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Pleasant Hill Wildlife Habitat Improvement

Pleasant Hill Ranger District, Ozark – St. Francis National Forests
Johnson, Franklin, Newton and Madison Counties, Arkansas

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SUMMARY

The Pleasant Hill Ranger District of the Ozark National Forest is proposing to improve wildlife habitat, maintain/improve forest health and reduce hazardous fuel accumulations. The actions we are proposing include enhancing wildlife & fish habitat through maintenance of existing wildlife openings, gating existing wildlife openings, construction of wildlife openings, implementation of woodland restoration, abatement of non-native invasive species (NNIS), restoration and maintenance of native warm season grasses, improvement of recreational fishing with fish structures, fertilization and liming, control of aquatic vegetation in ponds managed for recreational fishing, implementation of silvicultural practices on acquired lands and use of prescribed burning. The project area encompasses various areas north of Clarksville, AR in Johnson, Franklin, Newton and Madison Counties (see attached maps). We are asking for suggestions or ideas you may have that will help us make the best decisions on managing your public lands in this area. The proposal is located on federal lands in an area bounded on the north by State Highway 16, on the west by State Highway 23, on the east by State Highway 123, Forest Service Road 1003, State Highway 21, and State Highway 16, and on the south by the Ozark National Forest boundary. This proposed action is called the **"Pleasant Hill Wildlife Habitat Improvement"** Project. Table 1 lists the summary of projects for the Proposed Action.

Maintenance and construction of wildlife openings would provide winter feeding habitat for deer, spring and summer feeding habitat for wild turkey, and open land and edge habitat for resident and migratory birds. Gating roads leading to wildlife openings would improve these important habitat features by reducing disturbance to wildlife, while providing walk-in access to Forest users. Woodland restoration would return low site index hardwood forest stands to open woodland condition with improvements in forest floor vegetation abundance and diversity, providing associated benefits to wildlife. Abatement (treatment) of non-native invasive species (NNIS) would improve wildlife habitat and forest health by reducing generally undesirable non-native species, thereby reducing competition with native plants and providing associated benefits to wildlife. Restoration of native warm season grasses and forbs in acquired fields would improve game and non-game species habitat. Structures, fertilization, liming and control of aquatic vegetation in ponds/lakes managed for recreational fishing would improve accessibility for fishing, improve fish habitat and provide for better recreational experiences for Forest users. Implementation of silvicultural practices on the acquired Poole Tract would improve forest health and wildlife habitat. Prescribed burning would reintroduce fire into a fire adapted ecosystem, reduce hazardous fuels and wildfire risk, improve Fire Regime Condition Class (FRCC) from FRCC 3 to FRCC 2 or 1, and provide associated benefits to wildlife through improvement in forest floor vegetation abundance and diversity.

This proposal would maintain or improve the plant and animal diversity to meet overall multiple-use objectives. In addition, this proposal is in conformance with the Ozark – St. Francis National Forests Revised Land and Resource Management Plan (RLRMP).

Most work being proposed is on National Forest lands only. ***No work will occur on privately-owned land*** other than potential prescribed burning with landowners consent. The Forest Service would solicit cooperation with private landowners via Wyden/Stevens agreements, which allow the Forest Service to carry out prescribed burn treatments on private lands surrounded by or adjacent to federal land.

Table 1 - Summary of Projects - Alternative 2 (Proposed Action)

Activity	Approx. Acres	Scheduling/Frequency
Wildlife Opening Maintenance (mowing)	250 acres	annually
Wildlife Opening Maintenance (disk/seed/fertilize/lime)	250 acres	annually
Wildlife Opening Maintenance (herbicide application)	250 acres	annually
Gate Installation at Wildlife Openings	25 gates	
Wildlife Opening Construction	10 acres	Occurring over next 5 years
Woodland Restoration (thinning/herbicide)	431 acres	Incrementally over next 5 years
Existing Woodland Restoration Maintenance (herbicide)	2,667 acres	One application and potential 2nd application 2-3 years later
Non-native Invasive Species (NNIS) Abatement - plants	600 acres	annually
NNIS Abatement – feral hogs	districtwide	annually
Silvicutural Practices – Poole Tract	150 acres	Occurring over next 5 years
Native Warm Season Grass Restoration – Poole Tract	32 acres	Occurring over next 5 years
Native Warm Season Grass Maintenance – (prescribed fire) (Poole, Arbaugh, Baker, Woolsey, Yale, Mayo)	145 acres	annually
Native Warm Season Grass Maintenance (herbicide)	150 acres	annually
Native Warm Season Grass Maintenance (haying)	289 acres	annually
Native Warm Season Grass Maintenance (seed collection)	289 acres	annually
Pond Management (herbicide)	15 acres	annually
Pond Management (structures)	40 structures	annually
Pond/Lake Management (fertilization)	123 acres	annually
Pond/Lake Management (liming)	98 acres	annually
Prescribed Fire – Restoration & Hazardous Fuels Reduction	89,977 federal	3-5 year burn rotation
Prescribed Fire – Restoration & Hazardous Fuels Reduction	18,873 private*	3-5 year burn rotation

***Prescribed Fire-Private Lands – pending landowner approval through Wyden and Stevens Agreements only.**

In addition to the Proposed Action (Alternative 2), the Forest Service also evaluated the following alternative:

- Alternative 1 – A no action alternative where the present/existing level of management would continue in the analysis area

Based on the effects of the alternatives, the responsible official will decide which alternative will be selected to best meet the purpose and need identified for this project area. The District Ranger of the Pleasant Hill Ranger District has the authority to make this decision.

Part 1 – Introduction

Document Structure

The Forest Service has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the direct, indirect, and cumulative environmental impacts that would result from the Proposed Action and alternatives. The document is organized into five parts:

- ***Part 1 - Introduction:*** The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- ***Part 2 - Comparison of Alternatives, including the Proposed Action:*** This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on meeting desired future conditions described in the Revised Land and Resource Management Plan, and significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- ***Part 3 - Environmental Consequences:*** This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resources potentially affected. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provide a baseline for evaluation and comparison of the other alternatives that follow.
- ***Part 4 - Consultation and Coordination:*** This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- ***Part 5 - Appendices:*** The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Pleasant Hill Ranger District Office in Clarksville, Arkansas.

Background

Several ongoing Forest issues recognized by resource specialists on the Ranger District led to the development of this project proposal. The presence of invasive, non-native plant species on public lands, the need to maintain early seral native herbaceous vegetation, decline of oak species and oak regeneration in the ecosystem, reduced wildlife and plant biodiversity on public lands, accumulations of hazardous fuels and recreation opportunity potential were issues recognized by Pleasant Hill Ranger District resource specialists.

Purpose and Need for Action

The purpose of this initiative is to:

- Restore ecosystem health and sustainable conditions in woodlands by reducing basal area and restoring the historic/natural fire regime.
- Restore ecosystem health and biodiversity on public lands containing non-native invasive plants through abatement of these species and recovery of native species.

- Enhance plant and wildlife diversity in woodlands and through early seral habitat maintenance.
- Improve habitat for threatened and endangered species (TES).
- Provide improved recreation opportunities for the public.

This action responds to the goals and objectives outlined in the 2005 Ozark-St. Francis National Forests Land and Resources Management Plan (USDA, 2005), and helps move the project area toward desired conditions described in that plan. This action is needed for the following reasons:

Ecosystem Restoration and Promoting Sustainable Ecosystems

The Ozark-St. Francis National Forests Revised Land and Resource Management Plan (RLRMP) states desired conditions for the vegetation communities found within the project area. Desired conditions for the Dry Oak Forest and Woodland include a sparse midstory and an understory supporting a diversity of herbaceous and woody species. Fire intolerant species, such as red maple, comprise a small component of species composition. Advanced oak regeneration is common in the understory. Desired conditions for the Shortleaf Pine-Oak Forest and Woodland include an overstory dominated by shortleaf pine, a sparse midstory and an understory characterized by a well-developed grass and herbaceous component. Abundance and influence of invasive non-native plants is low. Desired conditions for Rare and Special Communities (including glades, canebrakes and native grasslands) include exhibiting the composition, structure, and function necessary to support vigorous populations of species characteristic of the community. Prescribed burning and vegetation management are appropriate to restore these areas. Non-native invasive species are rare or absent and do not substantially affect community composition, structure, or function (USDA, 2005).

The project area was historically subject to a more frequent regime of vegetation disturbance from anthropogenic fire. The project area is adjacent to study sites in the Lower Atoka Hills and Mountains Land Type Association (LTA) in which frequent fire return intervals have been documented. Here, mean fire return interval for the period of 1680-1820 ranged from 4.6 to 16 years; for the period of 1821-1880 ranged from 2 to 3.1 years; and for the period of 1881-1920 ranged from 1.4 to 5 years. From 1921-2000, mean fire return interval for these study sites ranged from 62-80 years (Guyette and Spetich, 2003). Anthropogenic fire is documented to have played a major role in shaping ecosystem structure in the Ozark Highlands. Documented presence of native people in the area prior to the earliest fire scars recorded in this study point to a fire regime with return intervals similar to those documented for the period of 1680-1920. Frequent fire in forest/woodland ecosystems would invariably have produced open, less dense stands with a higher proportion of vegetation adapted to fire. Displacement of anthropogenic fire, creation of barriers to fire such as roads and a long standing policy of fire suppression has led to current forest health problems associated with abnormally dense forest conditions and unsustainable ecosystems.

Historically, the lands that are now the Ozark – St. Francis National Forests consisted of fire-dependent woodland and forest ecosystems with well developed herbaceous understories. Currently, much of the ecosystem in the project area is considered unhealthy because the area lacks these forest conditions. This absence is due to a century of fire suppression and lack of vegetation management. The entire project area is within forest/grassland area described as Fire Regime Condition Class (FRCC) 2 and/or 3 and Fire Regime Group 1. Woodland restoration thinning coupled with prescribed burning would move the project area from FRCC 3 to FRCC 2 or FRCC 1. FRCC 1 is the most desirable fire regime condition class

from an ecological and fire prevention perspective. Movement of ecosystems to FRCC 1 also assists in reducing wildfire intensity and spread, and related damage to private developments and resources on public lands. Existing ecological conditions in the project area include dense, overstocked forest, a shift from the historic plant community composition toward fire intolerant plant species, lack of herbaceous species diversity and insect epidemics.

Forest health and insect epidemics have become of paramount importance on the Ozark- St Francis within the past few years. Beginning in the late 1990's, a red oak borer epidemic materialized with affected acreage going from 19,000 acres in 1999 to around 300,000 in 2001. The basic reason for this epidemic can be attributed to excessive forest density resulting in stressed trees. Field investigations in affected areas indicated that the red oak component was reduced by as much as 85 percent within the affected areas. The Pleasant Hill Ranger District was one of the hardest hit areas of the entire forest. It is where the epidemic first started and effects are still evident. Preventive action is limited but it is thought the best hope lies in regeneration harvest, thinning and prescribed fire utilized to benefit oak regeneration. Non-commercial and/or commercial thinning and prescribed fire associated with the project would accomplish three objectives:

1. It would reduce inter-tree competition and relieve the water stress on the remaining trees and help them repel diseases/pests;
2. Many trees that are cut would produce stump sprouts - a source of young oaks for the future; and
3. Thinning and prescribed fire would allow for greater herbaceous diversity and conditions suitable for oak regeneration to thrive.

Instigating a prescribed fire rotation mimicking historic (prior to 1920) fire return intervals following non-commercial thinning would maintain open forest conditions with reduced inter-tree competition and increased herbaceous diversity.

The Need for the Abatement of NNIS and Recovery of Native Species

Non-native invasive species (NNIS) are becoming more prevalent on the Pleasant Hill Ranger District, leading to displacement of native vegetation and decreased habitat quality for wildlife. NNIS plants have a number of biological characteristics which render them difficult to control using fire, hand control, or mechanical controls only. NNIS plants typically exhibit rapid growth rates, lack natural predators, are very good competitors, and produce abundant seed in early life stages. Most NNIS plants are perennials with extensive tough runners or roots which readily re-sprout upon cutting. Integrated invasive plant management techniques utilizing a combination of fire, mechanical and chemical methods often are most effective. Implementation of a NNIS management strategy would reduce the spread of newly established NNIS populations and help the recovery of native species in areas of larger infestations. Feral hogs have become problematic on public lands. They are detrimental to native vegetation and compete with and/or prey upon native wildlife.

The Need to Enhance Plant and Wildlife Diversity in Woodlands and Through Early Seral Habitat Maintenance

The Forests provide a wide variety of habitats that supports a diversity of wildlife species. One of the two most important is the early-successional habitat, (0-10 years old). Five of the

Management Indicator Species (MIS) from the RLRMP are dependent upon early-successional habitat. Two MIS are dependent upon open forest conditions/woodlands.
These disturbance-dependent MIS species population trends have been analyzed utilizing a variety of sources (AGFC 2001, 2006, 2007, 2009, 2011, 2012, USDA 2001, USDA 2007 and NatureServe 2013). Population monitoring associated with these sources shows the status of these seven species as such:

- Deer populations are stable to increasing over the last two decades based on harvest data.
- Black bear populations are stable to increasing; however, to maintain quality habitat over time, there is a need to maintain early seral habitat as a habitat component.
- Northern bobwhite populations are decreasing due to a lack of pine/oak woodland and native grassland areas.
- Population trends for turkey are stable to declining. This is a result of poor brood recruitment for multiple consecutive years. However, in 2012 the Arkansas Game and Fish Commission (AGFC annual turkey survey indicated an upward trend in turkey poults. In addition, downward trends in early-successional habitat would likely produce a negative effect on brood habitat in the future for turkey.
- Prairie warbler populations are decreasing primarily due to lack of young age-class forest (regenerating forest communities).
- Brown-headed nuthatches are dependent on open pine forest and woodlands. Populations of this species are decreasing in the Arkansas – Central Highlands Region. Available habitat is a limiting factor for this species.
- Red-headed woodpeckers are dependent on open oak woodlands. Populations of this species are stable to decreasing. Available habitat is a limiting factor.

The Ozark National Forest is dominated by late successional habitat >70 years old. Forest communities are characterized by very low proportions of early successional habitat (Taylor, 2013).

Table 2 – Percent of acreage in early and late seral stage in common forest communities

Forest Community	Total Acres	Early Successional Habitat 0-10 yrs.	Late Successional Habitat >70 yrs.
Dry Oak Forest & Woodland	358,382	0.3%	91%
Shortleaf Pine-Oak Forest and Woodland	297,409	1.5 %	75.5%
Dry-Mesic Oak Forest	444,518	0.2%	91%
Mesic Hardwood Forest	7,000	0%	95%
Riparian Forest	1,484	0%	96%

The amount of early-successional habitat on the Forest is tied very closely to the amount of regeneration harvests the Forest conducts in a given year (Tables 2-4). This type of harvesting has remained a small percentage of the total timber harvest on the National Forest and this has driven the decline in early-successional habitat.

Table 3 – Timber Harvest that Improved Wildlife Habitat 2006-2012

Ozark-St. Francis NFs Timber Treatment Acres by Type 2006-2012						
Year	**Clear Cut**	**Shelterwood**	**Seed Tree**	**Thin**	**Salvage**	**Total**
2006	0	881	32	5,752	208	6,873
2007	0	784	0	5,283	619	6,686
2008	0	1,317	324	5,852	0	7,493
2009	0	674	292	4,505	2,860	8,331
2010	0	1,440	210	7,632	1,367	10,649
2011	0	789	176	5,364	514	6,843
2012	0	2,163	223	6,556	1,082	10,024
Total	0	8,048	1,257	40,949	6,650	54,039

Table 4 – Herbaceous Species Improvement – Ozark-St. Francis NFs

RX Fire and Habitat Improvements – Ozark National Forest							
Treatment	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Wildlife Stand Improvement (acres)	709	1,427	408	10,548	982	1,416	1,953
Native grass establishment (acres)	786	800	916	402	314	500	623
Wildlife opening construction and maintenance (acres)	1,620	1,891	1,677	2,284	2,384	1,305	1,365

The seven disturbance-dependent MIS shown above would benefit from woodland restoration, prescribed fire and maintenance of early seral habitat in wildlife openings.

Hunter, et al. (2001) identified species of disturbance-dependent birds which are declining in the central hardwoods area. Forty-three of these species potentially occur within the analysis area. Of these, the United States Fish and Wildlife Service (USDI, 2002) identified seven of these species as disturbance dependent Bird Species of Conservation Concern that are declining in the Central Hardwoods Bird Conservation Region (BCR), and are disturbance-dependent species. These 43 species found within the analysis area would benefit from proposed vegetation treatments due to their reliance upon disturbance-associated habitats (Hunter, et al., 2001).

The Need to Improve Habitat for Region 8 Sensitive Species

The biological evaluation for this project (Taylor, 2014), identified 10 Region 8 sensitive species and five proposed, threatened or endangered species known or suspected to be present in the project area which require open (unshaded) and/or fire adapted and dependent habitats, or would benefit from vegetation management. These species would benefit from implementation of the proposed projects.

The Need to Improve Recreational Opportunities

Use of public lands for wildlife related recreation is becoming increasingly important with population increases and development of private lands. Woodland areas containing greater herbaceous diversity and abundance provide improved wildlife habitat for several species of importance to the public – including white tailed deer, wild turkey, bobwhite quail, resident passerine birds and neo-tropical migratory birds. Early seral habitat provided in wildlife openings and native warm season grass habitat help meet habitat requirements for these same

wildlife species which are important to the public for recreation. Opportunities for sport fishing on the National Forest are of importance to the public. Implementation of the proposed projects would improve recreational opportunities for wildlife viewing, hunting and sport fishing on public lands.

The Proposed Action

The action proposed by the Forest Service to address the purpose and need includes several vegetation/habitat management actions. This alternative proposes: wildlife opening maintenance consisting of mowing, herbicide application, and disking/seeding/fertilizing/liming (250 acres each activity annually); gate installation at wildlife openings (25 gates); construction of wildlife openings (approx. 10 acres); woodland restoration with thinning and/or herbicide (431 acres); existing restored woodland maintenance with foliar herbicide application (2,667 acres) and rotational prescribed burning; NNIS plant abatement (up to 600 acres annually); NNIS – feral hog hunting/trapping district wide; warm season grass restoration on 32 acres; previously restored native warm season grass field maintenance consisting of prescribed fire (up to 145 acres annually), herbicide application (up to 150 acres annually), and mowing (up to 289 acres annually); native warm season grass seed collection (up to 289 acres annually); control of aquatic weeds in recreational fishing ponds (up to 15 acres annually); installation of fish structures (40 annually); fertilization of ponds/lakes (123 acres annually); liming of Horsehead Lake (98 acres annually); silvicultural practices (including release, pre-commercial thinning, timber stand improvement, site preparation and planting) on acquired lands (approximately 150 acres) and prescribed fire implemented on approximately 108,870 acres.

Definitions of the different types of treatments that are proposed can be found in the detailed description of the action alternative (pages 8-19).

Decision Framework

Given the purpose and need, the deciding official reviews the Proposed Action and the other alternatives in order to make the following decisions:

- Which alternative best meets the purpose of this initiative; that is, to guide this project area toward the desired future conditions in the RLRMP and accomplish goals set forth in the RLRMP.
- Which alternative best meets the purpose of the initiative while producing the least adverse cumulative environmental impacts.
- Which alternative best meets the six strategic goals of the Forest Service's 2004 National Strategic Plan.

Public Involvement

The proposal was listed in the Schedule of Proposed Actions in December 2013 until present. It was provided to the public and other agencies for a combined scoping/comment period beginning May 15, 2014. Using the comments from the public, other agencies, and internal comments, the interdisciplinary team developed a list of issues to address.

Issues

The Forest Service separates issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the Proposed Action. Non-significant issues were identified as those: 1) outside the scope of the

Proposed Action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…"

Issues Studied in Detail

As for significant issues, the Forest Service identified **five** topics raised during scoping. No scoping comments were received from the public. All issues studied in detail were provided by USDA Forest Service specialists. These issues include:

Issue #1

Forest health problems in the area and sustainable ecosystems.

The measurement indicator for this issue is: acres of public land restored to sustainable conditions and increased biodiversity through implementation of mechanical, chemical and prescribed fire treatments.

Issue #2

The effects of proposed management activities on TES species.

The measurement indicator for this issue is: acres of TES habitat impacted.

Issue #3

The effects of vegetation management on wildlife/plants.

The measurement indicator for this issue is: acres of wildlife habitat effected.

Issue #4

The effects of proposed management on fire danger and potential damage to structures/private property.

The measurement indicator for this issue is: acres of wildland urban interface (WUI) protected.

Issue #5

The effects of proposed management activities on water quality

The measurement indicator for this issue is: use of State Best Management Practices (BMPs) and mitigation measures to ensure water quality remains within the acceptable levels according to Forest Service standards.

The issues addressed in this Environmental Assessment involve contrasts among optional uses of available forest resources. Once analyzed, they were then used by the team to develop project alternatives. All proposals within this EA meet all conditions of the ~~Revised~~ RLRMP and Amendments and other applicable State and Federal Laws and Regulations.

Part 2 - Comparison of Alternatives

This chapter describes and compares the alternatives considered for the **Pleasant Hill Wildlife Habitat Improvement** Project. It includes a description of each alternative considered. This section also presents the alternatives in comparison form, sharply defining

the differences between them and providing a clear basis for choice by the decision maker and the public. Some of the information used to compare the alternatives can be based upon the extent of the alternative (for example, the amount of prescribed burning) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (for example, the amount of erosion or the degree of risk to public safety).

ALTERNATIVE 1

No Action

Under the No Action Alternative for this project proposal, current management plans would continue to guide administration of the project area. Custodial administration would proceed; however, in-depth, substantive resource management would not be done with the following consequences:

- Wildlife species needing early-seral habitat would decline.
- In all likelihood, the effects of previous Oak Decline (insect & disease) would continue unchecked for the foreseeable future.
- Reintroduction of fire disturbance regimes into fire-adapted ecosystems would not occur.
- Vegetative diversity and quality wildlife browse would suffer due to closed-canopy conditions. Low occurrence of grasses and forbs would reduce populations of small mammals, seed-eating birds, and larger game animals such as turkey and deer.
- Critical levels of fuel such as leaf litter, and fallen timber will continue to accumulate, increasing the threat of destructive wildfire occurrence.
- Air quality would remain good; no short-term impacts to air quality from prescribed fire smoke emission would occur.
- Recreation opportunities would remain enjoyable, although visual penetration into the forest by recreational motorists may decline, especially during the summer. Hunting may be negatively impacted as well as observing wildlife due to closed-canopy conditions and lack of vegetative diversity.
- MIS and TES species that depend upon disturbance (e.g., fire, canopy openings) may decrease.
- NNIS plant species would continue to compete with and replace native vegetation. Feral hogs would continue to cause damage to native plants and wildlife.
- Recreational fish pond and lake habitat improvements would be delayed or postponed.

ALTERNATIVE 2

The Proposed Action

All herbicide treatments would follow Forest-Wide Standards FW19 through FW32 included in the Revised Land and Resource Management Plan for the Ozark-St. Francis National Forests, pages 3-4 through 3-5 (USDA Forest Service 2005). All herbicide treatments would follow Arkansas Forestry Commission Best Management Practices for Forest Chemicals 7.11 through 7.17 (AFC 2002). For all projects involving herbicide use, prior to application of approved chemicals an “Implementation Checklist for Invasive Plant Control” (see Appendix A) would be completed by the District Wildlife Biologist.

Existing Wildlife Opening Maintenance:
Existing wildlife openings would be maintained district-wide on a rotational basis. The District currently manages 221 permanent wildlife openings, averaging 1.3 acres in size (see map). In addition, the District currently has 31 wildlife opening locations, averaging 2 acres in size which have been approved under previous NEPA documentation. These 31 wildlife openings will be constructed within the next 5 years (see map). This proposal considers the long term maintenance of these 252 wildlife openings. Mowing would occur on a 1-2 year schedule. Disking, seeding native or non-invasive cool season forage plants, accompanied by application of fertilizer and lime would occur on a 2-3 year schedule. Application of approved herbicides such as glyphosate, imazapic, imazapyr, triclopyr, or hexazinone would occur on a 2-3 year schedule if needed to reduce encroachment of woody species on a maximum of 250 acres annually. These openings would disperse concentrations of animal species over a broader area and would meet goals outlined in the Ozark – St. Francis National Forests RLRMP. Many animals need these forest openings to fulfill all or some of their habitat requirements during their life cycle. The Arkansas Game and Fish Commission, local volunteers, the National Wild Turkey Federation and contractors would participate with the USDA Forest Service in wildlife opening maintenance.

Gate Installation:
Gates would be installed on identified wildlife opening access roads. Roads designated as open to the public would not be closed. Roads which provide access to private developments would not be closed. Gates at wildlife openings would improve wildlife habitat by reducing disturbance to wildlife from vehicles and provide better recreational experiences to Forest users by limiting areas to walk-in hunting/wildlife viewing only. Approximately 25 gates would be constructed under this proposal (see map).

Wildlife Opening Construction:
Three new wildlife openings are proposed in locations previously impacted by surface disturbance (see map). These three areas are previously cleared land, but have some encroachment of brush and small trees. Locations of these openings are Yarbrough Gap – east side of Highway 103 (decommissioned gas well pad and pipeline), Catalpa – northwest of Catalpa community on FDR 94335G (log landing), and Little Mulberry – south of Highway 215 on FDR 94404A (old field). Wildlife openings would be constructed with either use of a masticator and/or pushing stumps and debris with a dozer. Establishment of desired species would occur using disking, liming, seeding and fertilization or existing native herbaceous vegetation would suffice for wildlife habitat. Once constructed, these openings would be maintained as specified in "Existing Wildlife Opening Maintenance" (above).

Woodland Restoration:
This activity would occur in two geographic areas of the Pleasant Hill Ranger District on approximately 431 acres (Wolf Pen Glade and Barron – see map). Woodland restoration is also known as wildlife stand improvement (WSI) thinning. This project will occur incrementally over several years with approximately 100-300 acres occurring annually. This project will occur through the use of chainsaw felling, use of mechanized equipment such as a tree shear or masticator, and/or use of girdling and herbicide application. Foliar application of herbicide to treat stems less than 4 feet in height may also be used. If a commercial market becomes available for low quality hardwood, these areas may be commercially harvested. Currently, the areas designated for woodland restoration are characterized as low quality hardwood on dry sites that were historically maintained as open woodland by large fires. These areas contain approximately 70-90 overstory (large) trees per acre. Thinning would

reduce the number of trees per acre to approximately 25-50 trees per acre. Woodland restoration thinning would result in an average basal area of approximately 30-50 square feet per acre in treated stands. Cut trees will be left in place on site, or would be utilized as fire wood, unless they are utilized as commercial forest products. On appropriate sites, shortleaf pine planting may occur following thinning and prescribed fire. Shortleaf pine may be planted at the rate of 20-40 seedlings per acre to increase this species where it is lacking. Woodland restoration would allow more sunlight to reach the forest floor (thereby increasing herbaceous species diversity) and promote more mast (nut & fruit) production from the remaining trees. Woodland restoration will benefit a variety of game and non-game wildlife species. In association with prescribed fire, woodland restoration thinning will improve Fire Regime Condition Class (FRCC) from FRCC 2 or 3 to FRCC 1. All forest-wide standards and herbicide labels/precautions would be followed in the use of herbicide.

Existing Woodland Restoration Area Maintenance:
The Pleasant Hill Ranger District proposes to utilize foliar herbicide application and or cut surface herbicide application to improve and maintain woodland conditions. This would occur within designated subunits within the Barron, Morgan Mountain, Indian Creek, Clear Creek, Sarah Hollow, Batson, Lynn Hollow, and Arbaugh Woodland Prescribed Burn Units (see map). These subunits have been treated with non-commercial thinning previously to reduce canopy coverage and improve understory herbaceous species abundance and diversity. Prescribed fire is the preferred method of reducing understory hardwood and cedar density in these areas. Herbicide application would be utilized when prescribed fire is not possible due to prescription/smoke issues, or when hardwood saplings are not top killed by prescribed fires. On appropriate sites, shortleaf pine planting may occur following thinning and prescribed fire. Shortleaf pine may be planted at the rate of 20-40 seedlings per acre to increase this species where it is lacking.

Twelve areas comprising approximately 2,667 acres may be treated with herbicide to maintain and improve woodland condition (see map). These areas may receive herbicide treatment if prescribed fire is not effective in reducing understory woody species (see Table 7). It is anticipated that herbicide use in these areas would range from 50-500 acres annually. Use of herbicide will benefit herbaceous understory diversity and abundance by reducing competition and shading by woody species. This treatment would benefit a variety of game and non-game species which require open woodland habitat with diverse understory vegetation for all or a portion of their habitat needs. Approved herbicides such as glyphosate, imazapyr, or triclopyr would be used. All forest-wide standards and herbicide labels/precautions would be followed in the use of herbicide.

Non-native Invasive Species (NNIS - plants):
NNIS (plants) abatement is proposed throughout the Pleasant Hill Ranger District with the use of approved herbicides such as glyphosate, imazapic, imazapyr, triclopyr, or hexazinone. This would entail the treatment of undesirable non-native plants such as tall fescue, kudzu, sericea lespedeza, Japanese stiltgrass, Johnsongrass, tree of heaven, European privet and multiflora rose. Other NNIS plants which may be identified in the future would be treated in a similar manner. NNIS abatement would occur on a maximum of 600 acres annually district-wide. Following herbicide application, planting of native vegetation may occur if required. Abatement of NNIS would improve wildlife habitat for several mammal, bird and reptile species by reducing displacement of native vegetation by NNIS. Herbicide treatments would follow product label instructions regulating use, including application methods to minimize drift and contamination to non-target species.

Non-native Invasive Species (NNIS-feral hogs):
NNIS (feral hog) abatement is proposed throughout the Pleasant Hill Ranger District utilizing trapping and shooting. Feral hogs would be hunted only by approved volunteers governed by specific check-in, method and reporting procedures set forth by the Pleasant Hill Ranger District. Hunting with dogs is prohibited during Arkansas Game and Fish Commission (AGFC) established deer, bear and turkey firearms seasons.

Maintenance of Restored Native Warm Season Grass Fields
Approximately 289 acres of previously restored native warm season grass fields on the Pleasant Hill Ranger District would be maintained with prescribed fire, herbicide application and haying (see map). Maintenance would occur in the Woolsey, Yale, Mayo, Baker and Arbaugh fields. Approximately 145 acres would be burned annually to reduce woody species encroachment in these fields and improve warm season grasses. A maximum of 150 acres annually would be treated with approved herbicides to reduce woody species encroachment and NNIS (Johnsongrass, sericea lespedeza, etc.). Up to 289 acres may be hayed annually under special use permit or a stewardship agreement. Haying would also reduce woody species encroachment in the fields. Should the demand arise, these fields may be harvested for seed either by Forest Service personnel, or under special use permit or a stewardship agreement. All forest-wide standards and herbicide labels/precautions would be followed in the use of herbicide.

Restoration of Warm Season Grass in Acquired Fields
Approximately 32 acres of acquired fields on the former Poole property would be converted from fescue and Bermuda grass and restored to native warm season species, or portions may be converted to cool season forage wildlife openings (see map). A mix of cool season forage and native warm season grasses and forbs is desired for this area, and separate fields would facilitate this. For conversion/restoration, prescribed fire followed by herbicide application would be used to reduce fescue and Bermuda grasses. Following this, fields would be planted with desired warm season species (such as big blue stem, little blue stem, Indian grass, switchgrass and forbs) and desired cool season species (such as Virginia wildrye, clover, winter wheat and annual rye grass). Seeding will be accomplished with a no-till drill, or through disking, broadcast seeding and rolling. Following establishment of warm season grasses, these fields would be maintained under the same guidelines as described for previously restored native warm season grass fields. The cool season forage portions of these fields would be maintained under the same guidelines as described for wildlife opening maintenance. All forest-wide standards and herbicide labels/precautions would be followed in the use of herbicide.

Pond & Lake Management
Structures to improve fish cover, spawning habitat and recreational fishing would be introduced into District ponds and Horsehead Lake (see map). Structures could include gravel, brush piles and pvc. Up to 40 structures would be constructed at District ponds/lakes annually. Sodium bentonite would be used at the District discretion to seal ponds which are losing water through seepage. Fertilization of approximately 123 acres of District ponds and Horsehead Lake would occur annually. Fertilization would increase algae bloom and productivity of these recreational fishing areas. Liming of Horsehead Lake (98 ac.) would occur annually. Liming improves water pH and the effectiveness of fertilization. Control of dense aquatic vegetation such as watershield will improve ponds managed for recreational fishing. Approved herbicides with no restrictions upon swimming or fish consumption would be utilized. Ponds with dense aquatic vegetation will be treated with herbicide only after efforts to use biological control

methods have failed (grass carp). This activity will occur on a maximum of 15 pond acres annually. Twenty-eight ponds exist on the Pleasant Hill Ranger District which may receive these treatments. All forest-wide standards and herbicide labels/precautions would be followed in the use of herbicide. Approximately 30 acres of ponds may be stocked annually with forage fish to improve growth of sport fish. Approximately 30 acres of ponds may be stocked with sport fish if fish populations in ponds are depleted by fishing or other sources of mortality.

Access Improvement to Acquired Poole Tract:

With potential future removal or modification of the low-water, concrete bridge crossing the Mulberry River on the acquired Poole property, the Forest Service will require alternate access into this tract of land for facilitation of management. Access to this tract will be from the south side of the Mulberry River utilizing FDR 4432, FDR 94674A, and the termination of Johnson County Road 5241 on the Poole Tract. Approximately 3.2 miles of FDR 4432 and 0.8 miles of FDR 94674A would be maintained under normal Forest Service maintenance schedules to access this acquired tract. Approximately 0.4 miles of new road (using existing road templates where possible), would be constructed from the terminus of FDR 94674A into the Poole Tract. Road construction would occur in Township 12 North, Range 24 West, Section 29 NWNW and Section 20 SWSW. This section of road would be constructed to facilitate administrative access with high clearance vehicles and equipment necessary for maintenance of the Poole Tract fields. Approximately 0.4 miles of an existing section of 94674A would be decommissioned – where this existing section is located along a stream course. New road access would be constructed with drainage structures such as waterbars and culverts (as needed) to eliminate sedimentation in the watershed through road erosion. Vehicle access to the Poole Tract would be limited to administrative access only, through construction of a gate on FDR 94674A or FDR 4432 in Township 12 North, Range 24 West, Section 29 NENW, NWNE, or NENE.

Prescribed Burning:

The Pleasant Hill Ranger District proposes the use of management ignited prescribed fire on approximately 108,870 acres in 14 areas district-wide (see map). Of this total acreage, approximately 89,997 acres are public lands administered by the USDA Forest Service, and approximately 18,873 acres are private lands. Approximately 240 acres of Federal Land will be treated in the Arbaugh Fields/Woodland Project Area. Approximately 2,860 acres of Federal Land and 5 acres of private land will be treated with prescribed fire in the Barron Project Area. Approximately 7,274 acres of Federal Land and 2,831 acres of private land will be treated with prescribed fire in the Batson Project Area. Approximately 7,871 acres of Federal Land and 1,226 acres of private land will be treated with prescribed fire in the Catalpa Project Area. Approximately 2,043 acres of Federal Land and 2,880 acres of private land will be treated with prescribed fire in the Chinquapin Project Area. Approximately 7,177 acres of Federal Land and 2,934 acres of private land will be treated with prescribed fire in the Clear Creek Project Area. Approximately 19,551 acres of Federal Land and 1,336 acres of private land will be treated with prescribed fire in the Indian Creek Project Area. Approximately 11,529 acres of Federal Land and 1,421 acres of private land will be treated with prescribed fire in the Little Piney Watershed. Approximately 3,748 acres of Federal Land and 571 acres of private land will be treated with prescribed fire in the Lynn Hollow Project Area. Approximately 6,972 acres of Federal Land and 937 acres of private land will be treated with prescribed fire in the Morgan Mountain Project Area. Approximately 5,993 acres of Federal Land and 1,627 acres of private land will be treated with prescribed fire in the Sally Ann Hollow Project Area. Approximately 6,987 acres of Federal Land and 1,243

acres of private land will be treated with prescribed fire in the Sarah Hollow Project Area. Approximately 1,932 acres of Federal Land and 5 acres of private land will be treated with prescribed fire in the Wolf Pen Glade Project Area. Approximately 5,800 acres of Federal Land and 1,847 acres of private land will be treated with prescribed fire in the Woods Mountain Project Area. The U.S. Forest Service and the Arkansas Forestry Commission will solicit cooperation with private landowners through the use of Stevens (State) and Wyden (Federal) agreements, which allow the agencies to carry out prescribed fire treatments on private lands surrounded by or adjacent to public lands under federal management. If private land owners do not wish to participate in prescribed fire treatments, their lands will be excluded from the project.

The primary goals of the prescribed component of this project is to reduce fuel accumulation in order to better protect National Forest and adjacent private lands from wildfire, and to reintroduce fire as a disturbance factor into fire adapted ecosystems. Implementation of prescribed fire would improve Fire Regime Condition Class (FRCC) from FRCC 3 to FRCC 2 or 1. Prescribed fire would also promote oak regeneration, maintain pine/hardwood stands in open conditions, increase herbaceous understory species density and diversity, maintain/restore glades, improve habitat conditions for fire-dependent special-status plants, increase soft-mast production, reduce potentially hazardous accumulations of fuels on the forest floor, and improve wildlife habitat conditions.

Individual burn units would be treated with prescribed fire on an approximate 3-6 year rotation. Not all burn units will be burned in the same year, but would be burned incrementally over a multiple-year period.

Smoke emission modeling has been completed as part of the project analysis (see Air Quality Section). All prescribed burning would be conducted in compliance with Arkansas Department of Environmental Quality (ADEQ) voluntary smoke management guidelines.

Silvicultural Practices on Acquired Lands (Poole Tract)

The recently acquired Poole Tract comprises approximately 180 acres. In addition to fields, this tract contains approximately 150 acres of hardwood and pine forest vegetation. There have been varying levels of past timber harvest on this tract by the previous landowner.

Hardwood Release: If desired species have adequately replenished harvested stands by natural means, **release** measures may be implemented using handtools/herbicide, if necessary, to reduce competing vegetation. If desired species have failed to adequately establish new stands, **planting & release** of oak species would be required.

Hardwood Pre-commercial Thinning (PCT): This treatment would be applied in stands that are not commercially mature. The purpose of PCT would be to cut small, unmerchantable trees that are competing with desired hardwood species. Herbicide and/or handtools would be used to accomplish this. This treatment would allow for the selection of the trees with the best form to remain and to free them of competition. Prescribed burning may follow this treatment to further control unwanted competitors of oak.

Hardwood Timber Stand Improvement (TSI) - Midstory Treatment: This treatment would be applied to stands comprised of mostly immature sawtimber but having a component of mature trees. These stands often have a dense midstory and understory of undesirable species. Removal of these undesirable species will allow oak and other desirable species currently in and underneath the midstory to be released and become competitive.

Herbicide and/or handtools would be used to accomplish this. The success of this treatment would allow a regeneration harvest to be considered next entry. Prescribed burning may follow this treatment to further control unwanted competitors of oak.

Pine Release: If desired species have adequately replenished harvested stands by natural means, **release** measures may be implemented using handtools/herbicide to reduce competing vegetation. If desired species have failed to adequately establish new stands, **planting & release** of shortleaf pine would be required.

Pine Pre-commercial Thinning (PCT): This treatment would be applied in stands that are not commercially mature. The purpose of PCT would be to cut small, unmerchantable trees that are competing with desired shortleaf pine. Herbicide and/or handtools would be used to accomplish this. This treatment would allow for the selection of the trees with the best form to remain and to free them of competition. Prescribed burning may follow this treatment to further control hardwood species.

Pine TSI- Midstory Treatment: This treatment would be applied to previously harvested stands which have not accumulated any pine regeneration to be adequately stocked. Maturing pine stands need an adequate component of pine seedlings to be prepared for future regeneration harvest. Hardwood competition would be controlled by handtool/herbicide treatments and the seed bed prepared by Rx burning for natural seedfall.

Pine Site Preparation, Pine Planting, and Release: This treatment would be applied to stands which were harvested previously to start a new generation of trees. If natural regeneration methods have not been able to fully restock these sites, this treatment would be applied. Competing hardwood brush and saplings would be reduced, allowing pine seedlings to become established. Treatments in the form of handtool/herbicide/mechanical means would be employed in order to prepare these areas for seedfall. Where pine seedlings do occur, release treatments can be employed to reduce hardwood competition using handtools and/or herbicides. Finally, where pine regeneration has not become established, planting by hand would occur.

Removal of Structures on Acquired Lands (Poole Tract)

The Poole Tract acquisition contains old structures including a house, barn, and additional outbuildings. Some of these structures present a safety hazard on public lands and are a liability to the Forest Service due to their condition and remote location. Structures deemed unsafe or unneeded would be dismantled. However, before buildings can be dismantled the Forest Service Zone Archaeologist is required to complete structural documentation forms on all structures older than 50 years, and submit these to the State Historic Preservation Office for concurrence.

Table 5 - Alternative 2 – Summary of Projects (Cont'd)
(Wildlife Openings, Native Warm Season Grass Fields, Pond Maintenance & NNIS)

Activity	Approx. #	Scheduling	Location
Wildlife Openings			
Wildlife Opening Maintenance (mowing)	250 acres	annually	Various – Districtwide (see map)
Wildlife Opening Maintenance (disk/seed/fertilize/lime)	250 acres	annually	Various – Districtwide (see map)
Wildlife Opening Maintenance (herbicide application)	250 acres	annually	Various – Districtwide (see map)
Gate Installation at Wildlife Openings	25 gates	-	Various – Districtwide (see map)
Wildlife Opening Construction	10 acres	2015-2017	3 locations (see map)
Native Warm Season Grass (NWSG)			
Restoration of NWSG	32 acres	2015-2016	Poole Tract
Maintenance of NWSG Fields (RX fire)	145 acres	annually	Woolsey, Yale, Mayo, Baker, Arbaugh & Poole Tracts
Maintenance of NWSG Fields (Herbicide)	150 acres	annually	Woolsey, Yale, Mayo, Baker, Arbaugh & Poole Tracts
Maintenance of NWSG Fields (Haying)	289 acres	annually	Woolsey, Yale, Mayo, Baker, Arbaugh & Poole Tracts
Roadwork			
Access Improvement for NWSG Restoration & Maintenance	0.4 miles	2015-2016	Poole Tract
Road Decommissioning	0.4 miles	2015-2016	Poole Tract
Pond Maintenance			
Pond Management (herbicide) Pond/Lake Management (structures) Pond/Lake Management (fertilization) Pond/Lake Management (liming) Pond/Lake Management (stocking)	15 acres 40 123 acres 98 acres 30 acres	annually annually annually annually annually	Dry Spadra **(Harmony Quad)** McConnell Box Springs Batson Elkins North Batson **(Hunt Quad)** Horsehead Lake Gillian **(Ludwig Quad)** Weimar Phillips Loop Pine Hill Darby Flat Cazort Mikles Road #2 White Road #1 **(Hagarville Quad)** White Road #2 Chalybeate Woods Mountain Seven Devils Barnes **(Cass Quad)** Schoolhouse **(Oark Quad)** Black Road Patterson Bear Branch Rosetta **(Rosetta Quad)** Bee Ridge #1 Bee Ridge #2

Table 5 - Alternative 2 – Summary of Projects (Cont'd)
(Wildlife Openings, Native Warm Season Grass Fields, Pond Maintenance & NNIS)

Activity	Approx. #	Scheduling	Location
Pond Maintenance			
Pond Management (herbicide) Pond/Lake Management (structures) Pond/Lake Management (fertilization) Pond/Lake Management (liming) Pond/Lake Management (stocking)	15 acres 40 123 acres 98 acres 30 acres	annually annually annually annually annually	Gene #1 **(Yale Quad)** Gene #2 Mayo Ponds Mikles Road #1 **(Ozone Quad)**
Non Native Invasive Species (NNIS)			
NNIS Herbicide Application	600 acres	annually	Various – Districtwide as occurrences are identified*
NNIS Feral Hog Hunting/Trapping	districtwide	annually	Various – Districtwide as occurrences are identified*

***<u>NNIS abatement</u> – requires use of Implementation Checklist for Invasive Plant Control (Appendix A)**

Table 6 - Alternative 2 – Summary of Projects (Woodland Restoration Thinning)

Woodland Restoration Project Area Name (thinning)	Within this Burn Unit (on map)	Compt./Stand	FT/CC	Approximate Acres	7.5 Minute Quad.
Wolf Pen Glade	Wolf Pen Glade	453/3	5311	28	Yale & Oark
		453/6	5311	61	
		453/16	5311	82	
		453/20	5305	24	
		453/29	5311	46	
Subtotal				**241 acres**	
Barron	Barron	415/18	5307	80	Cass
		415/23	5307	32	
		415/25	5307	33	
		418/34	5307	45	
Subtotal				**190 acres**	
TOTALS		**9 stands**		**431 acres**	

Table 7 - Alternative 2 – Summary of Projects (Woodland Restoration Maintenance)

Woodland Restoration Project Area Name (maintenance)	Within this Burn Unit (on map)	Compt./Stand	FT/CC	Approximate Acres	7.5 Minute Quad.
Morgan Mountain	Morgan Mountain	447/12	5307	23	Cass
		447/16	5307	21	
		669/9	5307	35	
Subtotal				**79**	
Arbaugh Glade	Lynn Hollow	303/15	5307	84	Boston
		304/6	5307	57	
Subtotal				**141**	
Arbaugh Fields/Woodland	Arbaugh Woodland	458/15	5311	32	Oark
		458/17	5311	52	
Subtotal				**84**	
Cashew Stewardship – Pink Twist & Low Bridge Roads	Clear Creek	408/12	5307	22	Yale
		408/33	5307	90	
		408/19	5307	74	
Subtotal				**186**	
Cashew Stewardship – Beech Grove Road	Indian Creek	449/15	5407	118	Yale
		449/12	5307	10	
		465/7 & 5 partial	5311	135	
		449/10 partial	5307	48	
		668/8	5307	128	
Subtotal				**439**	
Cashew Stewardship – Barron/Redding Road	Barron	417/10	5307	64	Cass
		417/2	5307	189	
		417/13	5307	59	
Subtotal				**312**	
Cashew Stewardship – Morgan Mtn.	Morgan Mountain	445/3 & 24	5307	34	Cass
		445/8	5307	59	
Subtotal				**93**	
Big Flat Stewardship – Big Flat	Clear Creek	407/12,32 & 11 partial	5307	114	Yale
		663/1	5307	31	
		663/12,13 & 8 partial	5307	214	
		663/8	5307	44	
		663/5	5307	62	
		407/15	5307	50	
		407/19	5307	15	
Subtotal				**530**	
Big Flat Stewardship – Carr Road	Indian Creek	451/2,3 & 4	5307	228	Yale
Subtotal				**228**	
Big Flat Stewardship – Beech Grove Road	Indian Creek	448/19	5307	148	Yale
		465/6	5307	122	
		465/10	5307	72	
		465/11	5307	30	
Subtotal				**372**	
Big Flat Stewardship – Batson/Horsehead	Batson	395/24	5307	34	Hunt
		396/2	5307	24	
Subtotal				**58**	
Big Flat East	Sarah Hollow	404/1	5311	88	Yale
		405/13	5311	44	
		402/19	5311	13	
Subtotal				**145**	
TOTALS		**45 Stands**		**2,667 acres**	

Table 8 - Alternative 2 – Summary of Projects (Prescribed Fire)

Project Area	Approximate Acres	Scheduling	7.5 Minute Quad.
Arbaugh Fields/Woodland	240 federal	3-6 year burn rotation	Oark
	0 private*		
Subtotal	**240 acres**		
Barron – Redding Road	2,860 federal	3-6 year burn rotation	Cass
	5 private*		
Subtotal	**2,865 acres**		
Batson – Horsehead/Sinclair Hollow	7,274 federal	3-6 year burn rotation	Hunt & Harmony
	2,831 private*		
Subtotal	**10,105 acres**		
Catalpa	7,871 federal	3-6 year burn rotation	Oark & Ozone
	1,226 private*		
Subtotal	**9,097 acres**		
Chinquapin	2,043 federal	3-6 year burn rotation	Harmony & Hunt
	2,880 private*		
Subtotal	**4,923 acres**		
Clear Creek	7,177 federal	3-6 year burn rotation	Yale
	2,934 private*		
Subtotal	**10,111 acres**		
Indian Creek	19,551 federal	3-6 year burn rotation	Yale & Pettigrew
	1,336 private*		
Subtotal	**20,887 acres**		
Little Piney Watershed	11,529 federal	3-6 year burn rotation	Ozone & Rosetta
	1,421 private*		
Subtotal	**12,950 acres**		
Lynn Hollow	3,748 federal	3-6 year burn rotation	Boston
	571 private*		
Subtotal	**4,319 acres**		
Morgan Mountain	6,972 federal	3-6 year burn rotation	Cass
	937 private*		
Subtotal	**7,909 acres**		
Sally Ann Hollow	5,993 federal	3-6 year burn rotation	Hagarville & Rosetta
	1,627 private*		
Subtotal	**7,620 acres**		
Sarah Hollow	6,987 federal	3-6 year burn rotation	Yale & Oark
	1,243 private*		
Subtotal	**8,320 acres**		
Wolf Pen Glade	1,932 federal	3-6 year burn rotation	Yale & Oark
	5 private*		
Subtotal	**1,937 acres**		

Table 8 - Alternative 2 – Summary of Projects (Prescribed Fire) (Cont'd)

Project Area	Approximate Acres	Scheduling	7.5 Minute Quad.
Woods Mountain	5,800 federal	3-6 year burn rotation n	Ludwig & Hagarville
	1,857 private*		
Subtotal	**7,657 acres**		
TOTAL	**108,940 acres**		

***Prescribed Fire-Private Lands – pending landowner approval through Wyden and Stevens Agreements only.**

Forest-Wide Standards and Mitigation Measures

For the Proposed Action, all applicable standards in the Ozark-St. Francis RLRMP would be applied. The following standards and guidelines are incorporated by reference in this environmental assessment:

RLRMP – pages 3-1 to 3-21 (Forest-Wide Standards), and pages 3-22 to 3-38 (Management Area Standards).

Best Management Practices (BMP) Guidelines for Silviculture (Arkansas Forestry Commission) and selected Region 8 Timber Sale AT, BT, and CT Clauses would also apply as standard mitigation measures for all proposed actions.

Appropriate mitigation measures from the Scenery Management Guide – Southern Regional National Forests, April 2008 (USDA 2008) would apply as standard mitigation measures.

Appendix A of this document contains additional mitigation measures/procedures to implementation of Invasive Plant Control.

Appendix C of this document contains additional mitigation measures/procedures for implementation of prescribed fire in the vicinity of the Ozark Highlands Trail.

Some of the more important of these mitigation measures and standards and guidelines are summarized below along with specific mitigation measures for this project. This list is not all-inclusive. The above documents should be referenced for a complete list.

1. Logging slash would be placed above the ordinary high water mark of any stream (State BMP).
2. Water control structures necessary for the control of surface water movement from soil-disturbing activities will be constructed for temporary use roads, skid trails, and fire lines concurrent with construction operations. (RLRMP, p. 3-1)
3. In stands designated for pine management, use silvicultural treatments that allow a hardwood component up to 30 percent. (RLRMP, p. 3-2)
4. In stands designated for hardwood management, use silvicultural treatments that allow a conifer component up to 30 percent. (RLRMP, p. 3-2)
5. On hardwood stands where desired oak regeneration cannot be established naturally or artificially, pine planting will be appropriate to help reach stocking standards. Supplemental pine stocking in these stands will not exceed 30 percent of the total stocking. (RLRMP, p. 3-2)
6. Prescribed burn plans will identify, as smoke sensitive targets, areas where active eagle nests with eggs or chicks are present. Mitigation will be done to avoid putting heavy accumulations of smoke into those areas. Prescribed burns should not be planned closer than 1,500 feet from active nest sites during nesting season. (RLRMP, p. 3-9)

7. Sensitive species site records and databases that include the Arkansas Natural Heritage Commission database will be maintained and updated periodically. This information along with other information sources will be used to determine future management decisions. (RLRMP, p. 3-9)
8. Tree cutting and salvage operations can occur between December 1 and March 15 without a site-specific inventory. Additional coordination with USFWS is not required. (RLRMP, p. 3-10)
9. Shagbark hickory, because of its high value as roost/maternity sites, should receive special attention during sale layout and cultural treatments. In areas where shagbark hickory is uncommon, retain all shagbark hickory over six inches diameter at breast height (dbh) (6”dbh) except those that are immediate hazards. If multiple 6-inch or greater stems which are competing for moisture, nutrients, and growing space are encountered, thin to retain the largest shagbark trees with potential for crown development and longevity. Where shagbark hickory is common within the treatment stand and the surrounding landscape, retain the largest individual shagbark stems in the treatment stand as part of the 20 basal area (overstory) and allow smaller stems, which might be in excess of six inches dbh (6”dbh) to be removed during regeneration treatments. (RLRMP, p. 3-10)
10. A 200-ft buffer of undisturbed forest will be maintained around gray bat maternity and hibernation colony sites, Ozark big-eared bat maternity sites, bachelor sites, or winter colony sites. Prohibited activities within this buffer include cutting of overstory vegetation; construction of roads, trails, or wildlife openings or development of pastures; and prescribed burning. Exceptions may be made where coordination with USFWS determines these activities to be compatible with recovery of these species. (RLRMP, p. 3-11)
11. Promote and implement current Best Management Practices (BMPs) for forestry as recommended by the Arkansas Forestry Commission to all management activities in order to control non-point source pollution and comply with state water quality standards. (RLRMP, p. 3-11)
12. Concurrent with temporary road re-construction, install silt barriers at the base of the cut and fill slopes within 50 feet of a stream course. (RLRMP, p. 3-11).
13. Soil disturbances within streamside management zones (SMZs) would be treated with erosion control measures within five days. (RLRMP, p. 3-11).
14. SMZs would be identified and designated during the appropriate stages of project planning for all defined channels, perennial streams, and springs. Minimum SMZs would be as described in the following table based on the percent of the adjacent slope. (RLRMP, p. 3-12):

Table 9. Description of Minimum SMZs

Stream Type	Slope Adjacent to the Channel		
	0-15%	16-35%	36%+
Description	Horizontal Distance from Both Sides of Stream Bank or Lake/Pond		
Perennial & Springs	100’	125’	150’
Defined Channels	50’	75’	100’

- Vegetation within 20 feet of the bank of a perennial stream and 5 feet of a defined channel would not be removed.
- Retain at least 50 square feet per acre of basal area within the SMZs when available.

- No mechanical site preparation is allowed within the SMZs.
- Within SMZs, only non-motorized trails are allowed. Motorized trails are prohibited except at designated crossings or where the trail location requires some encroachment for safety.
- No more than five percent of the mineral soil within the SMZs would be exposed during ground disturbing activities.
- Exceptions to SMZ standards are only allowed after site-specific determinations and with consultation/approval by the appropriate Staff Officer. (RLRMP, p. 3-12).

15. On all soils dedicated to growing vegetation, the organic layers, topsoil, and root mat would be left intact over at least 85 percent of an activity area. (RLRMP, p. 3-12).
16. Removal of natural debris from streams would only be allowed where it poses a significant risk to public safety or threatens private property or Forest Service infrastructure. (RLRMP, p. 3-12)
17. Within the SMZs, cross only at designated crossings identified during planned activities. Cross at a 90-degree angle and utilize temporary structures to maintain bank stability. (RLRMP, p. 3-13)
18. When temporary culverts or other approved structures are used, they must be removed upon completion of the activity. Streamside management zones disturbances would be restored to a stable, natural condition. (RLRMP, p. 3-13)
19. Soil and debris would not be deposited in wetlands, springs, or seeps. (RLRMP, p. 3-13)
20. Any area that meets the riparian area definition (Page 2-71) will be managed as Riparian Corridors MA (3.I). These stands will be mapped and reallocated to Riparian Corridors MA (3.I) in subsequent RLRMP amendments. (RLRMP, p. 3-13)
21. Best available smoke management practices (FSM 5140, State Smoke Management Plans and State Implementation Plans) will be used to minimize the adverse effects of prescribed burning on public health and safety and to protect visibility in Class 1 Area (Upper Buffalo Wilderness). (RLRMP, p. 3-13)
22. Prescribed burning will be conducted in, or adjacent to, counties with forecasted high Air Quality Index (AQI) values (AQI equals orange or higher) only if meteorological conditions indicate that smoke will be carried away from the AQI area. (RLRMP, p. 3-13)
23. Conduct all National Forest management activities in a manner that does not result in (1) a significant contribution to a violation of National Ambient Air Quality Standards or (2) a violation of applicable provisions in the State Implementation Plan. (RLRMP, p. 3-13)
24. All areas of the Ozark-St. Francis National Forests except designated open roads (subject to applicable State laws) and trails are closed to OHV use in order to minimize disturbance, environmental damage, and other user conflicts. (RLRMP, p. 3-14)
25. Projects will be designed to meet the assigned scenic integrity objectives (SIO) as defined in Appendix G. (RLRMP, p. 3-14)
26. Coordinate management direction with the State Historic Preservation Office, federally recognized tribes, and other appropriate state and federal agencies pursuant to Programmatic Agreement. (RLRMP, p. 3-16)
27. Close or obliterate all temporary roads. (RLRMP, p. 3-16)
28. Temporary roads should have a grade which does not exceed 20 percent for lengths more than 200 feet. (RLRMP, p. 3-16)

29. Erosion control will be applied to all newly disturbed road cut and fill embankments before closing roads with native-bed surfaces that exceed a 10 percent grade. (RLRMP, p. 3-16)
30. The Fire Management Plan (FMP) will guide and formally document the Fire Management Program for the Ozark-St. Francis National Forests. The FMP will provide comprehensive guidelines for both the suppression and prescribed fire programs in relation to other management activities and resource objectives. (RLRMP, p. 3-20)
31. All prescribed burning will be fully coordinated with all resources and documented in silvicultural prescriptions signed by a certified Silviculturist and approved by the District Ranger. (RLRMP, p. 3-20)
32. Except when firefighter safety and/or life and human property are compromised, fire line construction within 20 feet of a perennial stream and five feet of a defined channel will be done using hand tools. (RLRMP, p. 3-20)
33. Herbicide treatment areas will not be prescribed burned for at least 30 days after application. (RLRMP, p. 3-20)
34. In any prescribed burning, the duff layer will remain present on 80 percent of the burn area. (RLRMP, p. 3-20)
35. Appropriate erosion control strategies will be applied to fire lines in order to minimize soil erosion. (RLRMP, p. 3-20)
36. If necessary to cross a stream with a fire line, the crossings will be as close to right angles as possible and be stabilized as soon after the fire is controlled as possible. (RLRMP, p. 3-20)
37. The full range of wildland suppression tactics (from immediate suppression to monitoring) may be used consistent with Forest and resource management objectives and direction. (RLRMP, p. 3-21)
38. The response to unplanned, natural ignitions may include fire use, which is managing the ignition to accomplish specific resource management objectives in predefined areas as outline in the Fire Management Plan. (RLRMP, p. 3-21)
39. Management activities are designed to meet or exceed the assigned Scenic Integrity Objectives. (RLRMP, p. 3-27)
40. Within 300 feet of Scenic Class 1 designated road, the following silvicultural prescriptions are allowed:
    - Group selection in hardwoods
    - Oak woodland prescription
    - Single tree selection
    - Shelterwood with reserves
    - Pine woodland

41. Vegetation management will be accomplished with management-ignited prescribed fire, wildland fire use, chemical, and mechanical treatments as an appropriate method of reducing costs associated with these activities. (RLRMP, p. 3-27)
42. Logging and roadwork would be restricted during wet soil conditions to minimize resource damage.
43. The State Historic Preservation Officer has reviewed and concurred with mitigation measures and avoidance treatments proposed in the project notification submitted to the State Historic Preservation Office. Sites that are determined eligible for the National Register and sites that have undetermined eligibility would be protected from any ground-disturbing activities associated with this project. Buffers would be

painted around these sites, and heavy machinery would not be allowed within these boundaries. If additional sites are found during implementation of this project, they would be examined and necessary mitigation measures prescribed by the Forest Archaeologist would be implemented (see Appendix D – Protection Measures for Historic Properties).

Sites that have been determined not eligible for nomination to the National Register would not be protected unless there is a safety concern or traditional cultural practice associated with the site.

44. A review of listings and locations of all known occurrences of proposed, endangered, threatened, or sensitive species (PETS) has been conducted (aka. TES). In addition, field surveys have been made on all stands to be impacted by each of the action alternatives. No critical or essential habitat for any PETS species was identified in these compartments. If any additional PETS species are discovered prior to or during implementation, the project would be halted and a new biological evaluation would be made to determine the effects on the species and its habitat. A Biological Evaluation was prepared for this project and is part of the process file.

HERBICIDES

45. No herbicide is broadcast within 100 feet of private lands or 300 feet of a private residence unless the landowner agrees to closer treatment. (RLRMP, p. 3-5).
46. Herbicides and application methods are chosen to minimize risk to human and wildlife health and the environment. Diesel oil would not be used as a carrier for herbicides, except as it may be a component of a formulated product when purchased from the manufacturer. Vegetable oils would be used as a carrier for herbicides when available and compatible with the application proposed. (RLRMP, p. 3-4).
47. Herbicides are applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human and wildlife health. Application rate and work time must not exceed levels that pose an unacceptable level of risk to human or wildlife health. If the rate or exposure time being evaluated causes the Margin of Safety or the Hazard Quotient computed for a proposed treatment to fail to achieve the current Forest Service Region 8 Standard for Acceptability (acceptability requires a MOS > 100 or, using the SERA Risk Assessments found on the Forest Service website, a hazard quotient (HQ) of < 1.0), additional risk management must be undertaken to reduce unacceptable risks to acceptable levels or an alternative method of treatment must be used. (RLRMP, p. 3-4).
48. Fuelwood sales would not be made for a minimum of 30 days after treatment in areas where pesticide treatments have been made. Should injection of trees be done, effected trees would not be sold as fuelwood. (RLRMP, p. 3-4).
49. Weather is monitored and the project is suspended if temperature, humidity, and/or wind meet the criteria shown in the table below. (RLRMP, p. 3-4).

Table 10. Monitoring Criteria Showing When To Halt Herbicide Treatments

Application Techniques	Temperatures Higher Than	Humidity Less Than	Wind (at Target) Greater Than
Ground			
Hand (cut surface)	NA	NA	NA
Hand (other)	98°	20%	15 mph
Mechanical (liquid)	95°	30%	10 mph
Mechanical (granular)	NA	NA	10 mph

50. Each Contracting Officer's Representative (COR), who must ensure compliance on contracted herbicide projects, is a certified pesticide applicator. (RLRMP, p. 3-5).
51. A certified pesticide applicator supervises each Forest Service application crew and trains crew members in personal safety, proper handling in application of herbicides, and proper disposal of empty containers. (RLRMP, p. 3-5).
52. With the exception of treatment by permittees of right-of-way corridors that are continuous into or out of private lands and through Forest Service managed areas, no herbicide is broadcast within 100 feet of private land or 300 feet of a private residence unless the landowner agrees to closer treatment. Buffers are clearly marked before treatment so applicators can easily see and avoid them. (RLRMP, p. 3-5).
53. Application equipment, empty herbicide containers, clothes worn during treatment, and skin are not cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate labeled containers. (RLRMP, p. 3-5).
54. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas. (RLRMP, p. 3-5).
55. Herbicide would not be used within the appropriate SMZs or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas. (RLRMP, p. 3-5)
56. The risk of herbicide spills would be reduced by securing containers during transport, carrying only enough for a day's work, mixing and cleaning on the work site, proper disposal of containers and preparation of an emergency spill plan (USDA. FS 1981). This spill plan is part of the process file.
57. Edible berries would not be treated with herbicide.
58. Herbicide application would be suspended by the COR or inspector if rainfall is heavy enough to cause movement of herbicide from target species.
59. Notice signs will be clearly posted on herbicide-treated areas.
60. Herbicides will not be applied within 60 feet of any threatened, endangered, proposed, or sensitive plant. However, after site-specific analysis, the district biologist can prescribe mitigation measures which allow treatment within this zone. Buffers are clearly marked before treatment, so that applicators can easily see and avoid them.
61. Accident preplanning will be done, and emergency spill plans (FSM 2109.12, chapter 30) will be prepared.

Additional mitigation measures for Integrated Pest Management adhered to by the U.S. Forest Service are listed in the RLRMP pages 3-4, and 3-5.

MONITORING

All activities will be monitored to ensure mitigation measures are applied.

a. Survival checks will be done to determine the effectiveness of reforestation activities and ensure that the stands have been re-established.
b. Herbicide off-site movement will be monitored on the district. Samples on a percentage of the areas will be taken before, during, and after herbicide applications. They will be analyzed by a certified testing laboratory.
c. Applicable RLRMP monitoring and evaluation requirements will be implemented as directed within budgetary limitations. These requirements include measures to monitor current and past activities in terms and implementation, effectiveness, and validation monitoring levels.

Table 11. Forest Wide Standards (Mitigation) Applied to Projects

Forest-wide Standard Category	Applicable Standards	Pages in Forest Plan	Management Action or Resource Affected
Integrated Pest Management	FW19 – FW32	3-4 thru 3-5	Herbicide Use
Fish and Wildlife	FW33 – FW41	3-6	Fish and Wildlife
TES Species	FW42 – FW71	3-7 thru 3-11	Special Status Species
Soil, Water, Air	FW72 – FW94	3-11 thru 3-13	Soil, Water and Air
Recreation	FW104 – FW106 and FW109 FW113	3-14 thru 3-15	Recreation and Scenery
Heritage Resources	FW115	3-16	Heritage and Cultural Resources
Transportation and Public Access	FW121	3-16	Public Access
Fire Management	FW149 – FW156, FW160, FW162	3-20 thru 3-21	Smoke Management and Resource Protection from Fire

Table 11 summarizes Forest Wide Standards (Mitigation) which are applied to all proposed projects.

Table 12. Comparison of Alternatives' Effects

Resource	Alternative 1	Alternative 2
Soil Resources	Natural erosion continues; unmaintained roads erode.	Erosion reduced by blocking of unauthorized/unmaintained roads in thinning units.
Air Resources	No change from current conditions	Short term direct effects include: 67,499-78,376 tons of CO2; 2,700-3,135 tons of particulate matter
Heritage Resources	428 recorded sites will continue to deteriorate; no protection/preservation associated with management actions will be done.	45 eligible and 274 undetermined eligibility sites protected, 109 non-eligible sites within treatment units will be avoided or mitigated.
Vegetation Resources	As forest ages, they will become more vulnerable to stress and disease; decrease in early-seral veg. = decrease in biodiversity. Current Ecological communities may not be sustained.	Indirect/cumulative effects = increase in biodiversity, more benefits to oak and pine regen. from RX fire and reduction of hazardous fuels. Current ecological communities would be sustained.
Wildlife Resources	Indirect/cumulative effects = species requiring closed canopy conditions remain stable or increase, early seral/disturbance-dependent species remain stable or decrease. Restored woodland areas not prevalent.	Indirect/cumulative effects = species requiring closed canopy conditons remain stable, early seral/disturbance-dependent species remain stable or increase; increased wildlife benefits occur from RX fire, woodland restoration, wildlife opening maintenance and NNIS abatement.
TES	No negative direct effects to TES species. Indirect negative effects to fire adapted/dependent species would occur.	No loss of viability for TES populations. Beneficial impacts to several TES species from prescribed fire, woodland restoration thinning and NNIS abatement.
Wetlands & Riparian Areas	No change from current conditions	No change from current conditions; No woodland restoration thinning proposed in riparian areas; Forest-wide standards and BMP's will be followed.
Human Health	Potential effects of injury and damage to personal property in general forest areas remain; mainly on travelways and camping/hunting sites	Risks of injury and damage to personal property in general forest area reduced; higher potential for worker injury due to wildlife opening maintenance, woodland restoration thinning and prescribed burning.
Social & Economic Factors	No reduction in fuel loading, no reduction of potential wildfire damage to private property. No opportunity for contract woodland restoration thinning to public.	Reduction in fuel loading and potential wildfire damage to private property on all acres proposed for prescribed fire. Opportunities for woodland restoration thinning and opening maintenance to public. Potential for forest products economic benefits to local community.
Recreation	No change from current conditions; recreational experience will not be enhanced	Recreation experiences in restored woodland (including wildlife viewing and hunting) improved. Hunting opportunity increased with widlife opening maintenance, prescribed burning and woodland restoration. Recreational fishing opportunities increased with pond maintenance. Short term effects to approx. 30 miles of OHT would occur from RX burning.

Part 3 – Environmental Consequences

This section summarizes the physical, biological, social, and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

1. Water Resources

Significant Issues Related to the Resource

Issues # 2 & 5

2 - The effects of proposed management activities on TES species
5 – The effects of proposed management activities on water quality

Current Conditions
The Pleasant Hill Ranger District includes a total of 271,925 acres within the Administrative Boundary, only 199,420 acres (73.3%) of which is administered as National Forest land. This leaves a sizable area within the district boundaries that is privately owned. National Forest activities combined with activities on private land together comprise the cumulative effects that may result from projects and affect water quality.

This project area occurs in the Arkansas-White-Red region (Hydrologic Unit Code (HUC) 11), the Lower Arkansas sub-region (1111), the Lower Arkansas-Fourche LaFave basin (111102), and the Dardanelle sub-basin unit (11110202) (USGS, 2003).

Climate information obtained for the project area was derived from information for the town of Ozone, AR (NRCS-Climate Product). The bars on Figure 1 indicate average precipitation over a 30-year data period or climatic norm. Mid-winter and late summer is found to be the driest portions of the year; this suggests that stream flow will most likely be the lowest during the late summer.

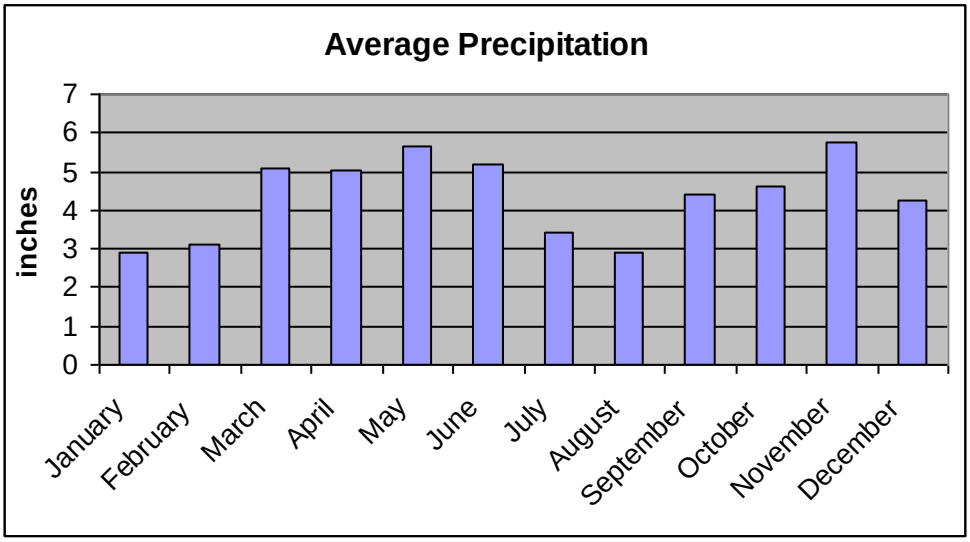

Figure 1 - Comparison of Average Precipitation/Month

Research conducted by Rogerson and Lawson (1982) on the hydrological characteristics of mixed hardwood watersheds in the Boston Mountains reveals some important traits for

runoff and stream flows within small ephemeral streams of this area. Runoff should be expected to occur every month except for the driest summer months, and the precipitation required to initiate channel flow is between 12-40 mm (.47-1.5 in). Very large discharges, termed by the authors as those above .1m^3/s, occurred 1.25 times per year and were initiated by precipitation in excess of 75 mm (2.9 in.) on very saturated soils. Soil moisture maintained consistent levels during the vegetation dormant season and correlated with the majority of the runoff periods during this study. During the vegetation growing season, soil moisture levels were found to dramatically drop due to evapotranspiration, and large summer storms were required to initiate stream flows as a large capacity of soil moisture storage was available for infiltration. Small stream channels known as ephemeral streams and headwater streams commonly carry storm-flows especially during the spring when there is little evapotranspiration and often drenching precipitation. Additional studies by Lawson, (1985) reported that for storm-flow values, the average turbidity from these ephemeral streams over a 5-year period averaged from 19 – 40 Nephelometric Turbidity Units (NTU) in the absence of any vegetation treatment. The authors concluded that as a result of their sampling methodology the results were heavily biased by large turbidity values resulting from a small number of storm flow events. These results are interpreted to indicate that storm flows are initiated by above average rainfall events and on occasion significant precipitation events can drive naturally occurring turbidity values in excess of 19 NTU from ephemeral streams in small undisturbed watersheds.

Forested land uses indicate a stable landscape that results in minimal amounts of natural or background erosion, especially for Arkansas (Miller and Liechty, 2001). For many parts of the Ozark-St. Francis NFs, the prevalent soil cover contains many rocks and rock fragments which ultimately limit the erosive susceptibility of the soils. Measured erosion for minimally-disturbed forest lands rarely exceed 0.25 tons per acre where soil erosion from cropland has been estimated at 3.8 tons per acre (Patric, et al. 1984).

The primary streams in the project area are: the Mulberry River, Little Mulberry Creek, Clear Creek, Little Piney Creek, Little Mulberry Creek, Herrods Creek, Indian Creek, Horsehead Creek, Murray Creek Spadra Creek and Mikes Creek. Much of the project area falls within the water supply intake protection areas for the Cass Job Corps (Mulberry River) and Clarksville waterworks (Spadra Creek) water supply inlets. The only dam in the project area is the Lake Ozone Dam on Little Piney Creek. No significant sized bodies of surface water are found within the analysis area (USGS, 1999; NHD, 2000). There are approximately 42 acres of small ponds which are larger than .5 acres in size across the project area.

The Mulberry River is designated as an Extraordinary Resource Water (ERW) by the Arkansas Department of Environmental Quality (ADEQ). Extraordinary Resource Waters are …"*a combination of the chemical, physical and biological characteristics of a water body and its watershed which is characterized by scenic beauty, aesthetics, scientific values, broad scope recreation potential and intangible social values."* (Arkansas Pollution Control and Ecology Commission Regulation 2.3.02). The lands under Forest Service jurisdiction within the corridor are managed to provide recreation opportunities within the capability of the resources for the protection of the free-flowing condition of the river and the preservation and enhancement of values for which the river was designated.

A segment of the Mulberry River within the project area has been designated as not meeting water quality standards for pH by the Arkansas Department of Environmental Quality. The cause of the occasional low pH readings has been determined to be a natural condition. The

Arkansas Department of Environmental Quality (ADEQ) maintains a monitoring station (ARK 0139) on the Mulberry River in the vicinity of Herrods Creek.

The project area geology consists of Pennsylvanian-age clastic sedimentary rocks of the Atoka formation (McFarland, 2004). This formation is predominantly composed of alternating sandstone and shale layers. Furthermore, the formation's structure and bulk characteristics do not support particularly good aquifers; in fact, the shale layers act as aquicludes preventing deep-seated infiltration. Therefore, the base flow contributions necessary to maintain perennial streams are highly variable and associated with seasonal climatic precipitation variation and shallow soil properties. This is documented by the Arkansas Geological Commission's (1975) low-flow determination of the Mulberry River which indicates base flows (exceeded 90% of time) of 2.7 cubic feet per second (CFS) and 7-day low flows of 1.4 CFS for a 2-year recurrence interval.

Wetland and floodplain determinations were made by comparing the project area to numerous data sources describing these features including: National Wetland Inventory database, FEMA flood maps, SSURGO soil use database, the USGS wetlands, swamps, and marsh DLG coverage, and detailed forest level soil survey information.

Less than 1 percent of the acres of the mapped soils in the project area possess hydric components. This suggests a low probability for large wetland communities to be present. Small, isolated wetlands are present but are uncommon.

Floodplains are formed by fluvial processes and often contain unconsolidated sediments such as sand and gravel that extend below the stream bed. Floodplains provide for nutrient cycling, sediment storage, floodwater storage, peak flow moderation, channel stability, and erosion prevention, and can support diverse ecosystems when compared to uplands. Floodplains are common riparian landforms. Approximately 9,300 acres of floodplains are present in the project area, located along primary streams.

Physical and biological stream inventories were conducted in the project area. Stream inventories confirmed that water quality objectives were met based on the presence and diversity of the fish communities in project area streams.

Existing land uses in the region, and their impacts on water quality have been studied by the US Geological Survey's Ozark Plateaus National Water Quality Assessment Program. Trends that show increased nitrogen, phosphorus and coliform bacteria concentrations occur with increases in agricultural and urban land uses (Davis and Bell, 1998). Forested land uses produce much lower concentrations of these constituents. Generally, effects produced by forestry operations on water quality are local, short lived, and less frequent than activities related to agricultural or urban activities. This data does not preclude timber harvest effects, but illustrates the water quality impacts of alternative land uses in the Ozarks. The effects of vegetation management practices in the Boston Mountains are similar to other areas of Arkansas, the most similar of which is found just south of the project area in the Ouachita Mountains.

Land uses for the analysis area were determined from a statewide 1999 land use dataset. Forested land uses were found to be the most prominent uses, making up about 96 percent. The remainder of the land use is primarily pasture and urban.

Other activities occurring in the area include construction and operation of oil and gas extraction sites. Mineral exploration and extraction activities have occurred in the past and are expected to continue for the near future over parts of the district.

Off-highway vehicle (OHV) use in the area is heavy, with many trails dispersing from existing roads. These are illegal routes and continue to contribute soil movement and sediment load to water courses in the project area.

Direct, Indirect & Cumulative Effects

Alternative 1 – No Action

Direct effects will not result from this alternative because no activities will result from its selection. Current trends and conditions are expected to continue. Indirect effects will result from the existing project area conditions.

Forested landscapes produce minimal amounts of natural, or background erosion (Miller and Liechty, 2001). Minimally disturbed forest lands have rarely been measured to exceed 0.25 tons per acre whereas soil erosion from cropland has been measured at 3.8 tons per acre (Patric et al., 1984; USDA SCS, 1989).

The National Forestry Manual (NFM) describes off-road erosion hazards. Ratings are based on sheet and rill erosion where 50% of the surface is exposed. Approximately 80 percent of the project area soils have a moderate or better rating. Moderate ratings indicate some erosion is likely and control measures are needed. The remaining ~20 percent of the project area has a severe rating, thus user-created trails should not exist.

The effects of user-created trails include: loss of vegetation, increased erosion susceptibility, potential pollutants, and damage to vulnerable landscapes. The effects are similar to those of poorly constructed roads (TWS, 2006). Within the analysis area, user created motorized and non-motorized trails exist and will not be closed or otherwise modified except in association with specific projects.

Other projects being conducted within the analysis area will continue as planned. These projects have been assessed in present and future conditions and analyzed for cumulative effects as related to this project.

Alternative 2 – The Proposed Action

Forest management activities can affect water quantity and quality. Water quality characteristics should not exceed standards determined for the designated uses. Where and if they occur, water quality changes can affect stream habitat for fish and other aquatic organisms. Forest management has the potential to affect water quality to the point of producing an impact on drinking water quality; however, this is a very rare occurrence (EDF, 1995).

Proposed actions which may result in direct and indirect effects are:

1. vegetation management
2. hazardous fuels reduction
3. wildlife habitat improvements
4. vegetation control using forest chemicals

VEGETATION MANAGEMENT

Generally, vegetation management effects on water quality are minor compared to agriculture; concern is warranted because of nonpoint source pollution potential. Typical management impacts are transient and rarely severe enough to threaten fish populations. Best Management Practices (BMPs) are generally effective for preventing and mitigating potential impacts (Binkley and MacDonald, 1994).

Vegetation management activities (tree cutting and removal, herbicide applications, and prescribed burning) can create nonpoint source pollution. The primary water-quality concern associated with vegetation management activities is sedimentation. Management actions can increase the risks of mass wasting, damage stream channels and banks, and increase soil erosion. Forest standards are designed to prevent dramatic land use changes.

From soil information compiled for the forest, ~75 percent of the project area soils have been given a moderate or better rating for equipment use; the remainder is classified as a severe risk (Various County Soil Surveys). Moderate equipment use ratings indicate that soil features are favorable to management uses with only one soil property that is less than desirable. Fair performance is expected and some maintenance will be required to maintain favorable conditions.

The effects of nutrient loading for southern streams following timber harvest were described (Lynch and Edwards, 1991). Best management practices (applicable to this proposal) include: 100-foot wide perennial buffers, thinning units monitored by a responsible party, operations ceased during wet weather, roads gated, and filtration strips maintained. These BMPs were evaluated as measures to control nutrient export. Nutrient concentrations will not exceed water quality standards and nutrients show a notable increase only during the treatment year. This demonstrates the effectiveness of BMPs for controlling nutrient export.

Generally, concentrations of nutrients following management activities are very low and with few exceptions have not been found to exceed drinking water standards (Binkley and MacDonald, 1994; Binkley and Brown, 1993).

HAZARDOUS FUELS REDUCTION

The effects of prescribed fire depend on fire severity, fuel characteristics, soil moisture, and recurrence interval. The effects primarily are a function of severity and ground cover removal. Less intense fires result in far fewer effects than moderate to severe fire intensity (Marion, 2004; DEIS Veg. Management in the Ozark and Ouachita Mountains Appendices Vol II). Controlled burns designed to meet wildlife, recreation, watershed, vegetation management, or ecological objectives have negligible effect on the physical, chemical, and biological properties of soils and soil productivity.

There is little evidence that sedimentation or water yield increases significantly in streams from forestlands burned under conditions specified in a prescribed burning plan designed to meet wildlife, recreation, watershed, vegetation management, or ecological objectives.

Erosion following a prescribed burn depends on soil erodibility, slope, precipitation timing, volume, intensity, fire severity, and soil cover remaining. For low intensity fires that avoid complete consumption of the organic layers, erosion has been found to not leave the treated site or be transported to stream channels (Fulton and West, 2002). The organic layer and root mat remain~~s~~ intact after low severity fires.

Prescribed burning can increase erosion and sediment delivery by eliminating protective cover and altering soil properties (Megahan, 1980). Prescribed fire will create ash, which can be eroded, dissolved, deposited, or transported into the aquatic systems. Increases in suspended solids and dissolved salts are likely to result from runoff producing precipitation events immediately following a controlled burn.

As fire severity increases, the chances for increasing damage to the soil structure also increases. Ground disturbance created by fire-line construction can increase the risk of soil erosion, and pose travel management problems. For burning designed to remove large amounts of vegetation, one effect is a transient increase in stormflow runoff attributed mainly to the loss in evapotranspiration and interception processes.

Erosion from prescribed burning is typically less than road and skid trail construction or intensive site preparation (Golden et. al 1984). Erosion following prescribed fire is mainly created from plowed fire-lines as opposed to the general treatment area (Van Lear et. al, 1985). Minor increases in stormflow and nutrients return to pre-treatment levels within 3 years.

Prescribed fire can affect water quality by altering the nutrient cycle within soils and increasing bioavailability of certain nutrients. Prescribed fire alone is not expected to increase nutrient content of runoff.

WILDLIFE HABITAT IMPROVEMENTS

Construction of wildlife openings can cause short term sedimentation into stream channels. However, the amount of sediment produced from disturbed soils is limited. Wildlife openings typically range in size from 1-3 acres. The amount of short term sediment produced from disturbed soil from these areas is minimal in comparison to the normal sediment load of watersheds on the Forest. Re-vegetation and associated soil stabilization occurs quickly on these sites due to fast growth and response of species seeded. Long term – these wildlife openings take on an additional component of native herbaceous species which lend themselves to increased soil stability.

HERBICIDES

Direct effects of forest chemicals on stream habitats depend on the toxicity of the herbicide, and level of exposure. Exposure is determined by application rate, chemical behavior in the environment and biological factors.

Herbicides enter waterbodies by direct application, wind drift, mobilization of residues in water, overland flow and leaching. Direct application, drift, and mobilization during intense precipitation are the most likely source of exposure; concentrations are highest when buffers are not used (Neary and Michael, 1996). Buffers between treatment areas and waterbodies, proper application and weather planning reduce this likelihood.

Draining areas of ephemeral and first-order streams treated with forest chemicals will contain low-levels of chemical residue and metabolites. Typically these levels are neither of sufficient concentration nor sufficient residence time to cause observable impacts to aquatic ecosystems (Michael, 2001). Measured in runoff, peak concentrations are of short duration.

Forest chemicals pose a low risk to groundwater pollution. The greatest potential risk to groundwater arises during storage, not from application (Neary and Michael, 1996). Proper handling during transport, storage, mixing-loading, and clean-up are important for preventing groundwater contamination (Neary and Michael, 1996).

Exposed, unconfined aquifers within application areas can become contaminated. These aquifers are exposed to leaching of root zone residues. Confined aquifers are less likely to be affected by herbicides (Neary, 1985). Studies have confirmed the absence of significant surface water contamination from forestry applications of herbicides.

When comparing chemical and mechanical management activities, chemicals do not disturb topsoil, create bare soil, or adversely affect watershed conditions when used responsibly (Neary and Michael, 1996). Organic matter is undisturbed and nutrient leaching is not exacerbated.

The activities described in this alternative are not expected to significantly affect wetlands or floodplains.

Stream temperature is not a significant issue for the project area.

The direct and indirect impacts from this project are not expected to contribute to degradation of the current water quality. Implementation of the activities associated with these alternatives will result in some of the above mentioned effects to water quantity and quality; but these effects have been shown from past research to be minimal and short-lived in this part of Arkansas. With the application of the Arkansas Forestry Commission's Best Management Practices for Silviculture, current Forest Plan standards, and any other mitigation measures noted in this EA, the activities of this alternative should not result in detrimental effects to the water resources. Erosion control through revegetation of disturbed ground and implementation of streamside management zones around surface water features are typical measures used to ensure the mitigation of adverse effects which may occur.

The activities proposed in this alternative will reduce the basal area by 50 percent on no more than 1.5 percent of the analysis area. Therefore, the water yield increases would be minimal (non-significant), and not quantifiable without an extensive record (>100 years). Vegetation would establish rapidly (~ 3 yrs) and water utilization patterns will become re-established.

Based on the limited increases in sediment production described in research, vegetation management activities proposed for this project are not expected to result in long term impacts from sediment. Although some impacts from sediment may occur, they are expected to be of minimal magnitude and for a short duration.

Numerous user-created roads and OHV trails exist in the area. Trees felled for woodland restoration thinning will help block un-maintained, user created roads, allowing vegetation to recover. Erosion associated with these roads and entrainment of sediment into streams will be reduced.

Herbicides, used properly, can protect water quality by reducing erosion while accomplishing management goals. Herbicides must not be applied directly to water, unless clearly labeled for aquatic uses; and herbicides should be used around particularly sensitive water resources only after careful consideration (Michael, 2001).

Monitoring conducted on the Ozark-St. Francis NFs has determined that low levels of herbicide residues occasionally enter waterbodies within a project area (SO unpublished reports). Herbicide concentrations have never exceeded established levels of concern and are not expected to for any application in the proposed project.

Herbicide application requires buffers between treated vegetation and waterbodies. Herbicide application adjacent to waterbodies and ephemeral streams will only use varieties which are not soil active.

The activities proposed by the Forest Service for the Proposed Action may result in additional sediment production from the landscape, but from a watershed perspective, contribute only a small increase to the overall estimated sediment yield. Through the use of Forest Plan standards and the use of Arkansas silviculture BMPs, the activities scheduled for implementation should not pose additional risks to water quality or designated uses. Monitoring in the form of subsequent fisheries evaluation and BMP compliance checks should be adequate to discern any adverse effects which may result from the implementation of the Proposed Action.

2. Soil Resources

Significant Issues Related to the Resource

Issue # 5

5 – The effects of proposed management activities on water quality

Current Conditions

The project is located on the southern side of the Ozark Plateau in a heavily dissected section called the Boston Mountains. Area elevation varies from about 600 feet to about 2,400 feet on the District. Several types of topography exist in this Boston Mountain section. Portions of the project area lie on a common stair-stepped landform, called "Bluff-Bench" topography, that developed from the long-term weathering/erosion of sedimentary layers of different hardness, mainly shales and sandstones. The remainder of the topography varies from nearly level to rolling mountain tops that developed from weathering of level-bedded sandstones. A lot of the private land on mountain tops, some of the benches, and some of the wider-level creek bottom areas are now or have been under cultivation or in pastures. Project area topography varies from 10-20 percent slope on mountain tops, benches, and creek bottoms, to fairly steep 40-60 percent on the 100 to 200 foot slopes between the benches and just above the stream bottoms. There are small inclusions of hydric soils in soil map units along the Mulberry River and other larger streams.

The major soils in the project area are Enders, Linker, Mountainburg, and Nella series or associations/complexes of these series. These soils are generally acid, medium in texture, and contain a wide variation in small to large stones. Linker, Mountainburg, and Nella series

soils developed from weathering of coarser sandstone (often contain remains of these stones) and, hence, are sandy loam in the upper layers, clay loam in lower levels, are moderately permeable, and low to severe erosion risk depending on slope. Enders soil developed from the weathering of fine shales and siltstones, but also can contain small to large residual stones from layers above. This soil generally has clay loam upper layers and heavy clay lower layers which makes permeability low and a high shrink-swell ratio. The low permeability at deeper levels makes Enders soils the best candidate for pond construction in the project area. Enders soils, which make up 10-20 percent of the project area, also have a stability problem when water saturated (slippage). Slope stability, compaction, erosion risk, and equipment use limitations are slight when dry, and moderate to severe when wet. County Soil Surveys recommend that heavy equipment activities on Enders soils be restricted to dry weather.

The shallowest soil affected in the project area is mapped as the Mountainburg series (20" or less to bedrock) or a complex of Mountainburg, Enders, and Nella series. It is mapped in small areas of multiple mapping units on mountaintop and side-slope sites and is rated severe for erosion.

The rock layers under the project area soils are generally solid sandstone and shale layers with occasional fractures. Much of the subsurface water movement is vertical for a short distance, then horizontal along the top of denser sandstone layers. Some surface weather fractures occur on the exposed sandstone bluffs.

Direct, Indirect & Cumulative Effects

Alternative 1 – No Action

There would be no increase in soil disturbance. Soil impacts would be limited to the existing road system and on-going forest management activities. At this time, there are no other specific reasonably foreseeable forest management actions planned within the area of effects.

Alternative 2 - The Proposed Action

Detrimental soil disturbance includes all of the physical factors that adversely affect soil, including erosion, displacement, puddling, severe burning, and compaction. A threshold has been established in the RLRMP (Forest-Wide Standard 85) that no more than 15 percent of the activity area should be detrimentally impacted to maintain soil productivity. To estimate the amount of disturbance; coefficients for each vegetation treatment method are multiplied by the number of acres affected by each method then added together and divided by the total acres treated. The result is multiplied by 100 to produce the percentage of predicted detrimental soil disturbance. Miles of road and fireline to be constructed are converted to acres. The coefficients for the vegetation treatment methods are based on monitoring done on Ozark National Forest timber harvest units from 1993 to 2007. The spreadsheet used is the Soil Disturbance Calculations Spreadsheet which is included in the process file.

Approximately six percent (26 acres) of the woodland restoration harvested area would sustain a temporary reduction in soil productivity due to cutting operations. Soil productivity would be lost on up to one acre due to road construction. Approximately 127 acres of the burned area would sustain a temporary reduction in soil productivity due to fireline construction. The proposed activities are not expected to negatively affect the functions and values of the floodplains and small inclusions of wetlands.

Including road construction, total expected temporary reduction of soil productivity would be 27 acres (6% of the woodland restoration harvested area). Fireline construction would result in one acre of soil being permanently taken out of production as a result of road construction. If used, primary skid trails and landings would be disked, seeded and closed following harvesting to speed the recovery of the soil productivity. Firelines would be bladed and seeded when prescribed burning is completed to speed recovery of soil productivity and to prevent erosion.

The types of burns planned normally do not remove all litter down to bare soil and firelines will be seeded to promote quick revegetation. Areas burned should quickly revegetate with grass, sprouts, and forbs. Maintenance of wildlife openings and ponds will cause some soil disturbance, but is not expected to result in a loss in soil productivity. Pond dams will be revegetated after maintenance and the openings will revegetate quickly. There should be no long-term cumulative effects as areas disturbed from the Proposed Action should return to their former conditions within 2-15 years.

Nutrient losses, changes in pH, and lowered site productivity within the treated areas could increase under this alternative. Nutrient reserves in the Forest are tied up in the standing biomass, litter, and soil. Losses occur naturally through surface erosion and deep soil leaching. The significant quantity of nutrients present in the trees being potentially removed will remove some nutrients from the site. The low-to-moderate intensity prescribed fires proposed for vegetation manipulation will cause temporary increases in nutrient availability, phosphorus cycling, and reduced soil acidity. The magnitude of these effects, as described in research under Arkansas conditions, is discussed more extensively by Drs. Wheeler and Eichman. Additional research by Masters, Engle, and Robinson (1993) in the Ouachita Mountains of Arkansas and Oklahoma on sites and soils similar to those in this project confirms earlier findings and indicates that most changes in chemical properties persist for less than 2 years. A large increase in standing legume crops was noted which should increase levels of nitrogen. No significant change was found in soil pH from harvest and burn treatments. They concluded that oak and pine ecosystems of Arkansas are adapted to site disturbances and periodic fire which redirect cycling pathways and enhance soil nutrient levels that conserve nutrient capital.

Prescribed Burning Effects on Soils

Fire affects soil through transfer of heat into the duff layer and underlying soil. These effects vary considerably depending upon fire intensity, duration, and soil conditions. Prescribed fire has the potential to affect soil physical, chemical, and biological properties. Prescribed burns are generally planned to burn at low to moderate intensities, limiting adverse impacts. These fires are often designed to reduce fuel loadings that reduce the likelihood of detrimental impacts from subsequent wildfires (USDA 2005).

The most important soil physical characteristic affected by fire is soil structure because the organic matter component can be lost at relatively low temperatures. Organic matter helps to hold soil particles together and along with biofilms created by soil organisms, aggregates are formed which make up soil structure. The magnitude of change in soil physical properties depends on the temperature threshold of soil properties and the severity of the fire (DeBano and Neary 2005). When the litter and duff are completely consumed by a high severity fire, the soil is bare and subject to raindrop splash and erosion. Moderate burns cause minor

erosion because they expose soil on less than 20 percent of the area and recovery usually takes one year. Light burns cause no erosion because they expose almost no soil (Dissmeyer and Stump 1978). Prescribed underburns are usually light to moderate, so their effect on erosion is generally negligible (USDA 2005). Low-intensity burns have little if any adverse effect on soil erosion even on relatively steep slopes (Brender and Cooper 1968, Cushwa and others 1971, Goebel and others 1967 cited in Stanturf and others 2002). The remaining duff, root mat, surface gravel and stones protect the soil from erosion after the burn.

Soil organic matter plays a key role in nutrient cycling, cation exchange, and water retention in soils. When organic matter is combusted, the stored nutrients are either volatilized or are changed into highly available forms that can be readily taken up by microbial organisms and vegetation (Knoepp, DeBano, and Neary 2005). The magnitude of nutrient losses during burning is positively and linearly correlated with fuel consumption (Hough 1981, Raison et al, 1985a; Schoch and Binkley, 1986 cited in Carter and Foster 2003). Liechty and others (2004) concluded that shortleaf pine-bluestem restoration, which includes harvesting, midstory reductions, and prescribed fire, can alter nutrient availability within surface soils. They found that pH, Ca, total N, C, and C:N ratios were increased by approximately 20 years of restoration activities.

Low-severity prescribed fire has a minimal effect on soil biota because maximum temperatures are generally nonlethal, except for the upper litter layer, and consumption of forest floor habitat is limited (Busse and DeBano 2005).

The use of herbicides would not cause soil disturbance because stems and roots of treated plants would remain in place until they decay. Soil microbes will break down any herbicide residue that reaches the soil.

The herbicides that are to be used are not expected to have any negative impacts on the soils. A brief summary of each of the herbicide's characteristics relating to soils is given below.

Glyphosate is readily absorbed by foliage. It had practically no leaching characteristics because it binds tightly to the soil((e.g., Alex et al. 2008; Landry et al. 2005; Mamy and Burrisuso et al. 2005) cited in SERA 2011). Soil binding of glyphosate is directly proportional to the organic carbon in the soil (e.g.; Winegardner 1996 cited in Durkin 2011). In soil, it is highly susceptible to degradation by microorganisms, being converted to natural products such as carbon dioxide and water. Many species of soil microorganisms can use glyphosate as their sole carbon source ([Dick and Quinn 1995a; dick and Quinn 1995b; Dotson et al. 1996; Wardle and Parkinson 1992a] cited in SERA 2011). Microorganisms like higher plants, use the shikimate pathway to produce aromatic amino acids. Since glyphosate inhibits this pathway, it is potentially toxic to microorganisms ([Cox 2002; Issa 1999] cited in SERA 2011). Nonetheless, there is very little information suggesting that glyphosate will be harmful to soil microorganisms under field conditions and a substantial body of information indicating that glyphosate is likely to enhance or have no effect on soil microorganisms ([Busse et al. 2001; Wardle and Parkinson 1990a; Wardle and Parkinson 1991] cited in Durkin 2011). Persistence in soils is about two months or less.

Triclopyr is absorbed by plant roots, but it is not considered effective as a soil-applied herbicide. Triclopyr is adsorbed primarily to organic matter particles in soil. The organic matter content is the primary factor in the degree of soil adsorption. Long-term forest and pasture field studies found very little indication that triclopyr will leach substantially either

horizontally or vertically in loamy soils (SERA, Inc. 1996c cited in USFS PNW Region 1996). Microorganisms degrade triclopyr readily. It degrades more rapidly under warm, moist conditions which favor microbial activity. Average soil half-lifes for triclopyr formulations are 0.2 days for triclopyr butoxyethyl ester (BEE); 14 days for triclopyr acid; and 69 days for 3,5,6-tricloro-2-pyridinol (TCP) one of the major metabolites of triclopyr (SERA 2011b). Several diverse studies are available on the toxicity of triclopyr to terrestrial microorganisms. None of these studies suggests that triclopyr is likely to have an impact on soil organisms (SERA 2011b). There is little indication that concentrations of triclopyr in soil are likely to adversely affect soil invertebrates. There are numerous field studies suggesting that effects on terrestrial invertebrates are most likely to be associated with changes in habitat and food availability rather than direct toxic effects from triclopyr (SERA 2011b). The warm temperatures at the time of application and the high density of plant roots are expected to rapidly degrade triclopyr.

Hexazinone is very water soluble and readily leaches through soil. The principal routes of loss are from photodegradation and plant and microbial metabolism (USDA 1984 cited in Michael et al. 1999). Soil factors, temperature, and precipitation duration and intensity play major roles in the leaching of hexazinone through soil profiles (Michael et al. 1999). Michael and others (1999) concluded in their study that the impact of hexazinone on soil microbes and particularly mycorrhizal fungi would be minimal, even at the rate of 6.72 kg/ha (3 times that listed on the label for site preparation for the study site). Additional field studies are available that demonstrate no adverse effects on terrestrial microorganisms after applications at rates that are substantially above those used in F.S. programs (SERA 2005). Half-life of hexazinone in soils from field tests ranged from 24 to 365 days. In laboratory studies the half-life in soils ranged from 74 to 80 days (Michael et al. 1999).

Imazapyr is relatively non-toxic to soil microorganisms, aquatic invertebrates, and fish. Effects on bacteria appear to be highly species specific with variations in sensitivity of up to a factor of 100. Imazapyr appears to have the potential to shift bacterial soil populations that contain sensitive species of bacteria. There does not appear to be any basis for asserting that imazapyr is likely to adversely effect microorganisms in soil. If imazapyr were extremely toxic to terrestrial microorganisms that are important for the maintenance of soil suitable for plant growth, it seems reasonable to assume that secondary signs of injury to microbial populations would have been reported (SERA 2011a). Degradation half-life in soils ranges from 5.9 to 8.1 years (SERA 2011a).

Imazapic's affect on soil invertebrates and soil microoganisms is not known due to lack of information. If imazapic were extremely toxic to terrestrial microorganisms that are important for the maintenance of soil suitable for plant growth, it seems reasonable to assume that secondary signs of injury to microbial populations would have been reported (SERA, 2004). Degradation half-life in soils ranges from 106 to 113 days (SERA, 2004).

Wildlife opening construction/restoration would cause some soil disturbance and a temporary increase in erosion. Disking, seeding, and fertilizing would quickly reduce the impacts on soil productivity and erosion.

Wildlife pond construction would cause a temporary increase in erosion and would convert the soil use from growing terrestrial plants to growing aquatic plants and a small amount of soil would be devoted to the dam and to growing grasses. A temporary reduction in soil productivity is expected in the area of the pond due to the removal to top soil. Soil

productivity in the pond area is expected to return to normal as aquatic plants and organisms decay and are added to the soil at the bottom of the pond. Nitrogen added in rainfall is also expected to help return productivity to the soils in the pond.

Fish pond improvement may cause some minor erosion on the pond dams and banks when brush and trees are cleared, but the dams and banks are expected to revegetate quickly with grasses and herbaceous plants.

Site prep, release, woodland restoration maintenance, and precommercial thinning would have little impact on soils because chain saws and/or hand tools would be used. Treatment of invasive species with hand tools and chemicals is also expected to have little or no impact on soils. Burning was included in the impacts.

Cumulative effects include the combination of direct and indirect effects from past, present, and reasonably foreseeable activities. Direct, indirect, and cumulative effects on soils are measured within each activity area. New system roads are discussed to provide extent of impacts but essentially are considered dedicated lands.

Evaluation of cumulative effects to soil productivity does not require an integrated "watershed-type" assessment since that is not considered an appropriate geographic area. This is because assessment of soil quality within too large an area can mask or "dilute" site specific effects and because of the variability in soil texture, the amount of organic matter and ground cover, soil response to past projects, and the intensity of the past project.

No cumulative effects are anticipated because there are no other past, present, or future actions whose effects on soils would add to the impacts to soil productivity from the Proposed Action. Impacts to soil productivity would be limited to the activity areas within the areas proposed for treatment.

There should be no long term effects. Based on the above analysis and the mitigation measures imposed, the proposed actions should not significantly degrade the soil or the water quality, including state water standards, of the analysis area and have no long term or cumulative effect.

3. Air Resources

Current Conditions

The entire project area lies within lands designated as a Class II area with respect to the air resource. The Clean Air Act (CAA) defines a Class II area as "a geographic area designated for a moderate degree of protection from future degradation of the air quality."

The RLRMP for the Ozark-St. Francis National Forests (OSFNFs) sets forth priorities related to air quality. Specifically, the RLRMP requires that the Forests work to:

- Prevent exceeding air quality standards from prescribed fire activity and other Forest actions;
- Plan for resource management emissions to fall within the current state implementation plan (SIP), which establishes acceptable levels of air pollution; and
- Minimize air pollution impacts to the Air Quality Related Values (AQRVs) of the Class I Area, Upper Buffalo Wilderness, through a cooperative working relationship with agencies managing air quality. Furthermore, the RLRMP establishes OBJ. 18, to

protect and improve the AQRVs of Upper Buffalo Wilderness with performance indicators of the number of Prevention of Significant Deterioration (PSD) permits reviewed and the number of regional air quality planning committees participated in. The Air Quality Specialist working with the OSFNFs reviews all PSD permit applications for air quality impacts to the Upper Buffalo Wilderness, and works with local, state and federal air quality agencies to ensure that increases in acidic deposition or regional haze do not occur.

Air pollution often has a subtle but critical impact on ecosystems and vistas, and can alter ecosystems by harming plants and animals, or changing soil or water chemistry. Ecosystems then become more vulnerable to damage from insects and diseases, drought, or invasive species. Additionally, since many visitors to National Forests value pristine areas with magnificent vistas, air pollution can lessen their experience and enjoyment of the National Forests.

The main air pollutants of concern on the Ozark-St. Francis National Forests are ozone, fine particulate matter, and sulfur and nitrogen deposition. Ozone is a pollutant formed by emissions of nitrogen oxides and volatile organic compounds in the presence of sunlight. At elevated concentrations, it causes human health concerns as well as negative impacts to vegetation. The US Environmental Protection Agency (EPA), as directed by Congress, has set a National Ambient Air Quality Standard (NAAQS) for ozone of 0.075 parts per million (ppm) to protect both human health and the environment. Particulate matter is a mixture of extremely small particles made up of soil, dust, organic chemicals, metals, and sulfate and nitrate acids. The size of the particles is directly linked to health effects, with smaller particles causing the worst impacts to human health. As a result, EPA has set a primary NAAQS for ultra-small (less than 2.5 microns in diameter) particulate matter on both a short-term (24-hour) and annual basis. The 24-hour fine particulate matter ($PM_{2.5}$) NAAQS is currently set at 35 $\mu g/m^3$, while the annual $PM_{2.5}$ NAAQS is 12 $\mu g/m^3$.

Air quality is recognized in the RLRMP for Ozark-St. Francis National Forests as an important parameter to measure forest health. The plan lists the following Forest-Wide Standards relating to air quality:

- FW93: Prescribed burning will be conducted in, or adjacent to, counties with forecasted high Air Quality Index (AQI) values (AQI equals orange and higher) only if meteorological conditions indicate that smoke will be carried away from the high AQI area.
- FW94: Conduct all National Forest management activities in a manner that does not result in (1) a significant contribution to a violation of National Ambient Air Quality Standards (NAAQS) or (2) a violation of the applicable provisions in the State Implementation Plan (SIP).

Standard FW93. The use of prescribed fire emits $PM_{2.5}$, along with other pollutants. With the growing prescribed fire program, it is important for the National Forests to be aware of downwind concentrations of fine particulate matter to ensure that prescribed fire emissions are not contributing to any violations of the NAAQS. There are two $PM_{2.5}$ monitors near the Ozark-St. Francis National Forests. One is located in Pope County, AR, and the other is located in Sebastian County, AR. The measured concentrations of fine particulate matter at each of these locations, both on a daily and an annual basis do not exceed the $PM_{2.5}$ NAAQS which are 35 and 12 µg/m3, respectively. Therefore, while prescribed fire may be

contributing to nearby concentrations of $PM_{2.5}$, the area is still meeting the NAAQS for this pollutant.

Standard FW94. NAAQs are based on three-year averages of the measured concentrations. Using 2008 through 2013 data, the measured concentrations near the Ozark-St. Francis National Forests were compared to the 24-hour and the annual $PM_{2.5}$ NAAQS. As shown in Figure 2, these monitors have not recorded any exceedances of the $PM_{2.5}$ NAAQS over the past six years. Thus, it can be concluded that forest management activities are not resulting in any exceedances of the NAAQS.

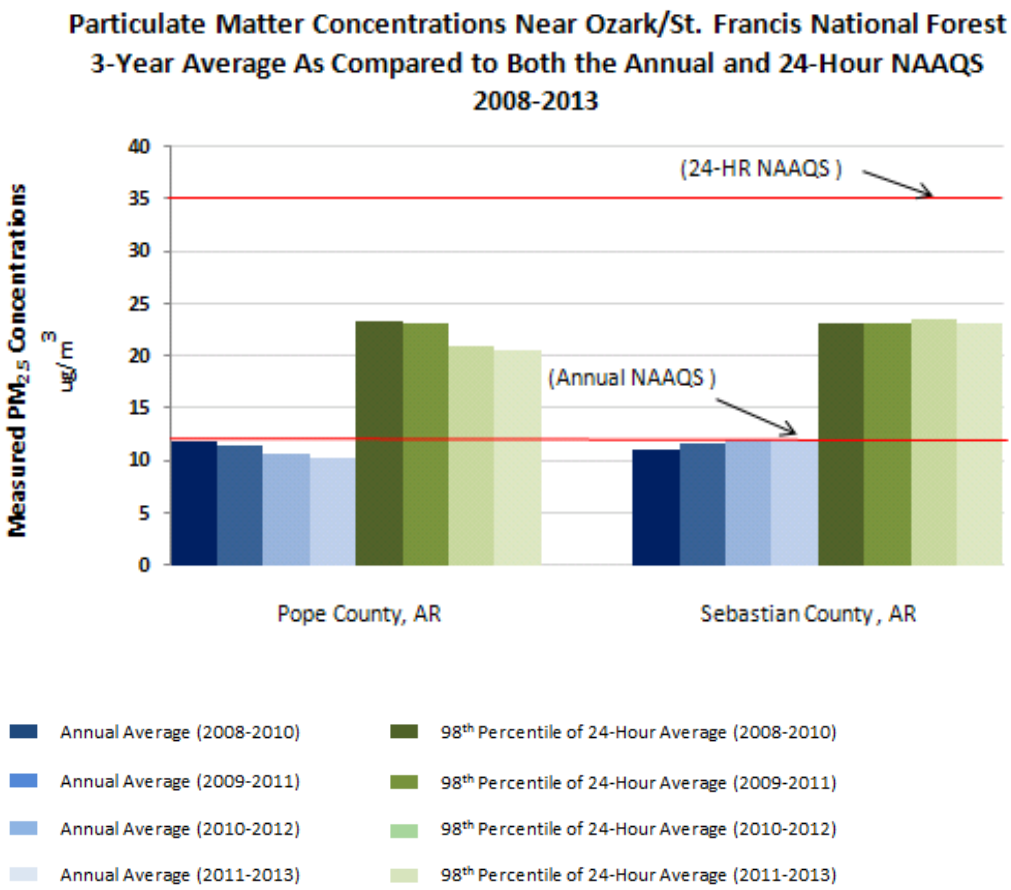

Figure 2 - Particulate Matter Concentrations near the Ozark-St. Francis National Forests

Ozone concentrations are also measured at several locations near the Ozark-St. Francis National Forests. The NAAQS is based on a three-year average of the 4th highest 8-hour ozone concentration. Figure 3 shows the nearby ozone concentrations as compared to the NAAQS. The three-year averages of ozone have recently risen in the past, but in the 2011-2013 three-year average from 2011-2013; data shows all sites recorded a decrease in ozone levels except for Sequoyah County, OK; which shows a slight increase. Though most of the yearly averages are below the ozone NAAQS, both the 2010-2012 and the 2011-2013 three-year averages for Adair County, OK, are exceeding the NAAQS.

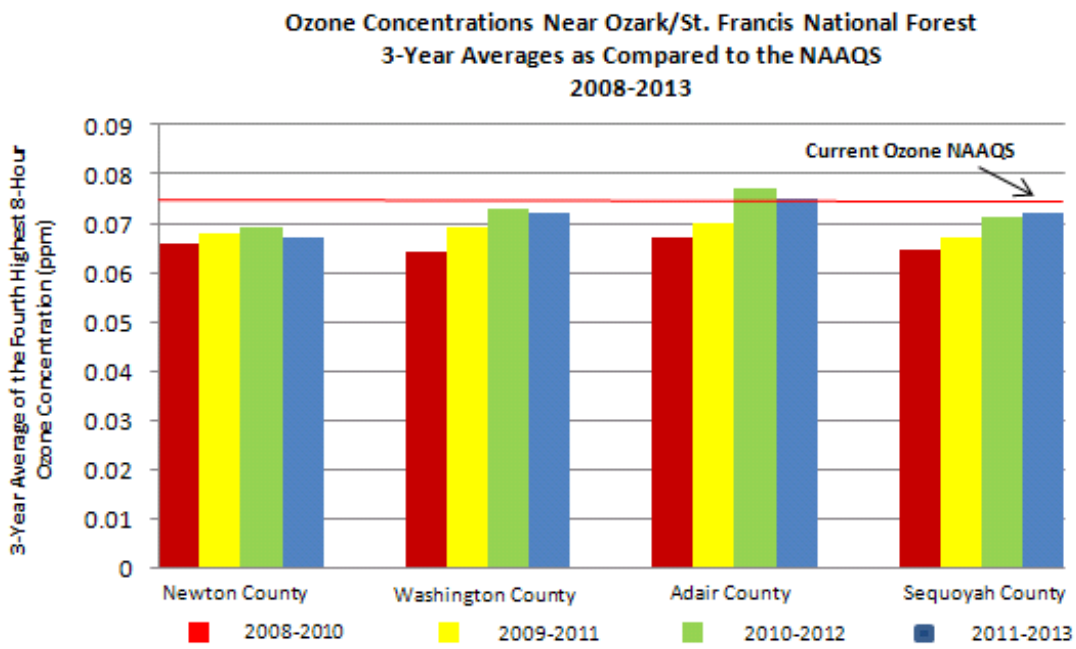

Figure 3 - Ozone Concentrations near Ozark-St. Francis National Forests

The atmosphere is a complex mixture of gases and other compounds and some are considered air pollutants because they can decrease visibility and have an adverse impact to people's health or to forest and aquatic ecosystems. As the atmosphere moves across the landscape, the air pollution can be deposited on the forest vegetation and soils. Scientists refer to this as dry deposition. Air pollutants can also travel through the atmosphere in the clouds and are deposited when it rains or snows; this can be called wet deposition or acid rain. The third method of deposition is when fog or clouds intercept the landscape, especially the tops of mountains. The amount of acid compounds deposited from clouds can be far greater than from dry deposition or rainfall and snow. The primary compounds in the atmosphere that contribute to acidification of forested ecosystems are:

- **Sulfur compounds** – Sulfur dioxide (SO^2) is converted in the atmosphere and forms sulfates and sulfuric acid. Sulfur dioxide is released primarily from coal-fired power plants.
- **Nitrogen compounds** – Nitrogen oxides and ammonia (NH4) can increase nitrogen deposition. Most forests types respond favorably to nitrogen, which is usually limiting, except old growth spruce-fir ecosystems. Automobiles and utilities are the major sources of nitrogen oxides.

The deposition of acid compounds in high concentrations or for a long time period can impact forest nutrient cycling of base cations. Excessive removal of base cations from forest soils can lead to unhealthy vegetation, and poor water quality for aquatic biota.

Wet Sulfate: Deposition has decreased on average about 0.2307 kilograms per hectare (kg/ha) each year. The model is highly significant with less than 1 in 1000 cases where there is actually no relationship between the mean of the annual wet sulfate deposition as predicted by the years since 1983 and the mean of the annual precipitation. Overall, 81 percent of the variation in the estimated mean of the annual wet sulfate deposition can be accounted for with the two predictors. The multiple regression model and graphic for wet sulfate deposition is shown in Figure 4.

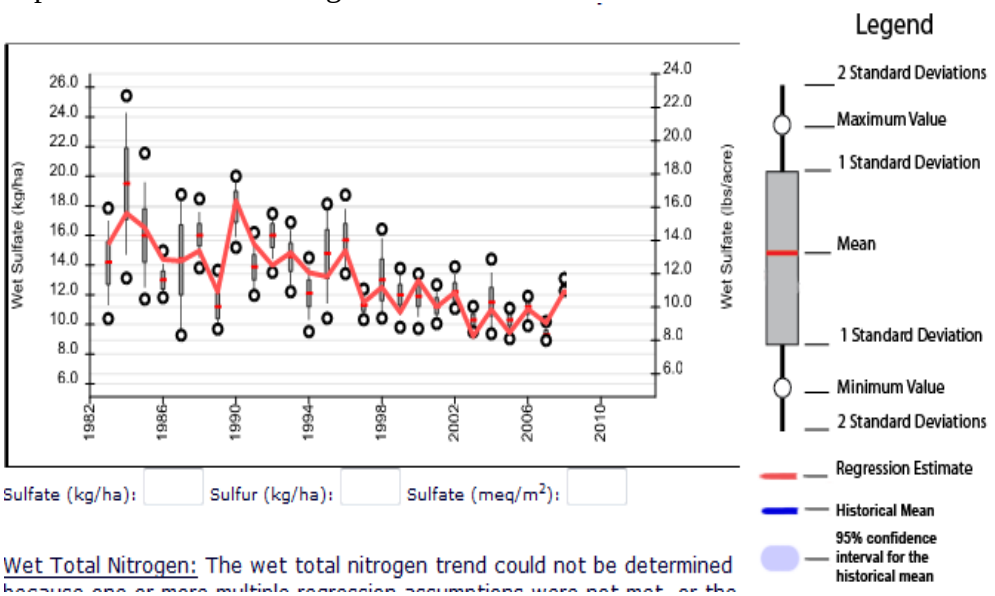

Figure 4. Wet Total Sulfate

Wet Total Nitrogen: The wet total nitrogen trend could not be determined because one or more multiple regression assumptions were not met, or the coefficient for the year and/or precipitation predictor was not significant. Therefore, Figure 5 shows the historical mean of the annual wet total nitrogen deposition of 4.8 kg/ha with the true mean between 4.53 and 5.12 kg/ha for 95 percent of the time.

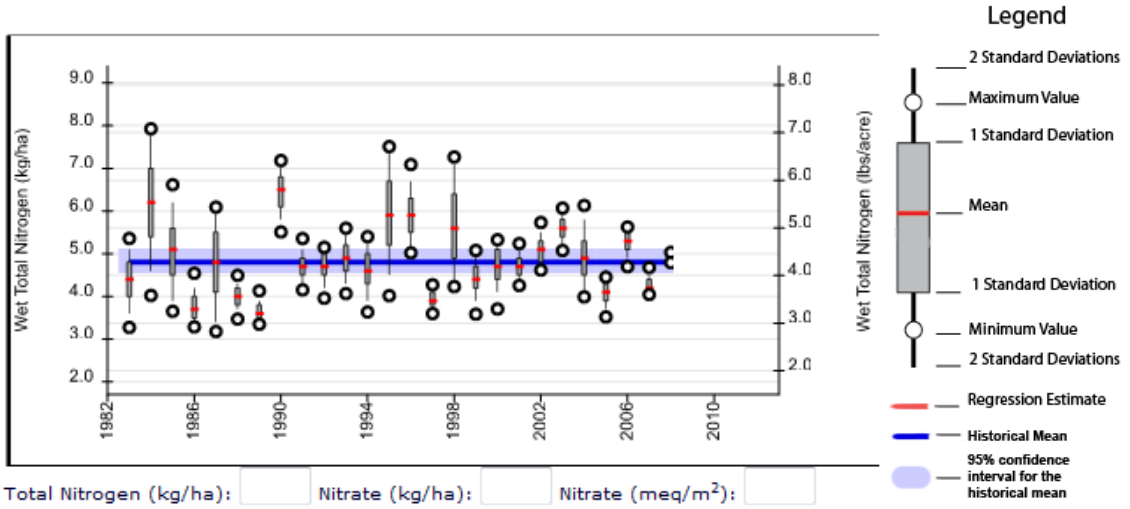

Figure 5. Wet Total Nitrogen

PSD Permit Review. The Clean Air Act and its amendments designate specific wilderness areas and national parks as mandatory Class I areas, and these areas are provided special protection against degradation of air quality related values such as visibility. The Ozark-St. Francis National Forests manage one Class I area, the Upper Buffalo Wilderness. The CCA requires federal land managers with the "affirmative responsibility" to protect the air quality related values at these Class I areas, and to consider whether a proposed new or modified source of air pollution may adversely impact these values. The Ozark-St. Francis National Forests work with state regulatory agencies in Arkansas and Oklahoma to determine if new or existing industry will impact air quality at Upper Buffalo Wilderness through the Prevention of Significant Deterioration (PSD) permitting process. Table 13shows the number of proposed new or modified sources that were reviewed over the past five years.

Table 13. PSD Permits Reviewed by the Ozark-St. Francis NFs

Prevention of Significant Deterioration (PSD) Permits Reviewed by the Ozark-St. Francis National Forests	
Fiscal Year	**Number of Permits**
2009	6
2010	3
2011	2
2012	5
2013	6

None of these proposed facilities were shown to cause an adverse impact to the Upper Buffalo Wilderness.

Visibility

Visibility has been monitored at the federally mandated Class I Upper Buffalo Wilderness Area since 1993 following the Interagency Monitoring of Protected Visual Environments (IMPROVE) protocols (http://vista.cira.colostate.edu/improve/). Figure 6 is based on the analysis of particulate matter data that include estimates of visibility conditions and the amount of light extinction attributed to different types of particulate matter measured at this IMPROVE monitoring site.

The Regional Haze Program relies on the haze index to track two different trends: visibility on the haziest days annually and on the clearest days annually. Both trends are measured beginning with the 2000-2004 "baseline" period. The haziest days are also compared to the goal of no manmade impairment in 2064. The haze index has a unit of measure called a deciview and a one unit change in a deciview may be noticeable under certain conditions. Higher deciview values correspond to hazier scenes.

Figure 6 shows the clearest and haziest annual deciview values for the entire data record for the Upper Buffalo Wilderness Area. The red line represents the haziest day "glide path" connecting the baseline conditions to the 2064 goal, and is intended to be a guide in gauging progress at this Class I area. The 2008 through 2012 haziest 5-year average (of available data) indicates the haze index is below the glide path; with 4 of 4 years below the red line in Figure 6. On the clearest days, the past 4 of 4 years of the clearest 5-year average (of available data) have been below the 11.71 deciview baseline (green line below). (http://webcam.srs.fs.fed.us/graphs/vis/index.php).

Between 2008 and 2012, ammonium sulfate was the primary particle in the atmosphere contributing to the light extinction observed on the days classified with the haziest conditions. On the clearest days, ammonium sulfate was also the primary particle contributing to light extinction. (http://webcam.srs.fs.fed.us/graphs/vis/index.php).

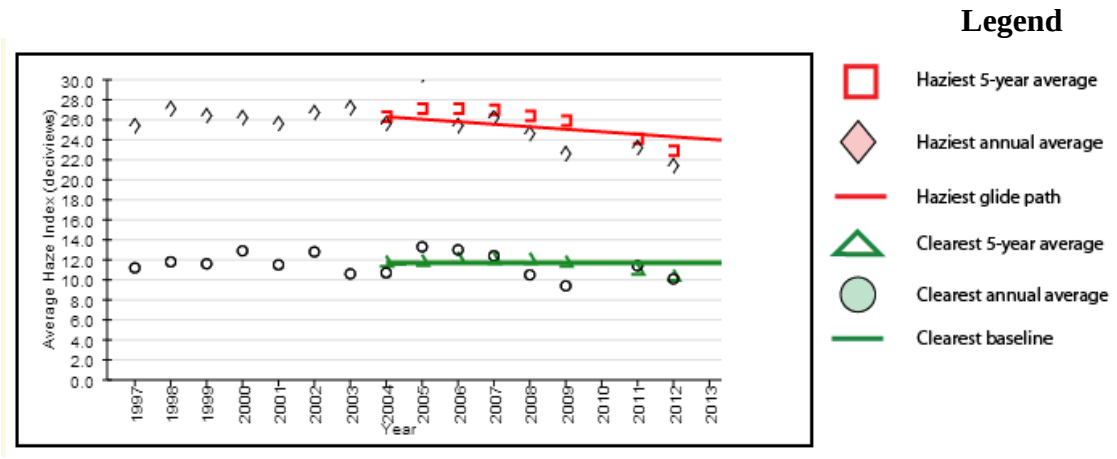

Figure 6 - Haze Index Results

Prescribed Burning

All prescribed burns require an approved prescribed burn plan and must comply with the Clean Air Act and the Arkansas Voluntary Smoke Management Program. (http://www.frames.gov/rcs/13000/13888.html).

Agency requirements for conducting prescribed burns identify specific weather conditions (parameters) that must be met prior to burning. Planning efforts include picking wind directions to avoid negatively impacting smoke sensitive sites and notifying the public of impending burns. Simple smoke screening is done to determine potential downwind impacts. (A model for simple smoke screening can be found at http://shrmc.ggy.uga.edu/smoke/).

Other more complex models such as VSMOKE (http://webcam.srs.fs.fed.us/tools/vsmoke/index.shtml) and HYSPLIT (http://www.arl.noaa.gov/ready/hysplit4.html) are used to model smoke from planned prescribed burns.

The Arkansas-Oklahoma Interagency Coordination Center (AOICC) provides detailed mapping and tables of information for each planned Forest Service burn. (http://www.fs.fed.us/r8/ouachita/fire/index_aoicc.shtml).

Archived tables of prescribed burn locations, sizes, and names can be found at (http://www.fs.fed.us/r8/ouachita/fire/rx_information_archive_shtml).

A toll free number is provided (1-888-243-1042) with daily messages detailing who is burning and location of the burn. Additionally, individual ranger districts maintain a “call-up” list of people wanting to be notified of local prescribed burns. Media (newspapers and radio), sheriff’s departments, and volunteer fire departments are also contacted prior to burning.

Smoke is monitored at near real-time through use of websites such as (http://adds.aviationweather.gov/satellite/) and (http://www.firedetect.noaa.gov/viewer.htm). Archived smoke plumes as detected from satellites from prescribed burns and other federal and non-federal sources (including wildfires) can be found via use of NOAA's website above.

Real-time ambient monitoring can be done via the use of (http://www.airnow.gov/), or when available, real-time reading from EBAM or E-Sampler $PM_{2.5}$ monitors. Archived emissions monitoring information can be extracted from these sites also.

Visibility monitoring is done using aircraft during burns or sometimes via webcams found at sites such as: (http://www.fsvisimages.com/upbu1/upbu1.html) or (http://www.wunderground.com/webcams/index.html).

There were very few smoke-related incidents attributable to FS prescribed burning between October 1, 2008 and October 1, 2013. Smoke impacts for these incidents were moderate in intensity and short-lived, lasting only a few hours. While not all the smoke that affected communities came from FS burning, it is probable that some did.

During the monitoring period, no prescribed burns conducted by the FS are known to have negatively affected any regulatory-related federal or state smoke monitors contributing to higher-than-average hourly or daily $PM_{2.5}$ emissions.

Fire Management activities across the OSFNFs are relatively stable with a general trend of 15 to 30 wildfires occurring annually burning an average of 862 acres in the past 6 years (Table 14), with the majority of those being human caused. Lightning activity as a source of fire ignition plays an important but relatively small role in fire cause.

Table 14. Acres of Wildland Fires on the OSFNFs from 2008 – 2013

Objective or Activity	Unit of Measure	2008	2009	2010	2011	2012	2013
Wildland Fire	Acres	285	1,221	273	626	2,459	309

The objective to treat 50,000 to 100,000 acres of the OSFNFs with prescribed fire for hazardous fuels reduction is usually reached (Table 15). However, this does not achieve the level to treat the management areas or communities with the return frequency desired. All opportunities to increase treatments are utilized. Through partnering with the state agencies, non-government organizations, and private land owners through agreements, landscapes and benefits are being achieved on a landscape scale crossing agency boundaries. Treatment activities across the Forests to move landscapes toward desired conditions through prescribed burning, mechanical methods, and integrated activities have remained fairly constant the last few years. We would expect this trend to continue.

Table 15. Acres of Prescribed Fire on the OSFNFs from 2008 – 2013.

Objective or Activity	Unit of Measure	2008	2009	2010	2011	2012	2013
Prescribed Fire	Acres	63,376	53,140	65,058	38,351	51,879	47,006

Effects of the fuels treatment program has resulted in gains toward restoration of ecosystems, reduction in risk of unwanted wildfires, and wildlife habitat improvement. Legal mandates, congressional intent expressed in annual budgets, natural disturbance events, and other issues or factors beyond the control of the fire program all influence performance. Opportunity to move toward desired conditions through the management of wildfires for multiple objectives has been increased.

At the time the RLRMP was approved, wildland fire was a general term describing any non-structure fire that occurs in the wildland. Wildland fire was categorized into three types:

- ***Wildfire*** – Unplanned ignitions or prescribed fires declared a wildfire. All wildfires had to be managed with the single objective of controlling/confining the fire so as to provide protection to public and firefighters, and limit damages to the extent possible.
- ***Fire Use Fires*** – Unplanned ignitions ignited from natural sources managed to achieve resource benefit objectives.
- ***Prescribed Fires*** – Planned ignitions to achieve resource goals, objectives, and benefits.

On February 13, 2009, the Fire Executive Council (FEC) approved guidance for implementation of federal wildland fire management policy. By direction of the Wildland Fire Leadership Council, this guidance provides for consistent implementation of the *Review and Update of the 1995 Federal Wildland Fire Management Policy* (January 2001). The guidance still defines wildland fire as a general term describing any non-structure fire that occurs in the wildland, however, the policy now directs that only two categories of wildland fire exist.

- ***Wildfires*** – Unplanned ignitions and prescribed fires declared a wildfire.
- ***Prescribed Fires*** – Planned ignitions.

Furthermore, it clarifies, directs, and recognizes that:

- A wildfire can be managed for more than one objective,
- Objectives can change as the fire spreads, and
- Objectives are affected by changes in fuels, weather, topography, and involvement of other government jurisdictions having differing missions and objectives.

All responses to wildland fire are based on objectives and constraints in the RLRMP.

Two design criteria in the RLRMP are:

- Forest-Wide Standard 162 which permits fire use,
- Management Area Standard MA1.A-13 which prohibits the use of prescribed fire in wilderness.

The RLRMP priorities for fire suppression strategy are to:

- Suppress wildfire at a minimum cost providing for firefighter and public safety while considering benefits as well as values at risk,
- Use a full range of suppression tactics consistent with forest and resource management objectives and direction, and
- Manage natural ignitions to accomplish resource management objectives, as outlined in the Fire Management Plan except in Wilderness (RLRMP p. 2-26).

It is reasonable to assume that since the RLRMP permitted Fire Use, managing wildfires for multiple objectives would also be permissible. It is recommended to include a short statement to add clarity to these changes in policy and wildfire categories. "Due to changing guidance and nation policy, wildfires occurring in Forest Management Areas that allowed Fire Use will be managed following the most up-to-date guidance for implementing wildland fire management policy."

SMOKE

Wildland and prescribed fires produce smoke. Smoke from prescribed burning is a problem when it creates an annoyance, nuisance, or negatively affects human health and safety. Managing smoke production from prescribed fires is one of the biggest challenges for fire managers. Through scientific modeling and developed smoke management guidelines, we are able to predict smoke production. Additionally, smoke production is monitored capturing particulate matter 2.5 ($PM_{2.5}$) measurements using portable real-time beta gauge monitors traceable to EPA requirements. Two portable Environmental Beta Attenuation Mass Monitors (EBAMs) are used across the Forests to gather real time information pre-burn, during burns, and post burns.

To manage impacts of smoke, the Forests have agreed through regional guidelines to follow Arkansas' State Department of Environmental Quality smoke guidelines in the planning and implementation of prescribed burns. The guidelines use reference weather data to determine a daily category rating (allowable smoke production) for each air shed in which a prescribed burn is being conducted. The total number of acres allowed to be burned each day in an air shed is based on fuel loadings and fuel types. Regional Prescribed Fire Manual guidance allowed for variance waivers to the state guidelines, as the state's position was that we were voluntarily following the guidelines, and they had no jurisdiction. In previous years, this amounted to about 10 percent of prescribed burns being conducted with regional waiver approval. The Regional Forester plans to delegate the waiver process to the Forest Supervisor level.

Prescribed burning to manage wildlife habitat improvement, vegetation for restoration, fuel reduction, and health and safety for employees and the public is a common and accepted practice.

Emission

Existing emission sources occurring within the project area consist mainly of mobile sources. These include, but are not limited to, combustion engines, dust from unpaved surfaces, and smoke from prescribed (federal, local, county) burning.

The primary means of ascertaining dispersion direction and projected $PM_{2.5}$ (Particulate Matter in the air 2.5 micrometers or less in size) concentration levels on the Ozark National Forest today is known as HYSPLIT (Hybrid Single-Particle Lagrangian Trajectory). HYSPLIT is a web-based model that combines forecast data, emissions, and heat release rates to estimate downwind pollutant concentration levels. The level of concentration of $PM_{2.5}$ becomes increasingly relevant in relation to the pollutant's proximity to population centers, Class I areas, or non-attainment areas.

The purpose of utilizing a program of this nature is to assure adherence to air quality standards and to manage smoke from prescribed fire to keep the smoke's impact on people and the environment within acceptable limits. The Environmental Protection Agency (EPA) has reported that fine particles (2.5 micrometers or smaller) have the potential to impair human health when people are exposed to high levels. The fine particles that can impair human health can also reduce visibility in federally-mandated Class I areas such as Caney Creek Wilderness Area and Upper Buffalo Wilderness Area where regulations have been implemented to make reasonable progress at removing any human impairment of visibility. Prescribed fire managers are using HYSPLIT to predict and subsequently limit public safety hazards posed by smoke intrusion into populated areas, prevent deterioration of air quality, prevent National Ambient Air Quality Standards (NAAQS) violations, and prevent visibility impairment at Class I areas and other smoke-sensitive areas.

Direct and Indirect Effects

Alternative 1 – No Action

There would be no substantial changes to present air quality. Exhaust emissions and dust from vehicles passing through the project area would continue. Occasionally, local residents will burn trash and small brush piles which will generate smoke.

Alternative 2 – The Proposed Action

Prescribed burning proposed in this alternative will have the potential to impact local and regional air quality. The area immediately downwind will have the greatest chances for impacts. Risks include respiratory damage and temporary impairment of visibility. The Final Environment Impact Statement (FEIS p. 3-62) indicates particulate matter may exceed the EPA 24-hour standard for short periods of time. The management guidelines within the site-specific burning plan will mitigate this effect in the immediate vicinity and downwind from it.

With respect to air quality in the proposed project area, the greatest potential for effect will be caused by prescribed burning. Short-term changes to the current air quality condition, including contributions to the greenhouse concentration of gases in the atmosphere, will result from the prescribed burning in the project. The burning will be conducted in accordance with a prescribed burn plan when conditions are favorable for rapid smoke

dispersal. Arkansas Smoke Management Guidelines will be observed. Because residual smoke flows and settles in low areas during the night and early morning and may contribute to heavy fog formation which creates hazardous road conditions, the proposed burn activities will generally be completed by mid-afternoon so that most smoke is dispersed by nightfall. Individual ignitions would typically not exceed 3,000-3,500 acres daily. Prescribed burning of the project area would be spread over multiple years, therefore, reducing potential for smoke impacts. Use of aerial ignition would serve to reduce burn-out time and associated duration of smoke impacts. Aerial ignition would also help develop smoke column lifting and reduction of smoke impacts.

The direct effects of prescribed burning on air quality will include temporary increases in particulate matter and carbon monoxide concentrations, eye, nose and throat irritations, decreased visibility along travel ways, and odor/nuisance of smoke. Smoke consists of small particles (particulate) of ash, partly consumed fuel, and liquid droplets. Other combustion products include invisible gases such as small quantities of nitrogen oxides. Oxides of nitrogen are usually produced at temperatures only reached in piled or windrowed slash or in very intense wildfires. In general, prescribed fires produce inconsequential amounts of these gases. Except for organic soils (which are not typically consumed in prescribed burns), forest fuels contain very little sulfur, so oxides of sulfur are not a problem (USDA Technical Publication R8-TP11). Persons near the actual burn area might receive some respiratory discomfort; however, it is expected that most impacts will be in the form of nuisance smoke and/or smell. Smoke from the proposed burning and the associated emissions would reside in the local area a relatively short time depending on the weather. Signs will be used along public roads to warn the public of smoky conditions. Smoke trapped in low-lying areas would be expected to dissipate once morning temperatures rise and the nighttime inversion lifts.

Other primary products of combustion are water vapor, particulate matter, hydrocarbons, carbon monoxide, polyaromatic hydrocarbons, and trace minerals. Carbon monoxide and particulate matter are EPA criteria pollutants. Polyaromatic hydrocarbons are listed as toxic substances. Strict adherence to RLMRP guidelines and a site-specific burning plan will limit the area where EPA standards are exceeded to a location very close in proximity to the flaming front. The burn plan will ensure that smoke or other combustion products do not reach smoke sensitive areas. Monitoring during and after the burns for adherence to guidelines and/or any potential problem areas will be conducted. These actions will ensure that the requirements of the Clean Air Act, EPA air standards, and state requirements will be met and there should be no long-term cumulative effects from these burns.

An indirect effect of prescribed burning is a reduction in the emissions that would be released from potential wildfires in the area. By removing the small diameter surface fuels with a controlled low-intensity prescribed fire, the potential of a high-intensity catastrophic fire developing within the stands would be reduced substantially. If a wildfire were to occur and reach into the crown canopy, the amount of live fuel that could burn would tend to release high amounts of particulate matter.

Tables 16 and 17 list the estimated amounts of CO_2 resulting from the prescribed burning proposed by this alternative. The organic matter consumed will be replaced by new vegetation so that there should be little net increase in the carbon dioxide in the atmosphere (Dipert 1992:2 draft/unpublished).

Table 16. Annual Total Emissions Released - Prescribed Burning in Areas with High Occurrence of Woodland Restoration Thinning

Compound Emitted	Estimated Release (U.S. Tons)*
	Higher Activity Fuels
Carbon Dioxide (CO_2)	78,376
Carbon Monoxide (CO)	8,151
Water Vapor	31,350
Particulate Matter	3,135
Hydrocarbons	784
Nitrogen Oxides	144
TOTAL	**121,940 tons**

Table 17. Annual Total Emissions Released –Prescribed Burning in Areas with Low Occurrence of Woodland Restoration Thinning

Compound Emitted	Estimated Release (U.S. Tons)*
	Lower Activity Fuels
Carbon Dioxide (CO_2)	67,499
Carbon Monoxide (CO)	7,020
Water Vapor	27,000
Particulate Matter	2,700
Hydrocarbons	675
Nitrogen Oxides	124
TOTAL	**105,018 tons**

***Estimates of coefficients used for calculations: a) 2.25 tons/ac actually consumed in hazardous fuel reduction burns; 4.5t/ac burned in thinning areas; 5.0t/ac burned in oak restoration and shelterwood areas; 5.4t/ac burned in seed-tree areas. (Representative of fuel models in the Prescribed Fire Guide for the Southern Region). b) 2,000-3,000 lbs of CO2/ton of fuel burned (Dipert, 1992).**

This document analyzes the effects of prescribed burning implemented on approximately 108,940 acres in total. However, the maximum area expected to be burned in one year is approximately 24,000 acres. To show the range of smoke emissions expected from prescribed burning two smoke emission models were run (Dipert, 1992). Table 16 shows smoke emission from implementing the Indian Creek, Wolf Pen Glade and Barron prescribed burns in one year (23,907 acres total). These burn units contain 1039 acres, 241 acres, and 502 acres of woodland restoration thinning respectively. Woodland restoration thinning produces "activity fuels" some of which are available to burn in prescribed fires and produce increased smoke emissions. Modeling associated with Table 16 represents the maximum smoke emissions produced by prescribed burning in one year.

Table 17 shows smoke emission from implementing the Morgan Mountain, Sarah Hollow and Woods Mountain prescribed burns in one year (23,886 acres total). These burn units contain only 93 acres of woodland restoration thinning. "Activity fuels" associated with woodland restoration thinning make up a very small proportion of the total burn area, therefore reducing smoke emission. Modeling associated with Table 17 represents the minimum smoke emissions produced by prescribed burning in one year.

Tables 16 and 17 show a range of smoke emissions that would be expected dependent upon the amount of "activity fuels" present within individual burn units.

In the consideration of total acres burned and smoke emissions produced for one year – it should be noted that total emissions shown in Tables 16 and 17 would be spread over approximately 6-10 burn days over the course of one year.

Some of the burn units described above and used in smoke emission modeling have had previous woodland restoration thinning and/or commercial timber harvest. However, only treatment areas producing activity fuels which have not been burned before were used in the modeling. Several older woodland restoration and commercial harvest units are found in the Morgan Mountain, Sarah Hollow and Woods Mountain prescribed burn areas. However, these units producing activity fuels have been burned a minimum of two times previously. Therefore, most activity fuels have been consumed, and these older treatments do not contribute significantly to increased smoke emissions.

An indirect effect of implementing the burning is a reduction in the emissions that would be released from potential wildfires in the area. By removing the small diameter surface fuels with controlled low intensity prescribed fire, the potential of a high intensity catastrophic fire developing within the stands would be reduced significantly. If a crown fire were to occur, the amount of live fuel that could burn would tend to release high amounts of particulate matter.

Wildfires will still occur in the proposed project area; however, because fuel loads will have been reduced with this alternative, there will be a lower risk of uncharacteristically severe wildfire for the treated acres than the current condition poses. The reduced risk has a two-fold effect on greenhouse gas emissions or the carbon cycle:

- There is a direct beneficial effect on climate change of decreased greenhouse gas emissions from the treated acres; because the risk of acres being burned by uncharacteristically severe wildfires will be reduced.
- There is an indirect beneficial effect because live stands of trees will retain higher capacity to sequester carbon dioxide compared to stands killed by uncharacteristically severe wildfires, especially if not immediately reforested.

Cumulative Effects

The global effects of prescribed burning are discussed in the VMEIS. Although it is possible to estimate the quantity of greenhouse gas emissions prescribed burns associated with this project may release, there is no certainty about the actual intensity of the project's individual effects on global climate change. As greenhouse gas emissions are integrated across the global atmosphere, it is not currently possible to ascertain the degree of indirect effects or cumulative impacts this project will have on global climate.

Air quality from implementation of the prescribed burning will not be affected by any past burns in the area or by any proposed future burns on the District because once the smoke has dispersed, the emissions are diluted and removed from local airsheds.

For air quality, cumulative effects include all reasonable and foreseeable activities that produce pollutants. Emissions from prescribed burning and from vehicles and machinery during management activities will contribute greenhouse gases and pollutants to the atmosphere, but the volume of these emissions will be inconsequential and are not expected to have a cumulative impact on current air quality.

4. Forest Improvements (Road Access)

Significant Issues Related to the Resource

Issue # 5

5 – The effects of proposed management activities on water quality

Direct, Indirect and Cumulative Effects

Alternative 1- No Action

Primary arterial roads would be maintained at their current level.

All of the roads which are currently open would remain so, and would continue to be maintained on a regular basis with implementation of the "No Action" Alternative. These roads are currently classed as Maintenance Level 2 or 3 and are maintained for the public to reach private residences or allow for administrative access. However, forest interior roads in need of maintenance or rehabilitation would continue to erode and contribute to sedimentation of creeks and streams.

Alternative 2- The Proposed Action

Approximately 0.4 miles of new road would be constructed with implementation of this alternative to access the Poole Tract acquisition from the south side of the Mulberry River. In the future, access to this tract from the north will probably be eliminated by removal of a slab crossing the Mulberry River. To access this tract from the south, approximately 0.4 miles of new road will be constructed to and 0.4 miles of road will be decommissioned. The existing section to be decommissioned is within close proximity to a stream channel. The road will be relocated to higher ground outside of the stream zone to facilitate better access and to reduce impacts to water quality.

Proposed woodland restoration thinning activities and wildlife opening maintenance will require maintenance of open and closed roads, limited to clearing travelways for work crews with a dozer, farm tractor or with hand tools. The effects of road maintenance on soil erosion and water quality are considered in the Soil and Water sections and other effects in the Wildlife and Social Sections of this EA. Some unmaintained and/or user created roads (unauthorized) would be blocked as a result of implementing woodland restoration thinning. Blocking these roads would in most cases allow for natural revegetation to occur and thereby reduced erosion and sediment entrainment into streams.

Routine maintenance on open and closed roads will be performed in this project to get the roads in a suitable condition for work crews when required. County roads that will be used are regularly maintained by their respective counties. Several Maintenance Level 1 and 2 roads that were previously closed and access wildlife openings will be re-closed with gates to reduce erosion and protect resources. The Forest Service Manual states that Level 1 roads are to be closed to motorized traffic when management activities are complete.

Re-closure and decommissioning of unauthorized roads would reduce erosion and improve water quality in the analysis area.

5. Heritage Resources

Current Conditions

The National Historic Preservation Act of 1966, as amended (NHPA), requires federal agencies to take into account the effects of federal undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. Additionally, federal agencies are required to follow the implementing regulations of the ACHP set forth in 36 CFR Part 800. Specifically, 36 CFR Part 800 requires that State Historic Preservation Offices and federally-recognized Tribes be consulted about any undertaking that has the potential to affect historic properties and/or properties of religious or cultural significance at the earliest possible stage in the planning process. Protocols for cultural resource reviews, surveys, and reporting are specified by a Programmatic Agreement (PA) between the U.S. Forest Service, relevant federally-recognized Tribes, and State Historic Preservation Offices (SHPO) of Arkansas and Oklahoma, signed in 2006 and extended in 2011, 2012, and 2013.

In compliance with NHPA Sections 106 and 110, a cultural resource review/inventory was conducted during the planning process for this proposed project to identify and assess effects of proposed activities on historic properties. With the exception of the acquired property, areas proposed for wildlife habitat improvement activities have been previously inventoried for cultural resources, as follows:

Project No.	Project Name
97-10-04-13	Barron Creek EA
98-10-04-03	Rosetta Timber Sale
00-10-04-18	Bee Ridge EA
02-10-04-01	Batson EA
03-10-04-01	Little Piney Watershed Assessment
03-10-04-02	West Morgan Project
04-10-04-01	Sarah Hollow Project
06-10-04-02	Clear Creek Project
06-10-04-03	Native Vegetation and Habitat Restoration
08-10-04-16	Indian Creek Rx Burn
09-10-04-01	Lynn Hollow Project
09-10-04-11	Wildlife Habitat Improvement
10-10-04-01	Upper Mulberry Watershed Assessment
13-10-04-01	Low Gap/Chinquapin Project

Field investigations were conducted in 2012 and 2014 to evaluate previously recorded sites located within or adjacent to existing native grass restoration areas and identify new sites located on the acquired property. Two prehistoric sites located within or adjacent to existing native vegetation restoration areas were tested to assess the potential for containing intact subsurface deposits. Testing indicated that cultural deposits were consistently recovered below the historic plow zone at depths of 60-100cm. On the acquired property, seven new sites were located and assessed, and information was collected necessary to complete documentation of still-standing historic structures required by the Arkansas SHPO. The results of these investigations are currently being compiled and will be reported to the Arkansas SHPO and our Tribal partners as report 15-10-04-02.

Cultural resource inventories have identified a total of 428 archeological sites located within the analysis area. These include 326 historic sites, 76 prehistoric sites, and 26 sites with both prehistoric and historic components. Of these, 45 sites are recommended eligible for listing, and 109 sites are recommended ineligible. Eligibility recommendations for the remaining 274 sites are undetermined, and these require additional field and/or archival research before recommendations can be made. Site distribution by management area is shown below. Sites listed on the National Register of Historic Places, recommended eligible for nomination, and with undetermined eligibility will be protected from effects of activities proposed by this project. Mitigation measures are discussed in detail in Appendix D.

Table 18. Archeological Sites within the Analysis Area

Management Areas containing Rx burns	Historic	Prehistoric	MultiComponent	Total	Eligible	Not Eligible	Undetermined
Barron	4	1		5	1	1	3
Batson	18	9	3	30	2	16	12
Catalpa	23	3		26		8	18
Low Gap/ Chinquapin	14	5	4	23	5	5	13
Clear Creek	37	9	4	50	5	16	29
Indian Creek	26	6	3	35	5	8	22
Little Piney Watershed	148	21	6	175	18	31	126
Lynn Hollow	11	3	1	15	3	1	11
West Morgan	17	11	2	30	3	6	21
Sarah Hollow	28	8	3	39	3	17	19
TOTAL (*)	**326**	**76**	**26**	**428**	**45**	**109**	**274**

***Represents total site type in management area boundaries**

Site Locations Not Yet Known. Some activities may require additional planning prior to implementation. These may include, but are not limited to:

(1) Burn boundary and fireline construction locations
(2) Temporary roads, skid trails, and log landings outside areas already surveyed
(3) Road reconstruction, maintenance, conversion, or decommissioning activities involving ground disturbance occurring outside areas already surveyed

Should additional cultural resource surveys and/or site testing be required, work will be done and consultation completed prior to implementation.

There may be American Indian sacred sites or landscapes currently unknown to the Forest. The Forest will continue to consult with our Tribal partners to ensure that American Indian sacred sites and landscapes are identified, assessed, and considered in project planning and implementation.

The scope of the analysis for potential effects to cultural resources includes the entire project area and considers the proposed activities within treatment areas, as well as access to these areas.

An effect to a cultural resource is the "…alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." (36 CFR 800.16(i)) Any project implementation activity that has potential to disturb the ground has potential to directly affect archeological sites, as does the use of fire as a management tool. Specific activities outlined in the project that have potential to directly affect cultural resources include:

- Woodland restoration – Wildlife stand improvement thinning where trees would be commercially harvested. As planned, the project proposes thinning of trees using handtools and herbicide and leaving trees in place or utilizing them as firewood. Should a commercial market become available, these areas may be commercially harvested. Activities associated with commercial removal (i.e. mechanical harvesting, associated log landings, skid trails, and temporary roads) have potential to directly effect.
- Removal of structures on acquired lands that present a public safety hazard and liability

Proposed activities that do not have potential to affect cultural resources are not considered undertakings for purposes of the NHPA. Additionally, the 2006 Programmatic Agreement specifies categories of project activities exempt from further review or consultation with the Arkansas SHPO and our Tribal partners. Specific activities outlined in the project that have no or low potential to directly affect cultural resources include:

- Maintenance of existing wildlife opening (mowing, disking, seeding, use of herbicide)
- Installation of gates on existing wildlife opening access roads within the existing road template and where no cultural resources are present
- Woodland Restoration - Wildlife stand improvement thinning where trees will be cut/treated and left in place or utilized as fire wood (use of handtools, herbicide)
- Maintenance of existing Woodland restoration areas – Wildlife stand improvement (use of herbicide)
- Treatment of non-native invasive species (use of herbicide)
- Maintenance of restored native grass fields (prescribed burning, use of herbicide, and haying)
- Restoration of native grass in acquired fields (prescribed burning, use of herbicide, planting using no-till drill or through disking, seeding, rolling)
- Manage existing wildlife ponds and Horsehead Lake (adding fish structures, fertilization of water, use of herbicide)

- Prescribed burning on areas previously burned, where no new firelines would be constructed, and where no cultural resources would be effected
- Silvicultural practices on acquired lands in areas previously harvested by the landowner and in areas where no cultural resources will be effected – may include pine/hardwood release, planting, thinning, stand improvement, and site preparation (use of handtools, herbicide, mechanical)

In general, proposed project activities that improve wildlife habitat have the potential to indirectly affect cultural resources by encouraging increased visitor use to areas of the Forest in which cultural resources are located. Increased visitor use of an area in which archeological sites are located can render the sites vulnerable to both intentional and unintentional damage. Intentional damage can occur through unauthorized digging in archeological sites and unauthorized collecting of artifacts from sites. Unintentional damage can result from such activities as driving motorized vehicles across archeological sites, as well as from other activities, principally related to dispersed recreation, that lead to ground disturbance. Effects may also include increased or decreased vegetation on protected sites due to increased light with canopy layer reduction outside of the protected buffer. However, increased visitor use of areas may aid in protection and monitoring of archeological sites by increasing the potential for discovery and reporting of illegal activities to Forest authorities.

Direct, Indirect and Cumulative Effects

Alternative 1 – No Action

In general, archeological surface and subsurface site integrity is subject to adverse effects that may result from the buildup of hazardous fuels and lack of forest management. These increase the potential for wildfire occurrence, intensity, and tree mortality. Fires occurring in areas with dense concentrations of combustible material have the potential to burn with greater than normal intensity and duration, potentially altering the physical integrity and/or research value of the archeological record. Resulting soil exposure can lead to increased erosion, potentially disturbing or resulting in a loss of archeological soil matrices and/or site components. With selection of the No Action Alternative, historic properties would continue to degrade.

Cumulatively, although the No Action Alternative would eliminate risk of inadvertent effects to cultural resources from planned activities, it would result in a marked increase in potential damage from unmanaged and unmonitored resources. Intrusive vegetation would not be controlled. Fuel load would accumulate, and the risk of uncontrolled fires, potentially damaging to cultural resources, would increase. The lack of federal presence in the area could be expected to increase the potential for damage to cultural resources from looting, vandalism, and other illegal or unmanaged use of the Forest.

Alternative 2 – The Proposed Action

Proposed access changes, soil restoration work, and opening of forested areas resulting from vegetation management can impact cultural resources. Improved access and visibility to the forest landscape increases the potential for damage from natural and human action (i.e. erosion, impacts of illegal or inappropriate OHV usage, and looting).

Project components with potential to directly affect archeological sites primarily include timber harvest, prescribed fire, road management, and some wildlife management activities. However, if the prescribed mitigation measures discussed in Appendix D are properly implemented, project activities would not be expected to adversely affect cultural resources.

Cumulatively, the greatest risks for archeological sites on the Forest come from unmanaged and unmonitored resources. Planned management and restoration activities benefit the cultural landscape by controlling intrusive vegetation, excessive accumulation of fuel load and risk of wildfire, and managing recreational use (i.e. dispersed campsites, OHV usage of roads and trails). The federal presence that results from the implementation of project activities would be expected to benefit cultural resources over time by increasing opportunities for the monitoring of sites for looting and vandalism, thus assisting with enforcement of federal protection laws.

6. Vegetation Resources and Vegetation Diversity

The definition of diversity established in the RLRMP is "the distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan."(RLRMP, p.A-10). The general environmental effects of vegetation management are discussed in the FEIS for the Ozark-St. Francis National Forest (RLRMP Chapter 1, pp. 1-19 to 1-33 and Appendix F).

Significant Issues Related to the Resource

Issues # 1 & 3

1 – Forest health problems in the area and sustainable ecosystems.
3 - The effects of vegetation management on wildlife/plants

Current and Historic Condition
The project area was historically subject to a more frequent regime of vegetation disturbance from anthropogenic fire. Here, mean fire return interval for the period of 1680-1820 ranged from 4.6 to 16 years, for the period of 1821-1880 ranged from 2 to 3.1 years and for the period of 1881-1920 ranged from 1.4 to 5 years. From 1921-2000 mean fire return interval for these study sites ranged from 62-80 years (Guyette and Spetich, 2003). Anthropogenic fire is documented to have played a major role in shaping ecosystem structure in the Ozark Highlands. Documented presence of native peoples in the area prior to the earliest fire scars recorded in this study point to a fire regime with return intervals similar to those documented for the period of 1680-1820. Frequent fire in forest/woodland ecosystems would invariably have produced open, less dense stands with a higher proportion of vegetation adapted to fire. Displacement of anthropogenic fire, creation of barriers to fire such as roads and a long standing policy of fire suppression has led to current forest health problems associated with abnormally dense forest conditions and unsustainable ecosystems.

Historically, the lands that are now the Ozark–St. Francis National Forests consisted of fire-dependent woodland and forest ecosystems with well-developed herbaceous understories. Currently, the ecosystem in the project area is considered unhealthy because the area lacks these forest conditions. This absence is due to 70 years of fire suppression and lack of sufficient vegetation management. Existing ecological conditions in the project area include

a dense, overstocked forest; a shift from the historic plant community composition toward fire intolerant plant species; lack of herbaceous species diversity and insect epidemics.

Of course, past events have determined the vegetative condition existing today. Most of the area, prior to National Forest acquisition, was extensively harvested for lumber and pulpwood during the early 1900's. Much of the hardwood forestlands were heavily logged for railroad ties and barrels in the early 1900's. Small acreage farms were settled along flood plains and flat ridges in the late 1800's and early 1900's, many of which were abandoned and later acquired or purchased by the Forest Service. Much of these acquired lands were then planted with shortleaf pine. Chestnut blight removed Ozark chinquapin, a common midstory/overstory species, during the 1920's and 30's. This area has also been subjected to recurrent wildfires in the past as evidenced from the charred stumps and basal fire scars of trees found throughout the project area. Settlers periodically burned the areas to control insect pests and improve grazing. Prior to this, the vegetative changes occurred because of natural effects (herbivore grazing, wind, disease, and wildfire) and Native American fires. Early travelers in the Ozarks reported that Native Americans burned the woods on a regular basis. Reviewing the historical fire records from 1930 to 1958 from the Pleasant Hill Ranger District (located in District Files) indicates that lightning had been a source of ignition and averaged around four fire occurrences per year. In 1936, lightning started 20 fires during the very dry summer and early fall months (rainfall less than half normal) across the District. Over the past 50-70 years, wildfires have been excluded from the project area due to an aggressive fire suppression program. This has allowed stem density to increase significantly in areas previously maintained in more open stand conditions by recurring fire. In addition, this has allowed shade-tolerant and fire-intolerant tree species such as red maple and elm to become more common in the understory. These species are likely to become more dominant than oaks in future stand composition since oaks are shade-intolerant and fire-tolerant.

Natural and Native American fires more than likely occurred periodically, long before European settlement and, along with other factors, greatly influenced the development and structure of the pine and hardwood forests that existed when the first settlers arrived in the Ozarks. Historian Steven Pyne:

> The modification of the American continent by fire… was the result of repeated, controlled surface burns on a cycle of one to three years, broken by occasional holocausts from escaped fires and periodic conflagrations during times of drought. Even under ideal circumstances, accidents occurred: signal fires escaped and campfires spread… So extensive were the cumulative effects of these modifications that it may be said that the general consequence of the Indian occupation of the New World was to replace forested lands with grassland or savannah, or, where the forest persisted, to open it up and free it from underbrush. Most of the impenetrable woods encountered by explorers were in bogs or swamps from which fire was excluded; naturally drained landscape was nearly everywhere burned. Conversely, almost wherever the European went, forests followed. The Great American Forest may be more a product of settlement than a victim of it.

Heavy cutting from the late 1800's to the 1930's combined with land clearing and periodic burning by settlers and the occasional lightning and Native American fires described above, and cattle and hog use, probably contributed to the ecological conditions that favored the development of the forests that now exist in the project area.

Forest disease has become of paramount importance on the Ozark National Forest within the past few years. A red oak borer epidemic which became evident in 1999 initially affected 19,000 acres. By 2001 the affected area had increased to 300,000 acres. Preliminary field

investigations indicated that the red oak component was reduced by as much as 85 percent within the affected areas. The Pleasant Hill Ranger District was the most affected area of the entire forest. It is where the epidemic was first discovered. Reduction of red oak in the ecosystem and replacement by shade tolerant species is easily noted today.

The areas proposed for woodland restoration thinning all lie on ridgetops, as well as south and west slopes. Under the historic frequent fire regime documented for the project area these areas would have been characterized by open woodland. Trees would have been spaced so that canopy shading would have been low. Understory grass/herbaceous plant abundance and diversity would have been much higher than what is found in these stands at present.

Historically prior to European settlement, NNIS would have been absent. NNIS displacement of native vegetation has only occurred since European settlement of the Ozark Highlands.

Direct, Indirect and Cumulative Effects

Alternative 1 – No Action

Existing trends in vegetation composition and health would continue. The health of stands needing treatment would continue to decline. Species succession would occur through natural processes and would favor the more shade-tolerant tree species present in the understory. Some of the old fields that have been planted with pine and the naturally-occurring pine areas would eventually be replaced in the distant future by the young hardwood that exists in the understory/midstory of these stands. Climax hardwood or hardwood/pine vegetation would eventually dominate the area if all fire or other site-disturbing activities were excluded. As trees age, the large mature/over-mature trees would be more susceptible to damaging agents such as insects, disease, and windthrow. Ground vegetation would decrease, with those species more tolerant of shade predominating. Catastrophic events like a major windstorm or intense fire may occur that would kill the overstory canopy, allowing development of early and mid-level successional habitats (i.e. openings, young growth).

Most of the vegetation and wildlife outputs identified in the Ozark-St. Francis National Forests RLRMP would not be gained in the project area under this alternative.

With no vegetation management, the analysis area would be expected to move further into closed canopy conditions with less vegetative diversity. Overall, age-classes would continue to skew toward older forest characteristics and would not supply a variety of vegetation needed to sustain diverse wildlife species.

Hardwood sites would experience episodic insect and disease outbreaks related to tree stress. Openings created by such events, wind damage, and wildfire would allow for younger age-classes of trees; however, most of these younger age-classes would be dominated by shade tolerant species such as maple, gum and elm. Also, these “natural events” openings, for the most part, do not impart maximum benefits on the temporal-spatial landscape as those designed through management. Understory species diversity would decrease further or remain stable at low current levels.

Sites dominated by pine would be expected to mature and be susceptible to episodic disease/insect-caused mortality. Openings created by these events and wind damage would allow for younger age classes of trees. However, with the lack of intentional fire and soil disturbance, which allows for suitable seed beds for pine seed, pine seedlings in such openings would be lacking and these openings would tend to become dominated by hardwood (often shade-tolerant species). Understory species diversity would decrease further or remain stable at low current levels. Thermal wildlife cover would gradually decrease. Corresponding loss of wildlife diversity would be expected for both pine and hardwood sites.

Alternative 2 – The Proposed Action

The effects of thinning 431 acres for woodland restoration and 2,667 of woodland maintenance will improve the vigor and growth of remnant trees in the stand and favor more vegetative diversity on the forest floor by permitting more sunlight penetration. Understory vegetation abundance and diversity will improve in these areas as well as more mast (nut & fruit production) from the residual trees. Select mast-producing trees would be retained in the stands to further promote ecosystem diversity. Herbicide and prescribed fire use to reduce hardwood sprouting will further improve woodland restoration areas. Prescribed fire will maintain these areas in open condition with greater abundance and diversity of understory vegetation in the long term. Woodland restoration practices (thinning, herbicide use, and maintenance prescribed burning) will return sites to their more natural setting of an oak-hickory overstory. Shade tolerant tree species will be reduced in the understory and oak regeneration in the understory will benefit.

The use of prescribed fire and herbicide will serve to arrest the spread of NNIS plants that supplant native vegetation. Reduction of NNIS occurrences will allow for greater native plant diversity and abundance.

The effects of maintaining and constructing wildlife openings will be the continuation of providing early seral habitat composed of a variety of grasses and forbs that will be suitable for forage by several species of wildlife.

The effects of prescribed burning will be the replacement of brushy and woody vegetation in the understory to a more grass and forb composition, benefiting quail, deer, and neotropical migratory birds. Oak and pine regeneration will be encouraged, fuel accumulations will be reduced, and historical fire-adapted/dependent vegetation species will be restored.

Based on the above analysis and the mitigation measures to be applied, there should be no long-term or cumulative negative effects on vegetative diversity from implementation of this alternative.

7. Wildlife Resources

Significant Issues Related to the Resource
Issues # 1 & 2

1 – Forest health problems in the area and sustainable ecosystems
2 - The effects of proposed management activities on TES species

Current Conditions
Wildlife, fish and plant species and their habitats in the project area are managed in cooperation with the Arkansas Game and Fish Commission (AGFC), and the Arkansas Natural Heritage Commission (ARNHC). The state wildlife management agencies main responsibilities are to set policy for hunting and fishing regulations and law enforcement programs. The Natural Heritage Commission is responsible for collecting and maintaining information on rare plants, animals and natural communities in Arkansas. The Forest Service is responsible for managing fish and wildlife habitat conditions. The following discussion focuses on the habitat conditions that support wildlife populations and fisheries.

The aquatic fauna in the project area is very diverse. The richness and diversity of this area is the result of several factors including long geological history of favorable climates and habitats, a lack of glaciation during the Pleistocene era, and a wide variety of aquatic habitats in the Boston Mountain eco-region. The streams within the eco-region are typically clear, extremely high gradient, and riffle and pool habitat dominated systems with gravel, cobble, boulder, and bedrock dominated substrates of sandstone, shale, and limestone. The Boston Mountain eco-region does not have as many karst features as some of the other eco-regions in this part of Arkansas, but there are still many caves, springs, and seeps within the system. Streams within the Boston Mountain eco-region are classified as nutrient poor systems with much of the energy derived from an allochthonous food chain.

The diversity of wildlife species within this project area is typical of the Boston Mountains of the Ozark Plateau (USDA, 1990).

The Forest has large amounts of late seral hardwood and pine habitat and high mast production capability, and both attributes are increasing. Conversely, on a Forest-wide basis acres of early seral habitat or acres of woodland having early seral habitat values are declining (Taylor, 2013).

Wildlife habitat has been altered by the oak decline phenomenon, particularly the red oak borer infestation. Habitat changes in the long term could include reduction in hard mast production, an increase in the amount of soft mast production as non-oaks make up more of the overstory, and a short-term higher density of snags and down trees.

The Pleasant Hill Ranger District reflects conditions that are seen Forest wide in relation to age classes of forest stands. The project analysis area contains a high proportion of late seral wildlife habitat, and lacks open woodland capable of supporting diverse understory grass and herbaceous vegetation (Taylor, 2013).

MANAGEMENT INDICATOR SPECIES (MIS)

Under the National Forest Management Act (NFMA) regulations, adopted in 1982, selection of management indicator species (MIS) during development of forest plans is required (36 CFR 219.19 [a]). Management Indicator Species (MIS) are selected "because their population changes are believed to indicate the effects of management activities" (36 CFR 219.19 [a][1]). They are used during planning to help compare effects of alternatives (36

CFR 219.19 [a][2]) and as a focus for monitoring. Where appropriate, MIS represent the following groups of groups of species (36 CFR 219.19 [a][1]):

- Threatened and endangers species on State and Federal Lists;
- Species with special habitat needs;
- Species commonly hunted, fished , or trapped (demand species);
- Non-game species of special interest; and
- Species selected to indicate effects on other species of selected major biological communities (ecological indicators).

MIS is a planning and monitoring tool that reflects a way to analyze a change in conditions. Therefore, MIS generally fall into three broad categories:

- Demand species are those species that provide important recreational and/or economic values.
- Species of concern are those species for which there is a concern about their population numbers.
- Ecological indicators are species that are tied to a particular element(s) of biological diversity and serve as surrogates for other species associated with that element(s).

Table 19. MIS Species, Habitat Requirements and Population Trends (summary)

Species	MIS Type	Habitat Requirements	Population Trend
Northern bobwhite	ecological indicator	pine and oak woodland and native grasslands (early successional habitat)	decreasing
Whitetail deer	demand	mosaic of forest age classes	stable to increasing*
Black bear	demand	remote habitat with mature forest component with intermixed 0-5 year old regeneration	stable to increasing*
Wild turkey	demand	mature forest with open areas containing grasses/forbs/soft mast	stable to decreasing* (increased poults 2012)
Prairie warbler	ecological indicator	regenerating forest communities, old fields, oak woodland (early successional habitat)	decreasing
Brown-headed nuthatch	ecological indicator	pine woodland habitat	R8Bird Ozark NF (increasing) BBS (decreasing)
Cerulean warbler	ecological indicator	mature and over-mature forest habitat	R8Bird Ozark NF (stable-increasing) BBS (decreasing)
Northern parula	ecological indicator	riparian forest habitat	R8Bird Ozark NF (increasing) BBS (decreasing)
Ovenbird	ecological indicator	dry oak & dry-mesic oak forest habitat	decreasing
Red-headed woodpecker	ecological indicator	dry oak & dry-mesic oak forest habitat	R8Bird Ozark NF (increasing) BBS (decreasing)
Pileated woodpecker	ecological indicator	large snags & older forest habitat	decreasing

Table 19. MIS Species, Habitat Requirements and Population Trends (summary) (Cont'd)

Species	MIS Type	Habitat Requirements	Population Trend
Scarlet tanager	ecological indicator	dry oak & dry-mesic oak forest habitat	R8Bird Ozark NF (increasing) BBS (decreasing)
Acadian flycatcher	ecological indicator	mid-aged to mature hardwood forest habitat	increasing
Smallmouth bass	demand	cool water stream communities	stable
Largemouth bass	demand	quality pond and lake habitat	stable

***Information from AGFC harvest and monitoring data**

Sixteen species were selected as MIS for the Ozark National Forest. These 16 species resulted from the Planning Team's review of the list of vertebrate species dependent upon forest habitats.

A MIS Report on population data including population trends was completed on July 6, 2001 (amended August 15, 2001) for the Ozark St Francis National Forests. This document is a part of the analysis file and was used for analysis of effects to MIS species associated with implementation of project alternatives. The 2001 MIS Report contains some but not all of the current MIS as selected for the RLRMP. Data from this report (USDA, 2001) was compared to AGFC harvest and survey information for game species, breeding bird survey data, and population trend data from the NatureServe database for MIS species (AGFC 2001, 2006, 2007, 2009, 2011, 2012, USDA 2001, USDA 2007 and NatureServe 2013).

Table 19 shows Ozark National Forest MIS species pertinent to the Pleasant Hill Ranger District, the habitat type they represent and population trends (AGFC 2001, 2006, 2007, 2009, 2011, 2012, USDA 2001, USDA 2007 and NatureServe 2013). From the Forest MIS list, 15 species have potential habitat on the Pleasant Hill Ranger District. Many of these species have documented occurrences on the District, others which have not been documented, have potential habitat existing on the District. All 15 MIS species shown in Table 19 will be addressed further in this document.

In 1996, the Southern Region of the USDA Forest Service adopted "The Southern National Forest's Migrant and Resident Landbird Conservation Strategy" (Gaines and Morris 1996) to improve monitoring, research, and management programs affecting forest birds and their habitats. A region-wide program of monitoring avian populations based on point-counts was initiated as part of this strategy. The results of this monitoring effort are reported in General Technical Report – NRS-9, and summarized in (Taylor, 2013 – Table 6) for MIS avian species on the Ozark National Forest (USDA, 2007). Data collected from 1992 to 2004 is utilized. Sampling strategy and point-count methodology is described in detail in Gaines and Morris (1996).

The project area is a mature forest matrix generally composed of an oak-hickory sub-matrix and a shortleaf pine sub-matrix. Grassland areas in the analysis area comprise less than 1 percent of the project area and are often characterized by non-native noxious weeds and introduced grasses providing poor wildlife habitat. Grass/forb habitat on federal lands is found only in glades, wildlife openings, former pastures restored to native warm season grasses, utility rights-of-way, and roadsides.

Hard mast capability is well distributed across the landscape. The majority of the project area's hardwood forest types are currently of mast-producing age. These age classes are

those which are 61+ years of age. These stands are found within stream corridors and on all aspects with the best representation found on the north and east slopes. Mast-producing trees are also represented within the shortleaf pine sub-matrix, but to a lesser degree.

The mast needs of many forest animals are met when at least 20 percent of 640 acres (one square mile) is occupied by well-distributed mast-producing hardwood trees (Wildlife Habitat Management Handbook, 204.1).

The majority of pine forest types in the project area are currently in age classes >61 years of age.

The project area reflects conditions that are seen Forest wide in relation to age classes of forest stands. The project area contains a high proportion of late-seral wildlife habitat, and lacks open woodland capable of supporting diverse understory grass and herbaceous vegetation.

With implementation of Alternative 2, approximately 431 acres would be restored to woodland condition and 2,667 acres existing woodland would be maintained, through thinning, herbicide use and prescribed fire in combination. Browse and early-successional forest habitat would be provided in these restored woodlands for a variety of wildlife species. Viability of disturbance-dependent avian species would be enhanced. Avian species requiring both large and small areas of early successional vegetation and forest edge would benefit.

Direct, Indirect and Cumulative Effects

Alternative 1 – No Action

Currently approved management actions would be maintained under this alternative.

Effects to wildlife and MIS from implementation of the No Action Alternative are analyzed in detail in a reference paper compiled by the Pleasant Hill Ranger District (Taylor, 2013). This paper is part of the project analysis file.

Wildlife Habitat Improvement.
Effects of implementation of the No Action Alternative are described in Taylor (2013), in relation to the subsections Early Successional Habitat, Soft Mast Production, and Hard Mast Production. Indirect beneficial effects to wildlife species dependent upon older seral stages, and habitat requirements associated closed canopy conditions would occur. Thinning to help restore woodland conditions and maintenance of wildlife openings to improve herbaceous diversity would not occur, thereby causing negative indirect effects to disturbance dependent and early successional obligate wildlife species. Lack of use of thinning would not allow for improved production of soft mast. Increases in abundance of soft mast, utilized by a variety of wildlife species as a reliable seasonal food source would not occur. Oak species would be expected to become a minor component of the forest ecosystem in the long term without significant forest stand disturbance or treatments that favor oak regeneration. This alternative would cause negative indirect impacts to wildlife species. Forest Plan (USDA, 2005) recommendations of diverse, high quality habitats supporting well-distributed and viable populations of all native and desired non-native plants and animals would not be met. Natural disturbance regimes within terrestrial habitats providing a stable and sustained flow

of both early- and late-successional habitats over time would not meet desired conditions for fish and wildlife habitat.

Prescribed Fire

Prescribed fire would not be implemented in the project analysis area with adoption of this alternative. Benefits to wildlife from: sustaining oak in the ecosystem for hard mast production; restoring woodlands for increased herbaceous diversity and density; maintaining pine as a significant component in the ecosystem; maintaining other fire-dependent or adapted species and habitats; and abatement of non-native invasive plant species would not occur. Lack of use of prescribed fire would not allow for improved production of soft mast. Increases in abundance of soft mast utilized by a variety of wildlife species as a reliable seasonal food source would not occur. This would cause negative indirect impacts to wildlife species. Forest Plan (USDA, 2005) recommendations of diverse, high quality habitats supporting well-distributed and viable populations of all native and desired non-native plants and animals would not be met. Natural disturbance regimes within terrestrial habitats providing a stable and sustained flow of both early- and late-successional habitats over time would not meet desired conditions for fish and wildlife habitat.

Herbicide Use

Herbicide use is also an important tool for benefiting oak/pine regeneration, by reducing interspecific competition and providing for these species presence in the ecosystem in the long term. Without use of this tool, benefits to creating diverse understory vegetation and oak/pine regeneration through removal of competing shade tolerant tree species would not occur. Maintenance of wildlife openings would not be as effective without this tool. Reduction of NNIS and restoration of native vegetation would not be possible without this tool. Improvement of recreational fishing opportunities in fish ponds would not be improved without use of this tool.

There would be no change short term in the amount of closed canopy forest habitat from current levels under the No Action Alternative. Species requiring interior/closed canopy forest habitat would be expected to remain stable or increase within the project analysis area. Species requiring forest openings, edges between different successional stages, and herbaceous/shrub browse would be expected to remain stable or decrease long term within the project analysis area.

Non-native invasive plants would continue to spread. Although no direct effects of no action are anticipated, indirect effects of the spread of non-native invasive plants would be negative, resulting in the continual degredation (decrease of biodiversity and alteration of natural ecosystem processes) of habitats for MIS. Across the landscape, the occupation of native ecosystems with non-native invasive plants is becoming an increasing threat to native biodiversity. Therefore, the indirect effects of no action on MIS and associated habitat would be negative. Cumulative effects in the project area could be negative since future projects could include timber harvesting which may facilitate spread of existing NNIS through scarification of the soil.

Gates blocking vehicle access to areas managed for wildlife habitat would not be constructed. This would allow continued disturbance of wildlife species and possible poaching from night-time spotlighting on wildlife openings.

Habitat components would continue to be less than specified in the Forest Plan within the project analysis area. Objectives as described in the Forest Plan (USDA, 2005) for bobwhite quail, whitetail deer, eastern wild turkey, black bear and largemouth/smallmouth bass (OBJ.10, OBJ.11, OBJ. 12, OBJ. 13, OBJ. 15 and OBJ. 16 respectively) would not be met in the project analysis area with implementation of the No Action Alternative. The objective for non-native invasive species treatment (OBJ. 9) would not be met in the project analysis area. The objective for oak and pine woodland restoration (OBJ. 4 and OBJ. 5) would not be met in the project analysis area. The objective for prescribed burning on the National Forest (OBJ. 7) would be hindered.

Alternative 2 – The Proposed Action

Effects to wildlife and MIS from implementation of the Proposed Action are analyzed in detail in a reference paper compiled by the Pleasant Hill Ranger District (Taylor, 2013). This paper is part of the project analysis file.

Wildlife Habitat Improvement.
Effects of implementation of the action alternative are described in Taylor (2013), in relation to the subsections Canopy Reduction, Soft Mast Production, and Hard Mast Production. Indirect negative effects to wildlife species dependent upon older seral stages and habitat requirements associated with closed canopy conditions would occur. Thinning to help restore woodland conditions and creation/maintenance of wildlife openings to improve herbaceous diversity would cause positive indirect impacts to wildlife. Long term early-successional habitat in forest stands restored to open woodland condition would occur, thereby causing positive indirect effects to disturbance-dependent and early successional obligate wildlife species. Use of thinning to create open woodland conditions would improve production of soft mast. Increases in abundance of soft mast utilized by a variety of wildlife species as a reliable seasonal food source would occur. Thinning and prescribed fire would improve chances of successful stand regeneration in the future and help maintain oak in the ecosystem as a source of hard mast for wildlife species. Oak species would be expected to be maintained as a component of the forest ecosystem in the long term. This alternative would cause positive indirect impacts to wildlife species. Diverse and high quality habitats supporting well-distributed and viable populations of all native and desired non-native plants and animals would meet desired conditions for fish and wildlife as specified in the Forest Plan (USDA, 2005). Disturbance regimes within terrestrial habitats providing a stable and sustained flow of both early and late-successional habitats over time would meet desired conditions for fish and wildlife habitat as specified in the Forest Plan (USDA, 2005).

Prescribed Fire
Data compiled from modern vegetation studies compared to General Land Office (GLO) spatial data indicate that the Ozark Highlands forest of Arkansas is 2.3-2.8 times denser today than 180 years ago. Studies suggest that periodic low-intensity fires, increased vegetation yield (understory) from 20-100 percent and increased large birds and mammals by 100-400 percent (Jurney, 2011).

Indirect effects to avian species occur from prescribed burning. It has been shown that implementation of prescribed fire may cause temporary reduced habitat suitability for ground-nesting birds. Short-term declines in abundance of three ground nesting species (black-and white warblers, worm-eating warblers and hooded warblers) for one breeding season were noted by researchers (Greenberg et al., 2013). Decreased abundance of ground-

or shrub nesting birds after burns is likely due to temporary reductions in shrubs and leaf litter. Many birds forage within burned sites despite a shortage of suitable nesting substrate. Open understory conditions created by low- or high-intensity prescribed fires may create optimal foraging conditions for flycatcher species such as eastern wood-pewees by improving visibility and/or abundance of flying insects. (Greenberg et al., 2013).

Implementation of prescribed fire may cause some direct mortality to small mammals and herpetofauna in short-term. However, Kirkland et al. (1997) found that fire effects upon small mammals in oak-dominated forests are transitory. Quantitative differences between burned and unburned habitats were found to disappear within eight months following the burn. Rapid recovery of populations of small mammals in burned forest may be due to the rapid regrowth of ground cover from surviving rootstocks. Research found there were few discernible differences in small mammal and herpetofauna populations between burned and control areas, supporting the contention that prescribed fire in the project area had little overall impact on the terrestrial vertebrate fauna. In addition, immediate impacts of the burn on small mammals are slight as many species exhibit varying degrees of fossorial habits (Ford et al., 1999).

Perry (2011) concludes fire may affect bats directly through heat and smoke during the burning process or indirectly through modifications in habitat. Studies suggest fire generally has beneficial effects on bat habitat by creating snags, reducing understory and midstory clutter, creating more open forests, and possibly increasing abundance of flying insects. Direct effects of fire on bats during the burning process are still largely unknown. Potential direct effects from fire likely differ for each species or roosting guild of bats, and may also vary by season and reproductive condition.

A study in eastern Kentucky on National Forest lands documented responses of Northern long-eared bats to prescribed fires. Home ranges of this species were found to be closer to burned habitats following fires than to unburned habitats. Abundance of coleopterans, dipterans, and all insects combined captured in traps increased following prescribed fires. Northern long-eared bats increased their consumption of dipterans following burning. More roosts of this species were observed in burned habitats (74.3%) after fires than in unburned habitats (25.7%). The results of this study suggest that Northern long-eared bats are tolerant of prescribed fire on the landscape pattern and scale observed in this study. This species responded to habitat alterations resulting from prescribed fires through shifts in the location of foraging areas as bats tracked changes in insect availability, and through shifts in the selection of roost trees and snags possessing more potential roosting microsites (Lacki et al. 2009).

In a study within the upper piedmont of South Carolina, Kilpatrick et al. (2004) found that prescribed burning and thinning for fuel reduction had minimal effects on herpetofauna in upland pine plantations. They report that opening the forest canopy by thinning created favorable conditions for two lizard species. Also, adjacent breeding habitat appears to have influenced the abundance and richness of amphibians in a treatment area more than did prescribed fire and thinning.

A study on effects of vegetation management on snakes, conducted in Madison County Arkansas found that rattlesnake prey abundance increased in cut-only and cut-burn treatment sites, relative to control and burn-only sites. After application of thinning and fire, snakes that used manipulated sites exhibited statistically significant increases in growth rates.

Growth rates and body conditions of timber rattlesnakes were improved for snakes that used areas where vegetation management occurred. Researchers suggested that not only does habitat manipulation enhance habitat quality for timber rattlesnakes, but also that both body conditions and growth rates of these snakes may be viable indicators of the effectiveness of large-scale habitat manipulations. Severity and timing of fire application was found to have a profound effect on outcomes for ground-dwelling reptiles. Application of fire immediately after emergence had local but devastating effect on ground-dwelling, leaf-litter hiding timber rattlesnakes (Beaupre and Douglas, 2011).

In another study conducted on the Ouachita National Forest, it was found woodland restoration with periodic burning affected species differently; some species benefitted, some species appeared negatively affected, but most species did not respond clearly either way. Overall reptile captures were significantly greater in pine-woodlands than in unrestored forest; one species of snake and three species of lizards were captured more often in woodlands than unrestored forests (Perry et al. 2009). Woodland restoration accomplished through thinning and prescribed fire creates more open forest habitats that are favored by many reptiles but may not be optimal for all herpetofaunal species, including some salamanders. If maintaining diversity across landscapes is the goal of management, woodland restoration practices which retain unthinned patches of forest in the form of buffers around stream drains, or unthinned stands, would likely contribute to greater herpetofaunal diversity across a landscape (Perry et al. 2009).

Prescribed fire has effects on the composition and structure of plant communities. Greenberg et al., (2013) found that even relatively low-intensity fire can affect tree mortality and have subtle effects on forest structure gradually over time, whereas higher-intensity fire has a much greater and more immediate influence on tree mortality and forest structure.

Prescribed fire has an effect on the composition and structure of plant communities and consequently on butterfly faunas. The effects on butterfly faunas are an interplay of effects on host plants, nectar resources, mortality of immature stages, microclimate and other interactions. Often, these effects are beneficial in maintaining populations of species that have declined due to habitat alteration in the absence of fire. The landscape scale restoration of a frequent fire regime within a large pine bluestem restoration area on the Ouachita National Forest has appeared to increase populations of most butterfly species, including Diana fritillary (*Speyeria diana*) – which is a species of conservation concern throughout its range (Rudolph et al. 2006).

As compared to eastern portions of the Central Hardwoods Forest Region, fire return intervals were generally shorter in the western portions of the region. Many studies conducted in the western portions documented fire return intervals of less than three years with some annual fires (Hart and Buchanan, 2011). Guyette et al. (2006) reports composite fire intervals for interior Boston Mountain study sites as 32.1 years, and intervals for perimeter Boston Mountain study sites as 10.7 years before 1810. The interior Boston Mountain fire history sites are surrounded by very rough topopgraphy which tends to limit the spread of fire. This topography is hypothesized to reduce the spread of fire into these sites thereby lengthening fire intervals. Fire frequency at the study sites was found to be positively related to the population of Native Americans moving in and out of the study region. Beginning circa 1817 the Cherokee inhabitation of Northern Arkansas corresponds to an increase in fire intervals. A mean fire return interval of 1.4 years occurred when Cherokee population density was highest. Large fires (with mixed severity) may have

contributed to the dominance of oak species in the Arkansas Ozarks. Fires are likely to suppress tree species that are significant competitors to oak and to open forest canopies, thus increasing the competitive capacity of oaks relative to fire susceptible competitors (Guyette et al., 2006). Based on General Land Office (GLO) survey records from the early 1800's Foti (2004) found that oak represented 70 percent of the survey record trees in the Boston Mountains. These communities were also more open than today. These conditions are consistent with that expected after frequent and periodically severe fires described above.

Prescribed burning has been found to change the composition of woody species seedlings. Due to reduction in the number of shade-tolerant species from prescribed burning, greater equitability among tolerant and intolerant species seedlings occurred. Mechanical removal of understory vegetation followed by prescribed fire provided both greater equitability among species and higher levels of photosynthetically active radiation reaching the forest floor (Dolan, 2004). Prescribed burning and sub-canopy removal are important tools in improving conditions for oak seedling establishment while reducing competition from shade-tolerant species. Shelterwood harvest followed by prescribed fire simulates the combined events of overstory disturbance followed by fire, related events that have shaped the composition of oak ecosystems for millennia (Van Lear, 2000).

Herbicide Use

Herbicide use is an important tool for creating and maintaining early successional wildlife habitat, non-native invasive species abatement and subsequent restoration of native vegetation species. Implementation of alternatives with herbicide use would be of benefit to birds and mammals requiring early-successional habitat and woodlands. Non-native invasive species such as fescue, sericea lespedeza and Johnsongrass would be controlled, thereby improving potential habitat for these species. Herbicide use, either foliar, hack and squirt, cut stump treatment, or soil application provides longer lasting beneficial impacts to creating and maintaining early-successional habitat and woodlands than can be expected with use of only mechanical means and prescribed fire. Herbicide use is also an important tool for benefiting oak/pine regeneration, by providing for these species presence in the ecosystem in the long term. Herbicide is an important tool for aquatic vegetation control in ponds and lakes managed for sport fishing. Use of aquatic herbicides benefits native fishes by preventing accumulation of heavy aquatic plant growth, subsequent fall/winter plant die off and potential fish kill due to lack of oxygen. Aquatic herbicide use is an important tool in controlling NNIS species and improving recreational fishing opportunities as well.

Effects of herbicide toxicity data and dosage estimates for 2,4-D, triclopyr, imazapic, imazapyr, glyphosate and hexazinone proposed for use in the action alternative indicate that there is only a very low risk to wildlife, both from realistic and extreme exposures. Monitoring for herbicide concentrations following use has been a continuous policy of the Ozark-St. Francis National Forests. Monitoring results have not documented any significant on-site concentrations of herbicides or off-site movement. In a study regarding the use of herbicides in forestry applications (Michael, 2001), the author found that maximum pesticide concentrations observed in water have been much lower than the maximum levels which the Environmental Protection Agency (EPA) considers safe for consumption on a daily basis over a lifetime (Health Advisory Level-HAL). In some studies the author reviewed maximum herbicide concentrations observed in ephemeral to first-order streams exceeded the lifetime HAL, but found that they last only a few hours and the highest concentrations did not exceed EPA's 1-day HAL. Even with the widespread use of pesticides in North America, those typically used in forestry vegetation management programs have not been

identified in surface or ground water at sufficiently high concentrations to impair drinking water quality. Their rapid break-down by physical, chemical, and biological routes coupled with current use patterns precludes the development of significant water contamination problems unless they are applied directly to water. Additionally, mitigation measures normally employed through State Best Management Practices (BMPs) further restrict herbicide's effects outside the boundaries of its application. On August 27 and 28, 2014 analysis of risk was completed for the chemicals 2,4-D, glyphosate, hexazinone, imazapic, imazapyr, triclopyr amine, and triclopyr ester at the proposed rate of application in SERA risk assessments prepared for the USDA Forest Service (SERA 2004, 2005, 2006 and 2011). Worksheets associated with the SERA risk assessments were completed for all proposed chemicals. Where required, application rates for each chemical were tailored to typical District use rates. In some instances, the standard application rate as modeled in the SERA worksheets was utilized when it was similar to typical District use rates.

In a variety of human health and environmental health scenarios (including a variety of wildlife scenarios) most HQs were projected to be below the Forest's maximum acceptable standard of 1.0. Application of mitigation measures shown previously in this document and adherence to Forest Standards for herbicide use and chemical labels for application will negate hazard quotients > 1.0 related to drift, accidental spills and run-off. Parameters and output from these analyses are available as part of the process record at the Pleasant Hill Ranger District Office, 2591 Highway 21, Clarksville, Arkansas 72830.

All herbicide treatments would follow Forest-Wide Standards FW19 through FW32 included in the Revised Land and Resource Management Plan for the Ozark-St. Francis National Forests, pages 3-4 through 3-5 (USDA Forest Service 2005). All herbicide treatments would follow Arkansas Forestry Commission Best Management Practices for Forest Chemicals 7.11 through 7.17 (AFC 2002). For all projects involving herbicide use, prior to application of approved chemicals an "Implementation Checklist for Invasive Plant Control" (see Appendix A) would be completed by the District Wildlife Biologist.

See the Environmental Assessment section 13. Herbicide Use (pg 93) for additional analysis and discussion of herbicide the effects of herbicide use.

NNIS (feral hog) Hunting/Trapping

Use of a small number of Forest Service approved hunters and/or trapping by AGFC and the Forest Service would be beneficial to native wildlife species and TES species. Negative impacts to native wildlife such as destruction of nests, predation on young, destruction of wildlife plantings and competition for resources would be reduced. Negative impacts caused by feral hogs to TES plant species (through rooting) would be reduced.

Aquatic Species/Habitat

Introduction of structures into lakes and ponds would improve fisheries and meet forest plan objectives. Fertilization and liming of ponds and lakes would improve water quality and productivity for sport fish. Herbicide use in ponds would improve recreational fishing and prevent eutrophication and fish die-offs.

In summary, the Proposed Action is predicted to have negative short term impacts on 10 of 15 management indicator species analyzed. Negative impacts would be primarily short term disturbance of individual animals and potential loss of nests. Viability of populations as a whole would not be reduced (Taylor, 2013).

The use of proposed management actions as described in this Environmental Assessment would be of long term benefit to MIS that rely upon forest ecosystems, particularly oak/pine ecosystems, for habitat. In summary, the Proposed Action is predicted to have positive long term effects on 15 of 15 management indicator species analyzed. Although some individual negative long term effects are predicted, populations of all MIS would be expected to remain viable in the Ozark Highlands and on the National Forest (Taylor, 2013).

8. Threatened, Endangered, Sensitive (TES) Species

Significant Issues Related to the Resource

Issues # 2 & 5

2 - The effects of proposed management activities on TES species
5 – The effects of proposed management activities on water quality

Current Conditions
Forest Service Manual (FSM) Section 2672.41 requires a biological evaluation (BE) and/or biological assessment (BA) for all Forest Service planned, funded, executed, or permitted programs and activities. The objectives of this BE/BA are to: 1) ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native species or contribute to trends toward federal listing, 2) comply with the requirements of the Endangered Species Act (ESA) so that federal agencies do not jeopardize or adversely modify critical habitat (as defined in ESA) of federally listed species, and 3) provide a process and standard to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision-making process.

Federally listed threatened and endangered species, species proposed for federal listing, and Southern Region sensitive species that may potentially be affected by this project were examined using the following existing available information:

1. Reviewing the list of TES plant and animal species known or likely to occur on the Ozark–St. Francis National Forests, and their habitat preferences. This review included the U.S. Fish and Wildlife Service current list of endangered, threatened, and proposed species for Arkansas dated December 3, 2013 (USDI 2013), the forest-wide list dated February 7, 2013 and the current Southern Region Sensitive Species list for the Forest, dated August 8, 2007 (list attached as Appendix A in Biological Evaluation).
2. Consulting element occurrence records (EORs) for TES species as maintained by the Arkansas Natural Heritage Program (ARNHP).
3. Consulting with individuals in the private and public sector who are knowledgeable about the area and its flora and/or fauna.
4. Reviewing sources listed in the reference portion of this report.
5. Reviewing the results of field surveys that have been conducted in the area.

Most TES species known to occur on the Forests have unique habitat requirements, such as glades, barrens, rock outcrops, bogs, caves, and natural ponds. Appendix A of the BE/BA lists all 67 TES species currently known or expected to occur on or near the Ozark–St.

Francis National Forests. All species on the list were considered during the analysis for this project.

A "step down" process was followed to eliminate species from further analysis and focus on those species that may be affected by proposed project activities. Species not eliminated are then analyzed in greater detail. Results of this "step down" analysis process are displayed in the Occurrence Analysis Results (OAR) column of the table in Appendix A. First, the range of a species was considered. Species' ranges on the Forests are based on county records contained in such documents as An Atlas and Annotated List of the Vascular Plants of Arkansas, and NatureServe Explorer, but are refined further when additional information is available, such as more recent occurrences documented in scientific literature or in Natural Heritage databases. Many times, historic range information clearly indicates a species will not occur in the analysis area due to the restricted geographic distribution of most TES species. When the analysis area is outside a known species range, that species is eliminated from further consideration by being coded as OAR code "1" in the Appendix A table. For the remaining species, after this first step, results from past surveys, knowledge of the analysis area and potential for suitable habitat were considered.

These resources and information were synthesized to produce a site-specific biological evaluation for this project (Taylor, 2014).

As a result of this process, the following species occur as documented by field surveys or may potentially occur in the activity area based on habitat observations (Table 20):

Table 20. Occurrence Analysis Results – TES Species

OAR Code	Scientific Name	Common Name	Taxa	Status
7	*Notropis ozarcanus*	Ozark Shiner	Fish	Sensitive
7	*Percina Nasuta*	Longnose darter	Fish	Sensitive
5	*Eurycea tynerensis*	Oklahoma salamander	Amphibian	Sensitive
6	*Aimophila aestivalis*	Bachman's sparrow	Bird	Sensitive
5	*Haliaeetus leucocephalus*	Bald eagle	Bird	Sensitive
5	*Corynorhinus townsendii ingens*	Ozark big-eared bat	Mammal	Endangered
5	*Myotis grisescens*	Gray bat	Mammal	Endangered
6	*Myotis leibii*	Eastern small- footed bat	Mammal	Sensitive
6	*Myotis sodalis*	Indiana bat	Mammal	Endangered
5	*Myotis septentrionalis*	Northern log-eared bat	Mammal	Proposed Endangered
6	*Cumberlandia monodonta*	Spectaclecase	Mussel	Proposed Endangered
6	*Lirceus bicuspicatus*	An isopod	Isopod	Sensitive
5	*Orconectes williamsi*	Williams' crayfish	Decapod	Sensitive
7	*Paduniella nearctica*	Nearctic paduniellan caddisfly	Insect	Sensitive
5	*Amorpha Ouachitensis*	Ouachita leadplant	Plant	Sensitive
5	*Callirhoe bushii*	Bush's poppymallow	Plant	Sensitive

Table 20. Occurrence Analysis Results – TES Species (Cont'd)

OAR Code	Scientific Name	Common Name	Taxa	Status
5	*Castanea pumila var. ozarkensis*	Ozark chinquapin	Plant	Sensitive
5	*Cypripedium kentuckiense*	Southern lady's slipper	Plant	Sensitive
6	*Delphinium newtonianum*	Moore's larkspur	Plant	Sensitive
5	*Dodecatheon frenchii*	French's shooting star	Plant	Sensitive
5	*Eriocaulon koernickianum*	Small-headed pipewort	Plant	Sensitive
6	*Silene ovata*	Ovate-leaf catchfly	Plant	Sensitive
5	*Tradescantia ozarkana*	Ozark Spiderwort	Plant	Sensitive
6	*Valerianella nuttallii*	Nutall's cornsalad	Plant	Sensitive
6	*Valerianella ozarkana*	Ozark cornsalad	Plant	Sensitive

Species Identified as Being in the Action Area or Potentially Affected by the Action
From past field surveys and knowledge of the area, and given the Proposed Action, those species which are analyzed and discussed further in this document are those that: a) are found to be located in the activity area (OAR code "5"), and b) were not seen during the survey(s), but possibly occur in the activity area based on habitat observed during the survey(s) or field survey was not conducted when species is recognizable (OAR code "6").

Table 20 shows two fish species (Ozark shiner and longnose darter) and one insect species (Nearctic paduniellan caddisfly) were identified downstream of the analysis area, but outside of the geographic bounds of the water resource cumulative effects analysis area (defined as the point below which sediment amounts are immeasurable and insignificant) (OAR "7").

Table 20 shows one amphibian species (Oklahoma salamander), one bird species (bald eagle), three mammal species (Ozark big-eared bat, gray bat and Northern long-eared bat), one crayfish species (*Orconectes williamsi*), and seven plant species (Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, French's shooting star, small-headed pipewort and Ozark spiderwort) were identified within the analysis area (OAR "5").

Nine species were not seen during field surveys, but possibly occur in the analysis area based on habitat observed or the field surveys were conducted when the species is not recognizable (OAR "6"); 1 bird species (Bachman's sparrow), 2 mammal species (Eastern small-footed bat and Indiana bat), 1 mussel species (spectaclecase), 1 isopod species (lirceus isopod), and 4 plant species (Moore's larkspur, ovate-leaf catchfly, Nuttall's cornsalad, and Ozark cornsalad).

Direct, Indirect & Cumulative Effects of Proposed Management Action on Each Identified Species
The analysis of possible effects to species identified as known or expected to occur in the vicinity of the proposed project, or likely to be affected by the action includes the following existing information:

1. Data on species/habitat relationships.
2. Species range distribution.
3. Occurrences developed from past field surveys or field observations.
4. The amount, condition, and distribution of suitable habitat.

Effects to species include anticipated effects from implementation of the Proposed Action. Predicted effects to species shown in Table XX ~~above~~ are described in the Biological Evaluation for the Pleasant Hill Wildlife Habitat Improvement Projects (Taylor 2014).

Determination of Effects – "No Action" Alternative (TES species)

No negative adverse effects would occur to federally listed (T&E) or species proposed for listing populations (Ozark big-eared bat, gray bat, Indiana bat, Northern long-eared bat and spectacle case mussel). Potential positive effects to these species through habitat improvement would not occur.

No negative adverse effects would occur to Region 8 sensitive species (Ozark shiner, longnose darter, Oklahoma salamander, Bachman's sparrow, bald eagle, Eastern small-footed bat, lirceus isopod, William's crayfish, Nearctic paduniellan caddisfly, Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, Moore's larkspur, French's shooting star, small-headed pipewort, ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad and Ozark cornsalad). Potential positive effects to species which require open (unshaded) and/or fire-dependent habitats would not occur. Positive impacts to these species through reduction of competition with NNIS would not occur.

Determination of Effects – "Proposed Action" Alternative 2 (TES species)

Ozark big-eared bat

The Proposed Action and action alternatives were all designed to totally incorporate all Forest-wide standards, and direction provided by the USFWS related to the conservation of all listed bat species.

There are no foreseeable, additional management activities in the area (not associated with this project) that would directly or indirectly affect the Ozark big-eared bat, or cause additive or synergistic adverse cumulative impacts in conjunction with the Proposed Action.

With implementation of Forest-wide standards from the RLRMP which were developed in coordination with the USFWS during the revision process, the determination of effect for the Ozark big-eared bat related to this proposed project is: "may affect – not likely to adversely affect."

Gray bat

There are no foreseeable, additional management activities in the area (not associated with this project) that would directly or indirectly affect the gray bat, or cause additive or synergistic adverse cumulative impacts in conjunction with the Proposed Action.

With implementation of Forest-wide standards from the RLRMP which were developed in coordination with the USFWS during the revision process, the determination of effect for the gray bat related to this proposed project is: "may affect – not likely to adversely affect."

Indiana bat
There are no foreseeable, additional management activities in the area (not associated with this project) that would directly or indirectly affect the Indiana bat, or cause additive or synergistic adverse cumulative impacts in conjunction with the proposed action.
With implementation of Forest-wide standards from the RLRMP which were developed in coordination with the USFWS during the revision process, the determination of effect for the Indiana bat related to this proposed project is: "may affect – not likely to adversely affect."

Implementation of this proposed project may benefit Ozark big-eared bat, gray bat and Indiana bat by providing habitat improvement.

Because there are no other threatened or endangered species or associated habitat present the proposed project will have no effect on any other listed or proposed species.

Northern long-eared bat
Until this species is listed under the Endangered Species Act, the Forest Service is directed to consider this species in Biological Evaluations and provide a determination of "Jeopardy" or "No Jeopardy." The jeopardy determination is based upon whether the proposed project would cause mortality for every individual of this species. The determination for Northern long-eared bat with implementation of this proposed project is "No Jeopardy.

Implementation of this proposed project may benefit Ozark big-eared bat, gray bat, Northern long-eared bat and Indiana bat by providing habitat improvement.

Spectaclecase mussel
There are no foreseeable, additional management activities in the area (not associated with this project) that would directly or indirectly affect the spectaclecase mussel, or cause additive or synergistic adverse cumulative impacts in conjunction with the proposed action.

With implementation of Forest-wide standards from the RLRMP which were developed in coordination with the USFWS during the revision process, the determination of effect for the spectaclecase related to this proposed project is: "may affect – not likely to adversely affect."

Because there are no other threatened or endangered species or associated habitat present the proposed project will have no effect on any other listed or proposed species (Taylor, 2014).

Sensitive Species
For sensitive species Ozark shiner, longnose darter, Oklahoma salamander, Bachman's sparrow, bald eagle, Eastern small-footed bat, *Lirceus bicuspicatus, Orconectes williamsi*, Nearctic paduneillan caddisfly, Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, Moore's larkspur, French's shooting star, small-headed pipewort, ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad, and Ozark cornsalad direct negative impacts to individuals of these species may occur through implementation of the project. However, the project is not likely to cause a trend to the federal listing of these species under the Endangered Species Act. Furthermore, there will be no loss of population viability for these species due to implementation of this project.

Implementation of the Pleasant Hill Wildlife Habitat Improvement Projects would benefit sensitive species which require open (unshaded) and/or fire dependent habitats. These sensitive species include Bachman's sparrow, Ouachita leadplant, Bush's poppymallow,

Moore's larkspur, small-headed pipewort, ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad and Ozark cornsalad.

Because there were no other sensitive species or habitat for such species present, the project will have no impact on any other Southern Region sensitive species (Taylor, 2014).

9. Wetlands, Riparian Areas, and Streamside Protection Zones

Significant Issues Related to the Resource

Issue # 5

5 – The effects of proposed management activities on water quality

Current Condition
The forest plan (RLRMP-2005) sets aside a completely separate management prescription area for Riparian Corridors. This area encompasses all area 100 feet on each side of any perennial stream on the Forest. A set of management goals and standards are set aside for this management area. This type of management area is part of this project area. The forest plan also calls for Streamside Management Zones that range from 50 to 150 feet for all streams and springs depending on the slope of adjacent channel and if the stream is classified as perennial, defined channel, or as a spring. Wetland areas are also found in the project area. Reference to these areas can be found in the Water Resources section of this EA.

Direct, Indirect and Cumulative Effects

Alternative 1 – No Action

Negative changes to wetlands, riparian areas and natural springs may result from the implementation of the No Action Alternative. These changes could result from increased sedimentation and erosion from existing open roads that are currently being damaged by motorized vehicles. Implementation of this alternative may lead to potential negative impacts to these resources because roads would remain open and resources would not be protected. As a result of implementing Alternative 1, roads in the project area which lead to wildlife openings and unauthorized roads within woodland restoration units would not be closed. These resources could possibly experience negative direct, indirect or cumulative impacts if proper management activities are not implemented.

Alternative 2 – The Proposed Action

Best management practices (BMPs) of clearly marking on the ground all riparian zones and protection zones along all streams will be adhered to in order to protect the water quality of streams within the project area. Additional standards to protect water quality in streams, springs, seeps, and other karst features can be found in the Forest Plan.

No thinning activities are planned in the floodplains of perennial streams on the District.

Following Stream Management Zone (SMZ) standards in the Forest Plan on width of stream and forest vegetation density would protect habitat for salamanders, snakes, and other riparian-dependent species. Project level compliance with these mitigation/protective

measures and adherence to BMPs will eliminate negative effects to wetlands, riparian areas and streamside protection zones. Closing and decommissioning roads would decrease the amount of erosion caused by excessive runoff from overusing these roads. Necessary upgrades to the road system through maintenance and reconstruction activities would minimize potential negative resource impacts. Implementation of this alternative would not result in direct, indirect or cumulative negative impacts.

10. Human Health Factors

Significant Issues Related to the Resource

Issue # 4

2 - The effects of proposed management on fire danger and potential damage to structures/private property

Current Condition
At the present time on public lands administered by the Ozark National Forest, there are existing risks to human health from the use of herbicides or cutting tools in the analysis area. These risks are from previously analyzed and approved projects. Another human health risk in the analysis area is dead and dying trees, which are mostly red and black oaks impacted heavily by oak decline. Falling trees and limbs in forested areas can cause injury to forest visitors and can cause damage to personal property. In addition, the combination of forest fuel accumulations and the interspersion of private lands/property within the analysis area lead to potential for negative effects to human health and property from wildfire.

Alternative 1 – No Action

There would be no change from the existing condition regarding risks to human health from the use of herbicides, controlled burning, or cutting tools. Risks to human health and safety from falling limbs and trees associated with oak decline would increase due to rot, decay, and wind-throw. Risks to human health/safety and private property would exist without the use of fuels reduction prescribed fire which reduces the intensity and spread of wildfires.

Alternative 2 –The Proposed Action

Herbicide is used in accordance with Forest-Wide Standards as described in the Revised Land and Resource Management Plan and in accordance with herbicide label requirements. The routine adherence to these standards and requirements minimizes potential risk to human health and the environment. Syracuse Environmental Research Associates, Inc. (SERA) Risk Assessments for herbicides evaluate 2,4-D, imazapic, imazapyr, triclopyr, hexazinone, and glyphosate from a human safety viewpoint, evaluating risks, short term effects and cumulative effects. All information contained in these Herbicide Risk Assessments (RAs) is incorporated by reference into this analysis (Refer to Herbicide Section). Risk assessments for these chemicals are documented in the project analysis file. Risk to the public from herbicide use is low and this is mitigated by use of Forest-Wide Standards and compliance with herbicide label requirements. The primary risk regarding herbicide use is related to herbicide applicators being exposed to chemical (either Forest Service employees or contractors). With proper handling/transport of herbicides, proper application equipment and

methods, and use of required protective personal equipment (PPE), risk of herbicide use to workers is mitigated.

Cumulative effects from using herbicides as proposed also pose no significant risk of causing unintended negative cumulative effects due to their short half-lives and the selectivity of the proposed treatment methods.

According to SERA Risk Assessments, a hazard quotient of one or less is considered as low-risk. A hazard quotient of 2-10 requires extended mitigation measures. Herbicide use proposed within all watersheds will be well-buffered from streams. Application of mitigation measures shown previously in this document, adherence to Forest Standards for herbicide use and chemical labels for application, as well as proper worker PPE and cleaning practices will negate hazard quotients > 1.0 related to drift, accidental spills, worker exposure and run-off.

All herbicide treatments would follow Forest-Wide Standards FW19 through FW32 included in the Revised Land and Resource Management Plan for the Ozark-St. Francis National Forests, pages 3-4 through 3-5 (USDA Forest Service 2005). All herbicide treatments would follow Arkansas Forestry Commission Best Management Practices for Forest Chemicals 7.11 through 7.17 (AFC 2002). For all projects involving herbicide use, prior to application of approved chemicals an "Implementation Checklist for Invasive Plant Control" (see Appendix A) would be completed by the District Wildlife Biologist. These mitigation measures will greatly reduce the chance of workers being exposed and mitigate the very slight risk for any public exposure to these compounds.

2,4-D (granules 17.5% active ingredient) is not likely to be absorbed through the skin in harmful amounts due to a single prolonged skin exposure. Hazard quotients for workers > 1 are for individuals continuing work with contaminated gloves. Proper chemical handling, cleaning procedures and use of impervious rubber gloves mitigates this concern. When applied at label rates, there is no restriction on swimming or fishing in areas treated with this chemical.

Hazard quotients for the general public are > 1 for acute ingestion of drinking water treated with 2,4-D, consumption of fish following spills of large amounts of this chemical into water, and consumption of contaminated terrestrial vegetation which has been treated with the upper field level concentrations of this chemical (SERA, 2006). The concern for these hazard quotients > 1 is reduced for the following reasons:

- 2,4-D will not be introduced into ponds which are utilized as drinking water or culinary sources.
- The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed on use of herbicides near water. Adherence to Forest-Wide Plan Standard FW30 precludes the possibility of large spills into water. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas. Chemical would be applied at the label application rates, with only the amount of chemical needed for the day's work being transported to the treatment site.
- Consumption of contaminated terrestrial vegetation is not of concern, since this chemical will not be used to treat terrestrial vegetation.

Glyphosate

Glyphosate when contacting eyes is no more than slightly irritating based on toxicity studies; with skin contact is not more than slightly toxic and not more than slightly irritating based up toxicity studies; when ingested is no more than slightly toxic based on toxicity studies – with no significant adverse health effects expected if only small amounts (less than a mouthful) are swallowed; when inhaled is no more than slightly toxic based on toxicity studies (MSDS for Foresters' Non-Selective Herbicide dated 11/26/2008). Lab studies conducted specifically on bobwhite quail also demonstrate extremely low toxicity.

Worksheets for Human Health and Ecological Risk Assessments for the chemical Glyphosate (SERA, 2010) were used to determine hazard quotients for workers, the general public and wildlife. All hazard quotients for humans and terrestrial wildlife are less than 1.0.

Hexazinone

Hexazinone when contacting eyes may cause corneal opacity or clouding of the eye and skin irritation or rash. Based on animal data, ingestion of large amounts of hexazinone may cause effects on the liver. Significant skin permeation and systemic toxicity after contact appears unlikely (MSDS for Velpar L dated 11/4/2010). When hexazinone is ingested by animals, it is broken down into metabolites which are rapidly excreted in the urine and feces. Hexazinone does not accumulate in the tissues of exposed animals (USDA, 2012).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Hexazinone (SERA, 2006) were used to determine hazard quotients for workers, the general public and wildlife. All hazard quotients for workers (herbicide applicators) are less than (<) 1, with the exception of hazard quotients modeled for application of upper level field solution concentrations (see process record for specific numbers). These upper level field solution concentrations are not used on the District. This mitigates these hazard quotients > 1.

All hazard quotients for the general public related to use of granular formulations of hexazinone were less than 1.

All hazard quotients for the general public related to use of liquid formulations of hexazinone were less than 1, with the exception of use of upper level field solution concentrations causing hazard quotients > 1.0 for adult females consuming contaminated fruit and contaminated vegetation (see process record for specific numbers). Also, modeling of central level field solution concentrations caused a hazard quotient > 1 for adult females consuming contaminated vegetation (see process record for specific numbers). The concern for these hazard quotients > 1 are reduced for the following reasons:

- The scenario modeled assumes contaminated vegetation/fruit is consumed by the individual for 90 days.
- Contaminated vegetation would show signs of stress/mortality before the termination of this 90 day period thereby discouraging and individual from eating it.
- The scenario assumes that hexazinone is applied to the foliage/fruit of vegetation. Soil application of this chemical is utilized on the District, not foliar spray application.

Imazapic

This chemical is weakly adsorbed in basic soils, but adsorption increases in acidic soils. Field studies have not shown movement of this chemical in surface water. This herbicide has low toxicity to animals. There is a high probability that imazapic is not acutely harmful to aquatic invertebrates, aquatic plants or fish. In addition, this chemical is non-irritating with exposure to skin and eyes (MSDS for Plateau dated 3/5/2012).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Imazapic (SERA, 2006) were used to determine hazard quotients for workers, the general public and wildlife. All hazard quotients for humans and terrestrial wildlife are less than 1

Imazapyr

Imazapyr is soil active, but mobility in soil is relatively low. It can be soil active particularly during spring leaf expansion. Application after mid-September may yield soil activity the following spring. This chemical has very low toxicity to mammals or other animals. It may cause slight but temporary irritation to the eyes and skin if exposure occurs (MSDS for Arsenal AC dated 6/15/2009).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Imazapyr (SERA, 2011) were used to determine hazard quotients for workers, the general public and wildlife. All hazard quotients for humans and terrestrial wildlife are less than 1.

Triclopyr Amine and Triclopyr Ester

Triclopyr is not soil active, except in examples of spills or misapplications not in accordance with label application rates. These chemicals have low bioconcentration potential and single-dose toxicity to mammals is low although prolonged or repeated exposure may cause skin irritation in mammals and corneal damage if introduced into the eye (MSDS for Element 3A Herbicide dated 5/25/2011). Worksheets for Human Health and Ecological Risk Assessments for the chemical Triclopyr (USDA, 2011) were used to determine hazard quotients for workers, the general public and wildlife. Both ester and amine formulations of this chemical were investigated.

All hazard quotients for workers (handling herbicide) related to use of triclopyr amine and ester formulations were less than 1, with the exception of use of upper level field solution concentrations causing hazard quotients > 1 for workers with contaminated gloves worn for more than one hour when applying the ester formulation (see process record for specific numbers). This upper bound HQ would be mitigated by changing protective clothing and washing following contamination as directed by policy, or by wearing rubber gloves impervious to the chemical.

Hazard quotients for workers associated with chronic exposure (repeated long term) are ≥ 1 for broadcast spray applications of triclopyr amine and > 1 for backpack and broadcast spray applications of triclopyr ester – all at the upper application level field solution concentrations (see process record for specific numbers).

Modeling shows that some workers applying triclopyr ester at the modeled application rate of .48 lb a.e./acre will be subject to exposures that exceed a HQ of 1, by a substantial margin. The concern for HQs > 1 for workers – taken from very conservative modeling is reduced by the following:

- Overt toxic effects in workers do not appear to be likely. There are no epidemiology studies or case reports which suggest that systemic toxic effects are associated with occupational or even accidental exposures to any form of triclopyr; furthermore, no poisoning reports involving any form of triclopyr are documented in the reasonably comprehensive summary of human case reports on pesticide exposures by Hayes (1982).

Hazard quotients for the general public are > 1 for situations modeled from accidental spills of triclopyr amine into small ponds with the water consumed by a child (see process record for specific numbers). These upper bound HQs are derived from spillage of the upper application level of field solution concentrations for both foliar application and hack and squirt application. The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed on use of herbicides near water.

- Adherence to Forest-Wide Plan Standard FW30. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas.
- Adherence to Forest-Wide Plan Standard FW32. Herbicide will not be used within the appropriate SMZs (streamside management zones) or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas.

Hazard quotients for the general public are ≥ 1 for non-accidental acute exposure (single exposure) for both triclopyr amine and ester formulations for adult female consumption of contaminated fruit, and skin contact with contaminated vegetation. These hazard quotients are associated with both the central and upper application levels of field solution concentrations (see process record for specific numbers). The concern for hazard quotients ≥ 1 for the general public – taken from very conservative modeling is reduced by the following:

- The modeling assumes that the adult female walks through an area shortly after treatment (vegetation still wet), wearing shorts. In most cases, herbicides are applied in relatively remote areas, and so it is not likely that members of the general public would be exposed to contaminated plants shortly after treatment (SERA, 2007). This general exposure scenario for the public may be implausible or at least extremely conservative.
- For contaminated fruit, the exposure scenario assumes that an area of edible plants is inadvertently sprayed. While such inadvertent contamination might occur, it is extremely unlikely to happen as a result of directed applications (backpack or broadcast applications). In all spraying scenarios, the possibility of inadvertent contamination of cultivated or edible wild vegetation would be low. For herbicides, it is likely that the contaminated plants would show obvious signs of damage over a relatively short period of time and would therefore not be consumed (SERA, 2007).
- Project level mitigation measures for herbicide use state "Edible berries would not be treated with herbicides."

- The typical hazard to the general public may often be negligible because significant levels of exposure are not likely. For the public, the general exposures may be regarded as extreme in that they are based on very conservative exposure assessments and/or very implausible events. These general exposure assessments are included because the risk assessment is intended to be extremely conservative with respect to potential effects on the general public (SERA, 2007).

Hazard quotients for the general public are ≥ 1 for chronic/longer term exposures for both triclopyr amine and ester formulations for adult female consumption of contaminated fruit and vegetation. These HQs are associated with only the upper application levels of field solution concentrations (see process record for specific numbers). The concern for hazard quotients > 1 for the general public – taken from very conservative modeling is **reduced by the following:**

- The exposure scenarios based on longer-term consumption of contaminated fruit and vegetation assume that an area of edible plants is inadvertently sprayed and that these plants are consumed by an individual over a 90-day period. With herbicide use, it is likely that the contaminated plants would show obvious signs of damage over a relatively short period of time and would therefore not be consumed (SERA, 2007).
- Project level mitigation measures for herbicide use state "Edible berries would not be treated with herbicides."
- The amount of non-target vegetation subject to spray deposition is small. The average half-life of this chemical is 30 days; degraded by both soil microbes and photolysis. The concern that humans would eat contaminated vegetation for 90 days in field conditions is further reduced by the average half-life of this chemical. Humans are even less likely to come in contact with chemical from cut surface herbicide application used for woodland restoration and NNIS treatment.
- Herbicide treatments occur on an infrequent basis in project areas – with applications usually separated by multiple years.
- The typical hazard to the general public may often be negligible because significant levels of exposure are not likely. For the public, the general exposures may be regarded as extreme in that they are based on very conservative exposure assessments and/or very implausible events. These general exposure assessments are included because the risk assessment is intended to be extremely conservative with respect to potential effects on the general public (SERA, 2007).

Hazard quotients for terrestrial animals are > 1 for situations modeled from accidental spills of triclopyr amine into small ponds. In these scenarios the contaminated water is consumed by a large mammal, and fish from the contaminated water are consumed by a large mammalian carnivore and a canid. These upper bound hazard quotients are derived from spillage of the upper application level of field solution concentrations for hack and squirt application where a higher concentration of chemical is used (see process record for specific numbers). These hazard quotients >1 for terrestrial wildlife are discussed here to indicate possible effects to humans. The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed upon use of herbicides near water.

- Adherence to Forest-Wide Plan Standard FW30. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas.

- Adherence to Forest-Wide Plan Standard FW32. Herbicide will not be used within the appropriate SMZs (streamside management zones) or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas.

Hazard quotients for terrestrial animals are ≥1 for scenarios modeled from some mammals and birds consuming contaminated vegetation with high residue rates, and some instances of large mammals and small birds consuming contaminated fruit with low residue rates. These hazard quotients are associated with both the central and upper application levels of field solution concentrations (see process record for specific numbers). These hazard quotients ≥1 for terrestrial wildlife are discussed here to indicate possible effects to humans. The concern for hazard quotients ≥1 for terrestrial wildlife, as derived very conservative modeling is reduced by the following:

- For both the acute and chronic exposure scenarios, the assumption is made that 100% of the diet is contaminated. This may not be a realistic assumption for some acute exposures and will probably be a rare event in chronic exposures—i.e., animals may move in and out of the treated areas (SERA, 2011).
- Chronic HQs assume that vegetation is consumed on the contaminated site for 90 days. This general, chronic exposure scenario for terrestrial wildlife may be implausible or at least extremely conservative.
- The amount of non-target vegetation subject to spray deposition is small. The average half-life of this chemical is 30 days; degraded by both soil microbes and photolysis. The concern that humans would eat contaminated vegetation for 90 days in field conditions is further reduced by the average half-life of this chemical. Humans are even less likely to come in contact with chemical from cut surface herbicide application used for woodland restoration and NNIS treatment.
- Project level mitigation measures for herbicide use state "Edible berries would not be treated with herbicides."
- Herbicide treatments occur on an infrequent basis in project areas – with applications usually separated by multiple years.

As reviewed in U.S. EPA/OPP (2009a, p. 82 ff) and detailed in Appendix O of the EPA risk assessment, the U.S. EPA/OPP maintains a database of ecological incidents associated with pesticide applications. A total of 63 incidents regarding triclopyr applications were reported to the EPA. None of these incidents reported adverse effects in mammals. As summarized in Appendix 2, Table A2-10, of the (SERA, 2011) triclopyr risk assessment, none of the available field studies associate adverse effects in mammals with the direct toxicity of triclopyr (SERA, 2011).

Two general factors may contribute to the apparent discrepancy between the high hazard quotients for triclopyr and the lack of reported adverse effects in field studies or incident reports. Like the human health risk assessment, the ecological risk assessment uses the extreme value approach. The upper bound hazard quotients represent multiple worst case exposure assumptions that may not occur frequently in the field. Also, the field study by Leslie et al. (1996) suggests that some mammals, such as deer, may avoid treated areas. As

discussed in the exposure assessment, the scenarios for the consumption of contaminated vegetation assume that 100% of the diet is contaminated. If larger mammals avoid treated areas, the proportion of the contaminated diet could be much less than 100%. As the proportion of the diet that is contaminated decreases, the consequent hazard quotients will also decrease (SERA, 2011).

Removal of some dead and/or aging trees through thinning operations and fireline preparation along roads will make the forest safer for forest visitors, through reducing the incidence of falling snags and limbs. Manual and mechanical vegetation treatments using hand tools and equipment inherently pose a risk for Forest Service personnel and contractors. Use of proper personal protective equipment (PPE), completion of certification training, annual chainsaw safety review and adherence to job hazard analyses will mitigate potential for injury.

Use of prescribed burning will lessen the potential for wildland fire spread, wildland fire severity and unplanned smoke emissions on all acres where this activity is implemented. Strict adherence to FEIS and RLRMP guidelines, a site-specific burning plan and Arkansas Voluntary Smoke Management Guidelines will limit the area where EPA standards are exceeded to a location very close in proximity to the flaming front. Site specific burn plans and Arkansas Voluntary Smoke Management Guidelines ensure that smoke or other combustion products do not reach, or significantly affect, smoke sensitive areas. Smoke monitoring during and after prescribed burns will be conducted to determine compliance with smoke management guidelines, and for potential future mitigation required for downwind smoke sensitive areas. These actions will ensure that the requirements of the Clean Air Act, EPA air standards, and state requirements will be met and there should be no smoke related long-term or cumulative effects from implementation of prescribed fire.

Downwind effects of reduced air quality would be short-term in nature. Impacting large population centers would be avoided. The acres burned under the Alternative 2 would occur over several days. Individual ignitions would generally be limited to 500 to 3,000 acres daily. Annually, ignition in the analysis area would be spread over several days, and probably over multiple seasons – thereby reducing potential for smoke impacts. All acres proposed for prescribed fire would not be burned in one year. Ignition of all prescribed burn units described in this document would occur over the span of several years. It is anticipated that the maximum acres, which would be burned annually with this proposal, would be approximately 24,000 acres. Use of aerial ignition would serve to reduce burn-out time and associated duration of smoke impacts. Aerial ignition would also help develop smoke column lifting and reduce smoke impacts.

Smoke concentrations from prescribed burning can be a very serious matter, particularly near homes of people with respiratory illnesses, or near health-care facilities, or on roadways. Human health effects related to particulate matter in smoke include aggravation of respiratory or cardiovascular illnesses and changes in lung function, structure, and immunity capability of the body. Site specific burn guidelines and compliance with Arkansas Voluntary Smoke Management Guidelines insure daily smoke/particulate matter emissions are acceptable, smoke sensitive targets are avoided, and negative effects of burning upon human health and safety are mitigated to the extent possible. The Forest Service complies with all applicable Federal and State regulations governing open burning. Additionally, adjacent private landowners, and known members of the public with respiratory health issues are notified before prescribed fires are ignited. If concerns related to human health exist, the

USFS will accommodate that citizen in an effort to provide a safe and healthy environment during the burn. (e.g., citizens with respiratory health issues will be given the option to stay in a hotel room provided by the USFS)

When implementing prescribed fire, all precautions are taken to avoid damage to private property and minimize risk to worker and public health as per site specific burn plans, smoke management guidelines, standard fire safety guidelines and job hazard analyses. Implementation of prescribed fire adjacent to private structures and developments would reduce the chances of loss or damage from unplanned wildfires, and reduce the potential for human injury or loss of life.

Based on the analysis, there should be no significant long-term cumulative effects on human health from implementation of herbicide use, manual/mechanical vegetation treatments, or prescribed fire associated with Alternative 2 (Proposed Action). For additional information regarding smoke emissions from prescribed fire refer to the "Air Resources" section of this EA.

11. Social and Economic Factors

Significant Issues Related to the Resource

Issue # 4

4 - The effects of proposed management on fire danger and potential damage to structures/private property

Current Condition
The project is located in a rural part of northwestern Arkansas. The income levels are primarily moderate to low and local residents derive much of their income from light industry, including processing timber products, in nearby towns. Some are directly involved in harvesting timber from public and private lands. Other vocations include ranching, farming (crops and poultry), and other forest use.

Direct, Indirect, & Cumulative Effects

Alternative 1 – No Action

This alternative proposes no wildlife habitat improvement activities. Therefore, there would be no economic benefits to the local communities resulting from jobs created by wildlife habitat improvement contracts. Wildlife habitat would not be improved or created for leisure and outdoor interests.

Alternative 2 – The Proposed Action

Activities proposed will affect the local economy by potentially employing people to do wildlife habitat improvement work. This alternative has a positive effect on the local economy by potentially providing local jobs in the completion of wildlife habitat improvement.

In addition to economic benefits to the local community derived from employment in widlife habitat improvement work, there will be other social benefits realized from implementation. Economic benefits would be realized through creation/improvement of wildlife habitat and associated improvement in recreation opportunities. Benefits to the public would be realized through reduction of fire hazard and potential loss/damage to personal property through implementation of prescribed fire. Reduction in fuel loading through implementation of Alternative 2 would serve to reduce potential wildfire spread and severity, thereby reducing costs associated with fire suppression, which far exceeds cost per acre for prescribed burning. Closure of wildlife opening access roads would create social benefits by reducing erosion and sedimentation. Closing access roads to wildlife openings would serve to reduce the proliferation of illegal OHV use. Treatment of noxious/invasive weeds, which would occur with implementation of Alternative 2, would create social benefits by reducing long-term indirect and cumulative negative effects to native vegetation which provides revenue to the local economy.

12. Recreation Management

Current Condition

Recreation use in and around the analysis area is moderate to high, with highest use periods during the spring, early summer and fall seasons. Use consists of swimming, fishing, camping, picnicking, sightseeing, hiking, hunting, and OHV driving. The analysis area has 4 developed recreation use sites, several scattered dispersed recreation use sites and several designated roads allow off highway vehicle (OHV) use.

The developed recreation sites within the analysis area are utilized by recreation visitors for camping, canoe access to the Mulberry River, trailheads for hiking the Ozark Highlands Trail (OHT), and day use picknicking and social gatherings. The OHT crosses the entire district generally from east to west, and is an important recreational feature for members of the public both locally and nationally.

The dispersed campsites within the analysis area are mostly utilized by recreation visitors who are participating in OHV recreation and hunting. OHVs and pick-up trucks are driven or brought to these dispersed campsites for use in sightseeing and/or hunting. Dispersed camping and hunting of deer, turkey and squirrel are common in the analysis area.

Off Highway Vehicles

There are currently several roads on the District where OHV use is allowed. OHV operators use this type of vehicle for one or more of the following reasons: to reach remote and lightly hunted areas that are difficult to reach on foot, to retrieve game after it has been shot, and/or to view forested scenery. There are numerous user-created trails that radiate out from dispersed campsites, private weekend cabins, and private property in the analysis area.

Desired future conditions of the RLRMP call for road systems that provide a range of recreation opportunities, experiences, and challenges for OHV enthusiasts (primarily ATVs and motorcycles) through the development of an integrated system of roads and trails. Few, if any, trails are developed for four-wheel drive vehicles. Some suitable low maintenance roads are available for four-wheel drive vehicle use. OHV use is now restricted to roads and trails designated by the National Forest. High use areas are managed within capacities in order to maintain the quality of experiences. Facilities that provide access to the OHV system are developed in conjunction with the development of the overall OHV system.

Conflicts between OHV enthusiasts and other recreation users, with private lands and homeowners adjacent to National Forest land, and with resource issues are addressed and resolved in a timely manner. Resolutions are consistent with area objectives and management direction. Recreational OHV visitors are informed where designated routes are, what types of vehicles are allowed, and what seasons they are allowed.

Direct, Indirect and Cumulative Effects

Alternative 1 – No Action

Aesthetics
Natural processes that move the forest ecosystems toward climax condition would continue. There would be few short-term changes; however, as ecosystems in the analysis area progress toward climax condition, hardwood would be expected to be an increasing component in the areas now dominated by pine, and hardwood stands would be expected to progress toward containing a greater component of shade-tolerant, fire-intolerant species. Visual color and pattern diversity, especially during leaf-off, would decrease with less of the contrasting green-gray patchwork patterns.

This alternative will have little immediate effect on the visual quality of recreational and scenic driving. The near foreground on public and private lands will not change.

Recreation and OHV Use
Dispersed camping and hunting of deer, turkey, bear, and squirrel will be affected in the long term under this alternative. Alternative 1 provides no activities which maintain or increase early seral habitat or woodlands on public lands. However, open pastures, ponds and other activities on private land which produce early-seral vegetation are expected to remain constant. Successful viewing of game and non-game species and hunting of deer and turkey could decrease on public lands under this alternative with possible increased use of private lands by wildlife. Squirrel hunting will improve as the hardwood stands age, except in areas affected by the oak decline. In the long term, species dependent upon hard mast such as deer, turkey and bear would be expected to decrease.

This alternative will not change the recreation use (OHV driving, camping, hiking the OHT, mountain bicycling, or swimming) in the project vicinity. User conflicts between adjacent landowners with OHVs and the continued growth of user-created OHV trails will continue with the No Action Alternative, resulting in increased erosion, disturbance of wildlife at wildlife openings and forest damage.

Alternative 2 – The Proposed Action

Aesthetics
All of the proposed actions are consistent with the Scenic Integrity Objectives (SIOs) for this area and no long-term adverse effects should occur.

Drivers and forest users along state highway, county and forest roads will notice more browning of vegetation from thinning, herbicide and burning activities during the initial work and for the first season. Hikers along the Ozark Highland Trail area may notice smoke during prescribed burns, and post fire effects in prescribed burn units containing the trail. In the short term, hikers may also hear chainsaws utilized for woodland restoration thinning at a

distance of 200 feet from the trail along short sections of the trail. In the short term, hikers may notice browned vegetation from control of NNIS with herbicides in proximity to the trail.

Thinning in stands would allow views which penetrate into the stands, allowing views further than the existing near foreground, giving the stands a more park-like appearance and providing for a greater diversity of under story species. Slash height reduction or prescribed fire (which would greatly reduce slash) should be completed in the first 200-300 feet in areas seen from high use travel ways and concentrated use areas.

Thinning of hardwood stands creates a more park-like appearance and increases vegetation diversity in the stand. Thinning causes greater sunlight penetration into the under-story, allowing for greater diversity of herbaceous species. Thinning also allow views into the stand further than the existing near foreground. Slash height reduction within 200 to 300 feet of areas of high public use accomplished with use of prescribed fire would improve views.

Visitors to all areas of the proposed project area may also smell and see smoke during burning and blackened trees and ground for the first season until the next spring green-up. Some browning of vegetation from thinning and herbicide use will be noticeable in treatment areas along county and forest roads. The foreground area that is private land will not be affected by this alternative. In the background, National Forest land will continue to offer viewers a variety of forest types from pines to hardwoods.

Recreation and OHV Use

Recreation users in the area may smell and see smoke during prescribed burning and browning of vegetation from thinning, herbicide and burning activities during the initial work and for the first season. To improve visitor safety, they may be prohibited from entering certain areas during prescribed burning (Appendix C). At the conclusion of the thinning activities and prescribed burning, existing roads which were used for administrative access or firelines will be closed, blocked and seeded. These activities will have no long-term negative effects on the dispersed recreation activities except with the use of closures on user created trails. User-created trails will be obliterated with gate structures, and woody material arising from thinning activities in an attempt to close these illegal trails.

OHV operators who use their vehicles to view forested scenery may notice the thinning, herbicide and prescribed burn activity, especially on county roads, more than other recreational groups. They will hear chainsaws, and will see stands as they are being thinned, burned, and treated with herbicide and other wildlife improvement activities. Other effects such as brown leaves on small stems in the prescribed burned areas will be short term. In addition, in areas where herbicides will be applied, treated vegetation will appear brown and dead until it falls to the ground. There should be a noticeable green-up of ground vegetation by the next year in areas that have been burned or treated with herbicides.

Roads closed with gates will allow foot travel for hunters to access more secluded hunting spots. Roads that are closed can be used by hikers to access the interior of the project area. Closing roads will reduce the miles of roads on which users can drive motorized vehicles. Due to the implementation of the new OHV policy, OHV users are allowed to drive only on designated routes on the National Forest. Implementation of forest-wide designated OHV routes will be managed to maintain a high-quality OHV experience.

Closing unauthorized roads will not affect authorized OHV use on the District.

The proposed wildlife habitat improvement activities will improve hunting opportunities around the dispersed hunter camps and adjacent private lands. It is unlikely that much thinning or prescribed burning will take place during the time of highest use (deer hunting seasons), so the sounds and sights of thinning operations should have minimal impacts on dispersed recreation. None of the hunter camps are scheduled for obliteration so the frequency of sites will not change.

Hunters are frequently drawn to thinned areas because game species are attracted to them also. Herbaceous vegetation will increase in the thinned areas, wildlife openings and burn units. Pond maintenance will also provide needed habitat on National Forest lands for game and non-game species – providing increased hunting and wildlife viewing opportunities. Deer and turkey hunting should be maintained or improved under the Proposed Action by improving habitat and dispersing game species over a wider area of the Forest. Squirrel hunting should be maintained near present levels. The maintenance of ponds, wildlife openings and areas restored to woodland condition will tend to attract animals to under-utilized areas on National Forest lands and, thereby, relieve hunting pressure on private lands.

Campers at dispersed sites will hear chainsaws, and will see stands as they are being thinned and notice other wildlife improvement activities. Campers may see some short term effects from other activities such as brown leaves in the prescribed burned and herbicide-treated areas, and areas where woodland restoration thinning has been conducted. After the green-up of more beneficial ground vegetation, the opportunity of successful wildlife sightings and viewing may improve.

Hikers using the OHT will hear chainsaws; however noise intrusion would be limited as most sections within hearing distance of chainsaw thinning are short trail stretches of 0.25 miles or less. One continuous section of 0.9 miles will be adjacent to or surrounded by woodland restoration maintenance. However, noise intrusion would affect only a small portion of this trail section at one time for the individual or groups using the trail. A 200-foot buffer would be maintained on either side of the trail centerline where no thinning would occur. Use of prescribed fire and thinning to manage fuels, maintain or improve TES habitat, and maintain rare communities and species dependent on disturbance can occur within the trail corridor. This is specified as per Forest-Wide Plan Standards for Management Area 2.A (MA2.A-8). Hikers using the OHT will notice short term effects such as blackened ground and vegetation browning from the use of prescribed fire. Prescribed fire activities will be conducted in a manner to minimize impact on OHT values. Heavy equipment fire-line construction on the OHT footpath would not occur as per Forest-Wide Plan Standards for Management Area 2.A (MA2.A-10). Use of herbicide to control NNIS within the trail corridor may occur as per Forest-Wide Plan Standards for Management Area 2.A (MA2.A-8). Should this become necessary, hikers will notice browned vegetation in the short term. After green-up and recovery of native plant species, visual aesthetics would improve.

The Ozark Highland Trail (OHT) is in proximity or within several of the planned woodland restoration units. Two rock climbing areas authorized under special use permits are located within or adjacent to planned woodland restoration maintenance units. In addition, the OHT runs through the interior of the Morgan Mountain, Indian Creek, Lynn Hollow and Little Piney prescribed fire units. Prior to prescribed burn implementation, trail clearing

procedures designed to reduce negative impacts to recreational experience on the OHT and designed to protect public safety will be implemented (see Appendix C).

This alternative will not change long-term recreation use (camping, hiking the OHT, mountain bicycling, swimming, or fishing) in the project vicinity in a negative manner. Wildlife habitat work and woodland restoration activities would improve recreational uses such as wildlife viewing, hunting and fishing. User conflicts between adjacent landowners with OHVs and the growth of user-created OHV trails would be reduced with implementation of the Alternative 2 (Proposed Action), resulting in decreased erosion and forest damage.

Based on the analysis, there is nothing in Alternative 2 (Proposed Action) which would significantly affect any attributes which might make all or part of the District suitable for proposal as a special interest area for dispersed recreation or scenic quality. This alternative complies with the Revised Forest Land and Resources Management Plan.

Mitigation measures shown in Tables 11 and 21 would eliminate or reduce visual, access and smoke issues for recreation users of the OHT, special use rock climbing areas and developed recreation areas.

Table 21. Effects to Recreation Uses and Mitigation

Project Area	Planned Action	Recreation Resource Affected	Mitigation
303/15 – Arbaugh Glade	woodland restoration maintenance	OHT – approx. 0.25 mile of trail adjacent to stand (south side). **Visual effects**	Insure a 200 foot buffer remains uncut between stand and trail.
304/6 – Arbaugh Glade	woodland restoration maintenance	OHT – approx. 0.25 mile of trail adjacent to stand (south side). **Visual effects**	Insure a 200 foot buffer remains uncut between stand and trail.
448/6 –Beech Grove Road area	woodland restoration maintenance	OHT – approx. 0.5 mile of trail in interior of stand. **Visual effects**	Insure a 200 foot buffer remains uncut between stand and trail.
448/19 –Beech Grove Road area	woodland restoration maintenance	OHT – approx. 0.4 mile of trail in northwest portion of stand. **Visual effects**	Insure a 200 foot buffer remains uncut between stand and trail.
445/3 & 445/24 – Morgan Mountain area	woodland restoration maintenance	OHT – approx. 0.3 mile of trail in stands **Visual effects**	Insure a 200 foot buffer remains uncut between stand and trail.
451/3 –Carr Road area	woodland restoration maintenance	Desoto Boulders Special Use Permit (rock climbing) within stand – approx. size 20 acres. **Visual effects/Access effects**	Exclude permit area from thinning. Insure access to permit area (roads/trails) remains open. T. 12N, R. 25W, Section 19 N2 SENE, N2 SWNE, Section 20 S2 SWNW
451/4 –Carr Road area	woodland restoration maintenance	Desoto Boulders Special Use Permit (rock climbing) within stand – approx. size 20 acres **Visual effects/Access effects**	Exclude permit area from thinning. Insure access to permit area (roads/trails) remains open. T. 12N, R. 25W, Section 19 N2 SENE, N2 SWNE, Section 20 S2 SWNW

Table 21. Effects to Recreation Uses and Mitigation (Cont'd)

Project Area	Planned Action	Recreation Resource Affected	Mitigation
451/5 –Carr Road area	woodland restoration maintenance	Desoto Boulders Special Use Permit (rock climbing) within stand – approx. size 20 acres **Visual effects/Access effects**	Exclude permit area from thinning. Insure access to permit area (roads/trails) remains open. T. 12N, R. 25W, Section 19 N2 SENE, N2 SWNE, Section 20 S2 SWNW
Batson	prescribed fire	Horsehead Lake day use area and campground. **Visual effects/Access effects/Smoke effects**	Use law enforcement to block access road to campground if required. Notify campers of prescribed burning. Implement RX fire during low use seasons when possible. Close campground and day use area for duration of ignition if necessary.
Indian Creek	prescribed fire	OHT – approx. 9 miles of trail within the interior of burn areas. **Visual effects/Access effects**	Utilize trail clearing procedures as shown in Appendix C.
Little Piney Watershed – (Bee Ridge & Rosetta Project Areas)	prescribed fire	OHT – approx. 10 miles of trail within the interior of burn areas. **Visual effects/Access effects**	Utilize trail clearing procedures as shown in Appendix C.
Lynn Hollow	prescribed fire	OHT – approx. 1mile of trail within the interior of burn areas. **Visual effects/Access effects**	Utilize trail clearing procedures as shown in Appendix C.
Morgan Mountain	prescribed fire	OHT – approx. 3 miles of trail within the interior of burn areas. **Visual effects/Access effects** Redding campground – south perimeter of burn unit	Utilize trail clearing procedures as shown in Appendix C. Use law enforcement to block access road to campground if required. Notify campers of prescribed burning. Implement RX fire during low use seasons when possible. Close campground area for duration of ignition if necessary.
Sarah Hollow	prescribed fire	Wolf Pen recreation area – north perimeter of burn unit	Use law enforcement to block access road to campground if required. Notify campers of prescribed burning. Implement RX fire during low use seasons when possible. Close recreation area for duration of ignition if necessary.
454/36 – Wolf Pen Glade	prescribed fire	OHT – approx. 0.2 mile of trail adjacent to stand (northeast side). **Visual effects/Access effects**	Utilize trail clearing procedures as shown in Appendix C.

13. Herbicide Use

Significant Issues Related to the Resource

Issue # 5

5 – The effects of proposed management activities on water quality

Current Condition
Herbicide use is an important tool for benefiting oak/pine regeneration by providing for these species presence in the ecosystem in the long term. Effects of herbicide toxicity data and dosage estimates for triclopyr, imazapic, imazapyr, glyphosate and hexazinone proposed for use in these projects indicate that there is only a very low risk to wildlife, both from realistic and extreme exposures. Monitoring for herbicide concentrations following use has been a continuous policy of the Ozark-St. Francis National Forests. Monitoring results have not documented any significant on-site concentrations of herbicides or off-site movement. In a study regarding the use of herbicides in forestry applications (Michael, 2001), the author found that maximum pesticide concentrations observed in water have been much lower than the maximum levels which the Environmental Protection Agency (EPA) considers safe for consumption on a daily basis over a lifetime (Health Advisory Level-HAL). In some studies, the author reviewed maximum herbicide concentrations observed in ephemeral to first-order streams exceeded the lifetime HAL, but found that they last only a few hours and the highest concentrations did not exceed EPA's 1-day HAL.

Even with the widespread use of pesticides in North America, those typically used in forestry vegetation management programs have not been identified in surface or ground water at sufficiently high concentrations to impair drinking water quality. Their rapid break-down by physical, chemical, and biological routes coupled with current use patterns precludes the development of significant water contamination problems unless they are applied directly to water. Additionally, mitigation measures normally employed through State Best Management Practices (BMPs) further restrict herbicide's effects outside the boundaries of its application. On August 27 and 28, 2014, analysis of risk was performed for the chemicals 2,4-D, glyphosate, hexazinone, imazapic, imazapyr, triclopyr amine, and triclopyr ester at the proposed rates of application in SERA Risk Assessments prepared for the USDA Forest Service (SERA 2004, 2005, 2006, 2007 and 2011). Worksheets associated with the SERA risk assessments were completed for all proposed chemicals. Where required, application rates for each chemical were tailored to typical District use rates. In some instances, the standard application rate as modeled in the SERA worksheets was utilized when it was similar to typical District use rates.

In a variety of human health and environmental health scenarios (including a variety of wildlife scenarios) most HQs were projected to be below the Forest's maximum acceptable standard of 1. Adherence to Forest-Wide Standards for herbicide use and chemical labels for application will negate hazard quotients > 1 related to drift, accidental spills, run-off and applicator (worker) exposure. Parameters and output from these analyses are available as part of the process record at the Pleasant Hill Ranger District Office, 2591 Highway 21, Clarksville, Arkansas 72830.

All herbicide treatments would follow Forest-Wide Standards FW19 through FW32 included in the Revised Land and Resource Management Plan for the Ozark-St. Francis National

Forests, pages 3-4 through 3-5 (USDA Forest Service 2005). All herbicide treatments would follow Arkansas Forestry Commission Best Management Practices for Forest Chemicals 7.11 through 7.17 (AFC 2002). For all projects involving herbicide use, prior to application of approved chemicals an "Implementation Checklist for Invasive Plant Control" (see Appendix A) would be completed by the District Wildlife Biologist. These mitigation measures will greatly reduce the chance of workers being exposed and mitigate the very slight risk for any public exposure to these compounds.

2,4-D

The Forest Service does not typically employ 2,4-D in direct aquatic applications. Nonetheless, this type of treatment is occasionally necessary and this type of treatment was included in the SERA Risk Assessment to support this treatment option. In this proposal, 2,4-D would be used only to treat vegetation within ponds. Lab studies conducted on fish showed that behavior effects (impaired swimming) occurred on sunfish and carp when they were exposed to 100 ppm and 24 ppm of chemical (SERA, 2006). This is much greater than the 1-4 ppm specified on the chemical label for pond application, and which is the rate proposed for use.

2,4-D and its salts and esters are of low acute toxicity on the basis of oral, dermal and inhalation routes of exposure, and are not skin sensitizers or primary skin irritants. This herbicide is a severe eye irritant which is of concern to herbicide applicators. When applied at the rate specified on the herbicide label, there are no associated restrictions on swimming or fishing in the treated area.

Worksheets for Human Health and Ecological Risk Assessments for the chemical 2,4-D (SERA, 2006) were used to determine hazard quotients for workers, the general public and wildlife. Hazard quotients for workers > 1 are for individuals continuing work with contaminated gloves. Proper chemical handling and use of impervious rubber gloves mitigates this concern.

Hazard quotients for the general public are > 1 for acute ingestion of drinking water treated with 2,4-D; consumption of fish following spills of large amounts of this chemical into water; and consumption of contaminated terrestrial vegetation which has been treated with the upper field level concentrations of this chemical. The concern for these hazard quotients > 1 is reduced for the following reasons:

- 2,4-D will not be introduced into ponds which are utilized as drinking water or culinary sources.
- The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed on use of herbicides near water. Adherence to Forest-Wide Plan Standard FW30 precludes the possibility of large spills into water. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas. Chemical would be applied at the label application rates, with only the amount of chemical needed for the specific pond treatment being transported to the work site.
- Consumption of contaminated terrestrial vegetation is not of concern, since this chemical will not be used to treat terrestrial vegetation.

Hazard quotients for wildlife which are > 1 relate to direct spraying of 2,4-D upon a small mammal; acute consumption of terrestrial vegetation treated with 2,4-D by mammals;

chronic consumption of terrestrial vegetation treated with 2,4-D by mammals; and accidental spills affecting amphibians and aquatic macrophytes. The concern for these HQs > 1 is reduced for the following reasons:

- The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed on use of herbicides near water. Adherence to Forest-Wide Plan Standard FW30 precludes the possibility of large spills into water. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas. Chemical would be applied at the label application rates, with only the amount of chemical needed for the specific pond treatment being transported to the work site.
- Consumption of contaminated terrestrial vegetation is not of concern, since this chemical will not be used to treat terrestrial vegetation.

2,4-D will not be applied on land. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use and adherence to application instructions on chemical labels will mitigate hazard quotients > 1.

Glyphosate

This chemical is not soil active and has low toxicity to animals. When contacting eyes, Glyphosate is no more than slightly irritating based on toxicity studies; with skin contact is not more than slightly toxic and not more than slightly irritating based up toxicity studies; when ingested is no more than slightly toxic based on toxicity studies – with no significant adverse health effects expected if only small amounts (less than a mouthful) are swallowed; when inhaled is no more than slightly toxic based on toxicity studies (MSDS for Foresters' Non-Selective Herbicide dated 11/26/2008). Lab studies conducted specifically on bobwhite quail also demonstrate extremely low toxicity.

Worksheets for Human Health and Ecological Risk Assessments for the chemical Glyphosate (SERA, 2010) were used to determine hazard quotients for workers, the general public and wildlife. All hazard quotients for humans and terrestrial wildlife are less than 1.0. Hazard quotients for many aquatic species are greater than 1 (see process record for specific numbers). These higher hazard quotients – suggesting risk to these species, were modeled from accidental chemical spills into aquatic environments. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use, adherence to Best Management Practices (BMP's) and adherence to application instructions on chemical labels mitigates hazard quotients > 1.

Hexazinone

This chemical is soil active, and if not applied correctly has the ability to move off site. Use of chemical label application rates and application methods, Forest-Wide Standards and BMPs mitigate this potential.

Contact with hexazinone may cause corneal opacity or clouding of the eye and skin irritation or rash. Based on animal data, ingestion of large amounts of hexazinone may cause effects on the liver. Significant skin permeation and systemic toxicity after contact appear unlikely (MSDS for Velpar L dated 11/4/2010). Hexazinone is practically non-toxic to fish, fresh water invertebrates and mollusks, and is slightly toxic to crustaceans. When hexazinone is ingested by animals, it is broken down into metabolites which are rapidly excreted in the

urine and feces. Hexazinone does not accumulate in the tissues of exposed animals (USDA, 2012).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Hexazinone (SERA, 2006) were used to determine hazard quotients for workers, the general public and wildlife. All hazard quotients for workers (herbicide applicators) are less than 1, with the exception of hazard quotients modeled for application of upper level field solution concentrations (see process record for specific numbers). These upper level field solution concentrations are not used on the District. This mitigates these hazard quotients > 1.

All hazard quotients for the general public related to use of granular formulations of hexazinone were less than 1.

All hazard quotients for the general public related to use of liquid formulations of hexazinone were less than 1, with the exception of use of upper level field solution concentrations causing hazard quotients > 1.0 for adult females consuming contaminated fruit and contaminated vegetation (see process record for specific numbers). Also, modeling of central level field solution concentrations caused a hazard quotient > 1 for adult females consuming contaminated vegetation (see process record for specific numbers). The concern for hazard quotients > 1 are reduced for the following reasons:

- The scenario modeled assumes contaminated vegetation/fruit is consumed by the individual for 90 days.
- Contaminated vegetation would show signs of stress/mortality before the termination of this 90-day period thereby discouraging and individual from eating it.
- The scenario assumes that hexazinone is applied to the foliage/fruit of vegetation. Soil application of this chemical is utilized on the District, not foliar spray application.

All hazard quotients for wildlife related to use of granular formulations of hexazinone were less than 1, with the exception of hazard quotients for some aquatic organisms (see process record for specific numbers). These higher hazard quotients – suggesting risk to these organisms, were modeled from accidental chemical spills into aquatic environments, and movement of higher field solution concentrations of this chemical off site into aquatic environments. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use, adherence to BMPs and adherence to application instructions on chemical labels will mitigate hazard quotients > 1.

All hazard quotients for wildlife related to use of liquid formulations of hexazinone were less than 1, with the exception of the hazard quotient for long term exposure of a large mammal on site, and hazard quotients for some aquatic organisms (see process record for specific numbers). The concern for these hazard quotients > 1 is reduced for the following reasons:

- The scenario assumes a diet composed of 100% contaminated vegetation or insects from the treated site which is highly unlikely.
- The long term hazard quotient assumes that vegetation is consumed on the same site for 90 days which is also unlikely.

Higher hazard quotients – suggesting risk to some aquatic organisms, were modeled from accidental chemical spills into aquatic environments, and movement of higher field solution concentrations of this chemical off site into aquatic environments (see process record for specific numbers). Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use and adherence to application instructions on chemical labels will mitigate hazard quotients > 1.

Imazapic

This chemical is weakly adsorbed in basic soils, but adsorption increases in acidic soils. Field studies have not shown movement of this chemical in surface water. This herbicide has low toxicity to animals. There is a high probability that imazapic is not acutely harmful to aquatic invertebrates, aquatic plants or fish. In addition, this chemical is non-irritating with exposure to skin and eyes (MSDS for Plateau dated 3/5/2012).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Imazapic (SERA, 2006) were used to determine hazard quotients for workers, the general public and wildlife. All hazard quotients for humans and terrestrial wildlife are less than 1. Hazard quotients for some aquatic organisms are greater than 1 (see process record for specific numbers). These higher hazard quotients – suggesting risk to these species, were modeled from accidental chemical spills into aquatic environments. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use, adherence to BMPs and adherence to application instructions on chemical labels will mitigate hazard quotients > 1.

Imazapyr

Imazapyr is soil active, but mobility in soil is relatively low. It can be soil active particularly during spring leaf expansion. Application after mid-September may yield soil activity the following spring. This chemical has very low toxicity to mammals or other animals. It may cause slight but temporary irritation to the eyes and skin if exposure occurs (MSDS for Arsenal AC dated 6/15/2009).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Imazapyr (SERA, 2011) were used to determine hazard quotients for workers, the general public and wildlife. All hazard quotients for humans and terrestrial wildlife are less than 1. Hazard quotients for some aquatic organisms are greater than 1 (see process record for specific numbers). These higher hazard quotients – suggesting risk to these species, were modeled from generally central and upper field solution concentrations representing either accidental or deliberate exposure to the chemical and long-term exposure. Forest-Wide standards preclude application of herbicide not labeled for aquatic use near or within aquatic environments. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use, adherence to BMPs and adherence to application instructions on chemical labels will mitigate hazard quotients > 1 for aquatic organisms.

Non-targeted plants which are also non-tolerant to this chemical, could be killed if they are within close proximity to targeted plants. This could indirectly affect habitat for wildlife on a small scale. However, the majority of application of this herbicide is through the cut surface or hack and squirt application methods – not foliar spraying. Therefore, the typical application method used for this chemical greatly limits the amount of non-target plant mortality.

Triclopyr Amine and Triclopyr Ester

Triclopyr is not soil active, except in examples of spills or misapplications not in accordance with label application rates. These chemicals have low bioconcentration potential and single-dose toxicity to mammals is low although prolonged or repeated exposure may cause skin irritation in mammals and corneal damage if introduced into the eye (MSDS for Element 3A Herbicide dated 5/25/2011). Worksheets for Human Health and Ecological Risk Assessments for the chemical Triclopyr (USDA, 2011) were used to determine hazard quotients for workers, the general public and wildlife. Both ester and amine formulations of this chemical were investigated.

All hazard quotients for workers (handling herbicide) related to use of triclopyr amine and ester formulations were less than 1, with the exception of use of upper level field solution concentrations causing hazard quotients > 1 for workers with contaminated gloves worn for more than one hour when applying the ester formulation (see process record for specific numbers). This upper bound HQ would be mitigated by changing contaminated protective clothing, washing following contamination as directed by policy and by wearing rubber gloves impervious to the chemical.

Hazard quotients for workers associated with chronic exposure (repeated long term) are ≥ 1 for broadcast spray applications of triclopyr amine and > 1 for backpack and broadcast spray applications of triclopyr ester – all at the upper application level field solution concentrations (see process record for specific numbers).

Modeling shows that some workers applying triclopyr ester at the modeled application rate of .48 lb a.e./acre will be subject to exposures that exceed a hazard quotient of 1, by a substantial margin. The concern for hazard quotients > 1 for workers – taken from very conservative modeling is reduced by the following:

- Overt toxic effects in workers do not appear to be likely. There are no epidemiology studies or case reports which suggest that systemic toxic effects are associated with occupational or even accidental exposures to any form of triclopyr; furthermore, no poisoning reports involving any form of triclopyr are documented in the reasonably comprehensive summary of human case reports on pesticide exposures by Hayes (1982).

Hazard quotients for the general public are > 1 for situations modeled from accidental spills of triclopyr amine into small ponds with the water consumed by a child (see process record for specific numbers). These upper bound hazard quotients are derived from spillage of the upper application level of field solution concentrations for both foliar application and hack and squirt application. The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed on use of herbicides near water.

- Adherence to Forest-Wide Plan Standard FW30. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas.
- Adherence to Forest-Wide Plan Standard FW32. Herbicide will not be used within the appropriate SMZs (streamside management zones) or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a “Finding of No Significant Impact”

(FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas.

Hazard quotients for the general public are ≥ 1 for non-accidental acute exposure (single exposure) for both triclopyr amine and ester formulations for adult female consumption of contaminated fruit, and skin contact with contaminated vegetation. These hazard quotients are associated with both the central and upper application levels of field solution concentrations (see process record for specific numbers). The concern for hazard quotients > 1 for the general public – taken from very conservative modeling is reduced by the following:

- The modeling assumes that the adult female walks through an area shortly after treatment (vegetation still wet), wearing shorts. In most cases, herbicides are applied in relatively remote areas, and so it is not likely that members of the general public would be exposed to contaminated plants shortly after treatment (SERA, 2007). This general exposure scenario for the public may be implausible or at least extremely conservative.
- For contaminated fruit, the exposure scenario assumes that an area of edible plants is inadvertently sprayed. While such inadvertent contamination might occur, it is extremely unlikely to happen as a result of directed applications (backpack or broadcast applications). In all spraying scenarios, the possibility of inadvertent contamination of cultivated or edible wild vegetation would be low. For herbicides, it is likely that the contaminated plants would show obvious signs of damage over a relatively short period of time and would therefore not be consumed (SERA, 2007).
- Project level mitigation measures for herbicide use state "Edible berries would not be treated with herbicide."
- The typical hazard to the general public may often be negligible because significant levels of exposure are not likely. For the public, the general exposures may be regarded as extreme in that they are based on very conservative exposure assessments and/or very implausible events. These general exposure assessments are included because the risk assessment is intended to be extremely conservative with respect to potential effects on the general public (SERA, 2007).

Hazard quotients for the general public are ≥ 1 for chronic/longer term exposures for both triclopyr amine and ester formulations for adult female consumption of contaminated fruit and vegetation. These hazard quotients are associated with only the upper application levels of field solution concentrations (see process record for specific numbers). The concern for hazard quotients > 1 for the general public – taken from very conservative modeling is reduced by the following:

- The exposure scenarios based on longer-term consumption of contaminated fruit and vegetation assume that an area of edible plants is inadvertently sprayed and that these plants are consumed by an individual over a 90-day period. With herbicide use, it is likely that the contaminated plants would show obvious signs of damage over a relatively short period of time and would therefore not be consumed (SERA, 2007).
- Project level mitigation measures for herbicide use state "Edible berries would not be treated with herbicide."
- The amount of non-target vegetation subject to spray deposition is small. The average half-life of this chemical is 30 days; degraded by both soil microbes and

photolysis. The concern that humans would eat contaminated vegetation for 90 days is field conditions is further reduced by the average half-life of this chemical.

- Herbicide treatments occur on an infrequent basis in project areas – with applications usually separated by multiple years.
- The typical hazard to the general public may often be negligible because significant levels of exposure are not likely. For the public, the general exposures may be regarded as extreme in that they are based on very conservative exposure assessments and/or very implausible events. These general exposure assessments are included because the risk assessment is intended to be extremely conservative with respect to potential effects on the general public (SERA, 2007).

Hazard quotients for terrestrial animals are > 1 for situations modeled from accidental spills of triclopyr amine into small ponds. In these scenarios, the contaminated water is consumed by a large mammal, and fish from the contaminated water are consumed by a large mammalian carnivore and a canid. These upper bound hazard quotients are derived from spillage of the upper application level of field solution concentrations for hack and squirt application where a higher concentration of chemical is used (see process record for specific numbers). The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed upon use of herbicides near water.

- Adherence to Forest-Wide Plan Standard FW30. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas.
- Adherence to Forest-Wide Plan Standard FW32. Herbicide will not be used within the appropriate SMZs (streamside management zones) or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas.

Hazard quotients for terrestrial animals are ≥1 for scenarios modeled from some mammals and birds consuming contaminated vegetation with high residue rates, and some instances of large mammals and small birds consuming contaminated fruit with low residue rates. These hazard quotients are associated with both the central and upper application levels of field solution concentrations (see process record for specific numbers). The concern for hazard quotients ≥1 for terrestrial wildlife - taken from very conservative modeling - is reduced by the following:

- For both the acute and chronic exposure scenarios, the assumption is made that 100% of the diet is contaminated. This may not be a realistic assumption for some acute exposures and will probably be a rare event in chronic exposures—i.e., animals may move in and out of the treated areas (SERA, 2011).
- Chronic hazard quotients assume that vegetation is consumed on the contaminated site for 90 days. This general, chronic exposure scenario for terrestrial wildlife may be implausible or at least extremely conservative.
- Project level mitigation measures for herbicide use state "Edible berries would not be treated with herbicide."

- The amount of non-target vegetation subject to spray deposition is small. The average half-life of this chemical is 30 days; degraded by both soil microbes and photolysis. The concern that humans would eat contaminated vegetation for 90 days is field conditions is further reduced by the average half-life of this chemical.
- Herbicide treatments occur on an infrequent basis in project areas – with applications usually separated by multiple years.

As reviewed in U.S. EPA/OPP (2009a, p. 82 ff) and detailed in Appendix O of the EPA Risk Assessment, the U.S. EPA/OPP maintains a database of ecological incidents associated with pesticide applications. A total of 63 incidents regarding triclopyr applications were reported to the EPA. None of these incidents reported adverse effects in mammals. As summarized in Appendix 2, Table A2-10, of the SERA (2011) triclopyr risk assessment, none of the available field studies associate adverse effects in mammals with the direct toxicity of triclopyr (SERA, 2011).

Two general factors may contribute to the apparent discrepancy between the high hazard quotients for triclopyr and the lack of reported adverse effects in field studies or incident reports. Like the human health risk assessment, the ecological risk assessment uses the extreme value approach. The upper bound hazard quotients represent multiple worst case exposure assumptions that may not occur frequently in the field. Also, the field study by Leslie et al. (1996) suggests that some mammals, such as deer, may avoid treated areas. As discussed in the exposure assessment, the scenarios for the consumption of contaminated vegetation assume that 100% of the diet is contaminated. If larger mammals avoid treated areas, the proportion of the contaminated diet could be much less than 100%. As the proportion of the diet that is contaminated decreases, the consequent hazard quotients will also decrease (SERA, 2011).

Hazard quotients are ≥1 for scenarios modeled for some aquatic organisms. These upper bounds hazard quotients are associated primarily with scenarios involving accidental acute exposure (one time exposure through a spill), a few through non-accidental acute exposure (one time exposure through direct spraying) and a few through chronic/longer term exposure. These hazard quotients are associated with both the lower, central and upper application levels of field solution concentrations, depending upon the sensitivity of the species (see process record for specific numbers). The concern for hazard quotients ≥ 1 for aquatic organisms - taken from very conservative modeling - is reduced by the following:

- Neither terrestrial nor aquatic applications of triclopyr amine pose substantial risks to aquatic animals across the range of labeled application rates. Triclopyr ester, however, is much more toxic than triclopyr amine to aquatic animals. At application rates in excess of about 3 lb a.e./acre, peak concentrations of triclopyr ester in surface water could pose acute risks to sensitive species of fish and aquatic phase amphibians. Similarly, acute risks to sensitive species of aquatic invertebrates could occur if application rates exceed about 1.5 lb a.e./acre (SERA, 2011). The typical District application rates of .36 - .48 lb a.e./ac is much less than this. The likelihood of acute risks to aquatic animals depends very much on site-specific conditions. In areas with low rates of rainfall, acute risks to aquatic animals would be negligible, so long as drift to surface water were minimal. In areas with high rates of rainfall, the surface water contamination is more likely (SERA, 2011).
- Adherence to Forest-Wide Plan Standard FW30 would minimize possibilities of spills of concentrated chemical entering water. Herbicide mixing, loading, or cleaning

areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas (USDA, 2005).

- Adherence to Forest-Wide Plan Standard FW32 would minimize possibilities of herbicide drift to surface waters. Herbicide will not be used within the appropriate SMZs (streamside management zones) or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas (USDA, 2005).
- Adherence to Forest-Wide Plan Standard FW23 would minimize the possibility of contamination of surface water through wind drift of herbicide. Weather is monitored and the project is suspended if temperature, humidity, and/or wind do not meet Forest-Wide Plan Standards criteria.
- Adherence to Arkansas Forestry Best Management Practice (BMP) for Water Quality Protection 7.15 – precludes chemical application immediately before precipitation, or after a rain if there is still runoff. Upcoming storm predictions are utilized to time chemical application (AFC, 2002).

On occasion it is more effective for herbicides to be mixed together. For example, when trying to eradicate fescue, mixtures of Glyphosate and Imazapyr are recommended. Application of herbicide for cut surface application may occasionally require mixing Triclopyr and Imazapyr, or Glyphosate and Imazapyr to control red maple. Mixing these herbicides does not increase potential toxicity to humans or wildlife. Hazard quotients for wildlife and humans would fall within the ranges modelled and discussed above through use of SERA Worksheets for Human Health and Ecological Risk Assessments.

Additionally, in order to improve the success of herbicide (foliar) applications, a surfactant (Cide-Kick, Cide-Kick II, JLB Oil Plus, JLB Oil and Red River 90) may be mixed with the above mentioned herbicides. These are non-ionic surfactants. They are added to aid the chemical in adhering to and/or penetrating the leaf's surface. Hazard quotients for wildlife and humans would fall within the ranges modelled and discussed above for individual herbicides through use of SERA Worksheets for Human Health and Ecological Risk Assessments. Surfactants increase the effectiveness of herbicides on plants, but do not increase risk to humans or wildlife. However, surfactants can affect aquatic species by disrupting oxygen transfer from water across the gill membrane. Adherence to Forest-Wide Standards FW23, FW30 and FW32 as well as Arkansas Forestry BMP 7.15 precludes entry of surfactants into water.

As per Forest-Wide Standard FW20, diesel oil is prohibited from use as a carrier or surfactant. (USDA, 2005).

Active ingredients for surfactants used by the District are:

- Red River 90- Alkylarpolyoxethylene, glycols, and free fatty acids.
- Cide-Kick – D'limonene, related isomers, and emulsifiers (citrus oil)
- Cide-Kick II – D'limonene, related isomers, and emulsifiers (pine oil)
- JLB Oil Plus – vegetable and limonene oil

Chemical composition of surfactants is innocuous. Surfactants proposed for use are not known to increase potential toxicity of herbicide in relation to humans or wildlife. They assist herbicide in adhering to plant surfaces and/or penetrating the targeted surface of foliage.

Direct, Indirect, and Cumulative Effects

Direct effects, occurring at time of application, to birds or large mammals are unlikely since these species are likely to move from the area when project activities are implemented. Although direct effects to amphibians are more likely since contact with herbicide could be absorbed through the skin, amphibians are likely to be under logs, rocks or leaves, making direct contact (from spray) with chemicals less likely. Direct effects to other non-target plants occurring in these habitats could occur. However, application methods, including directed application to target foliage or to freshly cut stumps/surfaces, would minimize the possibility of direct contamination to non-target species. The most plausible possible direct effects to humans would be to workers from continuing work in contaminated clothing. Proper handling, cleanliness and use of personal protective gear would mitigate this possibility. More implausible direct effects to the general public may occur through walking through recently treated (wet) vegetation in shorts and consuming contaminated fruit. Narrative (shown above) for hazard quotients ≥ 1 for non-accidental acute exposure (single exposure) for both triclopyr (amine and ester formulations) and hexazinone shows these situations are unlikely.

Direct effects to small wildlife species (reptiles, amphibians, rodents) is mitigated by proper use of cut surface herbicide application and foliar spraying directed at target vegetation.

Direct and indirect effects from chemical spills of all herbicides analyzed (to humans, wildlife and plants) are minimized by following proper mixing and handling procedures, Forest-Wide Standards and best management practices.

Indirect effects to humans and wildlife from consuming contaminated fruit is reduced by project level mitigation prohibiting treatment of edible berries with herbicide.

Adverse, indirect effects to MIS and habitats treated with all chemicals are reduced given that applicators treat target plants only, field formulations contain diluted concentrations of chemical and that mitigation measures, best management practices, project mitigation measures and Forest-Wide Standards will be used.

There are likely to be no negative cumulative effects to humans, wildlife or plants over time as a result of implementing Alternative 2 (Proposed Action). None of the herbicides proposed for use will bio-accumulate or have lengthy half lives in the environment.

Related to cumulative impacts, the Pleasant Hill Ranger District is authorized under previous NEPA analyses to apply herbicide for silvicultural purposes on approximately 500-1000 acres annually. Some authorized maintenance of utility corridors, and gas well pads with herbicide occurs on the District. Realistically, for the reasonably foreseeable future this may amount to 3,750 acres of silvicultural herbicide treatment and utility/gas pad maintenance on the District over the next five years. No other herbicide projects are known from the Ozark National Forest or the vicinity at present, though some herbicide use is likely to occur on private lands particularly in association with agricultural production. Efforts to maintain

early seral habitat and restore herbaceous species biodiversity in woodlands, and timber stand improvement (TSI) treatments to benefit hard mast producing species are also likely to cumulatively benefit associated MIS species.

The past and proposed use of herbicides would have no plausible negative direct, indirect or cumulative effects on humans, water quality or wildlife with adherence to Forest-Wide Standards FW19 - FW 32 (USDA, 2005), application and mixing guidelines from chemical labels, project specific herbicide mitigation measures and BMPs. Proposed herbicide use would have beneficial effects on species using early-successional habitat and/or requiring herbaceous diversity by creating and maintaining wildlife openings, restoring and maintaining native warm season grass fields, restoring and maintaining woodland conditions, and promoting oak and pine regeneration through TSI cultural practices.

Implementation of Alternative 2 (Proposed Action) would provide a level of indirect benefits to wildlife that would not be expected with implementation of Alternative 1. Herbicide use would increase the levels of early successional habitat, increase diversity of herbaceous species in woodland restoration areas and reduce NNIS species above levels which would be expected with implementation of Alternative 1.

Part 4 – Consultation and Coordination

The Forest Service consulted the following individuals, Federal, State, and local agencies, Native American tribes and non-Forest Service persons during the development of this environmental assessment:

ID TEAM MEMBERS:

Name	Position	Office
Mary Brennan	Zone Archaeologist	Pleasant Hill/Boston Mountain Ranger Districts
Tom Cravens	Forester	Pleasant Hill Ranger District
Dan Martin	Fire Management Officer	Pleasant Hill Ranger District
Pat Kowalewycz	District Ranger	Pleasant Hill Ranger District
Matt Pfeifler	Other Resources Assistant/NEPA Coordinator	Pleasant Hill Ranger District
Greg Taylor	Wildlife Biologist	Pleasant Hill Ranger District

FEDERAL, STATE, AND LOCAL AGENCIES:

Name	Position	Office
Melvin Tobin	Deputy Field Supervisor	U.S. Fish and Wildlife Service, Conway, Arkansas
Benny Bowers	Wildlife Biologist	Arkansas Game & Fish Commission, Eureka Springs, Arkansas
Matthew Melson	Wildlife Biologist	Arkansas Game & Fish Commission, Eureka Springs Arkansas
Frances McSwain	Deputy State Historic Preservation Officer	Department of Arkansas Heritage

NATIVE AMERICAN TRIBES/NATIONS:

Name	Location
Caddo Indian Tribe of Oklahoma	Binger, Oklahoma
Cherokee Nation of Oklahoma	Tahlequah, Oklahoma
Osage Tribe	Pawhuska, Oklahoma
Quapaw Tribe of Oklahoma	Fayetteville, Arkansas

OTHERS:

Interested Citizens on the Pleasant Hill Mailing List
(Received Public Scoping Notice)

Allen, Chris, 1690 CR 4200, Clarksville, AR 72830
Artley, Dick, 415 Northeast 2nd Street, Grangeville, ID 83530
Bowers, Benny, AGFC P.O. Box 286, Paris, AR 72855
Eichenberger, Frank, 391 Parette Lake Rd., Morrilton, AR 72110
Gainey, David & Claire, 592 CR 3537, Clarksville, AR 72830
Goodman, Sarah, 2469 CR 3341, Clarksville, AR 72830
Hooks, Glen, Sierra Club-state rep., 1308 West Second Street, Little Rock, AR 72201
Lacy, H. Miles, Green Bay Packaging, Inc., P.O. Box 711, Morrilton, AR 72110
Lewis, Nancy, Hwy 215 N, P.O. Box 58, Oark, AR 72852
Meers, Richard, 6228 Fallstone Rd., Fort Smith, AR 72916-8964
Michelson, Mike, 17504 Hwy 21, Ozone, AR 72854
Newton Co. Wildlife Association, HC 33, Box 40, Pettigrew, AR 72752

Appendix A
Implementation Checklist for Invasive Plant Control

The following implementation checklist will be completed prior to the implementation of any projects associated with the proposed action**.**

IMPLEMENTATION CHECKLIST NON-NATIVE INVASIVE SPECIES CONTROL

Comp/St.	**NNIS Species :**	**Approx. Patch Size:**
Habitat:		
Coordination w/Private Landowner Needed? Yes / No		

Threatened, Endangered, or Sensitive Species Habitat

Does high quality habitat for threatened, endangered, or sensitive plants or amphibians occur in the area proposed for treatment? Has the site been surveyed for Threatened, endangered or sensitive (TES) plants or amphibians? If TES plants or animals occur or potentially occur in the project area, describe how this project has been mitigated.

_____
_____
_____

Soil, Water and Aquatic Habitat

Does aquatic or riparian habitat occur in the area proposed for treatment? Is a herbicide labeled for use in wetlands being applied? Is other mitigation needed? If so, please state.

_____
_____
_____
_____

This project area has been reviewed to ensure compliance with the terms and conditions of the Decision Notice for the Pleasant Hill Wildlife Habitat Improvement Project which covers project activities.

WildlifeBiologist/Botanist:_____Date:_____

APPENDIX B
Response to Public Comments

No comments were received from the public during the scoping period spanning May 15, 2014 to June 14, 2014. Once a legal notice of Opportunity to Comment is posted in the newspaper of record – 36 CFR 218.25(a), the public will have 30 days to provide comments on the Draft Environmental Assessment.

APPENDIX C
Ozark Highlands Trail – Trail Clearing Procedures

Trail Clearing Procedure for Prescribed Burning
Pleasant Hill Ranger District
Ozark National Forest

Procedure

Post administrative maps that will depict areas to be burned for the current year at the Pleasant Hill Ranger District Office located at 2591 Highway 21 North in Clarksville, Arkansas. Post and maintain maps at all trailhead kiosk, plus other public contact points. Maps will be posted from *October 1 through April 30* of each fiscal year. Trailheads and FS Public Contact Points are defined as locations or media that can be used to disseminate information for a specific prescribed burn area. (Contact Points utilized will only consist of the ones affected by a specific burn area).

Trailheads and Forest Service Public Contact Points are as follows: ***** *indicates trailhead*

OHTA Website (update via tim@timernst.com)
FS Website (visit site to ensure burn area info is current)
Fanes Creek Road
***** Cherry Bend
Turner Bend Store
Fleming Creek Road
Morgan Road/Fly Gap
***** Morgan Fields
Redding Recreation Area
Spy Rock Loop
***** Redding
***** Lick Branch
Little Mulberry Crossing
***** Arbaugh TH
Moonhull CR Crossing
Oark Road
Fallsville Store
***** Ozone
Ozone Recreation Area
Mt. Pleasant CR Crossing
Mt. Levi CR crossing
Rossetta CR crossing
State Highway 123 Crossing
***** Haw Creek
Haw Creek Falls Recreation Area

To accomplish posting, updating, and clearing the trails, a “Trails Team” will be assigned the duty of completing the tasks, while maintaining coordination with the Fire Management Officer (FMO). The “Trails Team” will be comprised of recreation personnel who are familiar with the trails.

"Trails Team" Procedures and Responsibilities

- Keep all maps posted and updated. If any maps need to be replaced inform the FMO for a laminated replacement.

- Post all planned burn areas 10 days prior to anticipated burn date with the orange colored "Prescribed Burning Area" sign and write in the necessary information. Post signs on the entry point into the burn with the sign facing out. Place another sign 50-100 feet further in on the trail. Also, place sign where a road goes into the burn.

- 24-48 hours prior to burning an area a "Do Not Enter" or "Fire line, Do Not Cross" flagging tape will be placed across trails where they enter a planned burn area.

- Check all affected trailhead registers to see who might be in the area.

- Check with District Office Receptionist regarding known hiker itineraries within burn area.

- Reconnaissance on trail will be performed on day of burn *prior* to ignition to ensure hikers are not present. ("Trails Team" performing recon on the trail should identify themselves as Forest Service Employees when encountering the public).

- A flyover reconnaissance will be performed over the trail on larger burns.

- Contacted individuals will be asked if any other parties are in the area. Inquiry should consist of number of individuals, times, and known itineraries. (The Burn Boss will be immediately notified of "contacts").

- The prescribed burn will not be initiated until verification is made that the contacted public and/or suspected other publics are clear of the burn area.

- The "Trails Team" will also be the group utilized as road guards and as shuttle service.

PAT KOWALEWYCZ	**Date**	**DAN MARTIN**	**Date**
District Ranger		**FMO**	

APPENDIX D
Protection Measures for Historic Properties

The following measures only apply to cultural resource sites that are unevaluated, eligible for listing, or listed in the National Register of Historic Places.

HP1: Site Avoidance during Project Implementation
Avoidance of historic properties will require the protection from effects resulting from the undertaking. Mitigation measures include establishing clearly defined site boundaries and buffers around archeological sites where activities that might result in an adverse effect and routing proposed new roads, temporary roads, log landings, and skid trails away from historic properties. Buffers will be of sufficient size to ensure that site integrity is not compromised.

HP2: Site Protection during Prescribed Burns

(1) *Firelines.* Historic properties located along existing non-maintained woods roads used as fire lines will be protected by hand-clearing those sections that cross the sites. Although these roads are generally cleared of combustible debris using a small dozer, those sections crossing archeological sites will be cleared using leaf blowers and/or leaf rakes. There will be neither removal of soil, nor disturbance below the ground surface, during fireline preparation. Historic properties and features located along proposed routes of mechanically-constructed firelines, where firelines do not now exist, will be avoided by routing fireline construction around historic properties. Sites that lie along previously constructed dozer lines from past burns (where the firelines will be used again as firelines) will be protected during future burns by hand clearing sections of line that cross the site, rather than re-clearing using heavy equipment. Where these activities will take place outside stands not already surveyed, cultural resource surveys and consultation will be completed prior to project implementation. Protection measures HP1, HP3, and HP4 will be applied prior to project implementation to protect historic properties.

(2) *Burn Unit Interior.* Combustible elements at historic properties in burn unit interiors will be protected from damage during burns by removing excessive fuels from the feature vicinity and, where applicable, by burning out around the feature prior to igniting the main burn and creating a fuel-free zone. Historic properties containing above ground, non-combustible cultural features and exposed artifacts will be protected by removing fuel concentrations dense enough to significantly alter the characteristics of those cultural resources. For sites that have been previously burned or that do not contain combustible elements or other above-ground features and exposed artifacts, no additional measures are proposed. Past research indicates that prescribed burning will not be sufficiently intense to cause adverse effects to these features.

(3) *Post-Burn Monitoring.* Post-burn monitoring may be conducted at selected sites to assess actual and indirect effects of the burns on the sites against the expected effects. SHPO consultation will be carried out with respect to necessary mitigation for any sites that suffer unexpected damage during the burn or from indirect effects following the burn.

HP3: Other Protection Measures
If it is not feasible or desirable to avoid an historic property that may be harmed by a project activity (HP1), then the following steps will be taken:

(1) In consultation with the Arkansas SHPO, the site(s) will be evaluated against NRHP significance criteria (36 CFR 60.4) to determine eligibility for the NRHP. The evaluation may require subsurface site testing;
(2) In consultation with the Arkansas SHPO, relevant federally-recognized Tribes, and if required with the ACHP, mitigation measures will be developed to minimize the adverse effects on the site, so that a finding of No Adverse Effect results;
(3) The agreed-upon mitigation measures will be implemented prior to initiation of activities having the potential to affect the site.

HP4: Discovery of Cultural Resources during Project Implementation
Although cultural resources surveys were designed to locate all NRHP eligible archeological sites and components, these may go undetected for a variety of reasons. Should unrecorded cultural resources be discovered, activities that may be affecting that resource will halt immediately; the resource will be evaluated by an archaeologist, and consultation will be initiated with the SHPO, tribes and nations, and the ACHP, to determine appropriate actions for protecting the resource and mitigating adverse effects. Project activities at that locale will not resume until the resource is adequately protected and until agreed-upon mitigation measures are implemented with SHPO approval.

APPENDIX E

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APPENDIX F
Maps (Project Area and Vicinity)