect, or foreseeable cumulative effect upon a federal species or habitat in which the species is likely to occur.

The following species are not evaluated further in this BAE for the following reasons:

Topeka shiner (*Notropis topeka*)- the analysis area is not within the documented range of this species. It is found in only a few drainages north of the Missouri River approximately 90 miles north of the analysis area. The district that has potential to affect this species or its habitat is Cedar Creek.

Curtis’ pearlymussel (*Epioblasma florentina*)- the analysis area is not within the documented watersheds of this species. It is found in the Black, Castor, Little Black River, and Cane Creek. The Black River locations are approximately 65 miles SE of the analysis area. The districts that have potential to affect this species or its habitat are Doniphan and Poplar Bluff.

Scaleshell mussel (*Leptodea leptodon*)- The species is recorded in the Meramec River downstream of the analysis area, but is outside of the identified geographic bounds of water resource cumulative effects analysis area. It is recorded from Auxvasse Creek, Big, Gasconade, and Meramec Rivers. The Gasconade River locations are approximately 42 miles NW of the analysis area. The districts that have potential to affect this species or its habitat are Houston/Rolla and Potosi/Fredericktown.

Tumbling Creek cavesnail (*Antrobia culveri*)- the analysis area is not within the documented range of this species. It is known from one privately owned cave located in Taney County approximately 114 miles SW of the analysis area. The district that has potential to affect this species or its habitat is Ava.

Ozark hellbender (*Cryptobranchus allenganiensis bishopi*)- the analysis area is not within the documented watersheds of this species. It persists in the Current, Black and N. Fork of the White Rivers. The Current River locations are approximately 23 miles south of the analysis area. The districts that have the potential to affect this species or its habitat are Willow Springs and Doniphan/Eleven-Point.

Mead’s milkweed (*Asclepias meadii*)- the analysis area is not with the documented range of this species and suitable igneous glade/prairie habitat is not known to occur within the analysis area. It is located approximately 18 miles east of the analysis area. The district that has the potential to affect this species or its habitat is Potosi/Fredericktown.

The following species or their habitat could potentially be affected by actions in the analysis area, and potential effects to these species are displayed in this Biological Evaluation:

Gray bat (*Myotis grisescens*)

Indiana bat (*Myotis sodalis*)

Bald eagle (*Haliaeetus leucocephalus*)

Hine's emerald dragonfly (*Somatochlora hineanana*)

Running buffalo clover (*Trifolium stoloniferum*)

Pink mucket pearl mussel (*Lampsilis abrupta*).

Federally listed species described in the Missouri Fish and Wildlife Information System (MOFWIS) as known or likely to occur in Crawford and Dent Counties within the Meramec watershed are **bald eagle, gray bat, Indiana bat, Hine's emerald dragonfly, pink mucket, and scaleshell**. The MTNF BE Program documented the presence of habitat for **running buffalo clover, Indiana bat, and gray bat** within the LTA's for this project. A review of the Missouri Heritage database (10/28/03, ver.1.3) documented occurrences of only **Hine's emerald dragonfly** within the project influence area.

SURVEY INFORMATION

In preparation of this BAE, site-specific surveys within the analysis area were combined with a general knowledge of the habitats that are likely or known to occur within the project influence areas. Sarah Bradley (USFS biologist) conducted biological field surveys of the analysis area on 5/14/02, 5/23/02, 12/11/02, 4/29/03, 5/12/03, 8/13/03, 8/14/03, and 12/18/03. These surveys were cursory in nature and focused on determining the habitat conditions within the analysis area and locating potential habitat for wildlife species.

Botanical surveys are also being conducted by a contract botanist (Alan Brant) from September 2003 to September 2004 and results of those surveys have been reviewed as part of this BE. These botanical surveys are focusing on the drainages within the analysis area (generally considered areas of highest potential for rare plant communities).

Additional special habitat information such as seep, fen, and glade locations was collected by Angie Sites, Larry Ness (USFS Forestry Technicians) John Bryan, and David Massengale (USFS Foresters) during their extensive heritage resource and prescription field surveys within the analysis area and reviewed during the preparation of this BE.

Other surveys not specific to this project have been conducted in the vicinity of the analysis area. For example, in partnership with Mark Twain National Forest and others, the Missouri Department of Conservation has been very aggressive in conducting species surveys and maintaining data on both listed and common species. The Missouri Heritage Database not only includes specific locations of plant and animal species, but also includes occurrences of unique and/or rare natural communities. Many of these communities are suitable habitat for sensitive species. This database provides an excellent and up-to-date source of information on occurrences of TES species.

The Missouri Fish and Wildlife Information System (MOFWIS) includes information on over 700 species of animals and plants (life history, status, known & possible locations, etc.). This database is also an excellent source of information regarding possible locations of TES species on Mark Twain National Forest.

Species' experts in Missouri have also been very aggressive in publishing excellent reference material that includes species' locations in the state as well as potential habitat. Publications include: Missouri Wildflowers, Missouri Orchids, Field Guide to Missouri Ferns, Walk Softly Upon the Earth (lichens & mosses), Steyermark's Flora of Missouri, Flora of Missouri, Volume 1, Butterflies and Moths of Missouri, The Crayfish of Missouri, The Fishes of Missouri, Naiades of Missouri, Birds of Missouri, and The Amphibians and Reptiles of Missouri. All these publications were consulted during evaluation of potential effects to sensitive species within the Crooked Creek Analysis area.

The Nature Conservancy maintains Element Stewardship Abstracts and Element Global Rankings that give specific information on species' locations, habitats, threats, propagation, life history, etc. The Natureserve website contains distribution and status information on a variety of species and natural communities. These data sources were also consulted when analyzing potential effects of implementing alternatives in the Crooked Creek Analysis area.

In addition to the extensive fieldwork done in preparation of the Missouri Heritage and MOFWIS databases and the publications, there are numerous field surveys conducted annually or as part of research projects in Missouri. The Mark Twain National Forest also has conducted surveys in partnership with others, or on its own. A sampling of these, include but are not limited to:

- Annual mid-winter eagle surveys – Current River
- Annual eagle nest surveys
- Forest bat surveys (cave, fall, summer, winter, mist-net, harp-trap, Anabat)
- Missouri Breeding Bird Atlas
- Missouri Breeding Bird Survey Routes
- Cave Research Foundation Biological Inventories
- Gardner & Gardner Cave Inventories
- Botanical Surveys
- Naiades survey 1980-1982

All these surveys are relevant to the Crooked Creek Analysis area. While not all of them were conducted specifically on the Crooked Creek Analysis area, they provide information concerning suitable habitats for various species on this district.

Specialists in biology, soils, timber, and heritage resources conducted field visits throughout the analysis area during the pre-NEPA phase of planning, and during project planning. These visits were conducted at various times of the year for various reasons.

The information available on TES locations and potential habitats in the Crooked Creek Analysis area is of sufficient quantity, quality, and relevance to make an accurate and complete analysis of potential effects on TES species in the Crooked Creek Analysis area. I believe enough information is available to make a reasoned management decision. Therefore, additional surveys are not needed for this project decision.

In summary, this analysis of effects upon federally listed species is based upon information obtained during the field surveys that have been conducted in the vicinity of this project, as well as an assumption that habitat for the species addressed in detail may exist within the project influence area.

ENVIRONMENTAL BASELINE

Gray bat

General habitat requirements – Gray bats roost in colonies in a wide variety of caves throughout the year. Because of their high dependence upon caves for roosting and reproduction, this species is most vulnerable to activities that could disturb or negatively alter their cave environment. Foraging habitat for gray bats generally consists of forested riparian areas and/or over open water of rivers or lakes, generally up to 12 miles from their caves (U.S. Forest Service 1998). For both foraging and roosting, gray bats are generally restricted to areas in close proximity to rivers, lakes, and large streams.

Distribution on the MTNF – There are at least 14 known gray bat caves on Mark Twain National Forest, including one on the Salem District (U.S. Forest Service 1998). In addition, there are other gray bat caves on private lands adjacent to the National Forest. There is no critical habitat (as defined by the Endangered Species Act) for the gray bat on the Mark Twain National Forest.

Mist netting for forest bats was conducted in the spring-fall of 1997, 1998, 1999, 2001, and 2003 on several Mark Twain National Forest locations, including the Salem and Potosi/Fredericktown District. A few gray bats were caught at several locations. Harp trapping has also been done at known gray bat cave entrances in the fall of 1997, 1998, 1999, and 2001. Gray bats were also caught during these efforts. Population counts are conducted at gray bat caves in cooperation with the Missouri Department of Conservation bat biologist.

Occurrence within project area – No gray bats have been documented within the analysis area and no suitable caves are known to occur within the analysis area. The closest known gray bat cave lies approximately 16 miles to the north. Given the distribution and proximity of gray bats known from within the vicinity of the analysis area, it would not be surprising to find gray bats within the analysis area. Gray bats could potentially use any of the larger perennial streams as foraging habitat. The likelihood of a gray bat colony occurring in the analysis area is considered low due to the fact that no caves are known within the analysis area. According to the BE Program, 12 acres of suitable gray bat foraging habitat occurs within the analysis area. MOFWIS identified

this species as occurring or likely to occur in Crawford and Dent Counties within the Meramec drainage.

Indiana bat

General habitat requirements – The Indiana bat occupies a wide variety of roost sites and environments. During the hibernation period (generally November- March), the Indiana bat roosts in caves where it is protected from winter temperature extremes. Outside the winter period, however, the Indiana bat frequents areas outside its caves and utilizes standing snags, trees with loose bark, and occasionally abandoned buildings as roost sites and maternity colony sites. Generally, the male's summer roost trees are located with 5 miles of an Indiana bat occupied cave, in forested areas with some canopy gaps that allow moderate sunlight to warm roost trees. In Missouri, all the known female maternity roost trees have been located north of the Missouri River in the upper two tiers of counties within the prairie regions of Missouri, and not near or on the Mark Twain National Forest. Another fairly close known maternity colony is in Illinois, along the Mississippi River corridor. In June 2003, a pregnant Indiana bat was captured during mist net surveys at Silver Mines Recreation Area on the Mark Twain National Forest in Madison County, approximately 50 miles east of the Crooked Creek analysis area. This was the first documented record of a reproductively active female Indiana bat from the Mark Twain National Forest.

Distribution on the MTNF –The entire Mark Twain National Forest is within the documented range of the Indiana bat throughout the year. There are only two known Indiana bat hibernacula (caves) documented on the Mark Twain National Forest, one of which is located on the Potosi-Fredericktown District that adjoins the Salem District. When not hibernating, roosting male and female Indiana bats may occur anywhere on the National Forest where suitable habitat as described previously exists. However, in 5 years of spring-fall mist netting on the Mark Twain National Forest, no male Indiana bats have been captured. To date, 4 reproductively active female Indiana bats have been documented near the National Forest and in June 2003, a pregnant Indian bat was captured on the National Forest, indicating that maternity colonies may exist on the National Forest. However, none of these captures have led to the discovery of maternity colonies. Four of the five reproductively active females captured closest to the NF were found within 5 miles of significant Indiana bat hibernaculum. None of the National Forest has been designated by the USFWS as critical habitat for this species.

Occurrence within project area – No Indiana bats have been documented within the analysis area; however, the BE Program identified several acres of suitable foraging/roosting habitat within the analysis area. The closest know Indiana bat hibernacula is approximately 8 miles east of the analysis area. Reproductively active female Indiana bats have been documented from Iron and other nearby counties, with the closest being approximately 33 east miles of the analysis area. The closest documented maternity colonies are in Illinois, approximately 100 miles east of the analysis area. MOFWIS identified this species as occurring or likely to occur in Crawford and Dent Counties within the Meramec drainage.

Bald Eagle

General habitat requirements – Year-round, bald eagles are most often associated with areas near large bodies of water such as rivers, lakes and reservoirs. In the winter, bald eagles tend to congregate in these areas and roost communally, often in a tree in a ravine or other wind-protected areas. In the summer, bald eagles prefer to nest in a floodplain forest in which the largest, stoutest, tree or a coniferous or dead tree are most often selected as the nest tree. Once a nest tree is established, bald eagles may use it for several years. Usually, the nest site has a clear flight patch to a water source and is within 0.5 mile of water.

Distribution on the MTNF – Bald eagles are frequently observed singly or in small groups along major water bodies and rivers on the Mark Twain National Forest during the winter months. Associated with these wintering sites are reports of communal night and day roosts, however, none of these roosts have been reported from the National Forest. There are several bald eagle nest locations near the National Forest, however, none known on the Forest. However, potential for nesting eagles does exist in the habitats that are frequently utilized by the species in the winter months.

Occurrence within project area –The best potential habitat for bald eagle roosts and nests would be along the East and West Fork of Huzzah Creek and the edges of the larger perennial streams with/near the analysis area. No bald eagle roosts or nests are known to occur with the analysis area and none of the streams contained within the analysis area are likely to be large enough in size to support wintering or nesting bald eagles. The closest known bald eagle roost site and nest sites are 59 miles S and 22 miles SW respectively from the analysis area.

Bald eagles have been seen within/near the analysis area during the winter. This is not surprising since many bald eagles over-winter along the Meramec River and are often wide ranging during the winter months as they forage for food. However, even during the winter months, eagles would most likely be found near a large stream or lake.

The BE program did not identify any suitable habitat for the species within the analysis area. MOFWIS identified this species as occurring or likely to occur in Crawford and Dent Counties within the Meramec drainage.

Hine's Emerald Dragonfly

General habitat requirements – Hine's emerald dragonfly lives in wetlands dominated by grass or grass-like plants and fed primarily by water from a mineral source, or fens. Two important habitat characteristics common to sites occupied by this species are that the sites be fed by groundwater with shallow water moving through vegetation, and the presence of underlying dolomitic or calcareous limestone. Generally, these sites are also open with nearby or adjacent forest. Open areas provide places for the species to forage while forest areas provide shade and protection for roosting dragonflies. Preserving the natural hydrology and water quality of these sites are key to maintaining habitat for this species where it exists.

Distribution on the MTNF – This species was first discovered on the MTNF in August 1999, and prior to that discovery, had been assumed to occur north of the National Forest. Since the first discovery on the National Forest, an additional 12 sites that harbor this

species have been recorded on or near the MTNF (Vogt, 2004). All of these sites represent calcareous fens and open wetland areas typical of the habitat expected for this species.

Occurrence within project area – This species has been documented in Bates Hollow within the analysis area. There are other recently discovered fens within the analysis area that are suitable habitat and many of them have not yet been surveyed for this species.

The BE Program did not identify any other suitable habitat for this species within the analysis area. MOFWIS identified this species as occurring or likely to occur in Crawford and Dent Counties within the Meramec drainage.

Running Buffalo Clover

General habitat requirements – Running buffalo clover may have once been fairly widespread in Missouri, where it likely flourished along streams and bison trails. The species prefers semi-shaded woods and depends upon slight levels of disturbance. The species does not occur in areas of full sun. It is likely dispersed by the droppings of free-ranging herbivores and may have benefited from periodic burning that historically would have created open woodlands (U.S. Forest Service 1998).

Distribution on the MTNF – While it may have historically occurred on the National Forest, today, no naturally occurring wild populations are known on the MTNF. However, through an inter-agency cooperative effort, the species has been reintroduced to sites on the National Forest, none of which are located on the Salem District. These sites will be surveyed in 2004 to determine if the introduced populations still exist.

Occurrence within project area – There are no known occurrences of this species within the analysis area. The closest known site for this species is approximately 16 miles N of the analysis area. Potential habitat for the species would most likely be found along the perennial streams within the analysis area, especially where burning or some other prior disturbance has created semi-open conditions. However, no individuals of this species have been located so far during extensive botanical surveys of stream corridors during 2003 and 2004 by Alan Brant. The BE Program did not identify any suitable habitat for this species within the analysis area. MOFWIS did not identify this species as occurring or likely to occur in Crawford and Dent Counties within the Meramec drainage.

Pink mucket pearl mussel

General habitat requirements – This species is associated with large rivers with gravel-cobble substrate.

Distribution on the MTNF – The pink mucket persists in the Current River, Meramec River, and the Black River (below the dam). Its viability in the Meramec basin is questionable, but may be influenced by activities occurring in the headwaters of the Meramec River (U.S. Forest Service 1998). Part of the analysis area occurs in the Huzzah watershed, which is within the headwaters of the Meramec.

Occurrence within project area – No known sites for this aquatic species occur within the analysis area. The closest known site for this species is approximately 55 air miles (100 river miles) NE of the analysis area in the Meramec River.

The BE Program did not identify any suitable habitat for this species within the analysis area. MOFWIS identified this species as occurring or likely to occur in Crawford and Dent Counties within the Meramec drainage.

EFFECTS OF THE PROPOSED MANAGEMENT ACTIONS

Gray Bat

Direct Effects (Alternatives 1-3): Since no gray bats are known to occupy the analysis area and the closest known gray bat record is approximately 16 miles N of the analysis area, none of the activities proposed for implementation in Alternatives 1-3 would be expected to have a direct effect upon any gray bats or their occupied habitat. None of these activities would likely be directly impacting any known caves or individual gray bats.

Indirect Effects (Alternative 1): Under Alternative 1, there may be an indirect effect upon potential habitat for this species. The anticipated die-off of trees due to lack of treatment may contribute to more intense wildland fires within the analysis area. Fuels would build-up within the forested stands as they succumb to disease and insects. Should an intense wildland fire occur within the analysis area as a result of lack of treatment of forest stands, it could contribute to increased soil loss and sedimentation of streams in the analysis area. Negative impacts upon the water quality of these streams could have an adverse effect upon the aquatic insects within the stream, and therefore, indirectly affect the prey base for the gray bats. Exclusion of controlled prescribed burning within these stands would also increase the potential for wildland fires to become intense and difficult to control. The chances of a wildland fire occurring within the analysis area, however, are virtually impossible to predict, and so, these possible indirect effects may be considered speculative and are not considered “reasonably certain to occur”.

Alternative 1 would also not implement any activities, such as erosion control, dump removal, and non-system road closure, which could have an indirect beneficial effect upon the water quality of the streams within the analysis area.

Alternative 1 would not have any indirect effect upon caves known or likely to be occupied within the analysis area because no caves are known to occur within the analysis area.

Cumulative Effects (Alternative 1): Based upon known past, present, and foreseeable effects, Alternative 1 is not expected to contribute to an adverse cumulative effect upon the gray bat or its habitat. The MTNF caves constitute only 9% of the gray bat caves in Missouri and land use practices and activities that may impact the remaining gray bat caves are outside the control of the Forest Service.

Under Alternative 1, no new activities would contribute to the cumulative effect of soil movement into streams. However, the current effects occurring within the watersheds of the analysis area as the result of existing erosion from unregulated roads, streambank destabilization, and water contamination from garbage dumps would also not be minimized under Alternative 1. Therefore, while there are not any anticipated cumulative adverse effects resulting from the implementation of Alternative 1, there also are no anticipated cumulative beneficial effects, either, because this alternative would not involve a change in the existing conditions within the watersheds and no change in existing water quality, which has an influence on the availability food for the gray bat.

NEPA Cumulative Effects (Alternative 1): The implementation of Alternative 1, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is expected to maintain habitat conditions similar to the current conditions. No new activities would contribute to the cumulative effect of soil movement into streams. However, the current effects occurring within the watersheds of the analysis area as the result of existing erosion from unregulated roads, streambank destabilization, and water contamination from garbage dumps would also not be minimized under Alternative 1. Therefore, while there are not any anticipated cumulative adverse effects resulting from the implementation of Alternative 1, there also are no anticipated cumulative beneficial effects, either, because this alternative would not involve a change in the existing conditions within the watersheds and no change in existing water quality, which has an influence on the availability food for the gray bat.

Summary of BO Compliance (Alternative 1): The June 23, 1999 Biological Opinion requires compliance with Terms and Conditions developed to protect and maintain the gray bat and its habitat on the MTNF. Alternative 1 complies with those Terms and Conditions as follows:

- The alternative is not likely to result in disturbance to any gray bat caves.
- The alternative does not inhibit ongoing monitoring of gray bat populations.
- The alternative does not impact the 20 acres of designated old growth around occupied gray bat caves.
- The alternative does not involve or influence controlled burning activities that may impact gray bat caves.

Determination of Effect and Rationale (Alternative 1): Alternative 1 would have *no direct effect* and *is not likely to indirectly adversely affect* the gray bat or potential habitat for this species. The potential for indirect effects upon the prey base for this species may be increased under this alternative because no activities would occur to improve the health and conditions of forested stands within the analysis area, making them susceptible to intense wildland fires, insect outbreaks, disease, or other forces that could lead to diminished water quality. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 1 is expected to have *no cumulative adverse effect* upon the gray bat because it is not expected to influence potential recovery of this species throughout its range and would be in compliance with the FWS BO Terms and Conditions.

If a gray bat is found within the analysis area, consultation with the US Fish and Wildlife Service for this project will be re-initiated.

Indirect Effects (Alternatives 2-3): The activities proposed have some potential for indirect effects upon gray bats by indirectly affecting the water quality of streams within the analysis area. Negative impacts upon the water quality of these streams could have an adverse effect upon the aquatic insects within the stream, and therefore, indirectly affect the prey base for the gray bats.

Activities with the greatest potential for impacts upon water quality involve those activities that would disturb the soil surface. In these alternatives, these activities include temporary road construction, road reconstruction, skidding and dragging associated with commercial removal of merchantable timber, the construction of dozerlines, and, to a lesser degree, erosion control activities, glade restoration, fishing pond rehabilitation, wildlife habitat improvement, and grazing.

However, several protective measures have been incorporated into these alternatives that will minimize any potential for soil movement during these activities. With implementation of these protective measures, no soil movement is expected to occur at rates that would adversely affect the water quality of adjacent streams, and therefore, the prey base for gray bats. Past monitoring of similar projects on the MTNF has indicated that soil movement levels were well within the allowable soil loss established in the Forest Plan (U.S. Forest Service 2002).

There is also potential for indirect impacts upon gray bats that may be occupying undiscovered or unknown caves within the analysis area. This potential is considered very low due to the fact that no caves are known to occur within the analysis area and none were located during various field surveys of the analysis area. However, should a cave be located, its entrance will be protected from disturbance by a 100' buffer zone.

Prescribed burning activities proposed within the analysis area may create drift smoke in the vicinity of occupied gray bat caves. However, with implementation of parameters that will favor smoke dispersal, it is not likely that this smoke will settle heavily in areas that contain known gray bat caves. Considering the fact that the closest known gray bat site is 16 miles from the analysis area, it is highly unlikely that it would be impacted by any prescribed burning activities. Prescribed burning activities will be conducted in a manner to ensure that smoke does not accumulate heavily in areas likely to be occupied by Indiana or gray bats.

Some of the activities proposed in these alternatives may also have an indirect beneficial effect upon potential habitat for the gray bat. Under these alternatives, some activities would occur that may enhance the water quality of streams within the analysis area, and therefore, improve habitat for gray bat prey (aquatic insects). Activities that would improve water quality include non-system road closure, dump removal, and erosion control activities. All of these proposed activities would improve potential habitat for gray bats.

Cumulative Effects (Alternatives 2-3): Based upon known past, present, and foreseeable effects, Alternatives 2 and 3 are not expected to contribute to an adverse cumulative effect upon the gray bat or its habitat. The MTNF caves constitute only 9% of

the gray bat caves in Missouri and land use practices and activities that may impact the remaining gray bat caves are outside the control of the Forest Service. Management activities proposed in Alternatives 2 and 3 are not likely to contribute to activities that may adversely impact any gray bat caves or their foraging habitat. The current effects occurring within the watersheds of the analysis area as the result of existing erosion from unregulated roads, streambank destabilization, and water contamination from garbage dumps would be reduced under Alternative 2 and 3. Therefore, these activities may result in cumulative beneficial effects by helping to improve water quality within the analysis area.

NEPA Cumulative Effects (Alternatives 2-3): The implementation of Alternatives 2 and 3, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, are not likely to contribute to activities that may adversely impact any gray bat caves or their foraging habitat. The current effects occurring within the watersheds of the analysis area as the result of existing erosion from unregulated roads, streambank destabilization, and water contamination from garbage dumps would be reduced under Alternative 2 and 3. Therefore, these activities may result in cumulative beneficial effects by helping to improve water quality within the analysis area.

Summary of FWS BO Compliance (Alternatives 2-3): The June 23, 1999 Biological Opinion (U.S. Fish and Wildlife Service 1999) requires compliance with Terms and Conditions developed to protect and maintain the gray bat and its habitat on the MTNF. The activities proposed in Alternatives 2 and 3 comply with those Terms and Conditions as follows:

- The alternatives are not likely to result in disturbance to any gray bat caves.
- The alternatives do not inhibit ongoing monitoring of gray bat populations.
- The alternatives do not impact the 20 acres of designated old growth around occupied gray bat caves.
- Prescribed burning activities proposed will comply with BO terms and conditions.

Determination of Effect and Rationale (Alternatives 2-3): Implementation of activities proposed in Alternatives 2 and 3 are *not likely to have an adverse effect* upon gray bats or their habitat. No direct or indirect disturbance to known gray bat caves or their foraging habitat is anticipated as a result of any of these activities. While the potential does exist for undiscovered gray bat caves to be in the analysis area, based upon past surveys, this potential is considered very low. Any foraging gray bats or their foraging habitat that may be within the analysis area are not likely to be impacted by the proposed activities. The implementation of Alternatives 2 and 3 would be expected to have no cumulative effects upon gray bats because they do not jeopardize recovery of the species and is in compliance with USFSW BO terms and conditions.

If a gray bat is found within the analysis area, consultation with the US Fish and Wildlife Service for this project will be re-initiated.

Indiana Bat

Direct Effects (Alternative 1): Alternative 1 would not be expected to have any direct effects upon Indiana bats during their hibernation or fall and spring swarming periods (generally October thru April), or upon their hibernacula because no hibernacula are known to occur within or near the analysis area. The closest hibernaculum (Cave Hollow Cave) is approximately 8 miles from the analysis area and, therefore, neither it, nor the habitat likely to be used for spring and fall “swarming” (generally 5 miles from a hibernaculum) would be affected by this alternative. There is also no potential hibernation habitat within the analysis area, since no caves have been located. Therefore, no direct effect upon wintering habitat for the Indiana bat is anticipated as the result of implementation of Alternative 1.

Indiana bats may occur within the analysis area during their summer roosting period (generally May thru September). During this time, Indiana bats may be using trees within the analysis area as roosts and maternity colonies. If so, the bats are vulnerable to activities that may disturb these roost trees, such as tree felling, burning, etc. Under Alternative 1, no activities are proposed that would directly disturb any suitable Indiana bat roost trees and 0 acres of forested habitat would be directly affected by this alternative. Therefore, there are no anticipated direct effects upon Indiana bat summer habitat if Alternative 1 is implemented.

Indirect Effects (Alternative 1): The activities proposed in Alternative 1 are not expected to have any indirect effect upon Indiana bat hibernating, or fall/spring swarming habitat for the same reasons as stated above for the potential for direct effects.

However, there are indirect effects upon Indiana bat summer roosting and foraging habitat that are anticipated if Alternative 1 is implemented. These indirect effects include changes in the availability and quality of suitable foraging habitat for Indiana bats within the analysis area, as well as changes in the availability of suitable roost trees within the analysis area.

Under Alternative 1, no activities would occur within the analysis area that would improve the health and resistance of existing forest stands. Many of these stands are currently suffering from or highly susceptible to infestations of red oak borers and other insects. If no treatment occurs within these stands, it is anticipated that several hundred acres may be affected by these insect infestations, resulting in die-off of many oaks, particularly scarlet and black oaks (J. Bryan, pers.comm.). In the short-term, this may improve foraging and roosting habitat for the Indiana bat, because it would result in more open canopied stands and a high number of standing dead trees that could be used as roosts and maternity sites. Over the long-term, however, if no treatment occurs, these stands are likely to gradually succeed to more closed canopy conditions, especially with the exclusion of fire. Closed canopy (> 70%) would be considered less than optimum foraging habitat for Indiana bats.

The anticipated die-off of trees due to lack of treatment may also contribute to more intense wildland fires within the analysis area. Fuels would build-up with the forested stands as they succumb to disease and insects. Intense wildland fires would have the potential of creating large areas of < 30% canopy cover, which would not be considered

suitable Indiana bat foraging habitat. Exclusion of controlled prescribed burning within these stands would also increase the potential for wildland fires to become intense and difficult to control. The chances of a wildland fire occurring within the analysis area, however, are virtually impossible to predict, and so, these possible indirect effects may be considered speculative and are not considered “reasonably certain to occur”.

Overall, Alternative 1 is not expected to improve habitat conditions within the analysis area for the Indiana bat. While there would be no direct loss of existing foraging habitat within the analysis area, implementation of Alternative 1 may still contribute to an indirect loss of foraging habitat within the analysis area by failure to treat currently overstocked, unhealthy forest stands. Under Alternative 1, existing waterholes would not be maintained, eventually leading to a decrease in the availability of upland water sources. The availability of roost trees within the analysis area is anticipated to remain relatively constant or increase, since this alternative would allow existing forest stands to continue to mature and create conditions likely to lead to an increase in the number of dying trees within analysis area.

According to the BE Program, Alternative 1 will affect suitable Indiana bat foraging habitat as follows:

Acres Destroyed	Acres Reduced	Acres Maintained	Acres Created	Acres Enhanced
0	0	4980	0	0

Cumulative Effects (Alternative 1): Based upon known past, present, and foreseeable effects, the implementation of Alternative 1 is not likely to have an adverse cumulative effect upon the Indiana bat or its habitat. This alternative would not have any cumulative effect upon cave use by Indiana bats because it does not affect any habitat within 5 miles of a known Indiana bat cave. None of the activities proposed in this alternative would contribute to a permanent loss of foraging habitat for Indiana bats. Continued conversion of private forestland to agriculture or residences within the range of the Indiana bat may result in the cumulative loss of foraging and roosting habitat over the long term, however, these activities on private lands are not within the jurisdiction of the U.S. Forest Service and are not necessarily influenced by this proposal.

However, failure to take actions that would improve the resistance of forest stands to insects, wildfire, and disease may lead to a cumulative short-term loss of some suitable foraging habitat within the analysis area, however, this loss would be offset by the availability of suitable foraging habitat elsewhere in the analysis area, since not all stands would likely be vulnerable to these forces.

NEPA Cumulative Effects (Alternative 1): The implementation of Alternative 1, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is not likely to have an adverse cumulative effect upon the Indiana bat or its habitat. This alternative would not have any cumulative effect upon cave use by Indiana bats because it does not affect any habitat within 5 miles of a known Indiana bat cave. None of the activities proposed in this alternative would contribute to a permanent loss of foraging habitat for Indiana bats. Continued conversion of private forestland to agriculture or residences within the range of the Indiana bat may

result in the cumulative loss of foraging and roosting habitat over the long term, however, these activities on private lands are not within the jurisdiction of the U.S. Forest Service and are not necessarily influenced by this proposal.

However, failure to take actions that would improve the resistance of forest stands to insects, wildfire, and disease may lead to a cumulative short-term loss of some suitable foraging habitat within the analysis area, however, this loss would be offset by the availability of suitable foraging habitat elsewhere in the analysis area, since not all stands would likely be vulnerable to these forces.

Summary of BO Compliance (Alternative 1): The June 23, 1999 Biological Opinion requires compliance with Terms and Conditions developed to protect and maintain the Indiana bat and its habitat on the MTNF. Alternative 1 complies with those Terms and Conditions as follows:

- All known Indiana bat caves remain protected from human disturbance.
- The alternative does not impact the designated old growth and mature forest around Indiana bat caves.
- The alternative complies with minimum basal area and leave tree requirements specified in the BO and FLRMP.
- The alternative will not involve activities within 0.25 mile of a known Indiana bat maternity site or any Area of Influence (AOI) for Indiana bats.
- The alternative will not affect management recovery strategies for caves or lands on or adjacent to the MTNF.
- There are no prescribed burning activities proposed.
- The alternative does not affect ongoing Indiana bat monitoring, surveys or research activities.
- The alternative will not exceed allowable “take” during any given fiscal year because it does not implement any activities that would directly affect forested habitat.

Determination of Effect and Rationale (Alternative 1): Alternative 1 would have *no direct effect* and *is not likely to indirectly adversely affect* the Indiana bat or potential habitat for this species. The potential for indirect effects upon some potential habitat for this species may be increased under this alternative because no activities would occur to improve the health and conditions of forested stands within the project area, making them susceptible to intense wildland fires, insect outbreaks, disease, or other forces. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 1 is expected to have *no cumulative adverse effect* upon the Indiana bat because it is not expected to influence potential recovery of this species throughout its range and would be in compliance with the FWS BO Terms and Conditions.

If an Indiana bat is found within the analysis area, consultation with the US Fish and Wildlife Service for this project will be re-initiated

Direct Effects (Alternatives 2-3): The activities proposed in Alternatives 2-3 would not be expected to have any direct effects upon Indiana bats during their hibernation or fall and spring swarming periods (generally October thru April), or upon their hibernacula because no hibernacula are known to occur within or near the analysis area. The closest

hibernaculum (Cave Hollow Cave) to the project area is approximately 8 miles from the analysis area and, therefore, neither it, nor the habitat likely to be used for spring and fall “swarming” (generally 5 miles within a hibernaculum) would be impacted by any of the proposed activities in Alternatives 2-3. There is also no potential hibernation habitat within the analysis area, since no caves have been located. Therefore, no direct effect upon wintering habitat for the Indiana bat is anticipated as the result of activities proposed in Alternatives 2-3.

There is a potential for directly impacting Indiana bats, however, during their summer roosting period (generally May thru September). Activities proposed that may have a direct adverse effect upon Indiana bats include timber harvesting, temporary road construction, prescribed burning, dozerline construction, glade restoration, and wildlife habitat improvement. These activities all have the potential of impacting bats that may be roosting in trees during the summer, particularly trees with characteristics that make them favorable for bat use. These direct adverse impacts could be the killing of roosting bats when trees are felled or burned, or abandonment of roost sites caused by disturbance created by activities associated with these treatments.

Many of the stands that would be affected by tree felling activities or prescribed burning contain suitable potential roost trees for Indiana bats. Stands proposed for timber harvesting and prescribed burning would have the greatest potential for suitable roost trees, because these stands tend to have larger diameter, older trees than stands and areas proposed for wildlife habitat improvement, or glade restoration. The number of acres of forested habitat that would be treated in these alternatives and that offers potential summer habitat for Indiana bats can be found in Tables 3 and 4.

Table 3. As of April 13, 2004, forested acres offering suitable habitat for Indiana bat use that would be affected by Alternative 2 (Acres per FY is estimated).

Treatment	Forest Total Acres Incid Take Allowed Each FY	Total Ac Proposed in Analysis Area	FY 2004		FY 2005		FY 2006		FY 2007		FY 2008	
			Crooked Cr	Forest Total								
TIMBER HARVEST	20,000	5,904	710	7261	2315	7210	1587	5621	1292	4974	0	*
ROAD CN-Road Recon.	25	12	3	9	3	22	3	22	3	22	0	*
RX FIRE- Prescribed burning	12,000	8,401	0	9375	526	11162	2552	9322	3810	7380	941	*
SW IMP-rd closures and dump cleanup	150	68	17	59	17	25	17	17	17	17	0	*
WL HAB IMP-thin stands	2000	547	198	445	349	848	0	9	0	12	0	*

Table 4. As of April 13, 2004, forested acres offering suitable habitat for Indiana bat use that would be affected by Alternative 3 (Acres per FY is estimated).

Treatment	Forest Total Acres Incid Take Allowed Each FY	Total Ac Proposed in Analysis Area	FY 2004		FY 2005		FY 2006		FY 2007		FY 2008	
			Crooked Cr	Forest Total								
TIMBER HARVEST	20,000	5584	710	7261	1995	6890	1587	5621	1292	4974	0	*
ROAD CN-Road Recon.	25	12	3	9	3	22	3	22	3	22	0	*
RX FIRE-Prescribed burning	12,000	8,401	0	9375	526	11162	2552	9322	3810	7380	941	*
SW IMP-rd closures and dump cleanup	150	68	17	59	17	25	17	17	17	17	0	*
WL HAB IMP-thin stands	2000	547	198	445	349	848	0	9	0	12	0	*

*Indiana bat take database computes cumulative take acres only up to year 2007.

In order to minimize the potential for this direct adverse impact upon summer roosting Indiana bats, several protective measures have been incorporated into Alternatives 2 and 3. These protective measures (refer to Appendix B) would protect the majority of trees that offer the best potential roosting and maternity habitat for Indiana bats. For example, most unmerchantable dead trees (generally, the best dead trees for Indiana bat use are unmerchantable because they are hollow or decayed) will be retained in all timber harvest units. Other trees to be protected include all shagbark and shellbark hickories, sycamores, and lightning-struck trees. In addition, a minimum basal area of trees will be retained in these units to provide a future supply of roost trees and for protection of existing roost trees from windthrow. By implementing these protective measures, the risk of directly harming a roosting Indiana bat during timber harvest activities is greatly reduced. Activities such as glade restoration and wildlife habitat improvement would also strive to protect these trees when possible and would not be likely to impact very many suitable roost trees since they would involve tree felling on only a few acres.

There is potential that an occupied roost tree may be burned and individual bats harmed. It is likely, however, that should an occupied roost tree begin to burn or smoke accumulations become too heavy, that the bats would fly out of the tree to an adjacent, unburned area. Given the fact that the proposed prescribed burn areas are surrounded by adjacent, forested habitat of similar composition, this is not considered an unlikely scenario, since suitable roost trees are likely scattered across the forested area. It is also assumed that the loss of suitable roost trees to burning activities would be offset by the creation of new snags as a result of the burn, allowing a continual supply of suitable roost trees within the prescribed burn area over the long term.

Other activities proposed within these alternatives such as dump cleanup, erosion control, grazing, waterhole maintenance, and fishing pond rehabilitation, would not be expected to have a direct adverse effect upon Indiana bats because they would not likely involve any felling or disturbance to suitable roost trees.

Indirect Effects (Alternatives 2-3): The activities proposed in Alternatives 2-3 are not expected to have any indirect effect upon Indiana bat hibernating, or fall/spring swarming habitat for the same reasons as stated above in direct effects.

However, there are indirect effects upon Indiana bat summer roosting and foraging habitat that are anticipated if Alternatives 2 or 3 are implemented. Alternatives 2 and 3 are similar with alternative 3 having approximately 295 acres less of timber harvest. These indirect effects include changes in the availability and quality of suitable foraging habitat for Indiana bats within the analysis area, as well as changes in the availability of suitable roost trees within the analysis area. Activities proposed within these alternatives that are likely to contribute to these indirect effects include timber harvesting, temporary road construction, prescribed burning, glade restoration, and waterhole maintenance. Some of these indirect effects may be adverse, while others would be beneficial.

Adverse indirect effects may be created by timber harvest activities that would result in a temporary loss of suitable foraging habitat or connectivity among a colony's home range. Foraging habitat may be indirectly adversely affected when timber harvesting results in less than a 30% canopy closure (U.S. Forest Service 2002). Activities in Alternative 2 and 3 that are likely to create stands in this condition include timber harvesting that uses the clear cut with reserve trees technique. Temporary road construction also may slightly reduce foraging habitat if temporary roads are created in existing suitable foraging habitat. However, these temporary roads may also be used as travel corridors for foraging Indiana bats.

In some cases, foraging habitat may be indirectly improved by timber harvesting, glade restoration, wildlife habitat improvement, and prescribed burning. Many of the forest stands within the project have a greater than 100 basal area and are considered heavily stocked and dense. Several of these stands would be treated in these alternatives with methods that would reduce this basal area. Studies have shown that Indiana bats tend to prefer more open, less heavily stocked forest stands for foraging habitat; generally forest stands with 50-70% canopy cover are considered optimum for Indiana bat foraging (U.S. Forest Service 1998). These canopy conditions would be created by timber harvesting implementing the thinning techniques, wildlife habitat improvement, and possibly by glade restoration activities. The other techniques that would be used for timber harvesting (shelterwood cut, sanitation/salvage cut/overstory removal, and selection with groups) would be expected to leave a > 40% canopy cover, which would be considered suitable Indiana bat foraging habitat, yet not optimum.

Prescribed burning may also indirectly improve foraging habitat for Indiana bats. Prescribed burning, especially when an area is burned repetitively over the long term, would create a more open, woodland-type stand, in many of the stands currently heavily stocked. This effect would be similar to some of the mechanical treatments that would create a more open canopy of 50-70%. Prescribed burning has further indirect benefits to Indiana bats when done at a landscape level because it creates a mosaic pattern of open and less open forest with a scattered distribution of snags and dying trees. This mosaic often creates more opportunities for Indiana bats to select from a variety of roost tree settings and foraging habitat conditions, and generally creates a higher quality, more long-term foraging and roosting habitat (U.S. Forest Service 1998).

There is also potential for indirect impacts upon Indiana bats that may be occupying undiscovered or unknown caves within the analysis area. This potential is considered very low due to the fact that no caves are known to occur within the analysis area and none were located during various field surveys of the analysis area. However, should a cave be located, its entrance will be protected from disturbance by a 100' buffer zone.

Prescribed burning activities proposed within the analysis area may create drift smoke in the vicinity of occupied Indiana bat caves. However, with implementation of parameters that will favor smoke dispersal, it is not likely that this smoke will settle heavily in areas that contain known Indiana bat caves. Considering the fact that the closest known Indiana bat site is 8 miles from the analysis area, it is highly unlikely that it would be impacted by any prescribed burning activities. Prescribed burning activities will be conducted in a manner to ensure that smoke does not accumulate heavily in areas likely to be occupied by Indiana or gray bats.

According to the BE Program, Alternative 2 will affect suitable Indiana bat foraging habitat as follows:

Acres Destroyed	Acres Reduced	Acres Maintained	Acres Created	Acres Enhanced
0	882	0	2793	4499

According to the BE Program, Alternative 3 will affect suitable Indiana bat foraging habitat as follows:

Acres Destroyed	Acres Reduced	Acres Maintained	Acres Created	Acres Enhanced
0	655	0	2793	4499

Other activities that may have an indirect beneficial effect upon the Indiana bat that are proposed in Alternatives 2 and 3 are the maintenance of permanent waterholes. The availability of upland water sources is an important factor in creating suitable Indiana bat habitat, since research has indicated that Indiana bats frequent upland waterholes and road ruts regularly during the summer months, particularly if they are pregnant or lactating (L. Mills, pers. comm).

Old growth has already been designated within the analysis area. While designation of old growth may preclude the development of better foraging habitat because most old growth stands tend to approach > 100% canopy cover, it will likely increase the availability of suitable roost trees within the analysis area, particularly for maternity use. Old growth could also provide areas with wooded corridors that may be important landscape features for Indiana bat movement and foraging (Murray and Kurta, 2004). Old growth areas will eventually develop a structure that includes many large diameter trees. Some of these trees would likely become suitable for maternity roosts. Most of the old growth that has been designated is located in bottomland areas, along riparian zones and most maternity roosts have been found in elm-ash-cottonwood communities, typical of riparian zones. Studies of maternity habitat in Missouri have recommended that forest

management practices favor creation and retention of suitable roost trees and include a component of old growth (U.S. Forest Service 1998).

Cumulative Effects (Alternatives 3 and 4): Based upon known past, present, and foreseeable effects, the implementation of Alternatives 2 and 3 are not likely to have an adverse cumulative effect upon the Indiana bat or its habitat. These alternatives would not have any cumulative effect upon cave use by Indiana bats because they do not affect any habitat within 5 miles of a known Indiana bat cave. None of the activities proposed in these alternatives would contribute to a permanent loss of foraging habitat for Indiana bats. Continued conversion of private forestland to agriculture or residences within the range of the Indiana bat may result in the cumulative loss of foraging and roosting habitat over the long term, however, these activities on private lands are not within the jurisdiction of the US Forest Service and are not necessarily influenced by this proposal. Some of the activities proposed in Alternatives 2 and 3 may lead to a cumulative short-term loss of some habitat components considered desirable for Indiana bats, however, this negative impact would be offset by the creation and enhancement of several thousand acres of foraging habitat. For example, the loss of some suitable foraging habitat for Indiana bat as the result of some cutting techniques would be offset by the increase and enhancement of suitable foraging habitat created by thinning or prescribed burning techniques.

NEPA Cumulative Effects (Alternatives 2-3): The implementation of Alternatives 2 and 3, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, not likely to have an adverse to have a cumulative effect upon the Indiana bat or its habitat in the analysis area or elsewhere.

These alternatives would not have any cumulative effect upon cave use by Indiana bats because they do not affect any habitat within 5 miles of a known Indiana bat cave. None of the activities proposed in these alternatives would contribute to a permanent loss of foraging habitat for Indiana bats. Continued conversion of private forestland to agriculture or residences within the range of the Indiana bat may result in the cumulative loss of foraging and roosting habitat over the long term, however, these activities on private lands are not within the jurisdiction of the US Forest Service and are not necessarily influenced by this proposal. Some of the activities proposed in Alternatives 2 and 3 may lead to a cumulative short-term loss of some habitat components considered desirable for Indiana bats, however, this negative impact would be offset by the creation and enhancement of several thousand acres of foraging habitat. For example, the loss of some suitable foraging habitat for Indiana bat as the result of some cutting techniques would be offset by the increase and enhancement of suitable foraging habitat created by thinning or prescribed burning techniques.

Summary of BO Compliance (Alternatives 2 and 3): The June 23, 1999 Biological Opinion requires compliance with Terms and Conditions developed to protect and maintain the Indiana bat and its habitat on the MTNF. Alternatives 2 and 3 comply with those Terms and Conditions as follows:

- All known Indiana bat caves remain protected from human disturbance.
- The alternatives do not impact the designated old growth and mature forest around Indiana bat caves.

- The alternatives comply with minimum basal area and leave tree requirements specified in the BO and FLRMP.
- The alternatives will not involve activities within 0.25 mile of a known Indiana bat maternity site or any Area of Influence (AOI) for Indiana bats.
- The alternatives will not affect management recovery strategies for caves or lands on or adjacent to the MTNF.
- Prescribed burning activities proposed will comply with BO terms and conditions.
- The alternatives do not affect ongoing Indiana bat monitoring, surveys or research activities.
- The alternatives will not exceed allowable “take” during any given fiscal year.

Determination of Effect and Rationale (Alternatives 2 and 3): Because some of the activities proposed in Alternatives 2 and 3 may result in felling, knocking over, burning, or other disturbance to suitable roost trees while they may be occupied by Indiana bats, as well as temporarily reduce the availability of suitable foraging habitat for this species where it presently occurs, Alternatives 2 and 3 *may have an adverse effect* upon the Indiana bat and/or its habitat. While the potential for adverse impacts to the Indiana bat as a result of these kinds of activities is considered very low, it is not considered negligible and discountable because of the several hundred acres that would be treated by activities that may be potentially adverse. However, many of the activities proposed in Alternatives 2 and 3 may also have a beneficial indirect effect upon the Indiana bat and its habitat.

If an Indiana bat is found within the analysis area, consultation with the US Fish and Wildlife Service for this project will be re-initiated.

Bald Eagle

Direct Effects (Alternatives 1-3): There are no known records for bald eagles within the analysis area. No nests or roosts have been identified within the analysis area. Therefore, the activities proposed in Alternatives 1-3 would not be expected to have any direct effects upon known bald eagle nests or roosts. Protective measures incorporated into these alternatives would also protect any potential nest or roost trees where they would most likely occur (along larger perennial streams) because these measures would restrict any activities from occurring within the floodplains of these streams.

Indirect Effects (Alternative 1): There would be no prescribed burning or tree felling implemented under Alternative 1 and so, potential habitat for bald eagle would likely remain either in its current condition and be affected only by natural events such as windstorm, wildland fire, insect outbreaks, etc.

With implementation of Alternative 1, there may be an increased risk in insect infestations within potential habitat for bald eagles, because no activities would occur that would improve the resistance of forest stands that may currently be in an unhealthy condition. However, this would not be expected to have a measurable impact upon potential bald eagle habitat within the project area because most of the stands susceptible

to oak decline and insect infestations are in upland areas, and not within the riparian zones.

The anticipated die-off of trees due to lack of treatment may contribute to more intense wildland fires within the analysis area. Fuels would build-up with the forested stands as they succumb to disease and insects. Such a wildland fire has the potential of negatively impacting habitat for the bald eagle by killing large areas of standing timber along riparian zones and throughout the analysis area. However, the chances of such a wildland fire occurring would be hard to predict and therefore, these indirect effects may not be “reasonably certain to occur”.

Cumulative Effects (Alternative 1): Based upon known past, present, and foreseeable activities, this alternative is not expected to have a cumulative effect upon the bald eagle or its habitat. However, many of the watersheds and riparian corridors upon which this species depends for food, communal roosting, and nesting are under the control of private landowners and therefore, there is the possibility that actions by private individuals could negatively impact habitat occupied by this species. If this occurred, there is potential for lands along streams within the National Forest and within the analysis area to become more important for bald eagle recovery. However, since Alternative 1 will not involve activities that would reduce or destroy riparian habitat that is likely to be used by this species, it would not be expected to contribute to this potential cumulative effect.

NEPA Cumulative Effects (Alternative 1): The implementation of Alternative 1, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is expected to maintain habitat conditions similar to the current conditions. However, many of the watersheds and riparian corridors upon which this species depends for food, communal roosting, and nesting are under the control of private landowners and therefore, there is the possibility that actions by private individuals could negatively impact habitat occupied by this species. If this occurred, there is potential for lands along streams within the National Forest and within the analysis area to become more important for bald eagle recovery. Since Alternative 1 will not involve activities that would reduce or destroy riparian habitat that is likely to be used by this species, it would not be expected to contribute to this potential cumulative effect.

Summary of BO Compliance (Alternative 1): The June 23, 1999 Biological Opinion requires compliance with Terms and Conditions developed to protect and maintain the bald eagle and its habitat on the MTNF. Alternative 1 complies with those Terms and Conditions as follows:

- The alternative does not inhibit ongoing annual surveys for bald eagles.
- The alternative does not impact any known winter roost sites.
- The alternative does not occur within the 0.25 miles of old growth designated along water’s edge adjacent to known wintering areas.
- The alternative does not impact super-canopy trees along major riverways or lakes.
- The alternative does not involve or influence controlled burning activities that may impact bald eagles.

Determination of Effect and Rationale (Alternative 1): Alternative 1 would have *no direct effect* and *is not likely to indirectly adversely affect* the bald eagle or potential

habitat for this species. The potential for indirect effects upon its potential habitat (riparian forest) may be increased under this alternative because no activities would occur to improve the health and conditions of forested stands within the analysis area, making them susceptible to intense wildland fires, insect outbreaks, disease, or other forces that could lead to loss of forested conditions in riparian areas. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 1 is expected to have *no cumulative adverse effect* upon the bald eagle because it is not expected to influence potential recovery of this species throughout its range and would be in compliance with the FWS BO Terms and Conditions.

If a bald eagle nest or communal roost is discovered within the analysis area, consultation with the US Fish and Wildlife Service will be re-initiated for this project.

Indirect Effects (Alternatives 2-3): The greatest potential of a bald eagle occurring in the analysis area would be in the winter, when perhaps a transient bird may perch along a stream in the analysis area. Should such an eagle perch or pass through a proposed timber harvest or prescribed burning area during the time of treatment, it may be slightly disturbed by the human activity in the area, felling of trees, noise, or smoke, however, this disturbance would not be likely to adversely affect these birds since they are very mobile and perch in a variety of locations during the winter months.

There is some potential for loss of a suitable bald eagle roost tree if it occurs in upland areas where timber harvesting and other timber treatments and prescribed burning are proposed, however, this is not a high potential given that eagles prefer to roost along major bodies of water and not in upland areas. The retention of at least 15 basal area of canopy trees in all the treated areas, (as specified in Protective Measures in Appendix B), would also help to offset any loss of potential bald eagle roost/nest trees from these treatments by still providing some roosting habitat.

Activities that do not involve timber felling and burning are expected to have no impact upon bald eagles or their habitats.

Cumulative Effects (Alternatives 2-3): Based upon known past, present, and foreseeable activities, these alternatives are not expected to have a cumulative effect upon the bald eagle or its habitat. However, many of the watersheds and riparian corridors upon which this species depends for food, communal roosting, and nesting are under the control of private landowners and therefore, there is the possibility that actions by private individuals could negatively impact habitat occupied by this species. If this occurred, there is potential for lands along streams within the National Forest and within the analysis area to become more important for bald eagle recovery. However, since Alternatives 2-3 will not involve activities that would reduce or destroy riparian habitat that is likely to be used by this species, they would not be expected to contribute to this potential cumulative effect.

NEPA Cumulative Effects (Alternatives 2-3): The implementation of Alternatives 2 and 3, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is expected to maintain habitat conditions similar to the current conditions. However, many of the watersheds and riparian corridors upon which this species depends for food, communal roosting, and nesting are under the control of private landowners and therefore, there is the possibility

that actions by private individuals could negatively impact habitat occupied by this species. If this occurred, there is potential for lands along streams within the National Forest and within the analysis area to become more important for bald eagle recovery. However, since Alternatives 2-3 will not involve activities that would reduce or destroy riparian habitat that is likely to be used by this species, they would not be expected to contribute to this potential cumulative effect.

Summary of BO Compliance (Alternatives 2-3): The June 23, 1999 Biological Opinion requires compliance with Terms and Conditions developed to protect and maintain the bald eagle and its habitat on the MTNF. Alternatives 2-3 comply with those Terms and Conditions as follows:

- The alternatives do not inhibit ongoing annual surveys for bald eagles.
- The alternatives do not impact any known winter roost sites.
- The alternatives do not occur within the 0.25 miles of old growth designated along water's edge adjacent to known wintering areas.
- The alternatives do not impact super-canopy trees along major riverways or lakes.
- Prescribed burning activities proposed will comply with BO terms and conditions.

Determination of Effect and Rationale (Alternatives 2-3): Activities proposed in Alternatives 2-3 are *not likely to adversely affect* bald eagles or their roosting or nesting habitat. The activities would not impact habitat known to be used for nesting or winter communal roosting. There is potential for a transient, wintering bald eagle to occur within the analysis area, however, *transient winter use of the area is not likely to be affected* by any activities proposed in Alternatives 2-3. The implementation of Alternatives 2-3 are expected to have *no cumulative adverse effect* upon the bald eagle because they are not expected to influence potential recovery of this species throughout its range and would be in compliance with FWS BO terms and conditions.

If a bald eagle nest or communal roost is discovered within the analysis area, consultation with the US Fish and Wildlife Service will be re-initiated for this project.

Hine's Emerald Dragonfly

Direct Effects (Alternative 1): This species is documented within the analysis area on private land within Bates Hollow. There are also scattered fens within the analysis that could be potential habitat for this species. Alternative 1 would not implement any activities that may have a direct effect upon occupied or potential habitat for this species.

Indirect Effects (Alternative 1): With implementation of alternative 1, there may be an indirect effect upon potential habitat for this species. The anticipated die-off of trees due to lack of treatment may contribute to more intense wildland fires within the analysis area. Fuels would build-up with the forested stands as they succumb to disease and insects. Intense wildland fires would have the potential of burning over fens within and adjacent to the analysis area. This burning would most likely improve habitat conditions for this species, unless it occurred during a period of excessive drought or was of such intensity that it damaged the soils and root systems within the fen.

Intense wildland fires could indirectly affect potential habitat for the Hine's emerald dragonfly by changing the water quality or alter the waterflow through fens. Should an intense wildland fire occur within the analysis area as a result of lack of treatment of forest stands, it could contribute to increased soil loss and sedimentation of fens in the analysis area. Changes in water movement and availability could potentially have an indirect adverse effect upon nearby fens. Exclusion of controlled prescribed burning within these stands would also increase the potential for wildland fires to become intense and difficult to control. The chances of a wildland fire occurring within the analysis area, however, are virtually impossible to predict, and so, these possible indirect effects may be considered speculative and are not considered "reasonably certain to occur".

Cumulative Effects (Alternative 1): Based upon known past, present, and foreseeable activities, this alternative is not expected to have a cumulative effect upon this species or its habitat. Because of its dependence upon wetlands, fens, and similar habitats, the Hine's dragonfly is most vulnerable to activities that may result in the destruction of these habitats, alter the hydrology of the habitats, or contaminate their water sources. Many such activities are occurring on lands controlled by private landowners by individuals who refuse to follow restrictions developed in order to protect these habitats. Implementation of activities proposed in Alternative 1, however, would not result in any disturbance or degradation of habitat known to be occupied by Hine's emerald dragonfly, and therefore, is not expected to contribute to any cumulative adverse effects upon this species.

NEPA Cumulative Effects (Alternative 1): The implementation of Alternative 1, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is expected to maintain habitat conditions similar to the current conditions. Because of its dependence upon wetlands, fens, and similar habitats, the Hine's dragonfly is most vulnerable to activities that may result in the destruction of these habitats, alter the hydrology of the habitats, or contaminate their water sources. Many such activities are occurring on lands controlled by private landowners by individuals who refuse to follow restrictions developed in order to protect these habitats. Implementation of activities proposed in Alternative 1, however, would not result in any disturbance or degradation of habitat known to be occupied by Hine's emerald dragonfly, and therefore, is not expected to contribute to any cumulative adverse effects upon this species.

Summary of BO Compliance (Alternative 1): The 1998 Mark Twain National Forest Programmatic Biological Assessment did not address this species. The June 23, 1999 Biological Opinion did not address this species. Therefore, programmatic consultation has not been requested for this species, and there are no Reasonable and Prudent Measures or Terms and Conditions with which to comply.

Determination of Effect and Rationale (Alternative 1): Alternative 1 would have *no direct effect* and *is not likely to indirectly adversely affect* the Hine's emerald dragonfly or potential habitat for this species. The potential for indirect or cumulative adverse effects upon some potential habitat for this species may be increased under this alternative because no activities would occur to improve the health and conditions of forested stands within the project area, making them susceptible to intense wildland fires,

insect outbreaks, disease, or other forces. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 1 is expected to have *no cumulative adverse effect* upon the Hine's emerald dragonfly because it is not expected to influence potential recovery of this species throughout its range.

If a Hine's emerald dragonfly is found within the analysis area (other than the existing documented location), consultation with the US Fish and Wildlife Service for this project will be re-initiated.

Direct Effects (Alternatives 2-3): This species is documented within the analysis area on private land within Bates Hollow. There is suitable habitat for this species within the analysis area in the form of scattered fens on National Forest and private lands. The only activities proposed in Alternatives 2-3 that could directly impact potential individuals and habitat for the Hine's emerald dragonfly would be prescribed burning. There are fens located within some of the prescribed burning units and the Bates Hollow location is within 100 yards of a proposed burn. Prescribed burning that includes fens or is adjacent to the private land in Bates Hollow where this species is documented, would occur from November-April, when adults would not be present. Larva occur in streamlet and crayfish burrows and may become less active during this period as well, crawling into tight spaces from late fall to early spring. Prescribed burn also would not occur at times when these fens are likely to be adversely impacted by this activity (that is, on days when the fen is completely dry) because prescribed burns are not typically done during periods of extreme dry weather that would create these conditions. More than likely, burning would occur when the fens still have some wet soil, creating a "top" burn of vegetation but leaving the substrate and roost systems intact. Such a burn would likely have a rejuvenating effect upon the fens and could increase the availability of suitable habitat for this species, because many of these fens are being overtaken by encroaching wood vegetation. To benefit Hine's emerald dragonflies, these fens should be left in a grassy, open condition, and this condition may be maintained by periodic burning (P.Nelson, pers.comm.).

The remaining activities associated with these alternative, such as timber harvesting, temporary road construction, grazing, etc, would not be expected to have any direct impact upon fens because none of these activities would occur within 100 feet of a known fen.

Indirect Effects (Alternatives 2-3): Although botanical surveys identifying the location of fens and other rare habitats will be completed within the analysis area before proposed management activities are initiated, there is always a slight potential that an undiscovered fen occurs in the analysis area and could be indirectly affected by activities occurring within 100 feet of it, prior to its discovery. Such activities could be the felling of trees during timber harvesting, construction of temporary roads and dozerline for prescribed burn, etc. However, this potential for indirect effects upon an undiscovered fen is considered very low since a botanist and others will survey most of the area.

Potential habitat for the Hine's emerald dragonfly can also be indirectly affected by activities that may change the water quality or alter the waterflow through fens. In these alternatives, activities such as temporary road construction, road reconstruction, skidding and dragging associated with commercial removal of merchantable timber, the

construction of dozerlines and, to a lesser degree, waterhole maintenance, fishing pond rehabilitation, erosion control activities, glade restoration, grazing, and wildlife habitat improvement have the potential of disturbing soils, which may lead to increased sedimentation of adjacent streamcourses or fens. By restricting these activities within 100 feet of a fen, however, it is expected that the water quality within the fens will be protected by the 100 foot buffer that would act as a filter strip. Protective measures in the burn plan will be included to prevent contamination of water in fens from chemicals used in aerial ignition and petroleum products in drip torch fuel. These measures will include no hand lighting with drip torches within 100 feet of a fen and no aerial ignition within 100 yards of a fen. Fen locations will be identified on burn plan maps.

Timber harvest activities that result in the removal of the majority of the overstory could increase the amount of water movement on and beneath the soil surface, since fewer trees would be available to absorb this water through their root systems. Such changes in water movement and availability could potentially have an indirect adverse effect upon nearby fens. This increase in water would be offset, somewhat, however, by the proliferation of stump sprouts originating from the cut trees and more open, drier conditions created by overstory removal, as well as by the 100 foot buffer zone around existing fens.

Several protective measures have been incorporated into these alternatives that will minimize the potential for soil movement from activities proposed. With implementation of these protective measures, no soil movement is expected to occur at rates that would adversely affect the water quality of adjacent fens. Past monitoring of similar projects on the MTNF has indicated that soil movement levels were well within the allowable soil loss established in the Forest Plan (U.S. Forest Service 2002).

Cumulative Effects (Alternatives 2-3): Based upon known past, present, and foreseeable activities, these alternatives are not expected to have a negative cumulative effect upon this species or its habitat. Because of its dependence upon wetlands, fens, and similar habitats, the Hine's dragonfly is most vulnerable to activities that may result in the destruction of these habitats, alter the hydrology of the habitats, or contaminate their water sources. Many such activities are occurring on lands controlled by private landowners by individuals who refuse to follow restrictions developed in order to protect these habitats. Implementation of activities proposed in Alternatives 2-3, however, would not result in any degradation of habitat known to be occupied by Hine's emerald dragonfly, and therefore, is not expected to contribute to any cumulative adverse effects upon this species. The prescribed burning of fen habitat within the analysis area, however, over the long-term, may have a beneficial cumulative effect by maintaining and possibly increasing the potential habitat for this species within its range.

NEPA Cumulative Effects (Alternatives 2-3): The implementation of Alternatives 2 and 3, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, would help to improve habitat for this species within the analysis area. Because of its dependence upon wetlands, fens, and similar habitats, the Hine's dragonfly is most vulnerable to activities that may result in the destruction of these habitats, alter the hydrology of the habitats, or contaminate their water sources. Many such activities are occurring on lands controlled by private landowners by individuals who refuse to follow restrictions developed in order to protect these habitats. Implementation of activities proposed in Alternatives 2-3,

however, would not result in any degradation of habitat known to be occupied by Hine's emerald dragonfly, and therefore, is not expected to contribute to any cumulative adverse effects upon this species. The prescribed burning of fen habitat within the analysis area, however, over the long-term, may have a beneficial cumulative effect by maintaining and possibly increasing the potential habitat for this species within its range.

Summary of BO Compliance (Alternatives 2-3): The 1998 Mark Twain National Forest Programmatic Biological Assessment did not address this species. The June 23, 1999 Biological Opinion did not address this species. Therefore, programmatic consultation has not been requested for this species, and there are no Reasonable and Prudent Measures or Terms and Conditions with which to comply.

Determination of Effect and Rationale (Alternatives 2-3): The implementation of Alternatives 2-3 would have no impact upon known populations of Hine's emerald dragonfly and *is not likely to adversely affect* potential habitat for this species. Potential habitat for this species includes fens within the analysis area, however, these fens will be protected from potentially soil disturbing activities with a 100' buffer zone. Other activities proposed in these alternatives would be expected to have either no adverse impact upon fens or would have a beneficial effect upon fens, and therefore, upon potential habitat for this species. The implementation of Alternatives 2-3 *would not contribute to an adverse cumulative effect* upon this species or its habitat, but may have a *cumulative beneficial effect* upon this species by increasing the suitability of fens for this species by reducing woody vegetation competition in formerly open fens.

If a Hine's emerald dragonfly is found within the analysis area (other than the existing documented location), consultation with the US Fish and Wildlife Service for this project will be re-initiated.

Running Buffalo Clover

Direct Effects (Alternatives 1-3): Activities proposed in Alternatives 1-3 would not be expected to have any direct effects upon running buffalo clover because it is not known from the analysis area and has not been found during botanical surveys of the analysis area.

Indirect Effects (Alternative 1): With implementation of Alternative 1, there may be an increased risk in insect infestations within potential habitat for running buffalo, because no activities would occur that would improve the resistance of forest stands that may currently be in an unhealthy condition. As stands become infested by insects or disease, they would gradually become more open and likely create favorable short-term conditions for running buffalo clover. However, this would not be expected to have a measurable impact upon potential habitat within the analysis area because most of the stands susceptible to oak decline and insect infestations are in upland areas, and not within the riparian zones.

The anticipated die-off of trees due to lack of treatment may also contribute to more intense wildland fires within the analysis area. Fuels would build-up with the forested

stands as they succumb to disease and insects. Intense wildland fires would have the potential of creating large areas of little canopy cover, which would likely benefit running buffalo clover. Exclusion of controlled prescribed burning within these stands would also increase the potential for wildland fires to become intense and difficult to control. The chances of a wildland fire occurring within the analysis area, however, are virtually impossible to predict, and so, these possible indirect effects may be considered speculative and are not considered “reasonably certain to occur”.

Overall, Alternative 1 is not expected to improve habitat conditions within the analysis area for the running buffalo clover. Under Alternative 1, there would be no implementation of activities that would benefit this species, such as prescribed burning.

Cumulative Effects (Alternative 1): Based upon known past, present, and foreseeable activities, this alternative is not expected to have a cumulative effect upon this species or its habitat. While once likely widespread across Missouri, the habitat for running buffalo clover continues to decrease as open woodlands along streams on private lands continue to be converted to agriculture and urban development. Where riparian corridors are not developed, habitat for the species across its range is vulnerable to the ongoing maturation of forests, minus the periodic disturbances such as burning, that likely historically maintained its habitat. The cumulative effect of riparian corridor development and management unfavorable to running buffalo clover on private lands could result in a net loss of suitable habitat for this species. Implementation of Alternative 1, however, would not likely contribute to the cumulative effect of loss of suitable habitat.

NEPA Cumulative Effects (Alternative 1): The implementation of Alternative 1, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is expected to maintain habitat conditions similar to the current conditions. While once likely widespread across Missouri, the habitat for running buffalo clover continues to decrease as open woodlands along streams on private lands continue to be converted to agriculture and urban development. Where riparian corridors are not developed, habitat for the species across its range is vulnerable to the ongoing maturation of forests, minus the periodic disturbances such as burning, that likely historically maintained its habitat. The cumulative effect of riparian corridor development and management unfavorable to running buffalo clover on private lands could result in a net loss of suitable habitat for this species. Implementation of Alternative 1, however, would not likely contribute to the cumulative effect of loss of suitable habitat.

Summary of Compliance with BO (Alternative 1): The June 23, 1999 Biological Opinion did not address this species because a determination of “May Affect – Not Likely to Adversely Affect” was made in the programmatic BA, and the FWS concurred with this determination for running buffalo clover. Therefore, the Biological Opinion does not address this species, and there are no Reasonable and Prudent Measures or Terms and Conditions with which to comply.

Determination of Effect and Rationale (Alternative 1): Alternative 1 would have *no direct effect* and *is not likely to indirectly adversely affect* the running buffalo clover or potential habitat for this species. The potential for indirect effects upon some potential habitat for this species may be increased under this alternative because no activities would occur to improve the health and conditions of forested stands within the analysis

area, making them susceptible to intense wildfires, insect outbreaks, disease, or other forces. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 1 is expected to have *no cumulative adverse effect* upon the running buffalo clover because it is not expected to influence potential recovery of this species throughout its range.

If running buffalo clover is found within the analysis area, consultation with the US Fish and Wildlife Service for this project will be re-initiated.

Indirect Effects (Alternatives 2-3): There may be adverse indirect effects upon potential habitat for this species where activities that cause soil disturbance occur along bottomlands and riparian zones occur. However, protective measures incorporated into this project would minimize this potential adverse effect by restricting or minimizing the activities that would be allowed to occur within floodplains of streams. In some cases, the light soil disturbance created by a skidder or dozer and the opening of the forest canopy associated with timber felling has been believed to be responsible for the maintenance of habitat for some populations of running buffalo clover (U.S. Forest Service 1998).

Potential habitat for running buffalo clover along the perennial streams within the analysis area may be indirectly benefited by prescribed burning. On the MTNF, one of the most probable limiting factors for running buffalo clover is loss of open woodlands as forest have grown denser and loss of periodic fire (U.S. Forest Service 1998). Reintroduction of fire to potential habitat areas would likely improve habitat conditions for this species.

Aside from the beneficial effects of prescribed burning, and the unlikely adverse effects created by soil disturbance associated with dozerline construction, road reconstruction, dump cleanup, wildlife habitat improvement, grazing, and erosion control activities within potential habitat for this species, no other activities proposed in Alternatives 2 and 3 are anticipated to have any effect upon potential habitat for this species. Glade restoration and waterhole maintenance activities would not occur in suitable potential habitat for this species since these activities would occur on the higher elevations and uplands.

Cumulative Effect (Alternatives 2 and 3): Based upon known past, present, and foreseeable activities, this alternative is not expected to have a cumulative effect upon this species or its habitat. While once likely widespread across Missouri, the habitat for running buffalo clover continues to decrease as open woodlands along streams on private lands continue to be converted to agriculture and urban development. Where riparian corridors are not developed, habitat for the species across its range is vulnerable to the ongoing maturation of forests, minus the periodic disturbances such as burning, that likely historically maintained its habitat. The cumulative effect of riparian corridor development and management unfavorable to running buffalo clover could result in a net loss of suitable habitat for this species. Implementation of Alternatives 2 and 3, however, would not likely contribute to the cumulative effect of loss of suitable habitat. In contrast, some soil disturbance, the opening of the overstory, and prescribed burning of lower slopes and along streamcourses would potentially improve habitat for this species.

NEPA Cumulative Effects (Alternatives 2-3): The implementation of Alternatives 2 and 3, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, would help to improve habitat for this species within the analysis area. While once likely widespread across Missouri, the habitat for running buffalo clover continues to decrease as open woodlands along streams on private lands continue to be converted to agriculture and urban development. Where riparian corridors are not developed, habitat for the species across its range is vulnerable to the ongoing maturation of forests, minus the periodic disturbances such as burning, that likely historically maintained its habitat. The cumulative effect of riparian corridor development and management unfavorable to running buffalo clover could result in a net loss of suitable habitat for this species. Implementation of Alternatives 2 and 3, however, would not likely contribute to the cumulative effect of loss of suitable habitat. In contrast, some soil disturbance, the opening of the overstory, and prescribed burning of lower slopes and along streamcourses would potentially improve habitat for this species.

Summary of Compliance with BO (Alternatives 2 and 3): The June 23, 1999 Biological Opinion did not address this species because a determination of “May Affect – Not Likely to Adversely Affect” was made in the programmatic BA, and the FWS concurred with this determination for running buffalo clover. Therefore, the Biological Opinion does not address this species, and there are no Reasonable and Prudent Measures or Terms and Conditions with which to comply.

Determination of Effect and Rationale (Alternatives 2-3): Implementation of Alternatives 2 and 3 *are not likely to adversely affect* running buffalo clover. No habitat known to support this species is known to occur within the analysis area. Any anticipated adverse effects to potential habitat for this species would be negligible and offset by the beneficial effects these alternatives would have upon potential habitat.

If running buffalo clover is found within the analysis area, consultation with the US Fish and Wildlife Service for this project will be re-initiated.

Pink mucket pearl mussel

Direct Effects (Alternatives 1-3): Pink mucket pearl mussel has not been documented from within the analysis area. The closest known site for this species is approximately 55 air miles (100 river miles) NE of the analysis area in the Meramec River. None of the activities proposed would directly impact the Meramec River, so there are expected to be no direct effects upon this species or its habitat.

Indirect Effects (Alternative 1): Under Alternative 1, there may be an indirect effect upon potential habitat for this species. The anticipated die-off of trees due to lack of treatment may contribute to more intense wildland fires within the analysis area. Fuels would build-up within the forested stands as they succumb to disease and insects. Should an intense wildland fire occur within the analysis area as a result of lack of treatment of forest stands, it could contribute to increased soil loss and sedimentation of the headwaters of the Meramec River. Exclusion of controlled prescribed burning within these stands would also increase the potential for wildland fires to become intense and difficult to control. The chances of a wildland fire occurring within the analysis area,

however, are virtually impossible to predict, and so, these possible indirect effects may be considered speculative and are not considered “reasonably certain to occur”.

Alternative 1 would also not implement any activities, such as erosion control, dump removal, and non-system road closure, which could have an indirect beneficial effect upon the water quality of the headwaters of the Meramec River.

Cumulative Effects (Alternative 1): Based upon known past, present, and foreseeable activities, this alternative is not expected to have a cumulative effect upon this species or its habitat. The pink mucket pearlymussel is vulnerable to practices that cause soil movement on private and public lands, as this soil movement often leads to increases in sediment loads within the streams and rivers, and can adversely impact the species. The continued development of private land for homes, recreation residences, unmanaged timber harvests, and other uses may (if not done conscientiously) contribute to sediment and pollution loads in the watersheds occupied by the species.

Under Alternative 1, no new activities would contribute to the cumulative effect of soil movement into streams. However, the current effects occurring within the watershed as the result of existing erosion from unregulated roads, streambank destabilization, and water contamination from garbage dumps would also not be minimized under Alternative 1. Therefore, while there are not any anticipated cumulative adverse effects resulting from the implementation of Alternative 1, there also are no anticipated cumulative beneficial effects, either, because this alternative would not involve a change in the existing conditions within the watersheds.

NEPA Cumulative Effects (Alternative 1): The implementation of Alternative 1, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is expected to maintain habitat conditions similar to the current conditions. The pink mucket pearlymussel is vulnerable to practices that cause soil movement on private and public lands, as this soil movement often leads to increases in sediment loads within the streams and rivers, and can adversely impact the species. The continued development of private land for homes, recreation residences, unmanaged timber harvests, and other uses may (if not done conscientiously) contribute to sediment and pollution loads in the watersheds occupied by the species.

Under Alternative 1, no new activities would contribute to the cumulative effect of soil movement into streams. However, the current effects occurring within the watershed as the result of existing erosion from unregulated roads, streambank destabilization, and water contamination from garbage dumps would also not be minimized under Alternative 1. Therefore, while there are not any anticipated cumulative adverse effects resulting from the implementation of Alternative 1, there also are no anticipated cumulative beneficial effects, either, because this alternative would not involve a change in the existing conditions within the watersheds.

Summary of Compliance with BO (Alternative 1): The June 23, 1999 Biological Opinion did not specifically address the pink mucket pearlymussel because a determination of “May Affect – Not Likely to Adversely Affect” was made in the MTNF programmatic BA. The FWS concurred with this determination for this species, and formal consultation was not required. Therefore, the Biological Opinion does not address

this species, and there are no Reasonable and Prudent Measures or Terms and Conditions with which to comply.

Determination of Effect and Rationale (Alternative 1): Alternative 1 would have *no direct effect* and *is not likely to indirectly adversely affect* the pink mucket pearl mussel or potential habitat for this species. The potential for indirect effects upon its potential habitat (headwater of the Meramec River) may be increased under this alternative because no activities would occur to improve the health and conditions of forested stands within the analysis area, making them susceptible to intense wildland fires, insect outbreaks, disease, or other forces that could lead to diminished water quality. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 1 is expected to have *no cumulative adverse effect* upon the pink mucket pearl mussel because it is not expected to influence potential recovery of this species throughout its range and would be in compliance with the MTNF Programmatic BA.

If a pink mucket pearl mussel is found within the analysis area, consultation with the US Fish and Wildlife Service for this project will be re-initiated

Indirect Effects (Alternatives 2-3): Aquatic species that occupy or may occupy the Meramec River watershed, such as pink mucket pearl mussel, are most susceptible to the effects that activities occurring within the watershed may have upon water quality. The 1998 MTNF BA indicated that activities within the headwaters of the Meramec, particularly Courtois and Huzzah Creeks, may strongly influence downstream habitat conditions for this species.

Activities with the greatest potential for impacts upon water quality involve those activities that would disturb the soil surface. In these alternatives, these activities include temporary road construction, road reconstruction, skidding and dragging associated with commercial removal of merchantable timber, the construction of dozerlines, and, to a lesser degree, waterhole maintenance, erosion control activities, glade restoration, and grazing.

However, several protective measures have been incorporated into these alternatives that will minimize any potential for soil movement from these activities. With implementation of these protective measures, no soil movement is expected to occur at rates that would adversely affect the water quality of adjacent streams, and therefore, the habitat for pink mucket pearl mussel. Past monitoring of similar projects on the MTNF has indicated that soil movement levels were well within the allowable soil loss established in the Forest Plan (U.S. Forest Service 2002).

Some of the activities proposed in these alternatives may also have an indirect beneficial effect upon potential habitat for the pink mucket pearl mussel. Under these alternatives, some activities would occur that could enhance the water quality of streams within the analysis area, and therefore, improve water quality in the Meramec River watershed. Activities that would improve water quality include dump removal, erosion control activities, and non-system road closure. Old growth designation has already occurred in the analysis areas and could benefit potential habitat for pink mucket pearl mussel, because much of this designated old growth is within riparian areas and along streamcourses.

Cumulative Effects (Alternative 2-3): Based upon known past, present, and foreseeable activities, this alternative is not expected to have a cumulative effect upon this species or its habitat. In addition to activities occurring as part of this project, this species is also vulnerable to practices that cause soil movement on private and public lands, as this soil movement often leads to increases in sediment loads within the streams and rivers, and can adversely impact the species. The continued development of private land for homes, recreation residences, unmanaged timber harvests, and other uses may (if not done conscientiously) contribute to sediment and pollution loads in the watersheds occupied by the species.

Within the analysis area, approximately 12% of the private land base has been developed for agricultural and residential uses, which typically have the greatest potential for soil movement and disturbance. With the remaining 88% representing either National Forest or forested private lands, it does not appear that conversion from forested to unforested conditions is contributing significantly to deterioration of the watersheds within the analysis area. However, much of the 12% on private not in forested conditions does occur in bottomlands and along riparian areas, since these are often the most easily cultivated and developed areas, therefore, activities within this 12% of the land base may be having more of an effect upon the watersheds than may be presented by simple comparison of percentage of forest versus non-forest within the analysis area.

The activities that are planned on the Mark Twain National Forest are designed and implemented in a manner to minimize soil movement off-site, and would not be expected to contribute to any deterioration of habitat for these species. Because these activities would occur primarily within upland areas, and not bottomlands, they would not be expected to contribute to any cumulative effects being created by activities occurring on private lands that may impact the pink mucket pearlymussel or its habitat.

NEPA Cumulative Effects (Alternatives 2-3): Based upon known past, present, and foreseeable activities, these alternatives are not expected to have a negative cumulative effect upon this species or its habitat. In addition to activities occurring as part of this project, this species is also vulnerable to practices that cause soil movement on private and public lands, as this soil movement often leads to increases in sediment loads within the streams and rivers, and can adversely impact the species. The continued development of private land for homes, recreation residences, unmanaged timber harvests, and other uses may (if not done conscientiously) contribute to sediment and pollution loads in the watersheds occupied by the species.

Within the analysis area, approximately 12% of the private land base has been developed for agricultural and residential uses, which typically have the greatest potential for soil movement and disturbance. With the remaining 88% representing either National Forest or forested private lands, it does not appear that conversion from forested to unforested conditions is contributing significantly to deterioration of the watersheds within the analysis area. However, much of the 12% on private not in forested conditions does occur in bottomlands and along riparian areas, since these are often the most easily cultivated and developed areas, therefore, activities within this 12% of the land base may be having more of an effect upon the watersheds than may be presented by simple comparison of percentage of forest versus non-forest within the analysis area.

The activities that are planned on the Mark Twain National Forest are designed and implemented in a manner to minimize soil movement off-site, and would not be expected to contribute to any deterioration of habitat for these species. Because these activities would occur primarily within upland areas, and not bottomlands, they would not be expected to contribute to any cumulative effects being created by activities occurring on private lands that may impact the pink mucket pearl mussel or its habitat.

Summary of FWS BO Compliance (Alternatives 2-3): The June 23, 1999 Biological Opinion did not specifically address the pink mucket pearl mussel because a determination of “May Affect – Not Likely to Adversely Affect” was made in the MTNF programmatic BA. The FWS concurred with this determination for this species, and formal consultation was not required. Therefore, the Biological Opinion does not address this species, and there are no Reasonable and Prudent Measures or Terms and Conditions with which to comply.

Determination of Effect and Rationale (2-3): Activities proposed in Alternatives 2-3 are *not likely to adversely affect* the pink mucket pearl mussel or its habitat. These alternatives would not involve conducting activities within the floodplains of the Meramec River or its major tributaries. Activities proposed have incorporated protective measures to minimize the potential for soil erosion and deposition in the watershed of the Meramec River, considered suitable habitat for the pink mucket pearl mussel. Given that the closest known record for this species is approximately 55 air miles (100 river miles) NE from the analysis area in the Meramec River, it is not likely that any of the activities proposed within the analysis area will have direct, indirect, or cumulative effects upon known populations of this species. Some of the activities proposed in Alternatives 2-3 *may have a beneficial effect* upon potential habitat for this species because they will improve existing sources of soil erosion and/or stream degradation.

If a pink mucket pearl mussel is found within the analysis area, consultation with the US Fish and Wildlife Service for this project will be re-initiated

SUMMARY OF DETERMINATIONS

The summary of determinations below is based upon the proposed management action as described in this BAE. *Should any change in the proposed management action as outlined in this BAE occur after the date that this evaluation is signed, all effects upon these federally-listed species may warrant re-evaluation before project implementation may continue.* Changes that would require a re-evaluation of effects upon these species include but may not be limited to:

- inability or failure to implement one or more of the protective measures outlined in this evaluation;
- any change in the proposed action that may increase the potential for adverse effects upon federal species beyond what has been disclosed in this evaluation;
- unknown or previously unaddressed federal species or their habitats are discovered in the project influence area.

Alternative 1

Species	Species present in analysis area?	Habitat present in analysis area?	Habitat affected by project?	Determination
Indiana bat	Possible ; may roost in suitable trees in the analysis area; may forage in the analysis area	Yes ; suitable roost trees present in analysis area; suitable foraging habitat present	Not likely ; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect.
Gray bat	Possible ; may forage over streams in analysis area	Yes ; suitable foraging habitat available along perennial streams in analysis area	Not likely ; potential effects from wildland fire and other forces unpredictable and immeasurable.	May affect-Is not likely to adversely affect
Bald eagle	Possible ; may forage in analysis area in the winter	Yes ; suitable habitat along larger perennial streams and waterbodies in analysis area	Not likely ; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect
Topeka shiner	No ; not known south of Missouri River	No ; no streams which feed prairie regions	No	No effect
Hine's emerald dragonfly	Possible ; documented nearby	Yes ; fens known to occur throughout analysis area	Not likely ; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect
Curtis' pearlymussel	No ; known range not within analysis area	No	No	No effect
Pink mucket pearlymussel	Not likely ; known range (Meramec watershed) is within analysis area, but known locations 100 miles downstream	Yes ; watershed of Meramec River	Not likely ; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect
Scaleshell mussel	No ; known range not within analysis area	No	No	No effect
Tumbling creek cavesnail	No ; known range not within analysis area	No ; no caves known within analysis area	No	No effect
Ozark hellbender	No ; known range not within analysis area	No	No	No effect
Running buffalo clover	Possible ; however species not documented from within analysis area	Yes ; riparian habitat known to occur throughout analysis area	Not likely ; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect
Mead's milkweed	No ; known range not within analysis area	No	No	No effect

Alternatives 2-3

Species	Species present in project area?	Habitat present in project area?	Habitat affected by project?	Determination
Indiana bat	Possible; may roost in suitable trees in the analysis area; may forage in the analysis area	Yes; suitable roost trees present in the analysis area; suitable foraging habitat present	Yes; will involve burning and felling of some suitable roost trees during time they may be occupied, activities could change potential foraging habitat	May adversely affect but no effects beyond those evaluated in the programmatic BA/BO.
Gray bat	Possible; may forage over streams in the analysis area	Yes; suitable foraging habitat available along perennial streams in the analysis area	Not likely; protective measures incorporated to protect riparian habitat	May affect-Is not likely to adversely affect
Bald eagle	Possible; may forage in the analysis area in the winter	Yes; suitable habitat along larger perennial streams and waterbodies in analysis area	Not likely; protective measures incorporated to protect riparian habitat	May affect-Is not likely to adversely affect
Topeka shiner	No; not known south of Missouri River	No; no streams which feed prairie regions	No	No effect
Hine's emerald dragonfly	Possible; documented nearby	Yes; fens known to occur throughout the analysis area	Yes; burning could enhance fen habitat; protective measures incorporated to protect fen habitat from negative water quality changes	May affect-Is not likely to adversely affect
Curtis' pearlymussel	No; known range not within analysis area	No	No	No effect
Pink mucket pearlymussel	Not likely; known range (Meramec watershed) is within analysis area, but know locations are 100 miles downstream	Yes; watershed of Meramec River	Not likely; protective measures incorporated to protect water quality	May affect-Is not likely to adversely affect
Scaleshell mussel	No; known range not within analysis area	No	No	No effect
Tumbling creek cavesnail	No; range not within analysis area	No; no caves known in analysis area	No	No effect
Ozark hellbender	No; known range not within analysis area	No	No	No effect
Running buffalo clover	Possible; however species not documented from within analysis area	Yes; riparian habitat known to occur throughout analysis area	Not likely; protective measures incorporated to protect riparian habitat, prescribed burning could improve habitat	May affect-Is not likely to adversely affect
Mead's milkweed	No; known range not within analysis area	No	No	No effect

CONSULTATION WITH OTHERS

Brant, Alan. Botanist. Contractor, US Forest Service, Mark Twain National Forest.

Bryan, John. Timber and Recreation Program Manager. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Davidson, Theresa. Biologist. US Fish and Wildlife Service, Ava Field Office, Ava, Missouri.

Haines, Thomas. District Ranger. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Massengale, David. Forester. US Forest Service, Mark Twain National Forest. Salem Missouri.

Moore, Dave. Forest Botanist/Ecologist, US Forest Service, Mark Twain National Forest, Rolla, Missouri.

Nelson, Paul. Forest Planning Ecologist. US Forest Service, Mark Twain National Forest, Rolla, Missouri.

Soard, Jerry. Zone FMO. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Sullivan, Amy. Transportation Planner. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Turner, Jay. NEPA Coordinator and Project Leader. US Forest Service, Mark Twain National Forest, Salem, Missouri.

BAE Prepared by:

/s/ Sarah A. Bradley

Sarah A. Bradley
Wildlife Biologist

13 April 2004

Date

Contact: sbradley@fs.fed.us
US Forest Service
Mark Twain National Forest
PO Box 460, 1301 South Main Street
Salem, MO 65560

REFERENCES AND DATA SOURCES

- Johnson, Tom R. 1997. The Amphibians and Reptiles of Missouri. Mo. Depart. Conserv. 369 pp.
- Missouri Department of Conservation, 2003. Missouri species of conservation concern checklist. Jefferson City, Missouri. 28 pp.
- Murray, S.W. and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis*). *Journal of Zoology*. London. 262(2) 197-206.
- Oesch, Ronald D. 1995. Missouri Naiades-a guide to the mussels of Missouri. Mo. Depart. Conserv. 271 pp.
- U.S. Fish and Wildlife Service, 1999. Biological Opinion on the Impacts of Forest Management and Other Activities to the Gray Bat, Bald Eagle, Indiana Bat, and Mead's Milkweed on the Mark Twain National Forest, Missouri, Columbia, Missouri, June 23, 1999.
- U.S. Fish and Wildlife Service, 2002a. Request of listing of federally threatened, endangered, and proposed species for the Mark Twain National Forest. Response to letter from Forest Supervisor. December 29, 2003.
- U.S. Fish and Wildlife Service, 2002b. Technical/Agency Draft Mead's milkweed (*Asclepias meadi*) Recovery Plan. Fort Snelling, Minnesota. 104 pp.
- U.S. Forest Service, Ecological Land Classification Aquatic Subsystem, Mark Twain National Forest.
- U.S. Forest Service, 1981. Ecological Land Classification Terrestrial Subsystem, Mark Twain National Forest, December.
- U.S. Forest Service, 1986. Mark Twain National Forest Land and Resource Management Plan, as amended. 234pp.
- U.S. Forest Service, 1998. Mark Twain National Forest Programmatic Biological Assessment, Eastern Region, Milwaukee, Wisconsin, September 1998
- U.S. Forest Service, 2000. Regional Forester Sensitive Species List dated February 29, 2000 (with list maintenance on 10/20/03).
- U.S. Forest Service, 2003. Monitoring report for desired future condition, management indicator species, federal threatened, endangered and proposed, and regional forester sensitive species for the Mark Twain National Forest. October.
- US Forest Service, 2002. Final Environmental Impact Statement, Oak Decline and Forest Health. Mark Twain National Forest.

Vogt, T., 2004. A Status Survey for the Hine's Emerald Dragonfly (*Somatochlora hineana*) in Missouri – 2003.

Zercher, D., 1999. Hine's Emerald Dragonfly (*Somatochlora hineana*) Draft Recovery Plan, Technical/Agency Draft, Region 3, U.S. Fish & Wildlife Service, Fort Snelling, MN.

DATABASES

Salem Ranger District CDS database.

Missouri Department of Conservation, Missouri Fish & Wildlife Information System, 2003. <http://www.conservation.state.mo.us/nathiso/mofwis>.

Missouri Department of Conservation, Missouri Natural Heritage Database. 2003 data transfer to the Mark Twain National Forest.

Mark Twain National Forest Computerized BE Program.

SUPPLEMENT TO THE BIOLOGICAL ASSESSMENT and EVALUATION
FOR

FEDERALLY LISTED SPECIES

Mark Twain National Forest
Salem Ranger District
Crawford and Dent Counties, Missouri

Crooked Creek Project

INTRODUCTION/ SURVEYS

North Central Research Station (Sybill Amelon and crew) conducted mist net surveys for bats on various days between July 7 and July 26, 2004 on the Salem Ranger District, Mark Twain National Forest (Appendix A). The ten areas surveyed were mainly small wildlife ponds within and adjacent to the Crooked Creek Project Area (Map 1). Six of the survey areas were within the project area and four were adjacent to the project area.

Gray Bat

Two female gray bats were captured, one on 7/8/04, 2.6 miles northeast of the Crooked Creek Project Area and one on 7/14/04, within the project area (Map 1). These bats were not tracked.

Indiana Bat

A post-lactating female Indiana bat was captured on 7/7/04 at a small wildlife pond in T34NR2W section 9, 3.7 miles northeast of the Crooked Creek Project Area. A transmitter was placed on her and she was tracked for over a week until 7/20/04 when there was no longer a signal at night. The trackers were unable to pick up her signal during the day due to access problems, so her roost tree(s)/roosting spot(s) were not found. She foraged almost every night over the Viburnum Trend Riding Area, which is a private ATV/MC riding area approximately 4 miles from the project area. She also foraged over FS and Doe Run property in the vicinity of the lead recycling facility and over a tailings pond owned by Cominco. (Map 1).

An adult male Indiana bat was captured on 7/8/04 on a non-system road near a small wildlife pond in T34NR2W section 8, .2.6 miles northeast of the project area. A transmitter was placed on him and he was tracked for over a week until 7/20/04 when there was no longer a signal at night. The trackers were unable to pick up his signal during the day due to access problems, until 7/20/04 when his signal was tracked to a tree in a tailings pond. There was no signal that night, so it is assumed he dropped his transmitter in the tree. He foraged over FS and Doe Run property in the vicinity of the lead recycling facility and over a tailings pond owned by Cominco. (Map 2).

Another adult male Indiana bat was captured on 7/23/04 on a small wildlife pond in T33NR3W section 1, within the Crooked Creek Project Area. A transmitter was placed

on him and he was tracked for over a week until 8/5/04 when the transmitter was found at the base of a roost tree. He roosted in 5 different trees, all on FS and foraged mainly over FS in uplands and over old fields on FS and private. Enough data was collected for S. Amelon to run through a program she has to determine home range. Although he used 5 different trees, he roosted in one tree every day for a week. This tree was located in an area that had burned in a wildland fire on May 17, 2000. (Map 3)

Environmental Baseline

Gray Bat

Occurrence within the project area- The BE dated 4/13/04 states “it would not be surprising to find gray bats within the analysis area” and the effects to this species and its habitat were discussed in the BE. The capture of two gray bats during the mist net survey (one within the project area) indicates that gray bats are foraging within the analysis area. Gray bats are documented traveling several miles each night from their roost caves to forage (Amelon, pers. comm.). These captured bats could have easily traveled from a documented gray bat cave outside of the analysis area.

Effects of the Proposed Management Actions

Gray Bat

Alternative 1- There is no change to the direct, indirect, cumulative effects discussion, summary of BO compliance, and determination of effect and rationale for Alternative 1 in the BE dated 4/13/04.

Alternatives 2 and 3 (Direct Effects)- There would be no impact to known gray bat caves, since none are known to occur within the analysis area. Foraging gray bats would not likely be impacted by proposed management activities within the analysis area that take place during the day since they generally roost in caves during the day. The capture site of one of the gray bats is adjacent to a proposed prescribed burn (Map 4). Some prescribed burns, especially the larger burns proposed, could possibly produce smoke and flames throughout the night. Some areas may temporarily be unsuitable for foraging gray bats. Foraging gray bats could easily avoid these areas since they are known to travel several miles each night to forage. Smoke would be in the area for a relatively short period and prescribed burns are normally conducted during burn periods that are conducive to smoke dispersal. Wildlife ponds, perennial streams, and uplands would continue to be available for foraging after proposed management activities are implemented.

Alternatives 2 and 3 (Indirect, cumulative, summary of BO compliance)- There is no change to the indirect and cumulative effects discussion and summary of BO compliance for these alternatives from the BE dated 4/13/04.

Alternatives 2 and 3 (Determination of Effect and Rational)- Implementation of activities proposed in Alternatives 2 and 3 are *not likely to have an adverse effect* upon gray bats or their habitat. No direct or indirect disturbance to known gray bat caves is anticipated as a result of any of these activities. While the potential does exist for undiscovered gray bat caves to be in the analysis area, based upon past surveys, this potential is considered very low. Any foraging gray bats or their foraging habitat that

may be within the analysis area may be temporarily impacted by proposed activities during implementation, especially prescribed burns that continue into the night. Foraging gray bats could easily avoid these areas during implementation of proposed management activities since they are known to travel several miles each night to forage. Wildlife ponds, perennial streams, and uplands would continue to be available for foraging after proposed management activities are implemented. The implementation of Alternatives 2 and 3 would be expected to have no cumulative effect upon gray bats because the alternatives do not jeopardize recovery of the species and their implementation is in compliance with USFW BO terms and conditions.

Environmental Baseline

Indiana Bat

Occurrence within the project area- A male Indiana bat has been captured within the Crooked Creek Project Area. This male also roosted and foraged within the project area. A post lactating female Indiana bat and another male Indiana bat were also captured 3.7 and 2.6 miles respectively NE of the project area.

Effects of the Proposed Management Actions

Indiana Bat

Alternative 1- There is no change to the direct, indirect, cumulative effects discussion, summary of BO compliance, and determination of effect and rationale for Alternative 1 in the BE dated 4/13/04.

Alternatives 2 and 3 (Direct Effects)- The activities proposed in Alternatives 2-3 still would not be expected to have any direct effects upon Indiana bats during their hibernation or fall and spring swarming periods (generally October thru April), or upon their hibernacula because no hibernacula are known to occur within or near the analysis area. The closest hibernaculum (Cave Hollow Cave) is 8 miles away.

There is still a potential for directly impacting Indiana bats, however, during their summer roosting period (generally May thru September). Activities proposed that could have a direct adverse effect upon Indiana bats include timber harvesting, temporary road construction, prescribed burning, dozerline construction, glade restoration, and wildlife habitat improvement. These activities all have the potential of impacting bats that may be roosting in trees during the summer, particularly trees with characteristics that make them favorable for bat use. These direct adverse impacts could be the killing of roosting bats when trees are felled or burned, or abandonment of roost sites caused by disturbance created by activities associated with these treatments. Three of the documented roost trees of a male Indiana bat occur within a proposed final harvest and/or prescribed burn unit (Map 5).

The 4/13/04 BE refers to several protective measures that have been incorporated into these alternative to minimize the potential for this direct adverse impact upon summer roosting Indiana bats. One additional protective measure will be incorporated- not only will the known roost trees be retained during timber harvest activities (since they are all

dead trees), they will be identified as reserve trees when the unit is marked. Known roost trees within proposed prescribe burn units will be protected by raking the fuel away from the base of the trees before ignition of the burn unit to help prevent the known roost trees from igniting during the prescribed burn.

Alternatives 2 and 3 (Indirect, cumulative, summary of BO compliance)- There is no change to the indirect and cumulative effects discussion and summary of BO compliance for these alternatives from the BE dated 4/13/04.

Alternatives 2 and 3 (Determination of Effect and Rational)- Because an Indiana bat had been captured within the project area (and also roosted and foraged within the project area) and some of the activities proposed in Alternatives 2 and 3 may result in felling, knocking over, burning, or other disturbance to suitable roost trees while they may be occupied by Indiana bats, as well as temporarily reduce the availability of suitable foraging habitat for this species where it presently occurs, Alternatives 2 and 3 *may have an adverse effect* upon the Indiana bat and/or its habitat. While the potential for adverse impacts to the Indiana bat as a result of these kinds of activities is considered very low, it is not considered negligible and discountable because of the several hundred acres that would be treated by activities that may be potentially adverse and because a male Indiana has been captured within the project area. However, many of the activities proposed in Alternatives 2 and 3 may also have a beneficial indirect effect upon the Indiana bat and its habitat.

Update to Summary of Determinations *Alternative 1*

Species	Species present in analysis area?	Habitat present in analysis area?	Habitat affected by project?	Determination
Indiana bat	Yes; roosting in suitable trees in the analysis area; foraging in the analysis area	Yes; suitable roost trees present in analysis area; suitable foraging habitat present	Not likely; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect.
Gray bat	Yes; may forage over streams in analysis area, foraging over small ponds in the analysis area	Yes; suitable foraging habitat available along perennial streams and ponds in analysis area	Not likely; potential effects from wildland fire and other forces unpredictable and immeasurable.	May affect-Is not likely to adversely affect
Bald eagle	Possible; may forage in analysis area in the winter	Yes; suitable habitat along larger perennial streams and waterbodies in analysis area	Not likely; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect
Topeka shiner	No; not known south of Missouri River	No; no streams which feed prairie regions	No	No effect
Hine's emerald dragonfly	Possible; documented nearby	Yes; fens known to occur throughout analysis area	Not likely; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect
Curtis' pearlymussel	No; known range not within analysis area	No	No	No effect
Pink mucket pearlymussel	Not likely; known range (Meramec watershed) is within analysis area, but known locations 100 miles downstream	Yes; watershed of Meramec River	Not likely; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect
Scaleshell mussel	No; known range not within analysis area	No	No	No effect
Tumbling creek cavesnail	No; known range not within analysis area	No; no caves known within analysis area	No	No effect
Ozark hellbender	No; known range not within analysis area	No	No	No effect
Running buffalo clover	Possible; however species not documented from within analysis area	Yes; riparian habitat known to occur throughout analysis area	Not likely; potential effects from wildland fire and other forces unpredictable and immeasurable	May affect-Is not likely to adversely affect
Mead's milkweed	No; known range not within analysis area	No	No	No effect

Alternatives 2-3

Species	Species present in project area?	Habitat present in project area?	Habitat affected by project?	Determination
Indiana bat	Yes; roosting in suitable trees in the analysis area; foraging in the analysis area	Yes; suitable roost trees present in the analysis area; suitable foraging habitat present	Yes; will involve burning and felling of some suitable roost trees during time they may be occupied, activities could change potential foraging habitat	May adversely affect but no effects beyond those evaluated in the programmatic BA/BO.
Gray bat	Yes; may forage over streams in analysis area, foraging over small ponds in the analysis area	Yes; suitable foraging habitat available along perennial streams and ponds in the analysis area	Not likely; protective measures incorporated to protect riparian habitat; wildlife ponds, perennial streams, and uplands would continue to be available for foraging after proposed management activities are implemented.	May affect-Is not likely to adversely affect
Bald eagle	Possible; may forage in the analysis area in the winter	Yes; suitable habitat along larger perennial streams and waterbodies in analysis area	Not likely; protective measures incorporated to protect riparian habitat	May affect-Is not likely to adversely affect
Topeka shiner	No; not known south of Missouri River	No; no streams which feed prairie regions	No	No effect
Hine's emerald dragonfly	Possible; documented nearby	Yes; fens known to occur throughout the analysis area	Yes; burning could enhance fen habitat; protective measures incorporated to protect fen habitat from negative water quality changes	May affect-Is not likely to adversely affect
Curtis' pearlymussel	No; known range not within analysis area	No	No	No effect
Pink mucket pearlymussel	Not likely; known range (Meramec watershed) is within analysis area, but know locations are 100 miles downstream	Yes; watershed of Meramec River	Not likely; protective measures incorporated to protect water quality	May affect-Is not likely to adversely affect
Scaleshell mussel	No; known range not within analysis area	No	No	No effect
Tumbling creek cavesnail	No; range not within analysis area	No; no caves known in analysis area	No	No effect
Ozark hellbender	No; known range not within analysis area	No	No	No effect
Running buffalo clover	Possible; however species not documented from within analysis area	Yes; riparian habitat known to occur throughout analysis area	Not likely; protective measures incorporated to protect riparian habitat, prescribed burning could improve habitat	May affect-Is not likely to adversely affect
Mead's milkweed	No; known range not within analysis area	No	No	No effect

BAE Supplement Prepared by:

/s/ Sarah A. Bradley

Sarah A. Bradley
Wildlife Biologist

20 August 2004

Date

Contact: sbradley@fs.fed.us
US Forest Service
Mark Twain National Forest
PO Box 460, 1301 South Main Street
Salem, MO 65560

**Biological Evaluation
Regional Forester Sensitive Species
and Species of Concern**

**Crooked Creek Project
Salem Ranger District
Mark Twain National Forest**

(This BE includes species from the 02/29/00 R-9 list with maintenance on 10/20/03)

INTRODUCTION

Project Name: Crooked Creek

Analysis area Size: approximately 23,217 acres of Forest Service managed lands

Landtype Associations: Oak Hickory Hills (HM), Oak Pine Hills (HL)

Management Areas: 3.4-1, 2, 3

Counties: Crawford, Dent

Watershed: Meramec

Legal Description: See maps

The purpose of this Biological Evaluation (BE) is to document the potential effects that planned management activities associated with this project may have upon Regional Forester's Sensitive Species (RFSS) and other Species of Concern that are found on the Mark Twain National Forest (MTNF). The objectives of this BE are:

- e) to ensure that Forest Service actions do not contribute to a loss of viability on the Mark Twain National Forest or cause a trend toward federal listing of any species;
- f) to comply with the requirements of the Forest Land and Resource Management Plan and ensure that actions do not jeopardize the continued existence of these species on the National Forest;
- g) and to provide a process and standard by which to ensure that these species receive full consideration in the decision making process.

Site-specific effects determinations for each species are summarized at the end of this document.

PROPOSED MANAGEMENT ACTIONS

Summary of Proposed Action: The Salem Ranger District is proposing to improve forest health, enhance wildlife habitat, and provide additional recreational opportunities in the Crooked Creek Analysis Area. The proposed action is needed due to declining habitat diversity, forest health and vigor, and to meet desired future conditions as identified in the Mark Twain National Forest Land and Resource Management plan (LRMP), also known as the Forest Plan.

The alternatives that are being considered for implementation within the Crooked Creek Analysis Area are as follows:

Alternative 1 (No Action)

This alternative would initiate no new active management within the analysis area. This alternative provides a baseline (reference point) against which to describe the environmental effects of the two action alternatives being considered. This is a viable alternative and responds to concerns of those who want no active management to occur in the analysis area beyond what is currently ongoing as the result of natural processes, routine maintenance or current management direction. Existing grazing term permits would be allowed to expire.

Alternative 2 (Proposed Action)

This alternative would utilize commercial timber harvesting as a means for achieving forest health and vigor. This alternative would allow forest stands to be treated commercially by using the final harvests, seedtree, shelterwood, sanitation/salvage cut, overstory removal, selection with groups, and thinning methods. Some firewood removal would also be allowed. Some temporary openings created by proposed final harvest would be greater than 40 acres where proposed final harvest occurs next to existing final harvest temporary openings that are from 0 to 20 years old. Natural regeneration and pine planting would occur. These methods would achieve stand conditions that would favor regeneration of desirable tree species such as shortleaf pine, white oak, post oak, and hickories.

Several forest stands, including many timber harvest units, would be burned with prescribed fire to improve wildlife habitat and reduce hazardous fuels that may increase as a result of silvicultural treatments and may occur due to the level of tree mortality, wind and ice damage, understory growth, and past fire exclusion and to encourage pine and oak regeneration. Prescribed burning would most likely occur during the spring and fall seasons. In some cases, stands may be prescribed burned more than once in order to achieve woodland conditions and a more herbaceous understory and improve the grass, forb, and shrub components of the ground cover.

Wildlife habitat would also be improved by hand cutting and/or mowing of existing open and semi-open habitat in order to remove competing vegetation, including several small dolomite glades and the maintenance of existing waterholes. Some of the open and semi-open habitat areas will be burned on a 3 to 4 year rotation to encourage the proliferation of native grasses and forbs. In addition, term grazing permits will be re-issued with allotment management plans (that comply with the Forest Plan) for three existing grazing allotments.

The Forest Service in partnership with Missouri Department of Conservation would continue to maintain five lakes and ponds for fisheries: Howes Mill Lake, Howes Mill Pond, Howes Mill South, Huzzah cutoff pond number 3, and Gnuse pond. The Forest Service proposes fish stocking, fish habitat improvements (including fish structures, fertilization, liming), and dam maintenance and reconstruction (including draining and deepening Howe’s Mill Lake), for the five lakes and ponds managed for flat water fishing opportunities. This action will maintain existing flat water fishing opportunities for public fishing.

Soil and water improvements include cleanup of five dumps and closure of approximately 55 miles of non-system roads.

Some actions require other actions in order to be accomplished. These actions will be considered in the environmental analysis of this project.

Fire Lines: Existing roads and natural fire-breaks would be used whenever possible. New fire line construction would be necessary in some areas.

Proposed Road Work: There are 40 Forest Service system roads within the management areas, with a combined length of 52.5 miles. The analysis area contains approximately 36.3 square miles of National Forest System land. National Forest system roads within the analysis area vary from 0.1 miles to over 6 miles in length. The Crooked Creek project has 8.4 miles of system roads that need reconstruction before they can be used to access project activities. The other 44.1 miles of system road need routine maintenance, such as replacing surface material, surface blading, improving drainage features, removing brush from right-of-ways, and cleaning culverts. In addition to system roads, there are non-system roads on National Forest System land in the analysis area. The condition of these roads is usually fair to poor because no road improvement or maintenance work has ever been done.

Alternative 3 (Reduced Final Harvest with Natural Regeneration Only)

This alternative would be the same as Alternative 2 except there would be 320 acres less of final harvest (reduced final harvest) and there would be no pine planting (natural regeneration only). Proposed final harvest next to existing temporary openings that would result in final harvest temporary openings greater than 40 acres are dropped in this alternative.

Table 1. Alternative Activity Comparison Table

	Alt.1	Alt.2	Alt. 3
Silvicultural Methods	Acres	Acres	Acres
Final Harvest	0	932	637
Seed Tree	0	26	26
Shelterwood	0	1332	1332
Uneven Aged	0	1706	1706
Over-story Removal	0	122	122
Sanitation	0	580	580
Thin	0	1206	1206

<u>Reforestation</u>	Acres	Acres	Acres
Natural Regeneration	0	2462	2142
Pine Planting	0	667	0
<u>Timber Stand Improvement</u>	Acres	Acres	Acres
Crop Tree Release	0	0	0
<u>Prescribed Fire</u>		Acres	Acres
Open woodland development	0	2445	2445
Hazardous fuel reduction	0	5956	5956
<u>Transportation</u>	Miles	Miles	Miles
Temporary	0	25	23
Reconstruction	0	8.4	8.4
<u>Soil and Water</u>	Each	Each	Each
Dump Clean-up	0	5	5
Non-system closure	0	55	55
<u>Range/Wildlife</u>	Acres	Acres	Acres
Grazing	0	345	345
Fertilize	0	345	345
Mechanical-Hand Cut, Mow, and Waterhole Maintenance	0	1375	1375
<u>Fisheries *</u>	Acres	Acres	Acres
Pond Rehab	0	16	16
Stock Fish	0	16	16

* Includes Howe's Mill Lake Deepening, Fish Structures, and Howe's Mill South Spillway

SPECIES CONSIDERED AND EVALUATED

Regional Forester Sensitive species (RFSS) considered for the Crooked Creek BE are those known or likely to occur on Mark Twain National Forest. The Regional Forester's Sensitive Species list was first issued on March 8, 1994. An updated RFSS list was issued on February 29, 2000 with list maintenance on 10/20/03. As a result, the Mark Twain National Forest portion of the updated RFSS list contains 112 species of plants and animals. Of these 112 species, 53 species (21 animals, 32 plants) are likely or known to occur on the Salem Ranger District (see [Table xx](#), Appendix A).

In May 2001, the Mark Twain National Forest completed a Supplemental Information Report on RFSS. The analysis demonstrates how the 1986 Mark Twain National Forest Land and Resource Management Plan (Forest Plan) provides for ecological conditions that may lead to ensuring viable populations of these sensitive species. It concluded that the current Forest Plan adequately addresses habitat needs of all the species included on the list. By following the standards and guidelines in the current Forest Plan, the Mark Twain National Forest will provide habitat conditions conducive to maintaining viability of these

species. The SIR is on file at the Supervisor’s Office in Rolla and is hereby incorporated by reference. Population trends for RFSS can be found in the “Monitoring Report for DFC, MIS, Federal TEP, & RFSS Mark Twain National Forest (October 2003)”.

A review of field surveys, the Missouri Fish and Wildlife Information System (MoFWIS) for Crawford and Dent Counties (Meramec River drainage), Missouri, plus a review of the Missouri Heritage 2003 (10/28/03, ver. 1.3) database, and the MTNF BE Program for the two LTAs in the project area were done to determine which species to evaluate in this BE.

The “analysis area” is defined as the area in which activities associated with one or more of the alternatives could potentially have a direct, indirect, or foreseeable cumulative effect upon a RFSS species or species of concern or habitat in which the species is likely to occur.

RFSS and species of concern evaluated in the Crooked Creek BE are those species that

- a) are documented within the analysis area,
- b) have suitable habitat within the analysis area, or
- c) may be affected by project activities.

RFSS and species of concern that are known or likely to occur in Crawford and Dent counties in the Meramec River drainage or with documented occurrences or potential habitat in the Oak Hickory Hills (HM) and Oak Pine Hills (HL) LTA’s, but which do not have suitable habitat in the analysis area or that the project will not affect, were not evaluated further.

The following table shows **species evaluated** and their possible location in or near the analysis area.

Table 1. Regional Forester’s Sensitive Species likely or known to occur within the analysis area or that may be affected by project activities (Species’ scientific names in bold have been documented in the analysis area; species’ scientific names not in bold are considered known or likely, according to BE Program & MOFWIS, but have not been documented within the analysis area)			
Scientific Name	Common Name	Species Group	Suitable Habitat in Analysis Area
<i>Agalinis skinneriana</i>	Purple false-foxglove	Plant	Glades
<i>Aimophila aestivalis</i>	Bachman’s sparrow	Bird	Glades, old fields, clearcuts
<i>Anemone quinquefolia</i>	Wood anemone	Plant	Fens
<i>Aster dumosus var. strictior</i>	Tradescant aster	Plant	Fens
<i>Aster furcatus</i>	Forked aster	Plant	Moist rocky ledges
<i>Aster macrophyllus</i>	Big-leaved Aster	Plant	Cliff face/bare rock

Table 1. Regional Forester's Sensitive Species likely or known to occur within the analysis area or that may be affected by project activities
 (Species' scientific names in bold have been documented in the analysis area; species' scientific names not in bold are considered known or likely, according to BE Program & MOFWIS, but have not been documented within the analysis area)

Scientific Name	Common Name	Species Group	Suitable Habitat in Analysis Area
<i>Calamagrostis porteri</i> <i>var. insperata</i>	Oferhollow reed grass	Plant	Cliff face/bare rock
<i>Campanula aprinoides</i>	Marsh bellflower	Plant	Fens
<i>Campylium stellatum</i>	Yellow starry fen moss	Moss	Fens
<i>Carex buxbaumii</i>	Buxbaum's sedge	Plant	Fens
<i>Carex cherokeensis</i>	Cherokee sedge	Plant	Miscellaneous wetlands
<i>Carex decomposita</i>	Epiphytic sedge	Plant	Miscellaneous wetlands
<i>Carex fissa</i> <i>var. fissa</i>	Hammock sedge	Plant	Miscellaneous wetlands
<i>Carex sterilis</i>	Dioecious sedge	Plant	Fens
<i>Carex straminea</i>	Straw sedge	Plant	Miscellaneous wetlands
<i>Carex stricta</i>	Tussock sedge	Plant	Fens
<i>Carex tenanica</i>	Rigid sedge	Plant	Fens
<i>Carex triangularis</i>	Eastern fox sedge	Plant	Miscellaneous wetlands
<i>Cryptobranchus alleganiensis</i>	Eastern hellbender	Amphibian	Meramec drainage
<i>Crystallaria asprella</i>	Crystal darter	Fish	Meramec drainage
<i>Cumberlandia monodonta</i>	Spectacle case	Mollusk	Meramec drainage
<i>Cycleptus elongatus</i>	Blue sucker	Fish	Meramec drainage
<i>Dendroica cerulea</i>	Cerulean warbler	Bird	Bottomland hardwoods, riparian
<i>Echinacea simulata</i>	Wavy-leaf purple coneflower	Plant	Glades
<i>Juglans cinerea</i>	Butternut	Plant	Riparian, rich woods, base of slopes
<i>Juncus debilis</i>	Weak rush	Plant	Miscellaneous wetlands
<i>Lanius ludovicianus migrans</i>	Migrant loggerhead shrike	Bird	Old fields with scattered shrubs and trees
<i>Menyanthes trifoliata</i>	Bog buckbean	Plant	Fens
<i>Metzgeria furcata</i>	a liverwort	Plant	Cliff face/bare rock
<i>Ophiogomphus westfalli</i>	Westfall's snaketail	Insect	Fens
<i>Parnassia grandifolia</i>	Large-leaved grass of Parnassuss	Plant	Fens, seeps, springs
<i>Phlox maculata</i> <i>ssp. pyramidalis</i>	Spotted phlox	Plant	Fens
<i>Potamogeton pulcher</i>	Spotted pondweed	Plant	Miscellaneous wetlands
<i>Schoenoplectus purshianus</i>	Weak-stalk bulrush	Plant	Miscellaneous wetlands
<i>Scutellaria bushii</i>	Bush's skullcap	Plant	Glades

Table 1. Regional Forester’s Sensitive Species likely or known to occur within the analysis area or that may be affected by project activities
 (Species’ scientific names in bold have been documented in the analysis area; species’ scientific names not in bold are considered known or likely, according to BE Program & MOFWIS, but have not been documented within the analysis area)

<i>Scientific Name</i>	Common Name	Species Group	Suitable Habitat in Analysis Area
<i>Silene regia</i>	Royal catchfly	Plant	Glades
<i>Solidago gattingerii</i>	Gattinger’s goldenrod	Plant	Glades
<i>Spiranthes ovalis var. erostellata</i>	Ladies’ tresses	Plant	Fens
<i>Stenonema bednariki</i>	A heptageniid mayfly	Insect	Meramec drainage
<i>Sullivantia sullivantii</i>	Sullivantia	Plant	Cliff face/bare rock
<i>Torreychloa pallida</i>	Pale manna grass	Plant	Miscellaneous wetlands

(MoFWIS report 12/3/03; BE Program reports run 11/19/03)

There is **no designated essential habitat, either occupied or unoccupied** for any regional sensitive species in the Crooked Creek Analysis area.

In addition to these RFSS species, there are other Species of Concern that have no Regional Forester or federal status, yet, are considered in this evaluation because they have some type of state designation that determines they are at risk in Missouri or throughout their range. These species were identified for the Mark Twain National Forest using the Missouri Fish and Wildlife Information System (MoFWIS) 7/13/00 and Wildlife Code of Missouri (3/1/03) and are shown in Table 3A.

A review of this list using MoFWIS, the BE Program and the MTNF Heritage CD (10/28/03 ver. 1.3) indicated that, of all these Species of Concern, only the following would be expected to occur within the analysis area or be affected by project activities because there is habitat available within the analysis area or downstream from the analysis area.

Table 2. Additional Species of Concern known or likely to occur in the analysis area or that may be affected by project activities
 (Species’ scientific names in bold have been documented in the analysis area; species’ scientific names not in bold are considered known or likely, according to BE Program & MOFWIS, but have not been documented within the analysis area)

<i>Scientific Name</i>	Common Name	Species Group	Suitable Habitat in Analysis Area
<i>Circus cyaneus</i>	Northern harrier	Bird	Winter transient-pasture, large openings
<i>Platygobio gracilis</i>	Flathead chub	Fish	Meramec drainage
<i>Elliptio crassidens</i>	Elephantear	Mollusk	Meramec drainage

Table 2. Additional Species of Concern known or likely to occur in the analysis area or that may be affected by project activities
 (Species' scientific names in bold have been documented in the analysis area; species' scientific names not in bold are considered known or likely, according to BE Program & MOFWIS, but have not been documented within the analysis area)

<i>Scientific Name</i>	Common Name	Species Group	Suitable Habitat in Analysis Area
<i>Epioblasma triquetra</i>	Snuffbox	Mollusk	Meramec drainage
<i>Fusconaia ebena</i>	Ebonyshell	Mollusk	Meramec drainage
<i>Plethobasus cyphus</i>	Sheepnose	Mollusk	Meramec drainage

SURVEY INFORMATION

In preparation of this BE, site-specific surveys within the analysis area were combined with a general knowledge of the habitats that are likely or known to occur within the project influence areas. Sarah Bradley (USFS biologist) conducted biological field surveys of the project area on 5/14/02, 5/23/02, 12/11/02, 4/29/03, 5/12/03, 8/13/03, 8/14/03, and 12/18/03. These surveys were cursory in nature and focused on determining the habitat conditions within the analysis area and locating potential habitat for wildlife species.

Botanical surveys are also being conducted by a contract botanist (Alan Brant) from September 2003 to September 2004 and results of those surveys have been reviewed as part of this BE. These botanical surveys are focusing on the drainages within the analysis area (generally considered areas of highest potential for rare plant communities).

Additional special habitat information such as seep, fen, and glade locations was collected by Angie Sites, Larry Ness (USFS Forestry Technicians) John Bryan, and David Massengale (USFS Foresters) during their extensive heritage resource and prescription field surveys within the analysis area and reviewed during the preparation of this BE.

Other surveys not specific to this project have been conducted in the vicinity of the analysis area. For example, in partnership with Mark Twain National Forest and others, the Missouri Department of Conservation has been very aggressive in conducting species surveys and maintaining data on both listed and common species. The Missouri Heritage Database not only includes specific locations of plant and animal species, but also includes occurrences of unique and/or rare natural communities. Many of these communities are suitable habitat for RFFS. This database provides an excellent and up-to-date source of information on occurrences of TES species. **Missouri Heritage database has documented occurrences of RFFS species in the Crooked Creek Analysis area.**

The Missouri Fish and Wildlife Information System (MOFWIS) includes information on over 700 species of animals and plants (life history, status, known & possible locations, etc.). This database is also an excellent source of information regarding possible locations of TES species on Mark Twain National Forest.

Species' experts in Missouri have also been very aggressive in publishing excellent reference material that includes species' locations in the state as well as potential habitat. Publications include: Missouri Wildflowers, Missouri Orchids, Field Guide to Missouri Ferns, Walk Softly Upon the Earth (lichens & mosses), Steyermark's Flora of Missouri, Flora of Missouri, Volume 1, Butterflies and Moths of Missouri, The Crayfish of Missouri, The Fishes of Missouri, Naiades of Missouri, Birds of Missouri, and The Amphibians and Reptiles of Missouri. All these publications were consulted during evaluation of potential effects to RFSS species and Species of Concern in the Crooked Creek Analysis area.

The Nature Conservancy maintains Element Stewardship Abstracts and Element Global Rankings that give specific information on species' locations, habitats, threats, propagation, life history, etc. The Natureserve website contains distribution and status information on a variety of species and natural communities. These data sources were also consulted when analyzing potential effects of implementing alternatives in the Crooked Creek Analysis area.

In addition to the extensive fieldwork done in preparation of the Missouri Heritage and MOFWIS databases and the publications, there are numerous field surveys conducted annually or as part of research projects in Missouri. The Mark Twain National Forest also has conducted surveys in partnership with others, or on its own. A sampling of these, include but are not limited to:

- Annual mid-winter eagle surveys – Current River
- Annual eagle nest surveys
- Forest bat surveys (cave, fall, summer, winter, mist-net, harp-trap, Anabat)
- Missouri Breeding Bird Atlas
- Missouri Breeding Bird Survey Routes
- Cave Research Foundation Biological Inventories
- Gardner & Gardner Cave Inventories
- Botanical Surveys
- Naiades survey 1980-1982

All these surveys are relevant to the Crooked Creek Analysis area. While not all of them were conducted specifically on the Crooked Creek Analysis area, they provide information concerning suitable habitats for various species on this district.

Specialists in biology, soils, timber, heritage resources conducted field visits throughout the analysis area during the pre-NEPA phase of planning, and during project planning. These visits were conducted at various times of the year for various reasons.

The information available on TES locations and potential habitats in the Crooked Creek Analysis area is of sufficient quantity, quality, and relevance to make an accurate and complete analysis of potential effects on TES species in the Crooked Creek Analysis area. I believe enough information is available to make a reasoned management decision. Therefore, additional surveys are not needed for this project decision.

EXISTING CONDITION

Riparian/bottomland hardwood associated species.

Species that prefer riparian habitat tend to be most dependent upon periodic flooding to maintain their habitat. As a result, these species are generally limited to the transition zone between the stream or river's edge and the bottom of slopes. These species tend to prefer damp, rich soils, or the washed, scoured surface of streambanks or bottomland hardwoods. In some cases, the break in canopy created naturally by the stream or river corridor is a preferred element of this habitat.

Species occurrence within project area – One RFSS that is frequently associated with riparian habitat has been documented within the analysis area.

During his field surveys of the analysis area in 2003 and 2004, Alan Brant found *Juglans cinerea* (butternut) within the analysis area. These sites were on National Forest along James Branch. All of the specimens observed during these surveys were either diseased or dead.

According to BE Program one riparian/bottomland hardwood-associated species has potential habitat in the analysis area. However, based upon a review of the MTNF Heritage CD (10/28/03 ver. 1.3) and results of field surveys conducted for this project, this species is not known within the analysis area. Suitable habitat, as calculated by the BE Program does occur in the analysis area as follows:

Riparian and bottomland hardwood Species	Total Acres Suitable Habitat in Analysis Area (based upon BE Program)
<i>Dendroica cerulea</i>	58

(BE Program Report, run 11/19/03)

MoFWIS or other references have reported other species as known or likely in the counties surrounding the analysis area, but these species have not been documented in the analysis area. These species are *Carex cherokeensis*, *Dryopteris goldiana*, and *Platanthera flava var. herbiola*

Stream/River-associated species (Meramec drainage).

The species dependent upon streams or rivers are primarily aquatic organisms such as fish, mussels, and amphibians. These species spend all or most of their life cycle in aquatic environment. As a result, these species are most susceptible to activities that threaten the water quality of these streams by altering the temperature, oxygen or pH levels of the stream, as well as other factors. Many cold and warm water streams form the boundaries and intersect the Mark Twain National Forest.

Species occurrence within analysis area – No RFSS or Species of Concern frequently associated with streams/rivers have been documented in the analysis area.

According to BE Program, some stream/river-associated species have potential habitat in the analysis area or in the watershed within which the analysis area occurs. However, based upon a review of the MTNF Heritage CD (10/28/03 ver. 1.3) and results of field surveys conducted for this project, none of these species are known within the analysis area. Suitable habitat, as calculated by the BE Program for some of these species, does occur in the analysis area as follows:

Stream/River Species	Total Acres Suitable Habitat in Analysis Area (based upon BE Program)
<i>Stenonema bednariki</i>	201
<i>Plethobasus cyphus</i>	87
<i>Epioblasma triquetra</i>	201

MoFWIS or other references have reported other species as known or likely in the counties in the analysis area within the Meramec watershed, but these species have not been documented in the analysis area. These species are *Cryptobranchus alleganiensis*, *Crystallaria asprella*, *Cycleptus elongates*, *Cumberlandia monodonta*, *Elliptio crassidens*, *Fusconaia ebena*, *Platygio gracilis*.

Open, grassland-associated species.

Habitat for these species generally occurs in the form of large open areas with some scattered trees and brush.

Species occurrence within analysis area – No RFSS or Species of Concern frequently associated with openings, grasslands have been documented in the analysis area.

According to BE Program, one open grassland-associated species has potential habitat in the analysis area. However, based upon a review of the MTNF Heritage CD (10/28/03 ver. 1.3) and results of field surveys conducted for this project, this species is not known within the analysis area. Suitable habitat, as calculated by the BE Program does occur in the analysis area as follows:

Open/Grassland Species	Total Acres Suitable Habitat in Analysis Area (based upon BE Program)
<i>Lanius ludovicianus migrans</i>	3

MoFWIS or other references have reported other species as known or likely in the counties in the analysis area within the Meramec watershed, but these species have not been documented in the analysis area. These species are *Aimophila aestivalis* and *Circus cyaneus*.

Glade-associated species

Glade species are generally restricted or associated with limestone and igneous glade complexes. These glade complexes are characterized by exposed bedrock, shallow soils, and herbaceous vegetation. These glade habitats were likely historically maintained in an open, grassy condition by periodic fire, but today, many are being overtaken by woody vegetation as a result of decades of fire suppression. The plant community that occupies these glades is often influenced by the geology of the bedrock, with igneous glades often supporting different plant communities than limestone glades.

Species occurrence within analysis area – No RFSS or Species of Concern frequently associated with glades have been documented in the analysis area.

According to BE Program, one glade-associated species has potential habitat in the analysis area. However, based upon a review of the MTNF Heritage CD (10/28/03 ver. 1.3) and results of field surveys conducted for this project, this species is not known within the analysis area. Suitable habitat, as calculated by the BE Program does occur in the analysis area as follows:

Glade Species	Total Acres Suitable Habitat in Analysis Area (based upon BE Program)
<i>Solidago gattingerii</i>	4

(BE Program Report, run 11/19/03)

MoFWIS or other references have reported other species as known or likely in the counties in the analysis area within the Meramec watershed, but these species have not been documented in the analysis area. These species are *Aimophila aestivalis*, *Agalinis skinneriana*, *Echinacea simulata*, *Scutellaria bushii*, and *Silene regia*.

Seep, fen, spring-associated species

The seep habitat required by these species can often be found at the heads of perennial streams and around the edges of fens or springs. These seeps are characterized by the presence of groundwater leaching to the soil surface. They are similar to spring and fen habitats, but generally are much smaller in size and more shaded than fens and have slower moving water over a larger area than springs. In some cases, these seeps occur in acid soils, while others occur in calcareous soils. The acidic seeps frequently have a different plant community than calcareous seeps.

A fen could be considered a type of wetland. It is dominated by grass or grass-like plants and fed primarily by water from a mineral source. They are nearly always located adjacent to perennial streams in bottomland areas. The water flow through these fens is often slow and flowing through dense vegetation. The fen habitats are often adjacent to forest edge. Many fens are becoming dominated by encroaching woody vegetation. Periodic flooding or fire may maintain the grassy/open condition of these fens.

Species occurrence within analysis area – Three species frequently associated with seeps, fens, springs have been documented in the analysis area. These species are *Carex sterilis*, *Carex stricta*, and *Parnassia grandifolia*.

Carex sterilis and *Carex stricta* have been documented in Dent County on private land in seeps, fens in Bates Hollow. Alan Brant also tentatively identified these species as occurring in Dent County in Fortune Hollow and Thorny Hollow on National Forest lands in fens during his field surveys of the analysis area in 2003 and 2004. These sites will be surveyed during the growing season to confirm species identification.

During his field surveys of the analysis area in 2003 and 2004, Alan Brant found *Parnassia grandifolia* within the analysis area. These sites were on National Forest in fens in Crawford and Dent Counties along James Branch, Fortune Hollow and Thorny Hollow. He found hundreds of plants in these areas.

According to BE Program, one seep, fen, and spring associated species has potential habitat in the analysis area. However, based upon a review of the MTNF Heritage CD (10/28/03 ver. 1.3) and results of field surveys conducted for this project, this species is not known within the analysis area. Suitable habitat, as calculated by the BE Program does occur in the analysis area as follows:

Seep/Fen/Spring Species	Total Acres Suitable Habitat in Analysis Area (based upon BE Program)
<i>Spiranthes ovalis</i> var. <i>erostellata</i>	12

(BE Program Report, run 11/19/03)

MoFWIS or other references have reported other species as known or likely in the counties in and surrounding the analysis area, but these species have not been documented in the analysis area. These species are *Ophiogomphus westfalli*, *Anemone quinquefolia*, *Aster dumosus* var. *strictior*, *Campanula aprinoides*, *Carex buxbaumii*, *Carex decomposita*, *Menyanthes trifoliata*, *Phlox maculata* ssp. *Pyramidalis*, *Carex tetanica*, *Ludwigia microcarpa*, *Sphagnum centrale* and *Campylium stellatum*.

Miscellaneous wetland associated species

This category includes species that do not necessarily occur in seeps, fens or springs, but rather prefer standing water or open, wet, sunny soil. Examples of such habitat are

margins and shallow water of wildlife and sinkhole ponds, roadside ditches and low, wet places in open fields.

Species occurrence within project area – No RFSS or Species of Concern frequently associated with miscellaneous wetlands have been documented in the analysis area.

According to BE Program, miscellaneous wetland-associated species have potential habitat in the analysis area. However, according to Dave Moore, Forest Botanist/Ecologist, nine species have been reported in the counties in and surrounding the analysis area, but these species have not been documented in the analysis area. These species are *Carex cherokeensis*, *Carex decomposita*, *Carex fissa* var. *fissa*, *Carex straminea*, *Carex triangularis*, *Juncus debilis*, *Potamogeton pulcher*, *Schoenoplectus purshianus*, and *Torreychloa pallida*.

Cliff-associated species

Habitat for these species generally occurs in the form of cliffs, bluffs or large exposures of bedrock that may be either wet or dry.

Species occurrence within analysis area – No RFSS or Species of Concern frequently associated with this habitat have been documented in the analysis area.

According to BE Program, no cliff-associated species have potential habitat in the analysis area. However, according to Dave Moore, Forest Botanist/Ecologist, five species have been reported in the counties in and surrounding the analysis area, but these species have not been documented in the analysis area. These species are *Aster furcatus*, *Aster macrophyllus*, *Calamagrostis porteri* var. *insperata*, *Metzgeria furcata*, and *Sullivantia sullivantii*.

EFFECTS OF THE PROPOSED ACTION AND ALTERNATIVES

Riparian/bottomland hardwood associated species.

Direct Effects Alternative 1- This alternative would not be expected to have any direct effect upon riparian/bottomland hardwood-associated species because it would not involve any activities within riparian/bottomland hardwood habitat.

Alternatives 2 and 3- There is some potential that prescribed burning may directly impact some *Juglans cinerea* individuals. These individuals are diseased and would not likely survive longterm, regardless of whether or not they are impacted by prescribed burning activities.

Indirect Effects Alternative 1-With implementation of Alternative 1, there may be an increased risk in insect infestations within riparian/bottomland hardwood areas, because no activities would occur that would improve the resistance of forest stands that may currently be in an unhealthy condition. As insects or disease infests stands, the stands would gradually become more open and likely create a change in conditions, creating more open, drier habitats. However, this would not be expected to have a measurable

impact upon riparian/bottomland hardwood habitat within the analysis area because most of the stands susceptible to oak decline and insect infestations are in upland areas, and not within these zones.

The anticipated die-off of trees due to lack of treatment may also contribute to more intense wildland fires within the analysis area. Fuels would build-up within forest stands as they succumb to disease and insects. Intense wildland fires would have the potential of creating large areas of little canopy cover, which would likely impact riparian/bottomland hardwood species. Exclusion of controlled burns within these stands would also increase the potential for wildland fires to become intense and difficult to control.

Alternatives 2 and 3- Generally speaking, none of the activities proposed in Alternatives 2 and 3 should have an indirect impact upon riparian habitat for these species because of protective measures that have been incorporated into the proposed project. With implementation of these protective measures, a no cut zone will be designated within riparian zones along perennial and intermittent streams. Other protective measures will minimize impacts to unique habitats that frequently occur in riparian zones, such as seeps, fens.

There is potential for some riparian/bottomland hardwood habitat to be indirectly affected by prescribed burning proposed in this alternative since some of this burning and dozer line construction will occur in these areas. Generally, these areas are not directly fired unless necessary for reinforcement of control lines. If not directly fired, these areas would be less impacted since the fires would generally “back” down the slope into the areas and self-extinguish. Even if directly fired, however, these areas should not be heavily impacted since firing would not occur on extreme fire weather days when fires would burn hottest and be most likely to damage riparian/bottomland hardwood habitats. Known sites of RFSS species will be avoided during fireline construction.

Cumulative Effects All Alternatives- While once likely widespread across Missouri, high quality habitat for riparian/bottomland hardwood species continues to decrease as riparian zones along streams on private lands continue to be converted to agriculture and urban development. The cumulative effect of riparian corridor development and management unfavorable to the RFSS riparian species could result in a net loss of suitable habitat for these species. The implementation of the Alternatives, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is expected to maintain habitat conditions similar to the current conditions and would not likely contribute to the cumulative effect of loss of suitable habitat.

Quantification of Habitat Acres Affected The following table quantifies the number of acres of suitable habitat that would be *directly* affected by Alternatives 2 and 3. Because Alternative 1 would not involve any management activities that would directly alter the forest condition, it has been assumed that the acres of suitable habitat within the project area for these species are not directly affected by this alternative. These numbers are based solely upon the Mark Twain National Forest BE Program 11/19/03.

Only species identified by the BE Program as having suitable habitat within the project area are listed.

Riparian/bottomland and hardwood Species	Total Acres Suitable Habitat in Analysis Area	Acres of Suitable Habitat in Analysis Area Affected by Alternative									
		Destroyed		Reduced		Created		Enhanced		Maintained	
		Alt. 2	Alt. 3	Alt. 2	Alt. 3	Alt. 2	Alt. 3	Alt. 2	Alt. 3	Alt. 2	Alt. 3
<i>Dendroica cerulea</i>		0	0	0	0	0	0	0	0	58	58
<i>Juglan cinerea</i>		0	0	0	0	0	0	0	0	787	684

Determination of Effect and Rationale

Alternative 1- The implementation of Alternative 1 is expected to have *no impact* upon any riparian/bottomland hardwood-associated RFSS and Species of Concern because it would involve no direct or indirect disturbance to riparian habitats within the analysis area.

Alternatives 2 and 3- The activities proposed in Alternatives 2 and 3 *may impact individuals of Juglans cinerea but are not likely to cause a loss of viability or a trend toward federal listing*. This species is known to occur in the analysis area and occurs within stands proposed for activities that may impact them or their occupied habitat.

The activities proposed in Alternatives 2 and 3 may also impact suitable potential habitat for other riparian/bottomland hardwood-associated RFSS or Species of Concern because they involve prescribed burning and some soil disturbance within riparian zones.

Stream/River-associated species

Direct Effects Alternative 1- This alternative would have no direct impact upon any stream/river-associated RFSS or Species of Concern because it does not involve implementation of any activities.

Alternatives 2 & 3- Neither of these alternatives would be expected to have a direct impact upon any stream/river associated RFSS or Species of Concern because none of these species have been documented from National Forest lands in which proposed activities would occur.

Indirect Effects

Alternative 1- Under Alternative 1, there may be an indirect effect upon habitat for aquatic species. The anticipated die-off of trees due to lack of treatment may contribute to more intense wildland fires within the analysis area. Fuels would build-up within the forested stands as they succumb to disease and insects. Should an intense wildland fire

occur within the project area as a result of lack of treatment of forest stands, it could contribute to increased soil loss and sedimentation of streams and rivers within the analysis area. Exclusion of controlled prescribed burning within these stands would also increase the potential for wildland fires to become intense and difficult to control. The chances of a wildland fire occurring within the analysis area, however, are virtually impossible to predict, and so, these possible indirect effects may be considered speculative and are not considered “reasonably certain to occur”.

Alternative 1 would also not implement any activities, such as erosion control, dump rehabilitation, and road decommissioning, which could have an indirect beneficial effect upon the water quality of some streams within the analysis area.

Alternatives 2 and 3- Aquatic RFSS and Species of Concern that occupy or may occupy the Meramec River and other perennial streams within the analysis area are most susceptible to the effects that activities occurring within their watersheds may have upon water quality. Activities with the greatest potential for impacts upon water quality involve those activities that would disturb the soil surface. In Alternatives 2 and 3, these activities include the construction of dozerlines, erosion control activities, temporary road construction, road reconditioning, skidding, and dragging associated with commercial removal of merchantable timber.

However, several protective measures have been incorporated into Alternatives 2 and 3 that would minimize any potential for soil movement from proposed management activities. With implementation of these protective measures, no soil movement is expected to occur at rates that would adversely affect the water quality of adjacent streams, and therefore, the habitat stream/river-associated species. Past monitoring of similar projects on the MTNF has indicated that soil movement levels were well within the allowable soil loss established in the Forest Plan (U.S. Forest Service 2002).

Some of the activities proposed in both alternatives may also have an indirect beneficial effect upon potential habitat for stream/river-associated species. In both alternatives, some activities would occur that may enhance the water quality of streams within the project area, and therefore, improve water quality in the streams and rivers within the project area. Activities that would improve water quality include dump rehabilitation (some of which are located near streams), erosion control activities, and road decommissioning. All of these proposed activities would improve potential habitat for aquatic species.

Cumulative Effects Alternative 1- Aquatic species are vulnerable to practices that cause soil movement on private and public lands, as this soil movement often leads to increases in sediment loads within the streams and rivers, and can adversely impact the species. The continued development of private land for homes, recreation residences, unmanaged timber harvests, and other uses may (if not done conscientiously) contribute to sediment and pollution loads in the watersheds occupied by these species.

Under Alternative 1, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, would involve no new activities that would contribute to the cumulative effect of soil movement into streams. However, the current effects occurring within the watershed as the result of

existing erosion from unregulated roads, streambank destabilization, and water contamination from garbage dumps would also not be minimized under Alternative 1. Therefore, while there are not any anticipated cumulative adverse effects resulting from the implementation of Alternative 1, there also are no anticipated cumulative beneficial effects, either, because this alternative would not involve a change in the existing conditions within the watersheds.

Alternatives 2 and 3- In addition to activities occurring as part of this project, aquatic species are also vulnerable to practices that cause soil movement on private and public lands, as this soil movement often leads to increases in sediment loads within the streams and rivers, and can adversely impact the species. The continued development of private land for homes, recreation residences, unmanaged timber harvests, and other uses may (if not done conscientiously) contribute to sediment and pollution loads in the watersheds occupied by the species.

Within the project area, approximately 20% of the land base has been developed for agricultural and residential uses, which typically have the greatest potential for soil movement and disturbance. With the remaining 80% representing either National Forest or forested private lands, it does not appear that conversion from forested to unforested conditions is contributing significantly to deterioration of the watersheds within the project area. However, much of the 20% not in forested conditions does occur in bottomlands and along riparian areas, since these are often the most easily cultivated and developed areas, therefore, activities within this 20% of the land base may be having more of an effect upon the watersheds than may be presented by simple comparison of percentage of forest versus non-forest within the analysis area.

The activities that are planned in Alternatives 2 and 3 when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, are designed and implemented in a manner to minimize soil movement off-site, and would not be expected to contribute to any deterioration of habitat for these species. Because these activities would occur within the 80% of the forested area and are primarily within upland areas, and not bottomlands, they would not be expected to contribute to any cumulative effects being created by activities occurring on private lands that may impact aquatic RFSS or Species of Concern or their habitat.

Quantification of Habitat Acres Affected The following table quantifies the number of acres of suitable habitat that would be *directly* affected by Alternatives 2 and 3. Because Alternative 1 would not involve any management activities that would directly alter the forest condition, it has been assumed that the acres of suitable habitat within the analysis area for these species are not directly affected by this alternative. These numbers are based solely upon the Mark Twain National Forest BE Program, 11/18/03.

Only species identified by the BE Program as having suitable habitat within the analysis area are listed.

	Total Acres	
--	------------------------	--

Stream/River Species	Suitable Habitat in analysis Area	Acres of Suitable Habitat in Analysis Area Affected by Alternative									
		Destroyed		Reduced		Created		Enhanced		Maintained	
		Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2
<i>Stenonema bednariki</i>		0	0	0	0	0	0	0	0	201	201
<i>Plethobasus cyphus</i>		0	0	0	0	0	0	0	0	87	87
<i>Epioblasma triquetra</i>		0	0	0	0	0	0	0	0	201	201

Determination of Effect and Rationale

Alternative 1- The implementation of Alternative 3 is expected to have *no impact* upon any stream/river-associated RFSS and Species of Concern because it would not likely lead to or involve any disturbance to aquatic habitats within the analysis area.

Alternatives 2 and 3- The activities proposed in Alternatives 2 and 3 are expected to have *no impact* upon stream/river-associated RFSS and Species of Concern because none of these species have been documented within or adjacent to stands proposed for treatments and their aquatic habitat is likely to be adequately protected by protective measures that have been incorporated into the Proposed Actions for these two alternatives.

Open, grassland-associated species

Direct Effects

Alternative 1: This alternative would be expected to have no impact upon any open, grassland-associated RFSS or Species of Concern because it does not involve any activities that may impact habitat or known sites for these species.

Alternatives 2 and 3- No open, grassland-associated RFSS or Species of Concern have been documented from within stands proposed for treatments under these two alternatives, hence there would be no direct effects to these species.

Indirect Effects Alternative 1- This alternative would have no indirect effect upon open, grassland-associated species or their potential habitat because it would not involve any activities that would disturb or enhance open, grassland habitat. There is some potential for an increase in insect and disease outbreaks within the project area if Alternative 1 is implemented, which could enhance open, grassland habitat by increasing the intensity of wildland fires and/or contribute to a loss of large areas of forest overstory, however, this potential is difficult to predict.

Alternatives 2 and 3- Implementation of Alternatives 2 and 3 would enhance open, grassland-associated species habitat through the use of prescribed burning and mowing of existing openings. These activities could lead to an increase in the abundance of grasses and forbs in the openings. Prescribed burning in forest stands would increase the grasses and forbs in the understory. These activities would indirectly benefit these species. None of the other activities proposed in Alternatives 2 and 3 would be expected to have an adverse indirect impact upon habitat for open, grassland-associated species.

Cumulative Effects All Alternatives- Open, grassland habitat that is suitable for these species tends to occur in large areas of prairie, pasture, and old fields. The implementation of any of these Alternatives, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, would not contribute measurably to an increase or decrease in open, grassland habitat within the analysis area and would not be expected to have a cumulative effect upon the species that are likely to occupy such habitats.

Quantification of Habitat Acres Affected The following table quantifies the number of acres of suitable habitat that would be *directly* affected by Alternatives 2 and 3. Because Alternative 1 would not involve any management activities that would directly alter the forest condition, it has been assumed that the acres of suitable habitat within the analysis area for these species are not directly affected by this alternative. These numbers are based solely upon the Mark Twain National Forest BE Program, 11/19/03.

Only species identified by the BE Program as having suitable habitat within the analysis area are listed.

Grassland Species	Total Acres Suitable Habitat in Project Area	Acres of Suitable Habitat in Project Area Affected by Alternative									
		Destroyed		Reduced		Created		Enhanced		Maintained	
		Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2
<i>Lanius ludovicianus migrans</i>		0	0	0	0	0	0	3	3	0	0

Determination of Effect and Rationale Alternative 1- The implementation of Alternative 1 is expected to have *no impact* upon any open, grassland-associated RFSS and Species of Concern because no activities are proposed that are likely to impact these species or their habitat.

Alternatives 2 and 3- The some activities proposed in Alternatives 2 and 3 are expected to have a *beneficial effect* upon open, grassland-associated RFSS and Species of Concern

because mowing and prescribed burning would enhance/maintain habitat used by these species.

Glade-associated species

Direct Effects Alternative 1- This alternative would be expected to have no impact upon any glade-associated RFSS or Species of Concern because it does not involve any activities that would directly impact habitat or known sites for these species. Under Alternative 1, there would be no implementation of activities that would benefit glade species, such as glade restoration or prescribed burning.

Alternatives 2 and 3 – There are no glade-associated RFSS or Species of Concern sites documented within stands proposed for treatment in these Alternatives, and therefore, there are expected to be no impacts upon individual species with implementation of these Alternatives.

Indirect Effects Alternative 1- With implementation of Alternative 1, there may be an increased risk in insect infestations within the analysis area, because no activities would occur that would improve the resistance of forest stands that may currently be in an unhealthy condition. As insects or disease infest stands, they would gradually become more open and likely create favorable short-term conditions for glade species.

The anticipated die-off of trees due to lack of treatment may also contribute to more intense wildland fires within the analysis area. Fuels would build-up with the forested stands as they succumb to disease and insects. Intense wildland fires would have the potential burning over glades within and adjacent to the project area. This burning would most likely improve habitat conditions for this species, unless it occurred during a period of excessive drought or was of such intensity that it damaged the soils and root systems within the glade. However, the chances of such a wildland fire occurring would be hard to predict and therefore, these indirect effects may not be “reasonably certain to occur”.

Alternatives 2 and 3- There are many stands proposed for activities in this alternative that contain suitable glade habitat for some of these species and this habitat would be directly impacted by activities such as prescribed burning and handcutting of encroaching vegetation. These activities would likely benefit any RFSS or species of concern that occupy these glades by improving the conditions of the glade and reducing competition from encroaching vegetation within the glade, particularly red cedars. Other activities proposed in these alternatives would not be expected to impact glade habitat due to the incorporation of protective measures into the proposed action. These protective measures would protect glades from soil disturbance and other activities that could negatively impact any RFSS or Species of Concern within them.

Cumulative Effects All Alternatives- When considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, these alternatives are not expected to have a cumulative effect upon glade-associated species or their habitat. Much of the habitat that may be or once was occupied by glade-associated RFSS and Species of Concern is under the control of private landowners or other agencies, and therefore, there is the possibility that actions by

those groups could negatively impact habitat occupied by this species. The loss of original prairie habitat to agricultural uses, coupled with decades of fire-suppression in habitats formerly fire-maintained, as well as widespread use of herbicides and insecticides, may continue to contribute to the loss of glade-associated species. If this occurs, there is potential for lands within the National Forest and within the project area to become more important for these species' recovery. However, since none of these alternatives will involve activities that would reduce or destroy habitat that may be used by this species, they would not be expected to contribute to this potential cumulative effect.

Quantification of Habitat Acres Affected The following table quantifies the number of acres of suitable habitat that would be *directly* affected by Alternatives 2 and 3. Because Alternative 1 would not involve any management activities that would directly alter the forest condition, it has been assumed that the acres of suitable habitat within the analysis area for these species are not directly affected by this alternative. These numbers are based solely upon the Mark Twain National Forest BE Program, 11/19/03.

Glade Species	Total Acres Suitable Habitat in Analysis Area	Acres of Suitable Habitat in Analysis Area Affected by Alternative									
		Destroyed		Reduced		Created		Enhanced		Maintained	
		Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2
<i>Solidago gattingerii</i>		0	0	0	0	0	0	4	4	0	0

Determination of Effect and Rationale

Alternative 1- The implementation of Alternative 1 is expected to have *no impact* upon any glade-associated RFSS and Species of Concern because it would not likely lead to or involve any disturbance to glade habitats within the analysis area.

Alternatives 2 and 3- The some activities proposed in Alternatives 2 and 3 are expected to have a *beneficial effect* upon open, grassland-associated RFSS and Species of Concern because prescribed burning and handcutting of encroaching woody vegetation would enhance/maintain habitat used by these species.

Seep/Fen-associated species

Direct Effects Alternative 1- Alternative 1 would not implement any activities that are expected to have a direct effect upon seep/fen-associated RFSS or species of concern.

Alternatives 2 and 3- There is potential that some *Carex sterilis*, *Carex stricta*, *Parnassia grandifolia* individuals may be impacted by prescribed burning. There are several fens,

seeps, and springs located within some of the prescribed burning units, some of which contain these species. However, prescribed burning would not occur at times when these seeps and fens are likely to be adversely impacted by this activity (that is, on days when the fens or seeps are completely dry) because prescribed burns are not typically done during periods of extreme dry weather that would create these conditions. More than likely, burning would occur when the areas still have some wet soil, creating a “top” burn of vegetation but leaving the substrate and root systems intact. Such a burn could have a rejuvenating effect upon these areas and could increase the availability of suitable habitat for seep/fen/spring-associated species, because many of these areas are being overtaken by encroaching woody vegetation. To benefit many of these species, fens should be maintained in a grassy, open condition, and this condition may be maintained by periodic burning.

Other than prescribed burning, the remaining activities associated with these two alternatives would not be expected to have any direct impact upon fens/seeps/springs because of protective measures that have been incorporated into the Proposed Action for these alternatives. These protective measures would restrict potentially damaging activities from occurring within 100 feet of a known fen/seep/spring.

Indirect Effects Alternative 1- Under Alternative 1, there may be an indirect effect upon potential habitat for these species. The anticipated die-off of trees due to lack of treatment may contribute to more intense wildland fires within the project area. Fuels would build-up with the forested stands as they succumb to disease and insects. Intense wildland fires would have the potential burning over fens within and adjacent to the project area. This burning would most likely improve habitat conditions for these species, unless it occurred during a period of excessive drought or was of such intensity that it damaged the soils and root systems within the fen.

Potential habitat for seep/fen/spring-associated species can also be indirectly affected by intense wildland fires that change the water quality or alter the waterflow through fens. Should an intense wildland fire occur within the analysis area as a result of lack of treatment of forest stands, it could contribute to increased soil loss and sedimentation of fens/seeps/springs in the analysis area. Changes in water movement and availability could potentially have an indirect adverse effect upon nearby fens/seeps/springs. Exclusion of controlled prescribed burning within these stands would also increase the potential for wildland fires to become intense and difficult to control. The chances of a wildland fire occurring within the analysis area, however, are virtually impossible to predict, and so, these possible indirect effects may be considered speculative and are not considered “reasonably certain to occur”.

Alternatives 2 and 3- Although botanical surveys identifying the location of fens and other rare habitats are on-going within the project area, there is always a slight potential that an undiscovered fen occurs in the project area and could be indirectly affected by activities occurring within 100 feet of it, prior to its discovery. Such activities could be the felling of trees during mechanical timber treatments or construction of dozer line, etc. However, this potential for indirect effects upon an undiscovered fen is considered very low since most of the area has been thoroughly surveyed by a botanist and others.

Potential habitat for seep/fen/spring-associated species could also be indirectly affected by activities that may change the water quality or alter the waterflow through fens. In these alternatives, activities such as the construction of dozerlines, erosion control activities, and decommissioning of roads have the potential of disturbing soils that may lead to increased sedimentation of adjacent streamcourses or fens/seeps/springs. By restricting these activities within 100 feet of a fen, however, it is expected that the water quality within these areas will be protected by the 100 foot buffer that would act as a filter strip.

Mechanical timber treatments and harvest that result in the removal of the majority of the overstory could increase the amount of water movement on and beneath the soil surface, since few trees would be available to absorb this water through their root systems. Such changes in water movement and availability could potentially have an indirect adverse effect upon nearby seeps, springs, and fens. This increase in water would be offset, somewhat, however, by the proliferation of stump sprouts originating from the cut trees and more open, drier conditions created by overstory removal, as well as by the 100 foot buffer zone.

However, several protective measures have been incorporated into these alternatives that will minimize the potential for soil movement from proposed management activities. With implementation of these protective measures, no soil movement is expected to occur at rates that would adversely affect the water quality of adjacent seeps, springs, and fens. Past monitoring of similar projects on the MTNF has indicated that soil movement levels were well within the allowable soil loss established in the Forest Plan (U.S. Forest Service 2002). By restricting management activities within 100' of a seep, spring, or fen, the potential for waterflow alteration should be minimized. Protective measures in the burn plan will be included to prevent contamination of water in fens from chemicals used in aerial ignition and petroleum products in drip torch fuel. These measures will include no hand lighting with drip torches within 100 feet of a fen and no aerial ignition within 100 yards of a fen. Fen locations will be identified on burn plan maps.

Cumulative Effects All Alternatives- Because of its dependence upon wetlands, fens, and similar habitats, the seep/fen/spring-associated species are most vulnerable to activities that may result in the destruction of these habitats, alter the hydrology of the habitats, or contaminate their water sources. Many such activities are occurring on lands controlled by private landowners and on both private and public lands by individuals who refuse to follow restrictions developed in order to protect these habitats. When considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, the implementation of Alternatives 1, 2 and 3, however, would not result in any degradation of habitat known to be occupied by seep/fen/spring-associated RFSS or Species of Concern, and therefore, is not expected to contribute to any cumulative adverse effects upon these species.

Quantification of Habitat Acres Affected The following table quantifies the number of acres of suitable habitat that would be *directly* affected by Alternatives 2 and 3. Because Alternative 1 would not involve any management activities that would directly alter the forest condition, it has been assumed that the acres of suitable habitat within the analysis area for these species are not directly affected by this alternative.

These numbers are based solely upon the Mark Twain National Forest BE Program, 11/19/03.

Seep/Fen/Spring Species	Total Acres Suitable Habitat in Analysis Area	Acres of Suitable Habitat in Analysis Area Affected by Alternative									
		Destroyed		Reduced		Created		Enhanced		Maintained	
		Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2
<i>Spiranthes ovalis</i> <i>var. erostellata</i>		0	0	0	0	0	0	12	12	0	0

Determination of Effect and Rationale

Alternative 1- The implementation of Alternative 1 is expected to have *no impact* upon any seep/fen/spring-associated RFSS or Species of Concern because it does not implement activities that are likely to disturb known sites or potential habitat for these species.

Alternatives 2 and 3- The activities proposed in Alternatives 2 and 3 *may impact individuals of Carex sterilis, Carex stricta, and Parnassia grandifolia but are not likely to cause a loss of viability or a trend toward federal listing.* These species are known to occur in the analysis area and occur within stands proposed for activities that may impact them or their occupied habitat. The prescribed burning activities proposed in these alternatives could enhance existing and potential suitable habitat for these species and provide a *beneficial effect* by helping to keep the areas open and reduce competition from encroaching woody vegetation.

Miscellaneous wetland associated species

Direct Effects

Alternative 1- **This alternative would have no direct impact upon any miscellaneous wetland associated RFSS or Species of Concern because it does not involve implementation of any activities.**

Alternatives 2 & 3- Neither of these alternatives would be expected to have a direct impact upon any miscellaneous wetland associated RFSS or Species of Concern because none of these species have been documented from National Forest lands in which proposed activities would occur.

Indirect Effects Alternative 1- This alternative would have no indirect effect upon miscellaneous wetland associated species or their potential habitat because it would not involve any activities that would disturb or enhance wetland habitat.

Alternatives 2 and 3- Implementation of Alternatives 2 and 3 would enhance wetland habitat primarily through maintenance of existing waterholes, and less so through the use of prescribed burning of existing fields. These activities could lead to an increase in the abundance of grasses and forbs in the openings. None of the other activities proposed in Alternatives 2 and 3 would be expected to have an adverse indirect impact upon habitat for miscellaneous wetland species.

Cumulative Effects All Alternatives- Miscellaneous wetlands that are suitable for these species tend to occur in small areas of pasture and old fields, and along the margins of waterholes. The implementation of any of these Alternatives, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, would not contribute measurably to an increase or decrease in wetland habitat within the analysis area and would not be expected to have a cumulative effect upon the species that are likely to occupy such habitats.

Quantification of Habitat Acres Affected The following table quantifies the number of acres of suitable habitat that would be *directly* affected by Alternatives 2 and 3. Because Alternative 1 would not involve any management activities that would directly alter the forest condition, it has been assumed that the acres of suitable habitat within the analysis area for these species are not directly affected by this alternative.

Misc Wetland Species	Total Acres Suitable Habitat in Project Area	Acres of Suitable Habitat in Project Area Affected by Alternative									
		Destroyed		Reduced		Created		Enhanced		Maintained	
		Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2	Alt. 1	Alt. 2
<i>Carex cherokeensis</i>		0	0	0	0	0	0	43	43	0	0
<i>Carex decomposita</i>		0	0	0	0	0	0	43	43	0	0
<i>Carex fissa</i> var. <i>fissa</i>		0	0	0	0	0	0	43	43	0	0
<i>Carex straminea</i>		0	0	0	0	0	0	43	43	0	0
<i>Carex triangularis</i>		0	0	0	0	0	0	43	43	0	0
<i>Juncus debilis</i>		0	0	0	0	0	0	43	43	0	0
<i>Potamogeton pulcher</i>		0	0	0	0	0	0	43	43	0	0
<i>Schoenoplectus purshianus</i>		0	0	0	0	0	0	43	43	0	0
<i>Carex cherokeensis</i>		0	0	0	0	0	0	43	43	0	0

Alternative 1- The implementation of Alternative 1 is expected to have *no impact* upon any wetland- associated RFSS and Species of Concern because no activities are proposed that are likely to impact these species or their habitat.

Alternatives 2 and 3- The same activities proposed in Alternatives 2 and 3 are expected to have a *beneficial effect* upon wetland-associated RFSS and Species of Concern because mowing, prescribed burning and waterhole maintenance would enhance/maintain habitat used by these species.

Cliff species

Direct Effects Alternative 1- This alternative would have no direct impact upon any cliff-associated RFSS or Species of Concern because it does not involve implementation of any activities.

Alternatives 2 & 3- Neither of these alternatives would be expected to have a direct impact upon any cliff-associated RFSS or Species of Concern because none of these species have been documented from National Forest lands in which proposed activities would occur.

Indirect Effects **Alternative 1-** This alternative would have no indirect effect upon cliff-associated species or their potential habitat because it would not involve any activities that would disturb or enhance their habitat.

Alternatives 2 and 3- No activities proposed in Alternatives 2 and 3 would be expected to have an adverse indirect impact upon habitat for cliff-associated species.

Cumulative Effects **All Alternatives-** Cliffs that are suitable for these species tend to occur on moist to dry, north-facing, >50° slopes of various substrates. The implementation of any of these alternatives, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, would not contribute measurably to an increase or decrease in cliff habitat within the analysis area and would not be expected to have a cumulative effect upon the species that are likely to occupy such habitats.

SUMMARY OF DETERMINATIONS

The summary of determinations below is based upon the proposed management action as described in this evaluation. *Should any significant change in the proposed management action as outlined in this evaluation occur after the date that this evaluation is signed, all effects upon these species may warrant re-evaluation before project implementation may continue.* Changes that would require a re-evaluation of effects upon these species include but may not be limited to:

- any change in the proposed action that may increase the potential for adverse effects upon RFSS or Species of Concern beyond what has been disclosed in this evaluation;

- unknown or previously unaddressed RFSS or Species of Concern are discovered in the project area.

Species Habitat Group	Species documented from project area?	Habitat present in project area?	Habitat affected by proposed action?	Determination		
				Alternative 1	Alternative 2	Alternative 3
Riparian, bottomland hardwood-associated Species	Yes	Yes	Alternative 1 - No Alternatives 2 & 3- Not likely	No impact	May impact individuals or habitat but will not likely contribute to a trend towards federal listing or loss of population viability	May impact individuals or habitat but will not likely contribute to a trend towards federal listing or loss of population viability
Stream/River-associated Species	No	Yes	Alternative 1 - No Alternatives 2 & 3- Not likely	No impact	No impact	No impact
Grassland-associated Species	Yes	Yes	Alternative 1 - No Alternatives 2 & 3 – yes	No impact	Beneficial impact	Beneficial impact
Glade-associated Species	No	Yes	Alternative 1 – No Alternatives 2 & 3 – Yes;	No impact	Beneficial impact	Beneficial impact
Seep/Fen-associated Species	Yes	Yes	Alternative 1 – No Alternatives 2 & 3 – Yes;	No impact	May impact individuals or habitat but will not likely contribute to a trend towards federal listing or loss of population viability, beneficial impact through habitat enhancement	May impact individuals or habitat but will not likely contribute to a trend towards federal listing or loss of population viability, beneficial impact through habitat enhancement
Miscellaneous Wetland Species	No	Yes	Alternative 1 – No Alternatives 2 & 3 – Yes;	No impact	Beneficial impact	Beneficial impact
Cliff face/bare rock	No	Yes	Alternative 1 - No Alternatives 2 & 3- Not likely	No impact	No impact	No impact

CONSULTATION WITH OTHERS

Brant, Alan. Botanist. Contractor, US Forest Service, Mark Twain National Forest.

Bryan, John. Timber/Recreation Program Manager, Silviculturist. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Haines, Thomas. District Ranger. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Massengale, David. Forester. US Forest Service, Mark Twain National Forest. Salem Missouri.

Moore, Dave. Forest Botanist/Ecologist, US Forest Service, Mark Twain National Forest, Rolla, Missouri.

Nelson, Paul. Forest Planning Ecologist. US Forest Service, Mark Twain National Forest, Rolla, Missouri.

Ness, Larry. Forestry Technician. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Sites, Angie. Forestry Technician. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Soard, Jerry. Zone FMO. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Sullivan, Amy. Transportation Planner. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Turner, Jay. NEPA Coordinator and Project Leader. US Forest Service, Mark Twain National Forest, Salem, Missouri.

Preparer

Sarah A. Bradley

Sarah A. Bradley
Wildlife Biologist

24 March 2004

Date

Contact: sbradley@fs.fed.us
US Forest Service
Mark Twain National Forest
PO Box 460, 1301 South Main Street
Salem, MO 65560

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
MAMMALS					
1	Eastern small-footed bat	Eastern small-footed bat	FT, Cassville, southern MO	Caves, tunnels buildings	
BIRDS					
2	Bachman's sparrow	Bachman's sparrow	All but PB	Rare summer resident, glades, open pine woods, old fields, clearcuts, Ozark plateau	
3	Cerulean warbler	Cerulean warbler	All MT units in the Ozarks	Bottomland and moist slope forests with uneven canopy of scattered large trees.	
4	American peregrin falcon	American peregrin falcon	Meramec, Gasconade, Mississippi Rivers historically	Mature, wooded riparian with cliffs	Hacked in STL, KC, Springfield
5	Migrant loggerhead shrike	Migrant loggerhead shrike	All MT units, could occur statewide	Uncommon permanent resident of grasslands with scattered shrubs and trees	
6	Swainson's warbler	Swainson's warbler	Don/11-pt District- Current, 11-pt Rivers; PB- Black River	Rare summer resident in giant cane along rivers in southern tier of MO counties	
AMPHIBIAN					
7	Eastern hellbender	Eastern hellbender	H/R, Sal/Pot-Ozark plateau rivers that drain into the MO. and Miss. Rivers	Under large, flat rocks in large, clear, permanent streams, common in Missouri	

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
8	Ozark hellbender	Ozark hellbender	Black and N. Fork White River systems; Willow, Don/11Pt RD.	Large, clear permanent streams, endemic to S. MO and N. AR	Federal candidate
REPTILES					
9	Alligator snapping turtle	Alligator snapping turtle	PB	Mississippi and other large rivers, sloughs and oxbows	
FISH					
10	Crystal darter	Crystal darter	Historically in the Gasconade, Meramec, Black, St. Francis, and Little Rivers. Probably only occurs in Black (Dunklin County) and Gasconade Rivers (Gasconade County) now.	Open channels of large, clear streams having low to moderate gradients and extensive stretches of largely silt-free sand and small gravel substrate	
11	Blue sucker	Blue sucker	Common and widely distributed in the MO and Mississippi Rivers and lowland section of the St. Francis River. Also recorded in the Black and Current Rivers	Deep, swift channels of large rivers over a bottom of sand, gravel or rock, most often where the channel is constrict by natural or artificial obstructions	New

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
12	Blacknose shiner	Blacknose shiner	Prairie streams of upper Osage (Benton, Dade, Hickory, St. Clair counties) and in tribs of lower Missouri River (Pettis, Callaway, Montgomery), Upper Big Piney and Gasconade Rivers (Texas, Wright)	Small moderately clear prairie streams in quiet pools with considerable amount of aquatic vegetation and bottoms of muck and organic debris and in quiet, heavily vegetated pools and backwaters of Ozark streams	
13	Ozark shiner	Ozark shiner	Found only in the Ozark uplands of southern MO and northern AR. White, Eleven Point, Current, Black, St. Francis (Marble Creek). Probably extirpated from Black and 11-Pt. Last stronghold is Current and Jacks Fork	Clear streams with high gradients and permanent strong flow mainly near riffles over a silt free bottom	
14	Sabine shiner	Sabine shiner	Black River in Butler county	Large moderately clear river with a predominance of sand, small gravel substrate	

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
15	Bluestripe darter	Bluestripe darter	Endemic to MO, Osage and Gasconade systems of the northern ozarks. Historically in the Sac, Maries and Little Piney rivers	Large creeks and small rivers, along margins of pools with silt free substrate and dense cover	
16	Longnose darter	Longnose darter	Historically in the White River in Stone and Taney counties and the St. Francis River and Lake Wappapello in Madison and Wayne counties. Recently collected in St. Francis at Fish Trap on FT unit	Medum to large Ozark rivers in pools and backwater with little current and firm substrate.	
17	Stargazing darter	Stargazin g darter	One of the rarest fish in MO. Current River in Ripley county and Black River in Butler county	Large, clear rivers in the transition zone between the Ozark Highlands and lowlands of the Miss embayment	
18	Eastern slim minnow	Eastern slim minnow	Historically in White, Black, St. Francis and Castor Rivers. Recently only from the Black River in Butler county and the Castor River in Bollinger county	Clear, swift streams with silt free sand and gravel substrate	
MOLLUSKS					
19	Spectacle case	Spectacle case	Meramec, Gasconade, Osage, Bourbeuse, Salt Rivers and Joachim Creek	Stable bottom of large rocks or boulders	

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
20	Western fanshell	Western fanshell	Locally abundant in the St. Francis, Spring, and Black Rivers, rare in the Current and Meramec	Shallow water with mixed gravel and mud	
21	Ouachita kidneyshell	Ouachita kidneyshell	Widespread south of MO River but seldom locally abundant. St. Francis, Black, Current, N. Fork White	Medium rivers with a substrate of gravel-mud and gravel with a moderate current in fairly shallow water, in riffles	
22	Purple lilliput	Purple lilliput	St. Francis, Black, Current, N. Fork White, Spring River	Gravel with sand	
23	Bluff vertigo	Bluff vertigo	Huzzah Creek	Caves and wet sites, bluffs along Huzzah	
INSECTS					
24	Micro caddisfly	Micro caddisfly	Endemic to MO, 11-Pt	Known only from Greer Spring	
25	Westfall's snaketail	Westfall's snaketail	Endemic to interior highlands, documented on Salem, Potosi, Fredtown Hou/Rolla, Ava, Willow	Fens, clear rocky rivers with gravel bars, high quality water and stable flow	New
26	A springtail	A springtail	Endemic to MO, Ava, 11-Pt	Wet caves	

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
27	A heptageniid mayfly	A heptageniid mayfly	Documented in the Huzzah on private within Potosi RD boundaries. Current, 11-Pt, Meramec, Black, White, St. Francis, Gasconade Rivers and the Headwater diversion	Slow to moderate flowing, cool, unpolluted, medium to large rivers	New
INVERTEBRATES					
28	Central MO cave amphipod	Central MO cave amphipod	Hou/Rolla-Phelps, Pulaski counties; Potosi-Washington county	Caves	
29	An isopod	An isopod	Poplar Bluff-Wayne county	Known only from a spring/seep in Wayne county	
30	Salem cave crayfish	Salem cave crayfish	Meramec, Gasconade, Osage, Current, 11-Pt, Spring Rivers	Cave streams, subterranean lakes, large springs	
31	Coldwater crayfish	Coldwater crayfish	11- Pt and Spring Creek	Coarse gravel and rock in swift, shallow water. Most abundant crayfish in the 11-Pt River	
32	A crayfish	A crayfish	White River drainage	Small clear creeks having a stable substrate of bedrock, rubble and coarse gravel	
33	Big Creek crayfish	Big Creek crayfish	St. Francis River in Iron, Madison and Wayne counties, most abundant in Big Creek and tribs	Headwater species in small high gradient rocky creeks in cavities under rocks, in riffles or in shallow silt-free pools	

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
34	White River Midget crayfish	White River Midget crayfish	Upper White River drainage in Barry, Christian, Stone, Taney counties	Clear, rocky, gravelly headwater creeks, spring branches and cave streams	
35	Cavernicolous harvestman	Cavernicolous harvestman	Know only from Turner Spring Cave in Oregon Co	Caves	
36	Onondaga Cave amphipod	Onondaga Cave amphipod	Salem, 11-Pt	Wet caves	
PLANTS					Counties per Moore's Spreadsheet
1	Purple false foxglove	Purple false foxglove	Ava/Cas, Sal/Pot	Prairies, dry open woods, glades, SW MO, scattered statewide	Barry, Iron, Shannon, Taney
2	Wood anemone	Wood anemone	Salem RD, Medley hollow fen, lower NE slope near creek	Moist, shaded north slope near fens, wet areas	Shannon
3	Tradescant aster	Tradescant aster	Butler and Howell counties in a meadow	Wet meadows, fens	Butler, Howell, Reynolds
4	Forked aster	Forked aster	Willow Springs, Houston, Don/11Pt units	Moist, rocky ledges of bluffs along streams in the Ozarks	Douglas, Ozark, Shannon, Texas
5	Large-leaf aster	Large-leaf aster	Willow Springs (one site on the MT)	Dry, open woods with bluffs/outcrops	Howell, Shannon, Texas
6	Ofer Hollow reedgrass	Ofer Hollow reedgrass	Houston, Willow Springs, Don/11-Pt in Douglas, Ozark and Texas counties	Rocky, wooded ravines and rocky open slopes	Douglas, Howell, Iron, Laclede, Oregon, Ozark, Shannon, Texas, Wright
7	Bush's poppy mallow	Bush's poppy mallow	Ava/Cass, Houston	Rocky, open woods and borders of glades and White river drainage	Barry, Ozark, Pulaski, Stone, Taney

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
8	Marsh bellflower	Marsh bellflower	Salem Rd, Big creek in Shannon county and Grasshopper Hollow in Reynolds county	Swampy meadows and fens	None
9	Buxbaum's sedge	Buxbaum's sedge	Butler county	Fens	Butler, Howell, Reynolds
10	Cherokee sedge	Cherokee sedge	Butler county	Low, wet woods (flatwoods)	Butler, Christian, Dent, Taney
11	Fibrous-root sedge	Fibrous-root sedge	Cass, Taney, Barry counties	Rich woods, wooded limestone slopes along steams	None
12	Epiphytic sedge	Epiphytic sedge	Salem, Don/11-Pt	On bases of shrubs in sinkhole ponds in SE Ozarks	Dent, Howell, Oregon, Texas, Reynolds, Ripley, Shannon
13	Sedge	Sedge	Phelps, Laclede, Taney, Jasper counties	Uncommon and widely scattered, moist depressions of upland prairies, disturbed marshy areas, low areas along roads and railroads, seems to prefer disturbed areas	Laclede, Ozark, Phelps
14	Large sedge	Large sedge	SE MO in Mississippi lowlands, uncommon	Swamps and bottomland forests	Butler, Ripley, Wayne
15	Sedge	Sedge	SE MO, Butler county	Rich, lowland woods or dry sandy wooded slopes and knolls	None

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
16	Dioecious sedge	Dioecious sedge	E Ozarks, Dent, Reynolds, St. Francis counties	Fens	Dent, Shannon, St. Francis
17	Straw sedge	Straw sedge	Shannon county	Sinkhole ponds	Shannon
18	Tussock sedge	Tussock sedge	Maries, Reynolds- Bee Fork, Shannon-Big Creek	Fens	Carter, Dent, Howell, Wayne, Reynolds, Shannon, St. Francis
19	Rigid sedge	Rigid sedge	Ava/Cass/WS and St. Francis county	Fens	Dent, St. Francis
20	Fox sedge	Fox sedge	Poplar Bluff RD, Camden, Wayne, Butler, Stoddard, Scott, New Madrid counties	Mississippi lowlands, swamps, openings of bottomland forests, wet depressions along roads, sometimes emergent	Butler, Wayne
21	Ozark chinquapin	Ozark chinquapin	Ava/Cass/WS, Howell county, White River drainage	Glades, dry ridges, acid soils	Baryy, Howell, Stone
22	Southern cayaponia	Southern cayaponia	Poplar Bluff RD, Camden, Wayne, Butler, Stoddard, Scott, New Madrid counties	Mud creek only	None
23	Ivy treebine	Ivy treebine	SW MO, McDonald to Ozark counties	Limestone bluffs along streams	Barry, Ozark, Stone, Taney
24	Trelease's larkspur	Trelease's larkspur	SW MO- Ava/Cass	Glades and bald knobs	Barry, Stone, Taney
25	Open-ground Whitlow grass	Open-ground Whitlow grass	Fredtown, Salem RD in Madison and Reynolds counties	Low, rocky woods	Madison, Reynolds
26	Log fern	Log fern	Carter county	Sinkholes and spring branches	Carter, Howell, Oregon

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
27	Goldie's woodfern	Goldie's woodfern	Madison county	Shaded, spring-fed branches	Bollinger, Madison, Perry, Texas, Wright
28	Yellow coneflower	Yellow coneflower	Central and Western Ozarks in Ozark, Phelps, Pulaski, Wright, Cedar, Barry counties	Limestone glades, barrens, and bald knobs	None
29	Wavy-leaf purple coneflower	Wavy-leaf purple coneflower	Hou/Rolla, Salem, Potosi, Don/11-Pt, PB RD's	Glades, savannas, roadsides	None
30	Small-flower thoroughwort	Small-flower thoroughwort	Dunklin, Butler, Riply counties	Swamps, low meadows, wet prairies	Butler, Ripley
31	Pale (rough) avens	Pale (rough) avens	Wayne county	Wet areas, low woods	Shannon, St. Genevieve
32	Featherfoil	Featherfoil	Salem, PB, Don/11-Pt	Sinkhole ponds, tupelo swamps, SE MO	Bollinger, Butler, Reynolds, Ripley, Wayne
33	Whorled pennywort	Whorled pennywort	Ozark county	Moist banks of spring-fed streams	Ozark
34	Larged whorled pogonia	Larged whorled pogonia	St. Francis, St. Genevieve, Oregon, Butler, Stoddard counties	Mesic upland forests on acidic substrate, in bottoms and on lower slopes of ravines, dry upland forests on chert and sandstone	Butler, Oregon, St. Genevieve, St. Francis
35	Butternut	Butternut	All MT units	Rich woods, base of slopes, riparian	
36	Weak rush	Weak rush	Ripley county in Little Barren Creek	Little Barren Creek in the water	Ripley
37	Small-fruit seedbox	Small-fruit seedbox	Oregon county	Spring branches, swampy meadows	Oregon

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
38	Baldwin's milkvine	Baldwin's milkvine	Ava/Cass/WS, Houston, Don/11Pt	Open, rocky woods, edges of glades, along streams	Barry, Christian, Ozark, Phelps, Shannon, Stone, Taney, Wright
39	Bog buckbean	Bog buckbean	Reynolds county- Bee Fork	Fens	Reynolds
40	Large-leaved grass-of-parnassus	Large-leaved grass-of-parnassus	East and south, central Ozarks, Salem, Potosi/Fredtown, WS, Don/11Pt	Springs, fens, north facing bluffs, calcareous seeps	Carter, Crawford, Dent, Douglas, Howell, Iron, Oregon, Ozark, Reynolds, Shannon, Texas, Washington
41	Mudbank paspalum	Mudbank paspalum	S. and W. MO and STL in Barton, Jasper, Howell, Butler, Dunklin, St. Louis counties	sloughs, banks of streams and margins of ponds, also ditches, usually emergent aquatic	uncommon, know only from historical collections. Butler, Howell
42	Carolina phlox	Carolina phlox	Carter county	Low woods along Big Barren Creek	Carter
43	Spotted phlox (wild sweet william)	Spotted phlox (wild sweet william)	Iron, Dent, Reynolds, Carter counties	Fens	Carter, Dent, Iron, Reynolds, St. Genevieve
44	Knotweed leaf-flower	Knotweed leaf-flower	Stone county	Limestone glades	Stone
45	Yellow-fringe orchid	Yellow-fringe orchid	Historically- Ripley, Iron counties; currently Stoddard county	Edges of spring branches and sinkhole ponds	Carter, Iron, Ripley, St. Francis, Wayne
46	Small green woodland orchid	Small green woodland orchid	St. Francis, Bollinger, Wayne, Carter, Butler counties	Acid seeps and sinkhole pond edges	Bollinger, Butler, Carter, St. Francis, Wayne

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
47	Southern rein orchid	Southern rein orchid	Howell, Shannon, Wayne counties	Low, wet woods and bottomlands bordering streams	Shannon, Wayne
48	Pale green orchid	Pale green orchid	SE MO- Howell county	Wet woods and bottomlands bordering streams	Butler, Howell, Iron
49	Halberd-leaf tearthumb	Halberd-leaf tearthumb	Stoddard county	Wet, sandy swales of spring branches	None
50	Spotted pondweed	Spotted pondweed	Ozark uplands in Iron, Dent, Reynolds, Shannon counties	Sinkhole ponds	Bollinger, Bulter, Carter, Dent, Howell, Iron, Oregon, Reynolds, Ripley, Shannon, Texas, Wayne
51	Nuttall's oak	Nuttall's oak	SE MO in New Madrid and Butler counties	Bottomlands, low wet woods	
52	Harvey beakrush	Harvey beakrush	SW MO in St. Clair, Newton counties	Sandstone glades	Christian, Douglas
53	Orange coneflower	Orange coneflower	Iron, Shannon, Greene, Barton, Jasper, Newton	Moist openings, ledges, low woods	Benton, AR
54	Narrow-leaf pink	Narrow-leaf pink	Butler county near Mud Creek	Upland oak-hickory woods	Bulter
55	Gibbous panic grass	Gibbous panic grass	Oregon county	Sinkhole pond edges	Oregon, Perry
56	Canby bulrush	Canby bulrush	Oregon county	Sinkhole ponds including Tupelo Gum pond	Oregon

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
57	Weakstalk bulrush	Weakstalk bulrush	Washington county	Occurs in an artificial lake, emergent aquatics along margins of lake, probably brought by waterfowl	Washington
58	Bush's skullcap	Bush's skullcap	Ava/Cass/WS, Hou/Rol, Don/11Pt	Glades and bald knobs	Carter, Christian, Dent, Douglas, Howell, Oregon, Ozark, Pulaski, Taney
59	Royal catchfly	Royal catchfly	All but Cedar Creek	Rocky, open woods, glade edges, savannas	Barry, Carter, Christian, Dent, Douglas, Howell, Laclede, Oregon, Ozark, Phelps, Pulaski, Shannon, Stone, Taney, Texas, Washington, Wright
60	Gattinger's goldenrod	Gattinger's goldenrod	All but Cedar Creek	Glades, bald knobs	Christian, Laclede, Perry, Pulaski, Oregon, Ozark, Riply, St. Francis, Stone, Taney, Washington, Wright

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
61	Ladies' tresses	Ladies' tresses	Jackson, Reynolds, Boone, Buchanan, Iron, Franklin, Butler, Camden counties	Low, rich woods, terraced slopes along streams	Bollinger, Butler, Iron, Oregon, Perry, Phelps, Reynolds, Taney, Washington
62	Sullivantia	Sullivantia	Willow Springs, Don/11-Pt, Salem on private in Shannon county	Moist, shaded north facing slopes	Douglas, Howell, Shannon
63	Pale manna grass	Pale manna grass	Phelps, Reynolds, Shannon, Howell, Wayne, Butler, Scott counties; 11-Pt district	Swamps and margins of sinkhole ponds and spring branches, often emergent aquatic	Barry, Shannon
64	Ozark spiderwort	Ozark spiderwort	Ava/Cassville RD	Rich, rocky, wooded slopes and ledges in the White River drainage	Barry, Christian, Howell, Ozark, Stone, Taney
65	Ozark trillium (wake robin)	Ozark trillium (wake robin)	Ava/Cass, Don/11Pt in Barry, Lawrence, Shannon counties	Thin, cherty, acid soils of shallow draws	Barry, Howell, Shannon
66	Yellowleaf tinker's-weed	Yellowleaf tinker's-weed	Maries, Butler, Benton counties	West and south facing limestone slopes along Gasconade river, NE bluffs along Cole Camp Creek	None
67	Ozark cornsalad	Ozark cornsalad	Cass county in the White River drainage	Glades	Benton and Carroll- AR
68	Northern arrow-wood	Northern arrow-wood	Oregon county in Hurrigan Creek	Gravel bars along small streams	Oregon

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
69	Barren strawberry	Barren strawberry	Texas, Dallas, Douglas counties; Jack's Fork, Shannon county- across from Medley Hollow fen, Salem RD	Shaded, moist humus of steep wooded north facing slopes and ledges near the base of bluffs	Douglas, Shannon, Texas
70	Netted chainfern	Netted chainfern	Barton, Butler, Stoddard, Lawrence counties	Swampy, wet, wooded areas	Butler, Carter
NON-VASCULAR					
71	Yellow starry fen moss	Yellow starry fen moss	Reynolds county in Grasshopper Hollow fen, Brant found in fen during Oak decline botanical survey in vicinity of Little Creek in Dent county (Salem RD)	Fens	None
72	Moss	Moss	11-Pt on Little Barren Creek in Ripley county	On roots or bases of trees, shrubs, or fallen twigs or rocks in swamps; submerged at high water; also margins of lakes, ponds, waerholes, or slow moving brooks in wooded swamps	None
73	Forked liverwort	Forked liverwort	Howell, Madison, Iron counties, Bell Mtn glades	Pioneer plant, occurs on bare rock or bare bark	None
74	Moss	Moss	Madison county on Fredtown unit	On calcareous rock in moist, shaded areas, generally on cliffs	None
75	Narrow-leaf peatmoss	Narrow-leaf peatmoss	Poplar Bluff in Pump Hollow	Bogs, wet ledges, sandy creek banks	None

Table 1A- RFSS for the Mark Twain National Forest as of 2/29/00 with list maintenance on 10/20/03.

	Common Name	Common Name	MT Units, Counties, Rivers	Habitat	Remarks
76	Sphagnum	Sphagnum	11-Pt in Shannon and Oregon counties, Brant found in southern branch of Clear Creek in Washington county (Potosi RD) during botanical survey	Bogs, wet ledges, sandy creek banks	None

TABLE 2A . Additional Species of Concern in Missouri as of January 2003

Common Name	Scientific Name	Species Group	Suitable Habitat, Watershed
Elephantear	<i>Elliptio crassidens</i>	Mollusk	Meramec, Osage
Snuffbox	<i>Epioblasma triquetra</i>	Mollusk	Bourbeuse, Meramec, St. Francois
Ebonysell	<i>Fusconaia ebena</i>	Mollusk	Meramec, Mississippi, Osage, Little Black
Sheepnose	<i>Plethobasus cyphus</i>	Mollusk	Meramec
Lake sturgeon	<i>Acipenser fulvescens</i>	Fish	Missouri, Mississippi, Osage, Gasconade
Swamp darter	<i>Etheostoma fusiforme</i>	Fish	Allred Lake, Cane Creek- Butler County
Harlequin darter	<i>Etheostoma histrio</i>	Fish	Streams and ditches in SE MO
Goldstripe darter	<i>Etheostoma parvipinne</i>	Fish	Romine Spring- Butler County
Redfin darter	<i>Etheostoma whipplei</i>	Fish	Spring River- Jasper and Barton Counties
Spring cavefish	<i>Forbesichthys agassizi</i>	Fish	A spring in Scott County
Cypress minnow	<i>Hybognathus hayi</i>	Fish	Lower Black, St. Francois in backwaters
Taillight shiner	<i>Notropis maculatus</i>	Fish	Lower Black, St. Francois, Allred Lake-sloughs
Mountain madtom	<i>Noturus eleutherus</i>	Fish	Black, St. Francois, Current
Flathead chub	<i>Platygobio gracilis</i>	Fish	Missouri, Mississippi
Central mudminnow	<i>Umbra limi</i>	Fish	Mississippi- sloughs, swamps
Western chicken turtle	<i>Deirochelys reticularia miaria</i>	Reptile	SE MO- swamps, sloughs, ditches
Western fox snake	<i>Elaphe vulpina vulpina</i>	Reptile	N MO- wet prairies, marshes
Blanding's turtle	<i>Emydoidea blandingii</i>	Reptile	N MO- marshes, sloughs, ponds, ditches
Yellow mud turtle	<i>Kinosternon f. flavescens</i>	Reptile	SW MO- rivers, sloughs, lakes, ponds
Illinois mud turtle	<i>Kinosternon f. spooneri</i>	Reptile	NE MO- rivers, sloughs, lakes, ponds
Mississippi green water snake	<i>Nerodia cyclopion</i>	Reptile	Extirpated
American bittern	<i>Botaurus lentiginosus</i>	Bird	Uncommon transient- marshes
Northern harrier	<i>Circus cyaneus</i>	Bird	Uncommon transient- marshes, prairies

TABLE 2A . Additional Species of Concern in Missouri as of January 2003			
Common Name	Scientific Name	Species Group	Suitable Habitat, Watershed
Snowy egret	<i>Egretta thula</i>	Bird	Rare transient- marshes, flooded fields
King rail	<i>Rallus elegans</i>	Bird	Rare transient- marshes and swamps
Greater prairie chicken	<i>Tympanuchus cupido</i>	Bird	Prairie in the Osage plains
Barn owl	<i>Tyto alba</i>	Bird	Rare permanent resident- open country With abandoned buildings
Black-tailed jackrabbit	<i>Lepus californicus</i>	Mammal	SW MO- open plains, prairie
Mountain lion	<i>Puma concolor</i>	Mammal	Dense cover in areas with few humans, Recently more sightings in the state
Spotted skunk	<i>Spilogale putorius</i>	Mammal	Statewide- open prairie, brushy areas