

**BIOLOGICAL ASSESSMENT/EVALUATION  
FEDERALLY-LISTED SPECIES**

**Mark Twain National Forest  
*Potosi/Fredericktown District***

St. Genevieve, St. Francois, Madison, and Bollinger Counties, Missouri

***East Fredericktown***

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## *East Fredericktown*

### INTRODUCTION

The purpose of this Biological Assessment/Evaluation (BAE) is to address and document the potential effects that planned management activities within the East Fredericktown Analysis Area 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.

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

### PROPOSED MANAGEMENT ACTION

**Summary of Proposed Action:** The primary purpose of the East Fredericktown project area analysis is to explore opportunities within the East Fredericktown project area that would improve forest health. In particular, activities are considered that would reduce the threat of insects (primarily red-oak borer), wildfire, and disease within the project area. To reduce these threats, two action alternatives (Alternatives 1 and 2) have been proposed. These two alternatives would focus primarily on activities that would create a more resilient mix of tree species and reduce the density of trees within stands to a healthier, more sustainable level. This would be achieved by conducting treatments that would reduce the black and scarlet oak composition within stands and encourage the growth and regeneration of more resilient species such as shortleaf pine and white oak.

The two action alternatives that are being considered for implementation within the East Fredericktown project area are as follows:

### **Alternative 1 (Non-commercial Treatment)**

This alternative responds to the issue of improving forest health and vigor without the use of commercial timber harvesting. This alternative would allow approximately 4,754 acres of forest stands to be treated mechanically by using the seedtree, shelterwood, sanitation/salvage cut, selection with groups, and thinning methods (methods are defined in Appendix A) (J.Walker, pers.comm.). These methods would achieve stand conditions that would favor regeneration of desirable tree species such as shortleaf pine, white oak, post oak, and hickories. (D.Dostal, pers.comm.). Because these treatments would be conducted non-commercially, there would be no removal of timber products as the result of these treatments, with a few exceptions for firewood removal. Therefore, there would be no temporary road construction or road reconstruction associated with this alternative (J.Walker, pers.comm.).

Several stands, including some mechanically treated, would be burned with prescribed fire to reduce hazardous fuels that may increase as a result of silvicultural treatments and to encourage pine and oak regeneration. Prescribed burning may be conducted at any time of year, other than May 15 – August 15, but 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. Preparation of these areas for prescribed burning would involve the construction of approximately 5.4 miles of dozer line, with the remaining firelines being constructed with handtools or utilizing features such as existing roads and streams (C.Woods, per.comm.).

In addition to timber stand improvement activities, a variety of other activities are proposed to improve and enhance the forest community. This alternative would designate 1,608 acres of forest as “old growth” habitat in order to perpetuate a continual supply of large diameter trees and old growth conditions for wildlife species that require these habitat conditions. No timber stand improvement activities would occur in these designated “old growth” stands, however, some low-intensity prescribed burning for hazardous fuels reduction would occur.

Wildlife habitat would also be enhanced by the construction of 30 vernal pools within the analysis area and maintenance of 4 existing permanent ponds. Vernal pool construction would consist of using a small-size dozer to create a temporary pond approximately 300 square feet in size and the majority of these vernal ponds will be constructed in stands proposed for silvicultural treatments. Permanent pond maintenance would involve the felling of small diameter trees growing on the pond dam, and clearing encroaching brush from around the pond edge. In some cases, the pond may be cleaned out with a small dozer.

This alternative would also allow for the removal and clean-up of several dumps within the analysis area. Dump cleanup would involve using a small dozer to scoop the dump materials into a truck and refuse would be hauled off-site and disposed of properly. (J.Walker, pers.comm.).

Also proposed in the alternative are activities intended to improve water quality and reduce soil erosion. These activities involve relocation of a 0.6 mile section of the Audubon Trail in order to remove it from a riparian flood zone. Relocation of this trail would involve constructing a new 0.6 mile section of trail using a small dozer and hand tools and would disturb a corridor approximately 10 feet wide and closure of the old, former trail section (T.Leimer, pers.comm.). Also proposed is the revegetation and stabilization of eroding soils located in 19 stands within the project area, including at an existing Artesian well site.

Table 1. Summary of activities proposed for Alternative 1 (Non-commercial Treatment)

Proposed Activity	Approximate Area Affected
Heavy Mechanical Treatment (Seedtree Cut)	850 acres
Moderate Mechanical Treatment (Shelterwood Cut)	1,543 acres
Moderate Mechanical Treatment (Sanitation/Salvage Cut)	922 acres
Moderate Mechanical Treatment (Selection with Groups)	362 acres
Moderate Mechanical Treatment (Thinning)	1,077 acres
<i>Subtotal (Mechanical Treatments)</i>	<i>4,754 acres</i>
Prescribed burning	2,603 acres
Miles of dozer-constructed fireline	5.4 miles
Old growth designated	1,608 acres
Vernal ponds constructed	30 ponds
Permanent ponds maintained	4 ponds
Dumps removed	11 sites
Trail reconstructed	0.6 miles
Areas with erosion control activities	19 stands

### **Alternative 2 (Modified 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 seedtree, shelterwood, sanitation/salvage cut, overstory removal, selection with groups, and thinning methods (methods are defined in Appendix A) (J.Walker, pers.comm.). Some firewood removal may also be allowed. Release of desirable tree species from competition would also occur by implementing crop tree release and release of pine saplings. These methods would achieve stand conditions that would favor regeneration of desirable tree species such as shortleaf pine, white oak, post oak, and hickories. (D.Dostal, pers.comm.).

Because these treatments would be conducted commercially, the removal of timber products would require the construction of approximately 24.3 miles of temporary roads and reconstruction of approximately 9.5 miles of existing unimproved roads. Temporary roads would be constructed using a dozer or other heavy equipment and be approximately 20 feet wide. They may be unsurfaced or partially surfaced with rock. Following use for timber treatments, these temporary roads would be decommissioned. Decommissioning roads would involve placing a barricade, such as an earthen or rock berm at the road

entrance. It may also involve posting “road closed” signs, or obliterating the road by scarifying the road surface, reshaping the contours to match the surrounding area, and scattering tree tops in the area. Reconstruction of roads would include improving the condition of an existing road by clearing the roadside vegetation, constructing drainage features, and adding surfacing material. The clearing limit would be from 20-40 feet wide, which includes a driving surface width of 12-24 feet (A. Sullivan, pers.comm.).

Several forest stands, including many timber harvest units, would be burned with prescribed fire to reduce hazardous fuels that may increase as a result of silvicultural treatments and to encourage pine and oak regeneration. Prescribed burning may be conducted at any time of year, other than May 15 – August 15, but 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. Preparation of these areas for prescribed burning would involve the construction of approximately 5.4 miles of dozer line, with the remaining firelines being constructed with handtools or utilizing features such as existing roads and streams (C.Woods, per.comm.).

In addition to timber stand improvement activities, a variety of other activities are proposed to improve and enhance the forest community. This alternative would designate 1,608 acres of forest as “old growth” habitat in order to perpetuate a continual supply of large diameter trees and old growth conditions for wildlife species that require these habitat conditions. No timber stand improvement activities would occur in these designated “old growth” stands, however, some low-intensity prescribed burning for hazardous fuels reduction would occur.

Wildlife habitat would also be enhanced by the construction of 30 vernal pools within the analysis area and maintenance of 4 existing permanent ponds. Vernal pool construction would consist of using a small-size dozer to create a temporary pond approximately 300 square feet in size and the majority of these vernal ponds will be constructed in stands proposed for silvicultural treatments. Permanent pond maintenance would involve the felling of small diameter trees growing on the pond dam, and clearing encroaching brush from around the pond edge. In some cases, the pond may be cleaned out with a small dozer.

Habitat for rare terrestrial plants and animals associated with glade communities would also be improved as part of this alternative. A total of 33 glades have been identified for restoration activities that would involve the cutting and removal of undesirable woody species that are currently encroaching upon the historically open glades. These activities may be accomplished either non-commercially or commercially, depending upon whether or not there is a market for the trees. If done commercially, the encroaching trees would be felled and pulled out to a landing area outside of the glade. If done non-commercially, the trees would be felled, lopped, and tops would either be piled (and perhaps burned) or moved to the edge of the glade. Undesirable species to be treated would be identified by the forest ecologist/botanist on a site-specific basis but would mostly include red cedar and small diameter trees such as hawthorn and buckthorn.

This alternative would also allow for the removal and clean-up of several dumps within

the analysis area. Dump cleanup would involve using a small dozer to scoop the dump materials into a truck and refuse would be hauled off-site and disposed of properly. (J.Walker, pers. comm.).

Also proposed in the alternative are activities intended to improve water quality and reduce soil erosion. These activities involve relocation of a 0.6 mile section of the Audubon Trail in order to remove it from a riparian flood zone. Relocation of this trail would involve constructing a new 0.6 mile section of trail using a small dozer and hand tools and would disturb a corridor approximately 10 feet wide and closure of the old, former trail section (T.Leimer, pers.comm.). Other activities to reduce soil erosion potential include the decommissioning of 45.8 miles of existing roads. Decommissioning of these roads may involve placing a barricade, such as an earthen or rock berm at the road entrance. It may also involve obliterating the road by scarifying the road surface, reshaping the contours to match the surrounding area, and scattering tree tops in the road. (A. Sullivan, pers.comm.). Also proposed is the revegetation and stabilization of eroding soils located in 19 stands within the project area, including at an existing Artesian well site.

Table 2. Summary of activities proposed for Alternative 2 (Modified Proposed Action)

Proposed Activity	Approximate Area Affected
Timber Harvest (Seedtree Cut)	850 acres
Timber Harvest (Shelterwood Cut)	1,543 acres
Timber Harvest (Sanitation/Salvage/Overstory removal Cut)	987 acres
Timber Harvest (Selection with Groups Cut)	362 acres
Timber Harvest (Thinning)	1,077 acres
<i>Subtotal (Timber Harvest)</i>	<i>4,819 acres</i>
Release (Pine saplings)	173 acres
Crop Tree Release	1,607 acres
Temporary roads constructed	24.3 miles
Roads reconstructed	9.5 miles
Existing roads decommissioned	45.8 miles
Prescribed burning	2,603 acres
Miles of dozer-constructed fireline	5.4 miles
Old growth designated	1,608 acres
Vernal ponds constructed	30 ponds
Permanent ponds maintained	4 ponds
Glades restored	33 sites
Dumps removed	11 sites
Trail reconstructed	0.6 miles
Areas with erosion control activities	19 stands

Alternative 1 and 2 Protective Measures: Several protective measures that are in addition to the standards and guidelines required by the MTNF Land and Resource Management Plan (aka Forest Plan) have been incorporated into the proposed action for both Alternatives 1 and 2. These protective measures can be found in Appendix B.

### **Alternative 3 (No Action)**

This alternative would initiate no new active management within the project 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 project area beyond what is currently ongoing as the result of natural processes, routine maintenance or current management direction.

**Project Location:** The legal description for the project area is: Township 32 North, Range 7 East, Sections 11-13; Township 32 North, Range 8 East, Sections 3, 6-11, 15, 18, 19, 21-23, 25, 26, 34-36; Township 33 North, Range 8 East, Sections 29, 30, 35; Township 34 North, Range 7 East, Sections 12, 36; Township 34 North, Range 8 East, Sections 2-4, 9, 17, 19-21, 28-33; Township 35 North, Range 8 East, Sections 9, 11-14, 16, 19-30, 34-36; Township 35 North, Range 7 East, Section 24, Fifth Principal Meridian. A general map of the project area can be found in Appendix C.

**Project Management Prescription Areas:** 4.14, 4.15, 4.16 and 4.17

**Project Area Size:** The project area represents approximately 76,813 acres of which approximately 17,657 acres are National Forest.

**Land Type Associations in Project Area:** Oak-Pine Hills-Limestone (HC), Oak-Pine Plains-Limestone (PA), Oak-Pine Plains-Limestone (PB), Oak-Pine Hills-Limestone (HD), Oak Pine Hills-Felsite (HA)

## **CONSULTATION HISTORY**

In 1984, the Forest Service requested formal consultation with the U.S. Fish and Wildlife Service on the 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 affect 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 non-jeopardy Biological Opinion for bald eagle, gray bat, Indiana bat and Mead's milkweed. This BAE for the East Fredericktown project area is being prepared under the guidance and direction of these past consultations.

No contact with the U.S. Fish and Wildlife Service (FWS) specifically regarding the analysis for the East Fredericktown project area has been initiated. However, prior to

selecting and implementing one of the proposed alternatives, this BAE will be reviewed by the FWS. No actions will be implemented without the concurrence of the FWS. No other federal agencies or state agencies are involved in this proposal.

**SPECIES CONSIDERED AND EVALUATED**

Twelve species are considered in this BAE. These species represent the list of federal species identified by the FWS in their letter to the Forest Supervisor, dated 31 July 2002, as being near or on the Mark Twain National Forest.

**Species Considered but Dismissed from Further Evaluation:** Of these twelve species, the following five species are not discussed in detail in this BAE. These species would not be affected by activities associated with the project because their known ranges are outside the project area. Based upon field surveys and knowledge of the available habitats, they do not have known suitable habitat within the project area. Therefore, the proposed alternatives would be expected to have *no effect* upon these species.

<u>Status</u>	<u>Common Name</u>	<u>Scientific Name</u>	<u>Associated Habitat and Documented Range on the MTNF</u>	<u>Reason for Dismissal from Further Evaluation</u>
Endangered	Topeka shiner	<i>Notropis topeka</i>	Streams north of the Missouri R.	Project area not within documented range of species; not known in river systems within project area.
Endangered	Tumbling Creek cave snail	<i>Antrobia culveri</i>	Only known in Mo from one cave located in Taney County, Mo.	Project area not within documented range of species; suitable habitat not known within project area.
Endangered	Pink mucket pearlymussel	<i>Lampsilis orbiculata</i>	Large rivers; persists in lower St. Francis & Current R. & Black R. below Clearwater Dam	Project area not within documented range of species; not known in river systems within project area.
Candidate	Ozark hellbender	<i>Cryptobranchus alleganiensis bishopi</i>	Clear, cold rivers; known to persist only in Black and north fork of White Rivers	Project area not within documented range of species; not known in river systems within project area.
Endangered	Scaleshell mussel	<i>Leptodea leptodon</i>	Big R, Auxvasse R, Gasconade R. & Meramec R.	Project area not within documented range of species; not known in river systems within project area.

The “project 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. For this analysis, the project area includes all lands within East Fredericktown Analysis Area.

**Species Considered in Detail:** Those federal species which are known to occur or have potentially suitable habitat within the project area, and thus, are selected for detailed analysis, include the following:

<b>Status</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>Associated Habitat on the MTNF</b>
Threatened	Bald eagle	<i>Haliaeetus leucocephalus</i>	Forest along large streams, reservoirs and lakes
Endangered	Curtis' pearlymussel	<i>Epioblasma florentina</i>	Little Black & Castor Rivers
Endangered	Gray bat	<i>Myotis grisescens</i>	Caves; riparian areas
Endangered	Indiana bat	<i>Myotis sodalis</i>	Caves; forests
Endangered	Hine's emerald dragonfly	<i>Somatochlora hineana</i>	Groundwater fed, limestone or dolomite grassy wetlands or fens
Endangered	Running buffalo clover	<i>Trifolium stoloniferum</i>	Open, well-lit stream sides
Threatened	Mead's milkweed	<i>Asclepias meadii</i>	Igneous glades

Federally listed species described in the Missouri Fish and Wildlife Information System (MOFWIS) as known or likely to occur in St. Genevieve, St. Francois, Bollinger, and Madison counties are **Curtis' pearlymussel, bald eagle, and running buffalo clover** (as of 7/23/03, see Appendix D). A review of the MTNF Heritage database (6/24/03 ver 1.2) also indicated the presence of **gray and Indiana bats** within one or more of these counties. The MTNF BE Program documented the known or likely presence of **Indiana bat** within one (LTA HA) of the four LTAs for the East Fredericktown project area (BE Program Report 2, 7/28/03). Based upon a review of these databases, as well upon information from field surveys, **none of these species are known to occur within the project area.**

**SURVEY INFORMATION**

In preparation of this BAE, site-specific surveys within the project area were combined with a general knowledge of the habitats that are likely or known to occur within the project influence areas. Lynda Mills (USFS biologist) conducted biological field surveys of the project area during 2003 on January 8, March 4, April 1, 3, 23, and May 12. These surveys were cursory in nature and focused on determining the habitat conditions within the project area and locating potential habitat for wildlife species.

Botanical surveys were also conducted by a contract botanist (Alan Brant) during the growing season of 2003 and results of those surveys have been reviewed as part of this BAE. These botanical surveys focused on the drainages within the project area (generally considered areas of highest potential for rare plant communities) and were considered to be nearly complete by July 2003 and will continue until winter of 2003 (A.Brant, pers. comm.).

Additional special habitat information such as seep, fen, and glade locations was collected by Susan Stevens (USFS Archeology Technician) during her extensive field surveys within the project area and reviewed during the preparation of this BAE.

One night of survey work by Sybil Amelon (USFS biologist) was conducted within the project area during June 2003. The surveys involved mistnetting a location in the north end of the project area to determine bat use of the area. No federally listed bat species were captured during this survey.

Other surveys not specific to this project have been conducted in the vicinity of these rights-of-ways. For example, in partnership with the Mark Twain National Forest and others, the Missouri Department of Conservation (MDC) has been very aggressive in conducting species surveys and maintaining data on both listed and common species. Information collected by MDC during their surveys was reviewed as preparation for this BAE by utilizing the Missouri Fish and Wildlife Information System (MOFWIS) and the Missouri Heritage 6/24/2003 v. 1.2 database.

In addition to the extensive fieldwork done in preparation of the Missouri Heritage and MOFWIS databases, there are numerous field surveys conducted annually or as part of research projects in Missouri. The Mark Twain National Forest has also conducted surveys in partnership with others, or on its own such as:

- Annual mid-winter eagle surveys
- Annual eagle nest surveys
- Forest bat surveys (cave, fall, summer, winter, mist-net, harp-trap, Anabat)
- Missouri breeding bird atlas and survey routes
- Cave research foundation biological inventories
- Gardner & Gardner cave inventories
- Contracted botanical surveys
- Naiads survey 1980-82
- Periodic fish surveys

While not all of these surveys are relevant to the analysis for the East Fredericktown project area, they do provide information concerning suitable habitats and species distribution within the vicinity of the project area.

Additional information regarding species habitats and distributions within the project area was gathered from various publications and websites that are identified in the References and Data Sources section of this BAE.

In sum, 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 area.

## ENVIRONMENTAL BASELINE

### 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** – Within the East Fredericktown project area, the best potential habitat for bald eagle roosts and nests would be along the Castor River followed by along the edges of the larger perennial streams within the project area. However, no bald eagle roosts or nests are known to occur within the project area. The closest known bald eagle nest lies approximately 15.75 miles south of the project area along the Castor River. Another eagle nest is located approximately 22.6 miles to the north of the project area along Establishment Creek. These two sites are the closest known eagle nests/roosts to the project area.

It would not be surprising however, to find a wintering bald eagle anywhere within the project area, given the relatively close proximity of the project area to the Mississippi River. Many bald eagles overwinter along the Mississippi River and are often wide-ranging during the winter months as they forage for food. However, even during the winter months, it would be most likely to locate a bald eagle near a large stream or other water body.

The BE program (Reports 2 & 3) did not identify any known or expected locations for bald eagle within the project area, nor any suitable habitat for the species. MOFWIS did identify this species as occurring in at least one of the four counties within the project area.

### **Curtis' pearlymussel**

**General habitat requirements** – The Curtis' pearlymussel occurs in transition areas between headwater and lowland stream reaches in 4<sup>th</sup> to 7<sup>th</sup> order streams with gradients of 0.9 to 8.0 feet per mile. It requires shallow water and a stable substrate of small to medium gravel. These mussels are usually found in quiet water at the edge of a good current or in water with a moderate current. The fish host is unknown but may be one or more species of darters. Much of the original habitat for this species was inundated or altered by impoundments, stream channelization, and gravel dredging (U.S. Forest Service 1998).

**Distribution on the MTNF** – The two rivers known to still support this species in Missouri are the Little Black and Castor Rivers, both of which occur within the MTNF proclamation boundary. However, none of the sites on these two rivers where this species was most recently found are adjacent to our near National Forest lands. Historic records for this species do exist for the Poplar Bluff district in Cane Creek and the Black River, but more recent surveys did not locate any live specimens (U.S. Forest Service 1998)

**Occurrence within project area** – The only location within the project area where this species would be expected to possibly occur is within the Castor River, since previous surveys have located it within this stream. However, no records for this species from within the project area are known. The known locations for this species in the Castor River are approximately 40 miles downstream from the project area.

The BE program (Reports 2 & 3) did not identify any known or expected locations for Curtis' pearlymussel within the project area, nor any suitable habitat for the species. MOFWIS did identify this species as occurring in at least one of the four counties within the project area.

## **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 (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 forest bats was conducted in the spring and fall of 1997, 1998, 1999, and 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** – The closest gray bat record to the project area is located approximately 11 miles west. This record was reported to Lynda Mills by Mark Yates, a graduate student conducting mistnetting surveys in the general area. Mark Yates reported that he had caught a few individual gray bats at this site during July 2003. The bats were foraging over the St. Francis River and captured above the bridge on Highway

E. Sybil Amelon also captured several foraging gray bats approximately 12 miles west of the project area at the Silver Mines Recreation Area during June 2003. These bats also were foraging along the St. Francis River and adjacent tributaries and it was suspected that they may have been using abandoned mine portals at the recreation area (S. Amelon, pers. comm.).

There are no caves known from within the project area. The closest caves to the project area that are known are located approximately 6.5 miles to the west and 3.7 miles to the north of the project area, however, no gray bats are known to use these caves. The closest cave known to support gray bats to the project area is located approximately 33 miles west of the project area (Wick's cave). Assuming that the abandoned mines at Silver Mines are supporting gray bats, the closest gray bat colony may be approximately 12 miles west of the project area.

There are no gray bat records from within the project area and no known caves within the project area. However, given the distribution and proximity of gray bats known from within the vicinity of the project area, it would not be surprising to find gray bats within the project area. Gray bats could potentially use any of the larger perennial streams, and certainly the Castor River, as foraging habitat. The likelihood of a gray bat colony occurring in the project area is considered generally low, however, due to the fact that no caves are known within the project area.

The BE program (Reports 2 & 3) did not identify any known or expected locations for gray bat within the project area, nor any suitable habitat for the species.

## **Indiana Bat**

**General habitat requirements** – The Indiana bat occupies a wide variety of roost sites and environments. During cold periods, generally November through March, Indiana bats hibernate in caves. During warmer weather, however, the Indiana bat frequents areas outside its caves and utilizes standing snags and hollow or loose bark trees, and, occasionally, abandoned buildings, as roost sites and maternity colony sites. Generally, the male's summer roost trees are located within 5 miles of an Indiana bat hibernaculum, 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 mistnet surveys at the Silver Mines Recreation Area on the Mark Twain National Forest in Madison County. This was the first documented record of a reproductively active female Indiana bat from the Mark Twain National Forest. Capture of this bat supported the theory that Indiana bat maternity sites may occur on the Mark Twain National Forest, particularly on the Potosi-Fredericktown Ranger District.

**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 significant Indiana bat hibernacula (caves) known on the Mark Twain National Forest, one of which is located on the Potosi-Fredericktown 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 and 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 Indiana bat was captured on the National Forest, indicating that maternity colonies may exist on the National Forest. However, none of these captures led to the discovery of maternity colonies and four of the five of the reproductively active females captured closest to the National Forest were found within 5 miles of significant Indiana bat hibernaculum (T. Davidson, pers. comm. 1/23/03). None of the National Forest has been designated by the USFWS as critical habitat for this species.

**Occurrence within project area** – The largest known Indiana bat hibernacula in Missouri is also the closest known Indiana bat colony to the project area (Pilot Knob Mine). Pilot Knob Mine is located approximately 22.3 miles to the west of the project area. The closest record of an individual Indiana bat to the project area is from the Silver Mines Recreation Area, where a pregnant Indiana bat was captured in June 2003 foraging over Turkey Creek near its confluence with the St. Francis River (S.Amelon, pers. comm.). This site is located approximately 12.5 miles west of the project area.

There are no records of Indiana bats from within the project area. However, given the presence of Indiana bats from within the vicinity of the project area, it would not be surprising to discover an Indiana bat within the project area. It would be surprising, however, and not very likely, to discover an Indiana bat hibernacula within the project area than to discover a maternity colony or foraging individuals. This is due to the fact that no suitable caves are known to occur within the project area. There is a greater potential for discovery of a maternity site or foraging individuals within the project area because of the extensively forested condition of the project area, which supplies an innumerable amount of roosting habitat in the form of hollow, split, or loose barked trees. Some potential roosting habitat also exists in the form of abandoned structures located on private lands within the project area. Foraging Indiana bats could occur anywhere within the project area outside their hibernation period.

The BE program (Reports 2 & 3) identified Indiana bat as being known or expected in one of the four LTAs within the project area (LTA HA). Within this LTA, the BE program identified 12,399 acres of suitable habitat for this species, however, only 679 acres of this is located within the project area.

## **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 good 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, additional sites that harbor this species have been recorded on or near the MTNF. All of these sites represent calcareous fens and open wetland areas typical of the habitat expected for this species.

**Occurrence within project area** – The Hine’s emerald dragonfly has not been documented from within the project area. The closest known record for this species is from a fen on private land and the Barton Fen complex, located approximately 40 miles and 46 miles west of the project area, respectively. However, within the project area, there is suitable habitat for this species, much of which may have not yet been surveyed for this species. This habitat is in the form of fens scattered across the project area. Some of these fens, however, may not be good habitat for this species, due to the encroachment of woody shrubs and trees.

The BE program (Reports 2 & 3) did not identify any known or expected locations for Hine’s emerald dragonfly within the project area, nor any suitable habitat for the species.

## **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, usually along streams, 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, 2 of which are located on the Potosi-Fredericktown District and within the general vicinity of the project area.

**Occurrence within project area** – None of the known sites for this species are within the project area. The closest known site for this species is approximately 10.3 miles west of the project area, along Mill Creek. Based upon available records, the site appears to be naturally occurring and not an introduced population.

Suitable habitat for this species occurs within the project area. This habitat would be most likely to be found along the perennial streams within the project area, especially

where burning or some other prior disturbance has created semi-open conditions. Given the presence of naturally occurring populations within the vicinity of the project area, it would not be surprising to locate this species in the project area; however, no individuals of this species were located during the extensive botanical surveys of stream corridors conducted within the project area during 2003 by Alan Brant.

The BE program (Reports 2 & 3) did not identify any known or expected locations for running buffalo clover within the project area, nor any suitable habitat for the species. MOFWIS did identify this species as occurring in at least one of the four counties within the project area.

## **Mead's Milkweed**

**General habitat requirements** – Mead's milkweed occupies dry-mesic to mesic tallgrass prairie and igneous glades that historically were maintained by periodic fire and climate. The species prefers full sun and generally occurs between 800-1200 feet above sea level on slopes < 20 %. Studies have indicated that seedling survivorship of this species is enhanced by a combination of greater than average rainfall and fire and juvenile and adult survivorship is also benefited by burning (U.S. Fish and Wildlife Service 2002b).

**Distribution on the MTNF** – This species has been documented from only one site on the MTNF. This site is within the Bell Mountain Wilderness Area on the Potosi-Fredericktown District. Historic populations of the species on the MTNF are not known, although other suitable habitat likely existed on the MTNF prior to recent decades of fire suppression and encroachment of many glades and former prairie habitats by eastern red cedars and hardwood trees.

**Occurrence within project area** – No Mead's milkweed sites have been recorded from within the project area. The closest known record for this species comes from the Ketcherside Mountain Conservation Area (state land), located approximately 25 miles west of the project area.

Within the project area, there is suitable habitat for Mead's milkweed. This habitat lies mostly on the south end of the project area, where the substrate is igneous and supports numerous glades. Habitat is particularly abundant in the Cottoner Mountain area. During botanical surveys of this project area, several of these glades were surveyed during the May thru June period in search of Mead's milkweed; however, no individuals of the species were found (A.Brant, pers.comm.).

The BE program (Reports 2 & 3) did not identify any known or expected locations for Mead's milkweed within the project area, nor any suitable habitat for the species.

## EFFECTS OF PROPOSED MANAGEMENT ACTION

### Bald eagle

#### *Alternative 1*

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

**Indirect Effects:** The greatest potential of a bald eagle occurring in the project area would be in the winter, when perhaps a transient bird may perch along a stream in the project area. Should such an eagle perch or pass through a proposed mechanical treatment or prescribed burning treatment 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.

Because Alternative 1 proposes several hundred acres of mechanical treatment of timber stands, in which trees would be cut but not removed, there is some increased potential for a severe wildfire within the project area. The heavy fuel loads left in these stands following mechanical treatment would increase this potential. Heavy fuel loads could contribute to an intense, hard to control wildfire in the project area. Such a wildfire has the potential of negatively impacting habitat for the bald eagle by killing large areas of standing timber along riparian zones and throughout the project area. However, the chances of such a wildfire occurring would be hard to predict and therefore, these indirect effects may not be “reasonably certain to occur”.

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

The designation of 1,608 acres of old growth as part of this alternative may have an indirect beneficial effect upon potential bald eagle habitat. Much of this designated old growth would be located in bottomlands and along stream courses, therefore, favoring the development and protection of larger, super canopy trees within these riparian areas. These trees may someday contribute to bald eagle nesting/roosting habitat.

**Cumulative Effects:** Based upon known past, present, and foreseeable activities, this project 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 project 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.

**Summary of FWS BO Compliance:** 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:** Activities proposed in Alternative 1 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 project area, however, *transient winter use of the area is not likely to be affected* by any activities proposed in Alternative 1. 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 FWS BO terms and conditions.

Should bald eagle use within the project influence area be documented, consultation with the US Fish and Wildlife Service will be re-initiated for this project.

## *Alternative 2*

**Direct Effects:** There are no known records for bald eagles within the project area. No nests or roosts have been identified within the project area. Therefore, the activities

proposed in Alternative 2 would not be expected to have any direct effects upon known bald eagle nests or roosts. Protective measures incorporated into this alternative would also protect any potential nest or roost trees where they would most likely occur (along larger perennial streams and the Castor River) because these measures would restrict any activities from occurring within the floodplains of these streams.

**Indirect Effects:** The greatest potential of a bald eagle occurring in the project area would be in the winter, when perhaps a transient bird may perch along a stream in the project 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.

The designation of 1,608 acres of old growth as part of this alternative may have an indirect beneficial effect upon potential bald eagle habitat. Much of this designated old growth would be located in bottomlands and along stream courses, therefore, favoring the development and protection of larger, super canopy trees within these riparian areas. These trees may someday contribute to bald eagle nesting/roosting habitat.

**Cumulative Effects:** Based upon known past, present, and foreseeable activities, this project 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 project area to become more important for bald eagle recovery. However, since Alternative 2 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 FWS BO Compliance:** 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 2 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:** Activities proposed in Alternative 2 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 project area, however, *transient winter use of the area is not likely to be affected* by any activities proposed in Alternative 2. The implementation of Alternative 2 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 FWS BO terms and conditions.

Should bald eagle use within the project influence area be documented, consultation with the US Fish and Wildlife Service will be re-initiated for this project.

### *Alternative 3*

**Direct Effects:** There are no known records for bald eagles within the project area. No nests or roosts have been identified within the project area. Therefore, if Alternative 3 is implemented, it would not be expected to have any direct effects upon known bald eagle nests or roosts. Under Alternative 3, no new activities would occur within the project area that have the potential of disturbing potential habitat for this species.

**Indirect Effects:** There would be no prescribed burning or tree felling implemented under Alternative 3 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, wildfire, insect outbreaks, etc.

With implementation of Alternative 3, 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 wildfires within the project area. Fuels would build-up with the forested stands as they succumb to disease and insects. Such a wildfire has the potential of negatively impacting habitat for the bald eagle by killing large areas of standing timber along riparian zones and throughout the project area. However, the chances of such a wildfire occurring would be hard to predict and therefore, these indirect effects may not be “reasonably

certain to occur”.

**Cumulative Effects:** Based upon known past, present, and foreseeable activities, this project 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 project area to become more important for bald eagle recovery. However, since Alternative 3 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 FWS BO Compliance:** 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 3 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 3 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 project area, making them susceptible to intense wildfires, 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 3 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.

Should bald eagle use within the project area be documented, consultation with the US Fish and Wildlife Service will be re-initiated for this project.

## **Curtis’ pearlymussel**

### ***Alternative 1***

**Direct Effects:** Curtis’ pearlymussel has not been documented from within the project

area. The closest known record for the species is from a site approximately 40 miles downstream of the project area in the Castor River. None of the activities proposed in Alternative 1 would directly impact the Castor River, so there are expected to be no direct effects upon this species or its habitat.

**Indirect Effects:** Aquatic species that occupy or may occupy the Castor River, such as Curtis' pearlymussel, are most susceptible to the effects that activities occurring within the Castor River watershed 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 this alternative, these activities include the construction of dozerlines, vernal pond construction, erosion control activities, and reconstruction of trails. The mechanical treatment of stands for timber stand improvement activities would not be expected to significantly disturb the soil surface because these activities would be conducted using no heavy equipment and would not require any temporary road construction or road reconditioning (J.Walker, pers.comm).

However, several protective measures have been incorporated into this alternative that will minimize any potential for soil movement from dozerlines and trail reconstruction activity areas, as well as areas being treated mechanically. 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 Curtis' pearlymussel. 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).

Because Alternative 1 proposes several hundred acres of mechanical treatment of timber stands, in which trees would be cut but not removed, there is some increased potential for a severe wildfire within the project area. The heavy fuel loads left in these stands following mechanical treatment would increase this potential. Heavy fuel loads could contribute to an intense, hard to control wildfire in the project area. Such a wildfire has the potential of negatively impacting the water quality with the project area by increasing the amount of water and soil run-off. However, the chances of such a wildfire occurring would be hard to predict and therefore, these indirect effects may not be "reasonably certain to occur".

Some of the activities proposed in this alternative may also have an indirect beneficial effect upon potential habitat for the Curtis' pearlymussel. Under this alternative, some activities would occur that may enhance the water quality of streams within the project area, and therefore, improve water quality in the Castor River. Activities that would improve water quality include dump removal (some of which are located near streams), erosion control activities along perennial streams and Castor River, and relocation of a section of trail to an area outside the Bidwell Creek floodplain. The designation of 1,608 acres of old growth habitat would also occur under this alternative and benefit potential habitat for Curtis' pearlymussel, because much of this old growth would be designated within riparian areas and along streamcourses. All of these proposed activities would improve potential habitat for Curtis' pearlymussel.

**Cumulative Effects:** 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 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 project 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 this 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 the Curtis' pearlymussel or its habitat.

**Summary of FWS BO Compliance:** The June 23, 1999 Biological Opinion did not specifically address the Curtis' 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:** Activities proposed in Alternative 1 are *not likely to adversely affect* the Curtis' pearlymussel or its habitat. This alternative would not involve conducting activities within the floodplains of the Castor River or its major tributaries. Activities proposed have incorporated protective measures to minimize the potential for soil erosion and deposition in the Castor River, considered suitable habitat for the Curtis' pearlymussel. Given that the closest known record for this species is approximately 40 miles downstream from the project area, it is not likely that any of the activities proposed within the project area will have direct, indirect, or cumulative effects upon known populations of this species. Some of the activities proposed in Alternative 1 *may have a beneficial effect* upon potential habitat for this species because they will improve existing sources of soil erosion and/or stream degradation.

## *Alternative 2*

**Direct Effects:** Curtis' pearlymussel has not been documented from within the project area. The closest known record for the species is from a site approximately 40 miles downstream of the project area in the Castor River. None of the activities proposed in Alternative 2 would directly impact the Castor River, so there are expected to be no direct effects upon this species or its habitat.

**Indirect Effects:** Aquatic species that occupy or may occupy the Castor River, such as Curtis' pearlymussel, are most susceptible to the effects that activities occurring within the Castor River watershed 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 this alternative, these activities include temporary road construction, road reconditioning, skidding and dragging associated with commercial removal of merchantable timber, the construction of dozerlines, and, to a lesser degree, vernal pond construction, erosion control activities, glade restoration, and reconstruction of trails.

However, several protective measures have been incorporated into this alternative 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 Curtis' pearlymussel. 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 this alternative may also have an indirect beneficial effect upon potential habitat for the Curtis' pearlymussel. Under this alternative, some activities would occur that may enhance the water quality of streams within the project area, and therefore, improve water quality in the Castor River. Activities which would improve water quality include dump removal (some of which are located near streams), erosion control activities along perennial streams and Castor River, and relocation of a section of trail to an area outside the Bidwell Creek floodplain. The designation of 1,608 acres of old growth habitat would also occur under this alternative and benefit potential habitat for Curtis' pearlymussel, because much of this old growth would be designated within riparian areas and along streamcourses. All of these proposed activities would improve potential habitat for Curtis' pearlymussel.

**Cumulative Effects:** 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 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 project 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 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 the Curtis' pearlymussel or its habitat.

**Summary of FWS BO Compliance:** The June 23, 1999 Biological Opinion did not specifically address the Curtis' 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:** Activities proposed in Alternative 2 are *not likely to adversely affect* the Curtis' pearlymussel or its habitat. This alternative would not involve conducting activities within the floodplains of the Castor River or its major tributaries. Activities proposed have incorporated protective measures to minimize the potential for soil erosion and deposition in the Castor River, considered suitable habitat for the Curtis' pearlymussel. Given that the closest known record for this species is approximately 40 miles downstream from the project area, it is not likely that any of the activities proposed within the project area will have direct, indirect, or cumulative effects upon known populations of this species. Some of the activities proposed in Alternative 2 *may have a beneficial effect* upon potential habitat for this species because they will improve existing sources of soil erosion and/or stream degradation.

### *Alternative 3*

**Direct Effects:** Alternative 3 would have no direct effects upon Curtis' pearlymussel or its habitat. This alternative would not involve implementation of any new activities that would have any direct effect upon known locations or potential habitat for this species.

**Indirect Effects:** Under Alternative 3, 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 wildfires within the project area. Fuels would build-up within

the forested stands as they succumb to disease and insects. Should an intense wildfire 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 the Castor River. Exclusion of controlled prescribed burning within these stands would also increase the potential for wildfires to become intense and difficult to control. The chances of a wildfire occurring within the project 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 3 would also not implement any activities, such as erosion control, old growth designation, dump removal, and trail relocation, which could have an indirect beneficial effect upon the water quality of the Castor River.

**Cumulative Effects:** The Curtis’ pearl mussel 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 3, 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 3. Therefore, while there are not any anticipated cumulative adverse effects resulting from the implementation of Alternative 3, 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 FWS BO Compliance:** The June 23, 1999 Biological Opinion did not specifically address the Curtis’ 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:** Alternative 3 would have *no direct effect* and *is not likely to indirectly adversely affect* the Curtis’ pearl mussel or potential habitat for this species. The potential for indirect effects upon its potential habitat (Castor River) 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 wildfires, 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 3 is expected to have *no cumulative adverse effect* upon the Curtis’ 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.

## Gray bat

### *Alternative 1*

**Direct Effects:** Since no gray bats are known to occupy the project area and the closest known gray bat record is approximately 11 miles west of the project area, none of the activities proposed for implementation in Alternatives 1 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.

Foraging gray bats may be occupying the project area; however, none of the activities proposed would be expected to directly affect the quality or amount of foraging habitat for this species. No forested habitat that is known or likely to be used as a travel corridor for gray bats between their caves and foraging areas would be directly impacted by any of these activities, assuming gray bats likely follow streamcourses for foraging and travel corridors. With implementation of the protective measures identified in Appendix B, the forested condition within the floodplain of intermittent and perennial streams within the project area would be maintained.

**Indirect Effects:** The activities proposed have some potential for indirect effects upon gray bats by indirectly affecting the water quality of streams within the project 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 this alternative, these activities include the construction of dozerlines, vernal pond construction, erosion control activities, and reconstruction of trails. The mechanical treatment of stands for timber stand improvement activities would not be expected to significantly disturb the soil surface because these activities would be conducted using no heavy equipment and would not require any temporary road construction or road reconditioning (J.Walker, pers.comm).

However, several protective measures have been incorporated into this alternative that will minimize any potential for soil movement from dozerlines and trail reconstruction activity areas, as well as areas being treated mechanically. 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 project area. This potential is considered very low due to the fact that no caves are known to occur within the project area and none were located during various field surveys of the project 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 project 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 33 miles from the project area, it is highly unlikely that it would be impacted by any prescribed burning activities. Even if the abandoned mines at the Silver Mines Recreation Area (located 12 miles from the project area) are occupied by gray bats, it is not likely that they would be impacted by smoke accumulations given their distance from the project area. Prescribed burning activities will be conducted in a manner to ensure that smoke does not accumulate heavily in areas likely to be occupied by gray bats. These areas include Silver Mines Recreation Area, and caves known to support gray bats.

Because Alternative 1 proposes several hundred acres of mechanical treatment of timber stands, in which trees would be cut but not removed, there is some increased potential for a severe wildfire within the project area. The heavy fuel loads left in these stands following mechanical treatment would increase this potential. Heavy fuel loads could contribute to an intense, hard to control wildfire in the project area. Such a wildfire has the potential of negatively impacting the water quality with the project area by increasing the amount of water and soil run-off. These effects could impact the prey base for gray bats that forage over these streams. However, the chances of such a wildfire occurring would be hard to predict and therefore, these indirect effects may not be "reasonably certain to occur".

Some of the activities proposed in this alternative may also have an indirect beneficial effect upon potential habitat for the gray bat. Under this alternative, some activities would occur that may enhance the water quality of streams within the project area, and therefore, improve habitat for gray bat prey (aquatic insects). Activities which would improve water quality include dump removal (some of which are located near streams), erosion control activities along perennial streams and Castor River, and relocation of a section of trail to an area outside the Bidwell Creek floodplain. The designation of 1,608 acres of old growth habitat would also occur under this alternative and benefit potential habitat for gray bat, because much of this old growth would be designated within riparian areas and along streamcourses. All of these proposed activities would improve potential habitat for gray bats.

**Cumulative Effects:** Based upon known past, present, and foreseeable events, this project is not expected to have an adverse cumulative effect upon the gray bat or its habitat. The MTNF caves constitute only 9% of the gray bat caves in Missouri. The remaining 91% of gray bat caves are located on properties where land use practices and activities that may impact the remaining gray bat caves are outside the control of the Forest Service. Activities proposed in Alternative 1 are not likely to contribute to activities that may adversely impact any gray bat caves or their foraging habitat.

**Summary of FWS BO Compliance:** 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

Alternative 1 comply 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 are likely to impact gray bat caves.

**Determination of Effect and Rationale:** Implementation of activities proposed in Alternative 1 is *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 project area, based upon past surveys of these caves, this potential is considered very low. Any foraging gray bats or their foraging habitat that may be within the project area are not likely to be impacted by the proposed activities. The implementation of Alternative 1 would be expected to have no cumulative effects upon gray bats because it does not jeopardize recovery of the species and is in compliance with FWS BO terms and conditions.

Should an undiscovered gray bat cave later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

## *Alternative 2*

**Direct Effects:** Since no gray bats are known to occupy the project area and the closest known gray bat record is approximately 11 miles west of the project area, none of the activities proposed for implementation in Alternative 2 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. Foraging gray bats may be occupying the project area; however, none of the activities proposed would be expected to directly affect the quality or amount of foraging habitat for this species. No forested habitat that is known or likely to be used as a travel corridor for gray bats between their caves and foraging areas would be directly impacted by any of these activities, assuming gray bats likely follow stream courses for foraging and travel corridors. With implementation of the protective measures identified in Appendix B, the forested condition within the floodplain of intermittent and perennial streams within the project area would be maintained.

**Indirect Effects:** The activities proposed have some potential for indirect effects upon gray bats by indirectly affecting the water quality of streams within the project 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 this alternative, these activities include

temporary road construction, road reconditioning, skidding and dragging associated with commercial removal of merchantable timber, the construction of dozerlines, and, to a lesser degree, vernal pond construction, erosion control activities, glade restoration, and reconstruction of trails.

However, several protective measures have been incorporated into this alternative that will minimize any potential for soil 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 project area. This potential is considered very low due to the fact that no caves are known to occur within the project area and none were located during various field surveys of the project 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 project 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 33 miles from the project area, it is highly unlikely that it would be impacted by any prescribed burning activities. Even if the abandoned mines at the Silver Mines Recreation Area (located 12 miles from the project area) are occupied by gray bats, it is not likely that they would be impacted by smoke accumulations given their distance from the project area. 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. These areas include Silver Mines Recreation Area, and caves known to support gray bats.

Some of the activities proposed in this alternative may also have an indirect beneficial effect upon potential habitat for the gray bat. Under this alternative, some activities would occur that may enhance the water quality of streams within the project area, and therefore, improve habitat for gray bat prey (aquatic insects). Activities that would improve water quality include road decommissioning, dump removal (some of which are located near streams), erosion control activities along perennial streams and Castor River, and relocation of a section of trail to an area outside the Bidwell Creek floodplain. The designation of 1,608 acres of old growth habitat would also occur under this alternative and benefit potential habitat for gray bat, because much of this old growth would be designated within riparian areas and along stream courses. All of these proposed activities would improve potential habitat for gray bats.

**Cumulative Effects:** Based upon known past, present, and foreseeable events, this project is not expected to have an adverse cumulative effect upon the gray bat or its habitat. The MTNF caves constitute only 9% of the gray bat caves in Missouri. The remaining 91% of gray bat caves are located on properties where land use practices and

activities that may impact the remaining gray bat caves are outside the control of the Forest Service. Activities proposed in Alternative 2 are not likely to contribute to activities that may adversely impact any gray bat caves or their foraging habitat.

**Summary of FWS BO Compliance:** 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 Alternative 2 comply 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 are likely to impact gray bat caves.

**Determination of Effect and Rationale:** Implementation of activities proposed in Alternative 2 is *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 project influence areas, based upon past surveys of these caves, this potential is considered very low. Any foraging gray bats or their foraging habitat that may be within the project area are not likely to be impacted by the proposed activities. The implementation of Alternative 2 would be expected to have no cumulative effects upon gray bats because it does not jeopardize recovery of the species and is in compliance with USFSW BO terms and conditions.

Should an undiscovered gray bat cave later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

### *Alternative 3*

**Direct Effects:** Since no gray bats are known to occupy the project area and the closest known gray bat record is approximately 11 miles west of the project area, Alternative 3 would not be expected to have a direct effect upon any gray bats or their occupied habitat. Under Alternative 3, no new activities would occur that would directly impact any known caves or individual gray bats. No activities are proposed that may affect the quality or amount of foraging habitat for this species. No forested habitat that is known or likely to be used as a travel corridor for gray bats between their caves and foraging areas would be directly impacted under this alternative.

**Indirect Effects:** Under Alternative 3, 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 wildfires within the project area. Fuels would build-up within the forested stands as they succumb to disease and insects. Should an intense wildfire 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 in the project 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 wildfires to become intense and difficult to control. The chances of a wildfire occurring within the project 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 3 would also not implement any activities, such as erosion control, old growth designation, dump removal, and trail relocation, which could have an indirect beneficial effect upon the water quality of the streams within the project area

Alternative 3 would not have any indirect effect upon caves known or likely to be occupied within the project area because it does not involve implementation of activities that would change the existing conditions around these caves.

**Cumulative Effects:** Based upon known past, present, and foreseeable events, Alternative 3 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. The remaining 91% of gray bat caves are located on properties where land use practices and activities that may impact the remaining gray bat caves are outside the control of the Forest Service. Activities proposed in Alternative 3 are not likely to contribute to activities that may adversely impact any gray bat caves or their foraging habitat.

Under Alternative 3, no new activities would contribute to the cumulative effect of soil movement into streams. However, the current effects occurring within the watersheds as the result of existing erosion from unregulated roads, streambank destabilization, and water contamination from garbage dumps would also not be minimized under Alternative 3. Therefore, while there are not any anticipated cumulative adverse effects resulting from the implementation of Alternative 3, 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 FWS BO Compliance:** 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 Alternative 3 comply 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 are likely to impact gray bat caves.

**Determination of Effect and Rationale:** Alternative 3 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 project area, making them susceptible to intense wildfires, 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 3 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.

Should an undiscovered gray bat cave later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

## Indiana Bat

### *Alternative 1*

**Direct Effects:** The activities proposed in 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 project area. The closest hibernaculum (Pilot Knob Mine) to the project area is approximately 22 miles from the project 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 Alternative 1. There is also no potential hibernation habitat within the project area, since no caves have been located within the project area. Therefore, no direct effect upon wintering habitat for the Indiana bat is anticipated as the result of activities proposed in Alternative 1.

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 mechanical timber treatment, prescribed burning, dozerline construction, and trail reconstruction. 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 activity associated with these treatments.

Many of the stands that would be treated with mechanical methods and/or prescribed burning contain suitable potential roost trees for Indiana bats. Given the fact that a pregnant Indiana bat was captured in similar habitat approximately 12 miles from the project area, it is also being assumed that these stands may contain Indiana bat maternity colonies, in which a single tree may offer roosting habitat for several females and their young. The number of acres of forested habitat that would be treated in this alternative and that that offers potential summer habitat for Indiana bats can be found in Table 3.

Table 3. As of August 1, 2003, forested acres offering suitable habitat for Indiana bat use that would be affected by Alternative 1 (Acres per FY is estimated)

Treatment	Forest Total Acres Incid Take Allowed Each FY	Total Ac Proposed	FY 2005		FY 2006		FY 2007		FY 2008		FY 2009	
			EFred	Forest Total								
TIMBER HARVEST-Mechanical Treatment	20,000	4,754	1000	4023	1000	3370	1000	3297	1000	*	754	*
RX FIRE-Prescribed Burning & Dozerline Construction	12,000	2,603	1325	7888	722	5902	270	3248	286	*	1325	*
WL HAB IMP- Pond Devel.	2,000	6	1	497	1	1	2	2	1	*	1	*

\*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 Alternative 1. 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, all hollow or decaying dead trees will be retained in all mechanical treatment 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 mechanical treatment activities is greatly reduced.

Because it would be impracticable to protect all suitable roost trees within the prescribed burn areas from burning, a protective measure has also been developed specific to prescribed burning in order to minimize the adverse direct impact that burning may have upon roosting Indiana bats. This measure requires that all burning activities occur outside of the Indiana bat maternity season (May 15-August 15). Although burning may still occur during the period when bats may be within the project area, by prohibiting burning during the maternity period, the chances of flightless young being harmed if their roost tree burns is greatly reduced because Indiana bat research has indicated that young are usually mobile by end of July (U.S. Fish and Wildlife Service 1999). There is still a potential that an occupied roost tree may be burned and individual bats harmed as a result of this burning, however, it is probably more likely 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 prescribed burn areas proposed 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, hopefully, a continual supply of suitable roost trees within the prescribed burn area over the long

term.

Other activities proposed within this alternative such as dump cleanup, erosion control, and pond construction/rehab, 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:** 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 project area, as well as changes in the availability of suitable roost trees within the project area. Activities proposed within this alternative that are likely to contribute to these indirect effects include mechanical timber treatments, prescribed burning, old growth designation and pond construction/rehabilitation. Some of these indirect effects may be adverse, while others would be beneficial.

Adverse indirect effects may be created by mechanical treatment of timber stands that result in a temporary loss of suitable foraging habitat. Foraging habitat may be indirectly adversely affected by activities that result in less than a 30% canopy closure (U.S. Forest Service 2002). Activities in Alternative 1 that are likely to create stands in this condition include mechanical treatment of stands that use seed tree cut techniques.

Because Alternative 1 proposes several hundred acres of mechanical treatment of timber stands, in which trees would be cut but not removed, there is some increased potential for a severe wildfire within the project area. This potential would be increased by the heavy fuel loads left in these stands following mechanical treatment. Heavy fuel loads could contribute to an intense, hard to control wildfire in the project area. Such a wildfire has the potential of temporarily reducing large areas of currently suitable habitat throughout the project area. However, the chances of such a wildfire occurring would be hard to predict and therefore, these indirect effects may not be “reasonably certain to occur”.

In some cases, foraging habitat may be indirectly improved by the mechanical treatment activities 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. 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 mechanical treatments implementing the thinning techniques. The other techniques that would be used for mechanical treatment (shelterwood cut, sanitation/salvage cut, 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; LMills, pers. experience).

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	28	99	33	0

Based upon the BE program, these acres would only be affected in LTA HA.

Other activities that may have an indirect beneficial effect upon the Indiana bat that are proposed in Alternative 1 are the creation of 30 vernal ponds within the project area and the maintenance of 4 permanent ponds. These ponds will be constructed to supplement the existing upland water sources within the project area, many of which are road ruts and ditches. Since road ruts and ditches tend to be drained during heavy road use or road maintenance activities, the creation of these ponds will help mitigate that loss and hopefully provide foraging Indiana bats that may be within the project area with a continual supply of upland water. 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 ponds and road ruts regularly during the summer months, particularly if they are pregnant or lactating (L.Mills, pers. experience).

Other beneficial indirect effects upon the Indiana bat with implementation of Alternative 1 would be the designation of 1,608 acres of old growth. 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 project area, particularly for maternity use. Old growth areas will eventually develop a structure which includes many large diameter trees. Some of these trees would likely become suitable for maternity roosts. Most of the old growth that would be designated in Alternative 1 would also be 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 that favor creation and retention of suitable roost trees and include a component of old growth (U.S. Forest Service 1998).

**Cumulative Effects:** Based upon known past, present and foreseeable effects, the implementation of Alternative 1 is not likely to have an adverse to have a 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. Activities such as mechanical treatment of forest stands and burning may lead to a cumulative short-term loss of some habitat components considered desirable for Indiana bats, however, this negative impacts would be offset by the beneficial impact these activities would also have upon Indiana bat habitat. For example, the loss of some suitable foraging habitat for Indiana bat as the result of seedtree cutting techniques would be offset by the increase of suitable foraging habitat created by thinning or prescribed burning techniques.

**Summary of Compliance with FWS BO:** 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 project 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.
- Prescribed burning activities proposed will comply with BO terms and conditions.
- Project does not affect ongoing Indiana bat monitoring, surveys or research activities.
- Project will not exceed allowable “take” during any given fiscal year.

**Determination of Effect and Rationale:** Because some of the activities proposed in Alternative 1 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, Alternative 1 *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 several hundred acres that will be treated by activities that may be potentially adverse. However, many of the activities proposed in Alternative 1 may also have a beneficial indirect effect upon the Indiana bat and its habitat.

## *Alternative 2*

**Direct Effects:** The activities proposed in Alternative 2 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 project area. The closest hibernaculum (Pilot Knob Mine) to the project area is approximately 22 miles from the project 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 Alternative 2. There is also no potential hibernation habitat within the project area, since no caves have been located within the project area. Therefore, no direct effect upon wintering habitat for the Indiana bat is anticipated as the result of activities proposed in Alternative 2.

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, crop tree release, pine sapling release, temporary road construction, prescribed burning, dozerline construction, glade restoration, and trail reconstruction. 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 crop tree, pine sapling release, or glade restoration. Given the fact that a pregnant Indiana bat was captured in similar habitat approximately 12 miles from the project area, it is also being assumed that these stands may contain Indiana bat maternity colonies, in which a single tree may offer roosting habitat for several females and their young. The number of acres of forested habitat that would be treated in this alternative and that that offers potential summer habitat for Indiana bats can be found in Table 4.

Table 4. As of August 1, 2003, 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 Project Area	FY 2005		FY 2006		FY 2007		FY 2008		FY 2009	
			EFred	Forest Total								
TIMBER HARVEST	20,000	4,819	1000	4023	1000	3370	1000	3297	1000	*	819	*
TSI-CTR and Pine release	4,000	1,780	228	4000	572	1422	400	400	400	*	180	*
ROAD CN-Temp Road Const./Recon.	25	95 (24.3mi temp+9.5 mi recon)	19	19	19	19	19	19	19	*	19	*
RX FIRE-Prescribed burning & Dozerline Construction	12,000	2,603	1325	7888	722	5902	270	3248	286	*	1325	*
WL HAB IMP-Glade restoration/Pond Devel.	2,000	39 (33 glade + 6 pond)	3	499	9	9	12	12	11	*	4	*
SW IMP-Trail reconstruction	150	0.3 (0.6mi)	0.3	8	0	0	0	0	0	*	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 Alternative 2. 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, all 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 and TSI 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 trail reconstruction would also strive to protect these trees when possible and would not be likely to impact very many suitable roost trees since they would not involve tree felling on many acres.

Because it would be impracticable to protect all suitable roost trees within the prescribed burn areas from burning, a protective measure has also been developed to minimize the adverse direct impact that burning may have upon roosting Indiana bats. This measure requires that all burning activities occur outside of the Indiana bat maternity season (May 15-August 15). Although burning may still occur during the period when bats may be within the project area, by prohibiting burning during the maternity period, the chances of flightless young being harmed if their roost tree burns is greatly reduced because Indiana bat research has indicated that young are usually mobile by end of July (U.S. Fish and

Wildlife Service 1999). There is still a potential that an occupied roost tree may be burned and individual bats harmed as a result of this burning, however, it is probably more likely 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 prescribed burn areas proposed 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, hopefully, a continual supply of suitable roost trees within the prescribed burn area over the long term.

Other activities proposed within this alternative such as dump cleanup, erosion control, and pond construction/rehab, 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:** The activities proposed in Alternative 2 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 2 is implemented. These indirect effects include changes in the availability and quality of suitable foraging habitat for Indiana bats within the project area, as well as changes in the availability of suitable roost trees within the project area. Activities proposed within this alternative that are likely to contribute to these indirect effects include timber harvesting, crop tree release, pine sapling release, temporary road construction, prescribed burning, old growth designation, glade restoration, and pond construction/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. 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 that are likely to create stands in this condition include timber harvesting that uses the seed tree cut 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, crop tree and pine sapling release, glade restoration 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 this alternative 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, and possibly by glade restoration

activities, crop tree release, and pine sapling release. 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; LMills, pers. experience).

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

<b>Acres Destroyed</b>	<b>Acres Reduced</b>	<b>Acres Maintained</b>	<b>Acres Created</b>	<b>Acres Enhanced</b>
0	28	162	33	0

Based upon the BE program, these acres would only be affected in LTA HA.

Other activities that may have an indirect beneficial effect upon the Indiana bat that are proposed in Alternative 2 are the creation of 30 vernal ponds within the project area and the maintenance of 4 permanent ponds. These ponds will be constructed to supplement the existing upland water sources within the project area, many of which are road ruts and ditches. Since road ruts and ditches tend to be drained during heavy road use, road decommissioning, temporary road construction, or road maintenance activities, the creation of these ponds will help mitigate that loss and hopefully provide foraging Indiana bats that may be within the project area with a continual supply of upland water. 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 ponds and road ruts regularly during the summer months, particularly if they are pregnant or lactating (L. Mills, pers. experience).

Other beneficial indirect effects upon the Indiana bat with implementation of Alternative 2 would be the designation of 1,608 acres of old growth. 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 project area, particularly for maternity use. Old growth areas will eventually develop a structure which includes many large diameter trees. Some of these trees would likely become suitable for maternity roosts. Most of the old growth that would be designated in Alternative 2 would also be 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 that favor creation and

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

**Cumulative Effects:** Based upon known past, present, and foreseeable effects, the implementation of Alternative 2 is not likely to have an adverse to have a 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 US Forest Service and are not necessarily influenced by this proposal. Some of the activities proposed in Alternative 2 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 beneficial impact other activities proposed in Alternative 2 would have upon Indiana bat habitat. For example, the loss of some suitable foraging habitat for Indiana bat as the result of seedtree cutting techniques would be offset by the increase of suitable foraging habitat created by thinning or prescribed burning techniques.

**Summary of Compliance with FWS BO:** 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 2 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 project 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.
- Prescribed burning activities proposed will comply with BO terms and conditions.
- Project does not affect ongoing Indiana bat monitoring, surveys or research activities.
- Project will not exceed allowable “take” during any given fiscal year.

**Determination of Effect and Rationale:** Because some of the activities proposed in Alternative 2 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, Alternative 2 *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 Alternative 2 may also have a

beneficial indirect effect upon the Indiana bat and its habitat.

### *Alternative 3*

**Direct Effects:** Alternative 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 project area. The closest hibernaculum (Pilot Knob Mine) to the project area is approximately 22 miles from the project 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 affected by this alternative. There is also no potential hibernation habitat within the project area, since no caves have been located within the project area. Therefore, no direct effect upon wintering habitat for the Indiana bat is anticipated as the result of activities proposed in Alternative 3.

However, Indiana bats may occur within the project area during their summer roosting period (generally May thru September). During this time, Indiana bats may be using trees within the project 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 3, 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 3 is implemented.

**Indirect Effects:** 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 3 is implemented. These indirect effects include changes in the availability and quality of suitable foraging habitat for Indiana bats within the project area, as well as changes in the availability of suitable roost trees within the project area.

Under Alternative 3, no activities would occur within the project 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 (D.Dostal, 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 wildfires within the project area. Fuels would build-up with the forested stands as they succumb to disease and insects. Intense wildfires 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 wildfires to become intense and difficult to control. The chances of a wildfire occurring within the project 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 3 is not expected to improve habitat conditions within the project area for the Indiana bat. While there would be no direct loss of existing foraging habitat within the project area under this alternative, implementation of Alternative 3 may still contribute to an indirect loss of foraging habitat within the project area by failure to treat currently overstocked, unhealthy forest stands. Under Alternative 3, there would be no increase in upland ponds for Indiana bat use, and existing ponds would not be maintained, eventually leading to a decrease in the availability of upland water sources. The availability of roost trees within the project 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 the project area.

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	0	190	0	0

Based upon the BE program, these acres would only be affected in LTA HA.

**Cumulative Effects:** Based upon known past, present, and foreseeable effects, the implementation of Alternative 3 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 project area, however, this loss would be offset by the availability of suitable foraging habitat elsewhere in the project area, since not all stands would likely be vulnerable to these forces.

**Summary of Compliance with FWS BO:** 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 3 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 project 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.
- Project 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 3 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 wildfires, insect outbreaks, disease, or other forces. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 3 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.

Should an undiscovered Indiana bat later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

## Hine’s Emerald Dragonfly

### *Alternative 1*

**Direct Effects:** There is no habitat known to be occupied by the Hine’s emerald dragonfly within the project area and therefore, there are not expected to be any direct impacts upon known populations of this species.

There is suitable habitat for this species within the project area in the form of scattered fens on National Forest and private lands. The only activities proposed in Alternative 1 that would directly impact potential habitat for the Hine’s emerald dragonfly would be prescribed burning. There are fens located within some of the prescribed burning units. However, prescribed burning 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 root 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.

Other than prescribed burning, the remaining activities associated with this alternative, such as mechanical treatment of timber stands, 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:** Although botanical surveys identifying the location of fens and other rare habitats have been completed 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 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 this alternative, activities such as the construction of dozerlines, vernal pond construction, erosion control activities, and reconstruction of trails 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.

Mechanical timber treatments 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 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 this alternative that will minimize the potential for soil movement from dozerlines and trail reconstruction activity areas, as well as areas being treated mechanically. 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). By restricting mechanical treatments and other activities within 100’ of a fen, the potential for waterflow alteration

is expected to be minimized.

Because Alternative 1 proposes several hundred acres of mechanical treatment of timber stands, in which trees would be cut but not removed, there is some increased potential for a severe wildfire within the project area. This potential would be increased by the heavy fuel loads left in these stands following mechanical treatment. Heavy fuel loads could contribute to an intense, hard to control wildfire in the project area. Such a wildfire has the potential of improving habitat for Hine's emerald dragonfly throughout the project area, but could also lead to increased soil and water run-off near fens. However, the chances of such a wildfire occurring would be hard to predict and therefore, these indirect effects may not be "reasonably certain to occur".

No other indirect effects upon potential habitat for Hine's emerald dragonfly are expected with implementation of Alternative 1.

**Cumulative Effects:** 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 and on both private and public lands 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. The prescribed burning of fen habitat within the project area, however, over the long-term, may have a beneficial cumulative effect by increasing the potential habitat for this species within its range.

**Summary of Compliance with FWS BO:** 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:** The implementation of Alternative 1 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 project area, however, these fens will be protected from mechanical treatments and soil disturbing activities with a 100' buffer zone. Other activities proposed in this alternative 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 Alternative 1 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.

Should an undiscovered Hine's emerald dragonfly site later be found within the project area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

## *Alternative 2*

**Direct Effects:** There is no habitat known to be occupied by the Hine's emerald dragonfly within the project area and therefore, there are not expected to be any direct impacts upon known populations of this species.

There is suitable habitat for this species within the project area in the form of scattered fens on National Forest and private lands. The only activities proposed in Alternative 2 that would directly impact potential habitat for the Hine's emerald dragonfly would be prescribed burning. There are fens located within some of the prescribed burning units. However, prescribed burning 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.).

Other than prescribed burning, the remaining activities associated with this alternative, such as timber harvesting, temporary road construction, 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:** Although botanical surveys identifying the location of fens and other rare habitats have been completed 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 timber harvesting, construction of temporary roads and dozerline, 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 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 this alternative, activities such temporary road construction, road reconditioning, skidding and dragging associated with commercial removal of merchantable timber, the construction of dozerlines, and, to a lesser degree, vernal pond construction, erosion control activities, glade restoration, and reconstruction of trails 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.

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 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 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 this alternative that will minimize the potential for soil movement from activities proposed in Alternative 2. 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). By restricting timber harvesting and other activities within 100' of a fen, the potential for waterflow alteration is expected to be minimized.

No other indirect effects upon potential habitat for Hine's emerald dragonfly are expected with implementation of Alternative 2.

**Cumulative Effects:** 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 and on both private and public lands by individuals who refuse to follow restrictions developed in order to protect these habitats. Implementation of activities proposed in Alternative 2, 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. The prescribed burning of fen habitat within the project area, however, over the long-term, may have a beneficial cumulative effect by increasing the potential habitat for this species within its range.

**Summary of Compliance with FWS BO:** 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:** The implementation of Alternative 2 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 project area, however, these fens will be protected from potentially disturbing activities with a 100' buffer zone. Other activities proposed in this alternative 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 Alternative 2 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.

Should an undiscovered Hine's emerald dragonfly site later be found within the project area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

### *Alternative 3*

**Direct Effects:** There is no habitat known to be occupied by the Hine's emerald dragonfly within the project area and therefore, there are not expected to be any direct impacts upon known populations of this species. Alternative 3 also would not implement any activities that may have a direct effect upon potential habitat for this species.

**Indirect Effects:** Under Alternative 3, 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 wildfires within the project area. Fuels would build-up with the forested stands as they succumb to disease and insects. Intense wildfires would have the potential burning over fens 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 fen.

Potential habitat for the Hine's emerald dragonfly can also be indirectly affected by intense wildfires that change the water quality or alter the waterflow through fens. Should an intense wildfire 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 fens in the project 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 wildfires to become intense and difficult to control. The chances of a wildfire occurring within the project 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:** 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 and on both private and public lands by individuals who refuse to follow restrictions developed in order to protect these habitats. Implementation of activities proposed in Alternative 3, 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 Compliance with FWS BO:** 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 3 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 wildfires, insect outbreaks, disease, or other forces. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 3 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 and would be in compliance with the MTNF BA.

Should an undiscovered Hine's emerald dragonfly site later be found within the project area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

## Running Buffalo Clover

### *Alternative 1*

**Direct Effects:** Activities proposed in Alternative 1 would not be expected to have any direct effects upon running buffalo clover because it is not known from the project area and was not found during botanical surveys of the project area.

**Indirect Effects:** There may be potential 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 affect 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 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 project 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 in the previous decades, 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.

Because Alternative 1 proposes several hundred acres of mechanical treatment of timber stands, in which trees would be cut but not removed, there is some increased potential for a severe wildfire within the project area. This potential would be increased by the heavy fuel loads left in these stands following mechanical treatment. Heavy fuel loads could contribute to an intense, hard to control wildfire in the project area. Such a wildfire also

has the potential of improving habitat for running buffalo clover throughout the project area. However, the chances of such a wildfire occurring would be hard to predict and therefore, these indirect effects may not be “reasonably certain to occur”.

Aside from the beneficial effects of prescribed burning, and the unlikely adverse effects created by soil disturbance associated with dozerline construction, trail reconstruction, or dump cleanup, no other activities proposed in Alternative 1 are anticipated to have any effect upon potential habitat for this species.

The designation of 1,608 acres of old growth in this alternative would not be expected to improve habitat conditions for the running buffalo clover since activities that create open overstory conditions and slight soil disturbance are generally restricted within these old growth areas.

**Cumulative Effects:** 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 Alternative 1, 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 FWS BO:** 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:** Implementation of Alternative 1 *is not likely to adversely affect* running buffalo clover. No habitat known to support this species is known to occur within the project area. Any anticipated adverse effects to potential habitat for this species would be negligible and offset by the beneficial effects this alternative would have upon potential habitat.

Should an undiscovered running buffalo clover site later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would be re-initiated

## *Alternative 2*

**Direct Effects:** Activities proposed in Alternative 2 would not be expected to have any direct effects upon running buffalo clover because it is not known from the project area

and was not found during botanical surveys of the project area.

**Indirect Effects:** 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 project 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 in the previous decades, 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, trail reconstruction, dump cleanup, and erosion control activities within potential habitat for this species, no other activities proposed in Alternative 2 are anticipated to have any effect upon potential habitat for this species. Glade restoration and pond construction/maintenance activities would not occur in suitable potential habitat for this species since these activities would occur on the higher elevations and uplands.

The designation of 1,608 acres of old growth in this alternative would not be expected to improve habitat conditions for the running buffalo clover since activities that create open overstory conditions and slight soil disturbance are generally restricted within these old growth areas.

**Cumulative Effects:** 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 Alternative 2, 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 FWS BO:** 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:** Implementation of Alternative 2 *is not likely to adversely affect* running buffalo clover. No habitat known to support this species is known to occur within the project area. Any anticipated adverse effects to potential habitat for this species would be negligible and offset by the beneficial effects this alternative would have upon potential habitat.

Should an undiscovered running buffalo clover site later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

### *Alternative 3*

**Direct Effects:** Alternative 3 would not be expected to have any direct effects upon running buffalo clover because it is not known from the project area and was not found during botanical surveys of the project area.

**Indirect Effects:** With implementation of Alternative 3, 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 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 also contribute to more intense wildfires within the project area. Fuels would build-up with the forested stands as they succumb to disease and insects. Intense wildfires 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 wildfires to become intense and difficult to control. The chances of a wildfire occurring within the project 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 3 is not expected to improve habitat conditions within the project area for the running buffalo clover. Under Alternative 3, there would be no implementation of activities that would benefit this species, such as prescribed burning.

**Cumulative Effects:** 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 Alternative 3, however, would not likely contribute to the cumulative effect of loss of suitable habitat.

**Summary of Compliance with FWS BO:** 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 3 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 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 wildfires, insect outbreaks, disease, or other forces. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 3 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 and would be in compliance with the USFWS BO Terms and Conditions.

Should an undiscovered running buffalo clover site later be found within the project area, consultation with the US Fish and Wildlife Service for this project would be re-initiated

## **Mead’s milkweed**

### *Alternative 1*

**Direct Effects:** Implementation of Alternative 1 would not likely have any direct effects upon Mead’s milkweed since no populations of this plant are known to occur within 36 miles of the project area.

However, the prescribed burning proposed in Alternative 1 may have a direct beneficial effect upon potential habitat for Mead’s milkweed. This prescribed burning would help restore habitat within some of the glades found in the project area by reducing the encroachment of woody vegetation and non-native species. As a result, although Mead’s milkweed is not known to occur with these glades, potential habitat for it would be improved, which may someday allow this species to increase its range.

None of the other activities proposed in Alternative 1 would be expected to have any direct effects upon potential or suitable habitat for this species. Protective measures incorporated into Alternative 1 would protect suitable habitat for this species from any adverse effects.

**Indirect Effects:** Activities proposed in Alternative 1 would not be expected to have any indirect effects upon known populations of Mead's milkweed or its habitat.

Because Alternative 1 proposes several hundred acres of mechanical treatment of timber stands, in which trees would be cut but not removed, there is some increased potential for a severe wildfire within the project area. This potential would be increased by the heavy fuel loads left in these stands following mechanical treatment. Heavy fuel loads could contribute to an intense, hard to control wildfire in the project area. Such a wildfire has the potential of improving habitat for Mead's milkweed throughout the project area. However, the chances of such a wildfire occurring would be hard to predict and therefore, these indirect effects may not be "reasonably certain to occur".

**Cumulative Effects:** Based upon known past, present, and foreseeable effects, this project is not expected to have a cumulative effect upon Mead's milkweed or its habitat. Much of the habitat that may be or once was occupied by Mead's milkweed 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 Mead's milkweed populations. If this occurs, there is potential for lands within the National Forest and within the project area to become more important for Mead's milkweed recovery. However, since this project will not involve activities that would reduce or destroy habitat that may be used by this species, it would not be expected to contribute to this potential cumulative effect.

**Summary of Compliance with FWS BO:** While the June 23, 1999 Biological Opinion did address this species, it did not include any Reasonable and Prudent Measures or Terms and Conditions with which to comply for this species.

**Determination of Effect and Rationale:** Implementation of Alternative 1 *is not likely to adversely affect* Mead's milkweed or its potential habitat because no habitat known to support this species is known to occur within the project area. Prescribed burning activities proposed in Alternative 1 may have a beneficial effect upon potential habitat for this species.

Should an undiscovered Mead's milkweed site later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would be re-initiated.

## *Alternative 2*

**Direct Effects:** Implementation of Alternative 2 would not likely have any direct effects upon Mead's milkweed since no populations of this plant are known to occur within 36 miles of the project area.

However, the prescribed burning proposed in Alternative 2 may have a direct beneficial

effect upon potential habitat for Mead's milkweed. This prescribed burning would help restore habitat within some of the glades found in the project area by reducing the encroachment of woody vegetation and non-native species. As a result, although Mead's milkweed is not known to occur with these glades, potential habitat for it would be improved, which may someday allow this species to increase its range.

Also proposed in Alternative 2 are glade restoration activities that would occur at 33 glade sites. Many of these glades selected for restoration activities occur on Cottoner Mountain and represent igneous glades sites that may offer potential habitat for Mead's milkweed. The restoration activities would remove the competing woody vegetation within these glades, particularly red cedar, and reduce competition from non-native and encroaching plants. These activities would improve potential habitat for the Mead's milkweed.

None of the other activities proposed in Alternative 2 would be expected to have any direct effects upon potential or suitable habitat for this species. Protective measures incorporated into Alternative 2 would protect suitable habitat for this species from any direct adverse effects.

**Indirect Effects:** Activities proposed in Alternative 2 would not be expected to have any indirect effects upon known populations of Mead's milkweed or its potential habitat.

**Cumulative Effects:** Based upon known past, present, and foreseeable effects, this project is not expected to have a cumulative effect upon Mead's milkweed or its habitat. Much of the habitat that may be or once was occupied by Mead's milkweed 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 Mead's milkweed populations. If this occurs, there is potential for lands within the National Forest and within the project influence area to become more important for Mead's milkweed recovery. However, since this project will not involve activities that would reduce or destroy habitat that may be used by this species, it would not be expected to contribute to this potential cumulative effect.

**Summary of Compliance with FWS BO:** While the June 23, 1999 Biological Opinion did address this species, it did not include any Reasonable and Prudent Measures or Terms and Conditions with which to comply for this species.

**Determination of Effect and Rationale:** Implementation of Alternative 2 *is not likely to adversely affect* Mead's milkweed or its potential habitat because no habitat known to support this species is known to occur within the project area. Prescribed burning activities proposed in Alternative 2 may have a beneficial effect upon potential habitat for this species.

Should an undiscovered Mead's milkweed site later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would be re-

initiated.

### *Alternative 3*

**Direct Effects:** Alternative 3 would not be expected to have any direct effects upon Mead's milkweed because it is not known from the project area and was not found during botanical surveys of the project area.

**Indirect Effects:** With implementation of Alternative 3, there may be an increased risk in insect infestations within the project 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 Mead's milkweed.

The anticipated die-off of trees due to lack of treatment may also contribute to more intense wildfires within the project area. Fuels would build-up with the forested stands as they succumb to disease and insects. Intense wildfires 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 wildfire occurring would be hard to predict and therefore, these indirect effects may not be "reasonably certain to occur".

Overall, however, Alternative 3 is not expected to improve habitat conditions within the project area for Mead's milkweed. Under Alternative 3, there would be no implementation of activities that would benefit this species, such as glade restoration or prescribed burning.

**Cumulative Effects:** Based upon known past, present, and foreseeable effects, this project is not expected to have a cumulative effect upon Mead's milkweed or its habitat. Much of the habitat that may be or once was occupied by Mead's milkweed 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 Mead's milkweed populations. If this occurs, there is potential for lands within the National Forest and within the project influence area to become more important for Mead's milkweed recovery. However, since this project will not involve activities that would reduce or destroy habitat that may be used by this species, it would not be expected to contribute to this potential cumulative effect.

**Summary of Compliance with FWS BO:** While the June 23, 1999 Biological Opinion did address this species, it did not include any Reasonable and Prudent Measures or Terms and Conditions with which to comply for this species.

**Determination of Effect and Rationale:** Alternative 3 would have *no direct effect* and

*is not likely to indirectly adversely affect* the Mead's milkweed or potential habitat for this species. The potential for indirect 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 wildfires, insect outbreaks, disease, or other forces. However, this potential cannot be measured and may be considered speculative. The implementation of Alternative 3 is expected to have *no cumulative adverse effect* upon the Mead's milkweed because it is not expected to influence potential recovery of this species throughout its range and would be in compliance with the FWS BO.

Should an undiscovered Mead's milkweed site later be found within the project influence area, consultation with the US Fish and Wildlife Service for this project would 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:

- 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 area.

## Alternative 1

Species	Species present in project area?	Habitat present in project area?	Habitat affected by project?	Determination
<b>Topeka shiner</b>	<b>No;</b> not known south of Missouri River	<b>No;</b> no streams which feed prairie regions	<b>No</b>	<b>No effects.</b>
<b>Tumbling creek cavenail</b>	<b>No;</b> range not within project area	<b>No;</b> no caves known in project influence area	<b>No</b>	<b>No effects.</b>
<b>Gray bat</b>	<b>Possible;</b> documented nearby may forage over streams in project area	<b>Yes;</b> suitable foraging perennial streams in project area	<b>No</b>	<b>May affect-Is not likely to adversely affect</b>
<b>Indiana bat</b>	<b>Possible;</b> documented nearby; may roost in suitable trees on NFS and pvt lands in project area	<b>Yes;</b> suitable roost trees present on NFS and pvt lands in project area;	<b>Yes;</b> will involve burning and felling of some suitable roost trees during time they may be occupied;	<b>May adversely affect but no effects</b> beyond those evaluated in the programmatic BA/BO.
<b>Bald eagle</b>	<b>Possible;</b> documented nearby but species not documented from within project area	<b>Yes;</b> suitable habitat along Castor River and the larger perennial streams and waterbodies in project area	<b>Not likely;</b> protective measures incorporated to protect riparian habitat	<b>May affect-Is not likely to adversely affect</b>
<b>Hine's emerald dragonfly</b>	<b>Not likely;</b> not documented nearby; range is in project area but species not documented from within project area	<b>Yes;</b> fens known to occur throughout project area on pvt and NFS lands	<b>Not likely;</b> protective measures incorporated to protect fen habitat	<b>May affect-Is not likely to adversely affect</b>
<b>Running buffalo clover</b>	<b>Possible;</b> documented nearby but species not documented from within project area	<b>Yes;</b> riparian habitat known to occur throughout project area on pvt and NFS lands	<b>Not likely;</b> protective measures incorporated to protect riparian habitat	<b>May affect-Is not likely to adversely affect</b>
<b>Mead's milkweed</b>	<b>Not likely;</b> not documented nearby; range is in project area but species not documented from within project area	<b>Yes;</b> glade habitat, some igneous, known to occur throughout project area on pvt and NFS lands	<b>Yes;</b> prescribed burning activities within some glades	<b>May affect-Is not likely to adversely affect</b>
<b>Pink mucket pearlymussel</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Ozark hellbender</b>	<b>No;</b> known range not within project area	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Scaleshell mussel</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Curtis' pearlymussel</b>	<b>Not likely;</b> range (Castor River) is within project area but species not documented from within project area	<b>Yes;</b> Castor River	<b>Not likely;</b> protective measures incorporated to protect riparian habitat and water quality	<b>May affect-Is not likely to adversely affect</b>

## Alternative 2

Species	Species present in project area?	Habitat present in project area?	Habitat affected by project?	Determination
<b>Topeka shiner</b>	<b>No;</b> not known south of Missouri River	<b>No;</b> no streams which feed prairie regions	<b>No</b>	<b>No effects.</b>
<b>Tumbling creek cavenail</b>	<b>No;</b> range not within project area	<b>No;</b> no caves known in project influence area	<b>No</b>	<b>No effects.</b>
<b>Gray bat</b>	<b>Possible;</b> documented nearby may forage over streams in project area	<b>Yes;</b> suitable foraging perennial streams in project area	<b>No</b>	<b>May affect-Is not likely to adversely affect</b>
<b>Indiana bat</b>	<b>Possible;</b> documented nearby; may roost in suitable trees on NFS and pvt lands in project area	<b>Yes;</b> suitable roost trees present on NFS and pvt lands in project area;	<b>Yes;</b> will involve burning and felling of some suitable roost trees during time they may be occupied;	<b>May adversely affect but no effects</b> beyond those evaluated in the programmatic BA/BO.
<b>Bald eagle</b>	<b>Possible;</b> documented nearby but species not documented from within project area	<b>Yes;</b> suitable habitat along Castor River and the larger perennial streams and waterbodies in project area	<b>Not likely;</b> protective measures incorporated to protect riparian habitat	<b>May affect-Is not likely to adversely affect</b>
<b>Hine's emerald dragonfly</b>	<b>Not likely;</b> not documented nearby; range is in project area but species not documented from within project area	<b>Yes;</b> fens known to occur throughout project area on pvt and NFS lands	<b>Not likely;</b> protective measures incorporated to protect fen habitat	<b>May affect-Is not likely to adversely affect</b>
<b>Running buffalo clover</b>	<b>Possible;</b> documented nearby but species not documented from within project area	<b>Yes;</b> riparian habitat known to occur throughout project area on pvt and NFS lands	<b>Not likely;</b> protective measures incorporated to protect riparian habitat	<b>May affect-Is not likely to adversely affect</b>
<b>Mead's milkweed</b>	<b>Not likely;</b> not documented nearby; range is in project area but species not documented from within project area	<b>Yes;</b> glade habitat, some igneous, known to occur throughout project area on pvt and NFS lands	<b>Yes;</b> prescribed burning activities within some glades	<b>May affect-Is not likely to adversely affect</b>
<b>Pink mucket pearlymussel</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Ozark hellbender</b>	<b>No;</b> known range not within project area	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Scaleshell mussel</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Curtis' pearlymussel</b>	<b>Not likely;</b> range (Castor River) is within project area but species not documented from within project area	<b>Yes;</b> Castor River	<b>Not likely;</b> protective measures incorporated to protect riparian habitat and water quality	<b>May affect-Is not likely to adversely affect</b>

### Alternative 3

Species	Species present in project area?	Habitat present in project area?	Habitat affected by project?	Determination
<b>Topeka shiner</b>	<b>No</b> ; not known south of Missouri River	<b>No</b> ; no streams which feed prairie regions	<b>No</b>	<b>No effects.</b>
<b>Tumbling creek cavesnail</b>	<b>No</b> ; range not within project area	<b>No</b> ; no caves known in project influence area	<b>No</b>	<b>No effects.</b>
<b>Gray bat</b>	<b>Possible</b> ; documented nearby may forage over streams in project area	<b>Yes</b> ; suitable foraging perennial streams in project area	<b>Not likely</b> ; potential effects from wildfire and other forces unpredictable and immeasurable.	<b>May affect-Is not likely to adversely affect</b>
<b>Indiana bat</b>	<b>Possible</b> ; documented nearby; may roost in suitable trees on NFS and pvt lands in project area	<b>Yes</b> ; suitable roost trees present on NFS and pvt lands in project area;	<b>Not likely</b> ; potential effects from wildfire and other forces unpredictable and immeasurable	<b>May affect-Is not likely to adversely affect.</b>
<b>Bald eagle</b>	<b>Possible</b> ; documented nearby but species not documented from within project area	<b>Yes</b> ; suitable habitat along Castor River and the larger perennial streams and waterbodies in project area	<b>Not likely</b> ; potential effects from wildfire and other forces unpredictable and immeasurable	<b>May affect-Is not likely to adversely affect.</b>
<b>Hine's emerald dragonfly</b>	<b>Not likely</b> ; not documented nearby; range is in project area but species not documented from within project area	<b>Yes</b> ; fens known to occur throughout project area on pvt and NFS lands	<b>Not likely</b> ; potential effects from wildfire and other forces unpredictable and immeasurable	<b>May affect-Is not likely to adversely affect</b>
<b>Running buffalo clover</b>	<b>Possible</b> ; documented nearby but species not documented from within project area	<b>Yes</b> ; riparian habitat known to occur throughout project area on pvt and NFS lands	<b>Not likely</b> ; potential effects from wildfire and other forces unpredictable and immeasurable	<b>May affect-Is not likely to adversely affect</b>
<b>Mead's milkweed</b>	<b>Not likely</b> ; not documented nearby; range is in project area but species not documented from within project area	<b>Yes</b> ; glade habitat, some igneous, known to occur throughout project area on pvt and NFS lands	<b>Not likely</b> ; potential effects from wildfire and other forces unpredictable and immeasurable	<b>May affect-Is not likely to adversely affect</b>
<b>Pink mucket pearl mussel</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Ozark hellbender</b>	<b>No</b> ; known range not within project area	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Scaleshell mussel</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No effects</b>
<b>Curtis' pearl mussel</b>	<b>Not likely</b> ; range (Castor River) is within project area but species not documented from within project area	<b>Yes</b> ; Castor River	<b>Not likely</b> ; potential effects from wildfire and other forces unpredictable and immeasurable	<b>May affect-Is not likely to adversely affect</b>

## CONSULTATION WITH OTHERS

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*6 August 2003*

Date

## REFERENCES AND DATA SOURCES

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## APPENDIX A - Description of Silvicultural Terms & Methods

Common silvicultural terms are used here in an effort to describe what the end result of stand treatment will look like after the treatment is complete.

### Even-Aged Management Activities

What follows are descriptions of the various harvest methods involved in conducting even-aged management (EAM). The long-term, forest-wide effect of even-aged silviculture on vegetative patterns is to create horizontal diversity, which results from differences in the vegetative ages and sizes between stands. With implementation of activities identified in the Forest Plan one would encounter a mosaic of seedling, sapling, pole size timber, sawtimber, and old growth stands across the landscape (Forest Plan). This vegetative mix also contributes to a sustainable forest ecosystem.

**Seed Tree cuts** -A seed tree cut treatment is used on sites where it is desirable to maintain scattered large trees while establishing a fully stocked new stand of shade intolerant trees. Purposefully creating these open conditions will help arrest the trend of conversion to shade tolerant species by creating the light conditions necessary for the existing oak advance reproduction to develop, or pine to establish. Develop a lightly stocked over-story of superior trees that will maintain excellent growth rates due to low competition and have the potential to develop into trees of larger size than normally found on these sites under fully stocked conditions. The residual over-story will consist mostly of trees with a life expectancy of 20 years or greater. If oak, white oak will comprise the residual over-story remaining after the timber harvest due to white oak's longer life expectancy. If pine, the residual trees will be of good to superior quality, suitable for a seed source and capable of adding growth and value. Harvesting high risk and low quality trees, trees with inadequate growing space, and other trees not needed for the seed tree retention will be the treatment. This treatment also encourages a great variety of early successional plants to meet wildlife habitat needs in the form of temporary forage which is a primary need in this area (Forest Plan). It also promotes large tree crowns on thrifty sawtimber trees with more fruiting potential.

Residual stocking will average above 20 basal area, but below 30% stocking level, thus not fully utilizing the available growing space. Follow-up treatment will include cutting most non-commercial stems, including most dogwood and maples. It may also include sale and removal of round wood products. If present, 5 live cull trees over 12 inches DBH will be left per acre, along with all non-merchantable dead trees (B.O.1999). Minimum canopy cover estimated after completion of this treatment is expected to be 25%.

**Shelterwood**- A shelterwood cut treatment is used on sites where it is desirable to maintain a broken canopy of large trees while establishing a fully stocked new stand of shade intolerant trees. Crown gaps will be the rule rather than the exception. Purposefully creating these openings will help arrest the trend of conversion to shade tolerant species by creating the light conditions necessary for the existing oak advance reproduction to develop. Develop a moderately stocked over-story of good trees that will maintain excellent growth rates due to low competition and have the potential to develop into trees of larger size than normally found on these sites under fully stocked conditions. The residual over-story will consist mostly of trees with a life expectancy of 20 years or greater. White oak will become more abundant than in the present mature/over-mature because more of the advanced regeneration and thrifty younger trees are white oak, and white oak has a longer life expectancy. Harvesting high risk and low quality trees, trees with inadequate growing space, and other trees not needed for the shelterwood retention will be the treatment.

Residual stocking will average below 50% for the site, thus the residual sawtimber will not fully utilize the available growing space. Stocking will average above 30%, favoring thrifty young sawtimber as leave trees. Follow-up treatment will include cutting of most non-commercial stems. It may also include sales of round wood products. If present, 5 live cull trees over 12 inches DBH will be left per acre along with all non-merchantable dead trees. Minimum canopy cover estimated after completion of this treatment is expected to be 40%.

**Over-story removal**-An over-story removal cut treatment is used on sites where there has been acceptable regeneration resulting from the preceding shelterwood cut or cuts, so the removal of some or all of the remaining over-story trees which would inhibit the new stand's proper growth and development can be carried out. Reserve trees will be longer-lived pine or white oak, as available, to meet wildlife needs for mast and cover. Additional work will be made this entry to continue development of the new age class of shade intolerant species. The residual over-story will consist mostly of trees with a life

expectancy of 20 years or greater and will average below 30% stocking, thus allowing the new regenerating stand to fully utilize the site's resources, as well as increase oxygen production and carbon dioxide absorption by maintaining a high percentage of the growing space in healthy, actively growing trees. Reserve trees in excess of the 5 live trees/acre over 12 inches DBH will be removed, as well as trees seriously damaged during logging. Minimum canopy cover estimated after completion of this treatment is expected to be 40-50%.

**Sanitation cuts**-Sanitation cuts are designed to harvest trees that are of poor quality, at risk of dying during the next 5 to 10 years, and to reduce stocking in overly-dense stands to enhance residual tree survival, health and growth. Maintain fast growth on best trees to avoid stagnation, insect and disease problems and promote larger diameter trees in a shorter time frame. Opening up the stand will maintain and encourage a forage component in the stand by allowing more light to reach the ground. This will also stimulate under-story development. The visual characteristics will be enhanced in the stand by promoting larger trees. Promoting larger tree crowns will increase seed and mast production on residuals.

Leaving the best-formed, healthiest and youngest trees in the dominant size class in the stand for future growth will be the practice in these stands. Removing the high risk and poor quality trees will be the objective. Some healthy appearing trees may be cut to provide additional growing space for trees nearby. The trees that remain following harvest would consist primarily of larger diameter trees with healthy crowns and adequate growing space. Most of the trees removed will be from high risk and poor quality trees (red oak group). Minimum canopy cover estimated after completion of this treatment is expected to be 40-50%.

## Uneven-aged Management Activities

Uneven-aged treatments are designed to move the stand in a direction of having three or more 20-year age classes developed within the stand. With an uneven-aged system, a portion of each stand must be harvested on a routine cutting cycle such as 15 to 20 years. Our residual stands will consist mostly of trees with a remaining life expectancy of 20 years or greater. White oak will become more prevalent because of its longer life expectancy; white oaks tolerate more shade than red oaks, so will also accumulate in relatively greater numbers in the younger age classes. In this first entry we propose to remove most of the red oak group because of its high-risk condition, while keeping residual stocking above 50% of maximum stocking for the site. (Over-story stocking will generally be capable of utilizing the site resources, except in areas of openings). Create conditions to favor development of a new age class of shade intolerant tree species including oaks, hickories and short leaf pine and reduce the trend of conversion to shade tolerant species using a combination of individual tree selection and group selection as necessary. (See Stambaugh, 2001; Larson, et al., 1999; Larson, et al., 1997)

Maintain and encourage a forage component in the stand by increasing light to the ground. Increase the potential for mast production by promoting larger tree crowns on younger trees with more fruiting potential. Maintain or develop fast growth on best trees to avoid stagnation, insect and disease problems and promote larger diameter trees in a shorter time frame.

**Selection with Groups**- Uneven-aged management is the application of a combination of actions needed to simultaneously maintain continuous high-forest cover, continual or periodic regeneration of desirable species to develop and maintain at least three age classes, and the orderly growth and development of trees through a range of diameter and age classes. The use of UAM, as well as the other silvicultural treatments, is based on the vegetative composition and biological capability of the sites. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection. Both methods would usually be applied concurrently in the Analysis Areas. This combination of the two distinct UAM methods has been termed "Selection with Groups" on the Mark Twain National Forest. Minimum canopy cover estimated after completion of this treatment is expected to be 50%.

**Reforestation and restoration**- treatments proposed have similar implications. In a healthy, sustainable forest ecosystem, tree seedlings, herbaceous vegetation, and shrubs develop naturally whenever suitable light conditions are created on the forest floor. When over-story trees die, young tree seedlings replace them, thus helping to ensure that a forested condition is maintained on the site. The proposed treatments would be implemented to allow suitable light conditions to promote the development of desired tree seedlings, herbaceous vegetation, and shrubs.

**Prescribed fire for regeneration**- is proposed in stands that lack adequate numbers of tree seedlings and that contain dense covers of grasses, logging slash, duff layer, dogwood and red maple. This treatment would only occur on sites where establishment of new tree seedlings is desired to perpetuate well-stocked forest cover or where removal cut activities are planned to establish young, even-aged

stands. This controlled fire would also reduce hazardous fuels.

**Site preparation-** would be completed on many sites proposed for either even-aged or uneven-aged regeneration. If conducted before the removal cut, site preparation involves the cutting of dogwood, red maple, sassafras, or other selected woody species to reduce shading and to promote development of commercial tree seedlings. These small trees are usually 5 to 30 feet tall. If conducted following a removal cut, release would involve cutting the same species, as well as poorly formed or severely damaged stems that may interfere with desired tree seedling development and growth. Trees specially designated for retention on the site would not be cut. Cutting dogwood, red maple, and sassafras will not kill them or eliminate them from treated stands because most stumps will produce stump sprouts. Cutting them will primarily reduce their stature, shading and competitive advantage over commercially desired oak-hickory and short leaf pine reproduction.

**Crop tree release-** treatments proposed for each alternative involve the non-commercial mechanical cutting of woody vegetation that interferes with the tree seedlings (either naturally occurring or planted) desired on the site. The treatment can be used to direct stand development and to regulate species composition to those best suited for the site or to maintain species diversity. Release can promote growth and survival of desirable species which otherwise would be at risk of being suppressed or killed by more prevalent species that out-compete them. Release potentially increases species richness on the site and is expected to improve tree species composition in the long term.

Crop Tree Release generally is carried out in young mixed oak stands when they are between 15 and 30 years of age, depending upon site-specific stand development patterns and weather conditions. Crop Tree Release work helps ensure desired tree species composition in young forested stands as well as the development of desired forest stand conditions. This early manipulation of composition will help to alleviate the problems we now see in stands that developed on their own into mostly homogeneous stands of black and scarlet oak.

**Release treatments-** involve the mechanical cutting of non-commercial woody vegetation that interferes with pine tree seedlings (either naturally occurring or planted) desired on the site. The treatment can be used to direct stand development and to regulate species composition to those best suited for the site or treatment or to maintain species diversity. Release can promote growth and survival of desired individuals and species which otherwise would be at risk of being suppressed or killed by less desirable competitors. Release potentially increases species richness on the site and is expected to improve tree species composition and stand vigor in the long term.

Release generally is carried out in regenerating pine stands when they are between 5 and 10 years of age, depending upon site specific stand development patterns and weather conditions. Release work helps ensure the survival of pine, which is a desired tree species for south and west facing stands (ELT 17) that otherwise would contain high percentages of black and scarlet oak which would later be predisposed to decline.

**Prescribed fire for woodland development-** proposed for open woodlands would run a light fire through these stands every 3 to 4 years would top-kill and thin out the dense underbrush. The forest floor would open up. Some of the weakened trees would die, creating snags. Grasses and fire dependent species would eventually occupy the forest floor and fire resistant trees the over-story. The vegetation composition would eventually revert back toward pre-settlement conditions (Forest Plan, Appendix E).

## **APPENDIX B - Protective Measures Incorporated into All Alternatives as part of the Proposed Actions**

The following are protective measures that may be in addition to the Forest Plan standards and guidelines. Protective measures identified with a "T" pertain to timber harvesting and an "M" refers to mechanical treatments, "P" refers to pond construction/maintenance, "G" refers to glade restoration, "D" refers to dump removal, "R" refers to road construction/reconstruction, and "F" pertain to prescribed fire.

*Protective Measures that apply to species habitat protection are highlighted in red and italicized.*

*Some of the mitigation measures included represent revisions made after August 2003 but do not change any determination of effects for any federally listed species. /s/ Lynda M. Mills July 22, 2004*

### **Protective Measures - Heritage Resources (CR):**

#### **CR1 (T, M, P, G, D, R, &F)**

Heritage resource sites eligible for inclusion in the National Register of Historic Places (NRHP), as well as sites whose National Register significance has not been evaluated, will be avoided and protected from all project activities. Avoidance of cultural resources will be understood to require the retention of such properties in place and their protection from effects resulting from the undertaking (Memorandum of Understanding between the Mark Twain National Forest and the Missouri State Historic Preservation Officer, June, 1995). Effects will be avoided by: (1) rerouting around sites those roads for which reconstruction is proposed; and (2) establishing buffer zones around those sites in areas where harvest activities will take place. Roads will by-pass sites at a sufficient distance and buffer zones will be of sufficient size to ensure that the integrity of the characteristics and values that contribute, or may contribute, to the properties' significance will not be affected. Site avoidance is the preferred protective action pursuant to the Forest Plan, Section IV-30, 31 (also FSM 2361.21[2]).

#### **CR2 (T, M, P, G, D&F)**

Discovery of Heritage Resources During Project Implementation: Pursuant to the provisions found in 36 CFR 800.13, should any previously unrecorded heritage resources be discovered during project implementation, activities that may adversely affect that resource will be stopped immediately. A professional archaeologist will evaluate the resource to determine appropriate actions for protecting the resource and for mitigating the adverse effects on the resource. Consultation will be initiated with the Missouri State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation as required. Project activities will not be resumed until the resource is adequately protected and agreed-upon protective actions are implemented with SHPO approval.

#### **CR3 (T, M, P, G, D & F)**

If sites cannot be avoided by project related activities, test excavations will be conducted at such sites in order to determine their eligibility for listing on the NRHP. For those sites found to be eligible for the NRHP, protective plans will be developed in consultation with the Missouri SHPO and the Advisory Council on Historic Preservation. Sites found to not be eligible for the NRHP will not be protected.

#### **CR4 (F)**

Protective measures recommended for prescribed burning are based on those used for landscape burns conducted elsewhere on the Mark Twain National Forest (Price 1996; 2000a; 2000b) and found to be effective by the monitoring of such burns (Price 1998; 2001). Protective measures relating to prescribed burning fall into two categories: fireline construction prior to the burn (CR4) and firing operations (CR5). To ensure that none of the sites in the areas proposed for burning are damaged by fireline construction, all sites will be identified and flagged ahead of fireline construction. The firelines will then be constructed so as to avoid these sites. There will be no removal of soil or disturbance below the ground surface during fireline cleaning. In the unlikely event that spotting occurs within the site, only hand tools will be used to contain the spots within the site boundaries. If it is deemed necessary to construct fireline through a site due to safety considerations, this line will be constructed using hand tools (leaf blowers, rakes), avoiding all features.

## CR5 (F)

There are several basic protective measures that may be taken as needed in regards to the prescribed burning firing operations that will help ensure that the measures listed below succeed in protecting the sites. These protective measures are listed as follows:

- 1) Some sites contain artifacts or structural material (i.e., wood) that could be damaged or consumed by fire. Because of the presence of these materials, a fire burning through these sites could potentially alter the historic integrity of the sites. To mitigate this potential damage, a set of two parallel hand lines should be constructed around the areas of the sites that could be damaged by fire. These lines should be 30 to 50 ft apart. The area between the hand lines will then be carefully burned to create a fuel-free zone around the combustible material prior to conducting the main burn.
- 2) Features at some sites are constructed using sandstone or limestone rocks that could be damaged by a high intensity fire. To protect these features, all leaf litter and duff will be removed from the vicinity of the structures using rakes or leaf blowers and all dead woody vegetation in the area will be cut and removed.
- 3) Those sites requiring pre-burn protection will be visited by the burn boss and an archaeologist prior to initiating the burn. Protective measures will be discussed during visits to each of these sites. All sites requiring protective actions will be clearly flagged by an archaeologist prior to the burn.
- 4) A no-drop zone will be established around each of the sites containing combustible material to insure that the sites are not inadvertently damaged by aerial ignition if this method is used. The helicopter crew will be fully briefed on the locations of vulnerable heritage resources and the latitude and longitude of each of the sites in no-drop zones will be provided to the helicopter crew.
- 5) Those sites with combustible materials and features may be marked prior to the burn with a large orange fabric "X" which will be clearly visible from a helicopter.
- 6) If sites are present within a particular burn area that are determined by the archaeologist to require special protective actions (such as those sites with combustible material), all personnel involved in the prescribed burning operation will be fully briefed on the presence of archaeological sites and the need to protect sites vulnerable to damage during the burning operation. A member of the Forest Heritage Staff familiar with the burn and the sites will conduct this briefing prior to the burn.
- 7) Forest Service personnel will be assigned to accompany any non-Forest Service crews and squads used on the burn that will work in areas near vulnerable archaeological sites during ground ignition operations.

### Protective Measures - Air Quality (A):

#### A1 (F)

*Prescribed burning would be completed during weather conditions that facilitate smoke dispersal.*

The public would be informed of the planned burning days and the Forest Service employees would control traffic, if needed, along Forest Roads.

### Protective Measures – Soil and Water (SW):

#### SW1 (T&M)

*Temporary roads and main skid trails will be approved on the ground by Forest Service personnel prior to harvest operations, avoiding layouts that concentrate runoff into draws, ephemeral drainages, sinkholes, or watercourses.*

#### SW2 (T&R)

*Proper grade and water control structures will be constructed and maintained on skid trails. Specifications that are indicated in the Missouri Department of Conservation's "Missouri Watershed Protection Practice" would be followed. Roads will not drain directly onto skid trails or into stream channels.*

#### SW3 (T)

When logging is complete pull additional slash onto skid trails as needed.

#### SW4 (T&R)

*Forest Service will suspend skidding during wet periods, when excessive rutting and churning of the soil begins, or when runoff from skid trails is turbid and no longer infiltrates within a short distance from the skid trail.*

#### SW5 (F&T)

*Prescribed burn units should have as little mechanical disturbance to the soil before and just after*

*burning as possible. Equipment will not use stream channels as "roads". Where stream crossing is unavoidable, it would be done in locations that would create the least impact on stream banks and beds.*

**SW6 (F)**

*Fire lines created with dozers would not be placed in riparian areas, fens, wetlands, or other sensitive habitats.*

**SW7 (F&T)**

*All fire lines will be seeded with a cover crop suited to the area objectives and will be fertilized with a standard fertilizer immediately after construction (fall-spring) or as soon afterwards as will give the best chance of germination. Water bars will be constructed in accordance with the MDC "Missouri Watershed Protection Practice" to minimize water movement along fire lines.*

**SW8 (T & M)**

*Trees anchoring the banks of any distinct channel, even will not be cut unless they are a species that is known to "sprout" from a cut tree's roots. This includes channels that are the result of road drainage ditches.*

**SW9 (T & M)**

*Reconstructed and temporary roads, which have the potential for severe erosion, will have additional ground water protection measures as follows: Temporary roads that cross drainages will be closed as soon after the unit is harvested or treated as possible. All crossings would be constructed at right angles to the channel at locations chosen to have the least impact as possible on the stream channel and banks. A slash filter will be placed uphill from any drainage and used as filter at the outside of the water-bar nearest the drainage. If the crossing location is soft, it would be reinforced with aggregate.*

**SW10 (T, M, P, G, D & F)**

*No mechanical disturbance of the soil would occur on slopes greater than 35%.*

**SW11 (T, M, P, G, D & F)**

*Stands with soils which have perched water tables will have little or no mechanical disturbance to wet soil.*

**SW12 (T)**

*A 100-foot no cut zone will be placed around all fens, seeps and springs. A buffer zone of at least 100 feet in radius would be retained in association with seeps, fens, springs, and any other special features or habitats. Skidding and decking would be prohibited within these buffer zones.*

**SW13 (T & F)**

*There will be a no cut zone of at least 50 feet from the edge of any sinkhole that currently exists within the activity area, or if one develops before the action is initiated. Strips of unburned vegetation will be maintained around sinkholes and long stream corridors to filter and control surface water flow. A buffer of 100 feet will be provided around natural sinkhole ponds. Within this buffer, there will be no commercial harvest of trees, no firewood permits, and no ground-disturbing activity. Prescribed fire would be allowed within the buffer zone.*

**SW14 (T)**

*Log landings, major skid trails, and other areas where mineral soil is exposed would be naturally re-vegetated. If not successful after one growing season, artificial seeding and fertilizing would be done for cover crop only. No invasive non native species would be seeded to provide permanent vegetation.*

**Protective Measures - Vegetation (V):**

**V1 (F)**

*Prescribed burn plans will incorporate burning conditions that best meet specific management area objectives to reduce fuel loads, stimulate forest regeneration, have minimal impact on future timber resources, meet visual standards, and protect sensitive species. Time of year prescribed burns are conducted will be determined based upon the site-specific objectives and follow guidance in the 5100 Fire Management section of the Forest Plan.*

**V2 (T & M)**

*For perennial and intermittent streams, the no cut zone will include the riparian zone as defined by the forest plan, or 50 feet, whichever is greater. Riparian zone includes frequently and occasionally flooded areas.*

**V3 (T, M, R &F)**

*A protection zone will be designated around glades. This zone will surround the glade itself, as well as any adjacent grassy areas, rock ledges, exposed bedrock, and/or rock outcrops. Trees, other than post oak and chinquapin oak, may be removed from within this zone, but may only be removed by winching or dragging. No heavy equipment may be used within this zone unless pre-approved by a biologist/ecologist. Removal of small diameter trees, especially red cedar, is encouraged within this zone.*

**Protective Measures - Wildlife (WL):****WL1 (T&M)**

*Retain a minimum of 15 sq. ft. of basal area in seed tree harvests, and a minimum of 25 sq. ft. of basal area in shelterwood seed cut harvest units, of reserve trees grouped or retained around large snags, large live trees, den trees, and within intermittent drainages to minimize potential for wind throw and provide thermal protection of suitable Indiana bat roost trees. Leave larger, long-lived trees (white oak, post oak, pine or hickory) where opportunities exist. For both cavity trees and snags, retain at least 0.5/ac nineteen inches (19") dbh or greater in size, if available. Retain at least 4.0/ac 11-18" dbh cavity trees and snags, if available. Retain at least 2.0/ac 10 inches (10") dbh or less in size cavity trees and snags, if available.*

**WL2 (T&M)**

*In all even-aged harvests (seed tree, and shelterwood seed cut), reserve trees should be left in groups of at least 5 or more trees wherever possible. No snags should be left standing alone within the cut area, but rather, should be surrounded by several live trees. In uneven-age harvests (group selection with improvement cutting), the longer-lived trees (white oak, post oak, hickory, and pine) will be featured leave trees with a range in the diameter distribution. Snags and dens from the red oaks will be left, if available, to meet standards and guidelines.*

**WL3 (T, P, &M)**

*In all harvest areas retain all shagbark hickory, shellbark hickory, sycamore, and lightning struck trees (MTNF Biol. Assess. p. 32). Retain, as available and to the maximum extent possible and logistically practical, all unmerchantable dead trees, any existing dead trees  $\geq 20"$  dbh and any tree  $\geq 26"$  dbh unless a human safety hazard. Also, retain some (not all) dead or dying trees  $\geq 9"$  with at least 10% exfoliating/defoliating bark, and most den/cull trees.*

**WL4 (T&M)**

*There will be no harvest within 50 feet of a sinkhole or pond.*

**WL5 (T, M, F, G, P, R &D)**

*The discovery of a new site occupied by federally listed species within the project area (such as eagle communal night roosts, or Indiana bat maternity sites) at any time during the course of activities described in this EIS, will lead to further consultation with the US Fish and Wildlife Service and development of protective measures as determined necessary for protection of the species and its habitat.*

**WL6 (T, M, R, P&F)**

*A buffer zone of at least 100 feet in radius will be retained in association with seeps, fens, springs, and any other special features or habitats (other special features to be determined by a biologist). Temporary road construction, skidding and decking and new dozer line construction will be prohibited within these buffer zones.*

**WL7 (T)**

*Any active sharp-shinned and Cooper's hawk nests discovered shall be protected when encountered. Within mature pine stands retain 2 mature pine trees per 5 acres to provide potential nest trees.*

**WL8 (T&M)**

*During harvest and reforestation treatments, retain butternut dogwood, serviceberry, walnut and other minor components of the stand, particularly soft and hard mast producers.*

**WL 9 (T, R &M)**

*Retain water-holding ruts and puddles where they do not conflict with road maintenance and use activities or create an increased potential for erosion and runoff (MTNF Biol Assess, p. 34)*

**WL 10 (F)**

*To avoid adverse impacts to potential maternity sites for Indiana bats, no burning will occur during their maternity season (May 15-August 15).*

**WL 11 (F)**

*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. These areas include Silver Mines Recreation Area, and caves known to support gray or Indiana bats.*

**Protective Measures - Visuals (VS):****VS1 (T & M)**

"Not more than 10 chains (660') of temporary opening may occur along any 40 chains (0.5 mile) of hiker or horse trail during this plan period. Log landings are prohibited within 100' of a recreation trail. Where skidding across a recreation trail is unavoidable it will be done at a right angle and at designated locations."

**VS2 (T & M)**

Slash adjacent to travel ways within a Sensitivity Level (SL) 1 or 2 (including the Audubon Trail) will be lopped and scattered to lie within 30" of the ground. Slash adjacent to travel ways within SL 3 with a Variety Class of A or B will be lopped and scattered to lie within 48" of the ground. No trees along the Audubon Trail would be left across the trail.

**VS3 (T&M)**

Slash disposal protective measures are specified by stand within contract specifications by Forest Plan regulation. The negative visual impacts will be mitigated concurrently with or immediately after each phase of activity. Protective measures will be completed for each cutting unit before beginning activities in the next sequential block in the same corridor or view shed. The total lapsed time from initiation of activities to completion of obligations specified by a contract or a project prescription shall not exceed one year for any single cutting unit. Emphasis will be placed on completing all work within these areas in a systematic manner within the shortest practical time." (Page IV-31 Forest Plan)

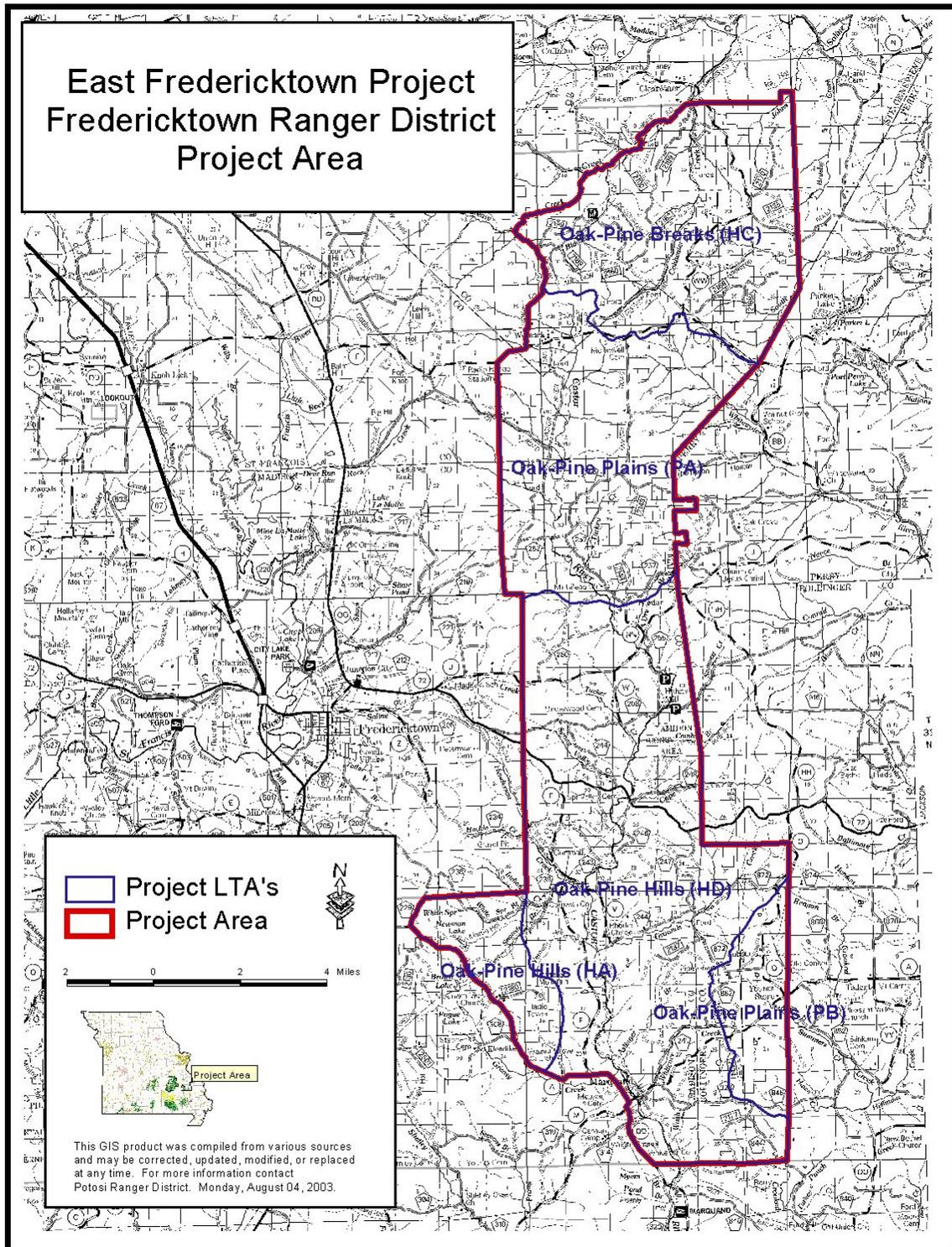
**VS4 (T&M)**

Harvest edges will be feathered away from the property line where the private land is open.

**VS5 (T&M)**

All harvest areas will be laid out on the ground in a manner that will reflect natural lines and be visually subordinate to the characteristic landscape.

## APPENDIX C - Map of the Project Area



## APPENDIX D - Reports from BE Program and MOFWIS

Rpt 2. Dist: 05. Proj: E Fredericktown EIS. Alt: none. LTA: HA

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07/28/03 11:29

Identification of listed species known or expected  
to be in the LTA or that the project potentially affects

Avail

US MO R9 MT Sp SS	Habitat	Scientific Name
Common Name		
St St St St Rk Rk	Acres	
-----		
Indiana bat		Myotis sodalis
E E L C 2	12399	
Big creek crayfish		Orconectes peruncus
S 2	1449	
St Francis river crayfish		Orconectes quadruncus
S 2	1449	
Rabbitsfoot		Quadrula cylindrica cylindrica
S 3 3	266	
Gattinger goldenrod		Solidago gattingerii
S 3	0	
Large-leaf grass-of-parnassus		Parnassia grandifolia
S 2	99	
Sand grape		Vitis rupestris
S 3	581	
Wavy-leaf purple coneflower		Echinacea simulata
S 3	239	

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Rpt 2. Dist: 05. Proj: East Fredericktown EIS. Alt: none. LTA: HC

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07/24/03 08:53

Identification of listed species known or expected  
to be in the LTA or that the project potentially affects

Avail

US MO R9 MT Sp SS	Habitat	Scientific Name
Common Name		
St St St St Rk Rk	Acres	
-----		
Cerulean warbler		Dendroica cerulea
S 4	120	
Gattinger goldenrod		Solidago gattingerii
S 3	0	
Large-leaf grass-of-parnassus		Parnassia grandifolia
S 2	972	
Sand grape		Vitis rupestris
S 3	572	
Spotted Phlox		Phlox maculata var. pyramidalis
S 5	64	
Wavy-leaf purple coneflower		Echinacea simulata
S 3	0	

\*\*\*\*\*

Rpt 2. Dist: 05. Proj: East Fred EIS. Alt: none. LTA: HD

07/24/03 08:51

Identification of listed species known or expected  
to be in the LTA or that the project potentially affects

Avail

US MO R9 MT Sp SS	Habitat	Scientific Name
Common Name		
St St St St Rk Rk	Acres	
Cerulean warbler		Dendroica cerulea
S 4	0	
Blacknose shiner		Notropis heterolepis
S 5	357	
A moss		Seligeria donniana
S 4	0	
Gattinger goldenrod		Solidago gattingerii
S 3	0	
Goldie's woodfern		Dryopteris goldiana
S 4	0	
Large-leaf grass-of-parnassus		Parnassia grandifolia
S 2	0	
Sand grape		Vitis rupestris
S 3	186	
Wavy-leaf purple coneflower		Echinacea simulata
S 3	0	

\*\*\*\*\*

Rpt 2. Dist: 05. Proj: EAST FREDERICKTOWN EIS. Alt: 2. LTA: PA

07/24/03 08:48

Identification of listed species known or expected  
to be in the LTA or that the project potentially affects

Cerulean warbler		Dendroica cerulea
S 4	0	
Migrant loggerhead shrike		Lanius ludovicianus migrans
S 4 3	24	
Gattinger goldenrod		Solidago gattingerii
S 3	0	
Large-leaf grass-of-parnassus		Parnassia grandifolia
S 2	0	
Sand grape		Vitis rupestris
S 3	120	
Wavy-leaf purple coneflower		Echinacea simulata
S 3	0	

## East Fredericktown

07/23/03 10:24

MOFWIS Genus, Species, Common Name

Page 0

Rpt: mofwis\_genus\_comnam

for 36 species

### Selection Criteria for Subsequent Pages

Species Selected: All Species

county: 'STE. GENEVIEVE', 'ST. FRANCOIS', 'MADISON', 'BOLLINGER'

occurrence\_type: 'extirpated', 'historic', 'known', 'likely'

status: 'FEDERAL CANDIDATE', 'FEDERAL ENDANGERED', 'FEDERAL THREATENED', 'GLOBAL RANK G1', 'GLOBAL RANK G2', 'GLOBAL RANK G3', 'SENSITIVE', 'STATE ENDANGERED'

### Genus and Species

### Common Name

Genus and Species	Common Name
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Accipiter cooperii	Hawk, Cooper'S
Aimophila aestivalis	Sparrow, Bachman'S
Ardea herodias	Heron, Great Blue
Aster furcatus	Forked Aster
Botaurus lentiginosus	Bittern, American
Carex decomposita	Epiphytic Sedge
Circus cyaneus	Harrier, Northern
Cycleptus elongatus	Sucker, Blue
Cyprogenia aberti	Western Fanshell
Dodecatheon frenchii	French'S Shooting Star
Draba aprica	Whitlow-Grass
Egretta thula	Egret, Snowy
Epioblasma florentina	Pearlymussel, Curtis'
Epioblasma triquetra	Snuffbox
Etheostoma clarum	Darter, Western Sand
Etheostoma histrio	Darter, Harlequin
Falco peregrinus	Falcon, Peregrine
Haliaeetus leucocephalus	Eagle, Bald
Isotria medeoloides	Small Whorled Pogonia
Macrhybopsis meeki	Chub, Sicklefin
Notropis maculatus	Shiner, Taillight
Notropis ozarcanus	Shiner, Ozark
Orconectes harrisoni	Crayfish, Belted
Orconectes peruncus	Crayfish, Big Creek
Orconectes quadruncus	Crayfish, St. Francis River
Percina nasuta	Darter, Longnose
Platanthera leucophaea	Eastern Prairie Fringed Orchid
Platygobio gracilis	Chub, Flathead
Rallus elegans	Rail, King
Scaphirhynchus albus	Sturgeon, Pallid
Sterna antillarum	Tern, Interior Least
Stygobromus onondagaensis	Onondaga Cave Amphipod
Toxolasma lividus	Purple Lilliput
Trifolium stoloniferum	Running Buffalo Clover
Tyto alba	Owl, Barn
Valerianella ozarkana	Ozark Corn Salad