United States Department of Agriculture

Forest Service

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DRAFT Environmental Assessment

Locust Gap Project

Pleasant Hill Ranger District, Ozark – St. Francis National Forests
Johnson County, Arkansas

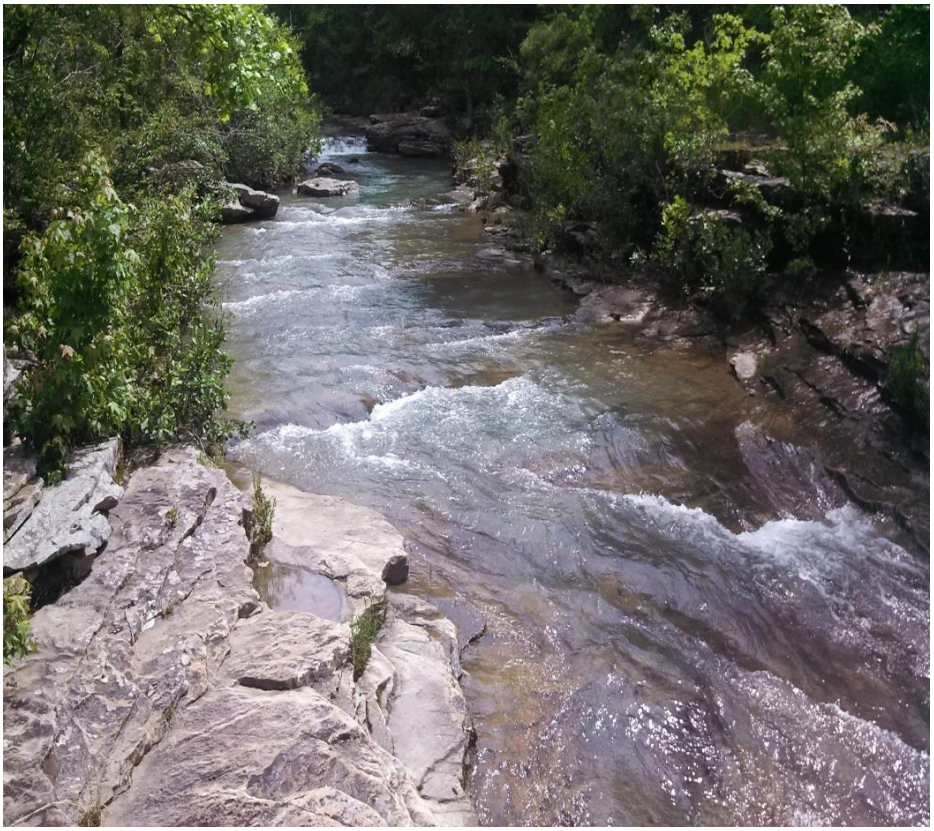

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TABLE OF CONTENTS

TABLES

FIGURES

Additional project maps are attached with the EA

SUMMARY

The Pleasant Hill Ranger District is proposing to improve ecosystem health, manage vegetation to improve forest stands, enhance wildlife habitat, and improve recreational opportunities in the **Locust Gap Project** of the Ozark-St. Francis National Forests (OSNFs) located in Madison County, Arkansas. The actions we are proposing include enhancing wildlife and fish habitat; regeneration cutting as well as thinning timber for biodiversity, forest health, and visual quality; decommissioning roads (some by gating) while improving others; and reducing the build-up of hazardous fuels through prescribed burning. The activities would occur on ***federal lands only***. The project area of **Locust Gap** comprises a total of approximately 10,553 total acres; 7,049 acres of National Forest land and 3,504 acres of private land. The Locust Gap Project area includes compartments 270, 271, 272, 276, 277, and 278. The legal description is T13N R25W Sections 1 and 12; T13N R24W Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, and 18; T14N R25W Sections 26, 35, and 36; and T14N R24W Sections 21, 28, 29, 30, 31, 32, and 33 (Figure 1). The project area is bounded on the north, east, and west by State Highway 16 while the southern boundary is bounded by Madison County Road 4310 and Clifty Creek. The town of Red Star is situated on the northern boundary of Locust Gap. Locust Gap is also approximately 6.5 miles to the north and west of Fallsville and approximately 11 miles east of St. Paul.

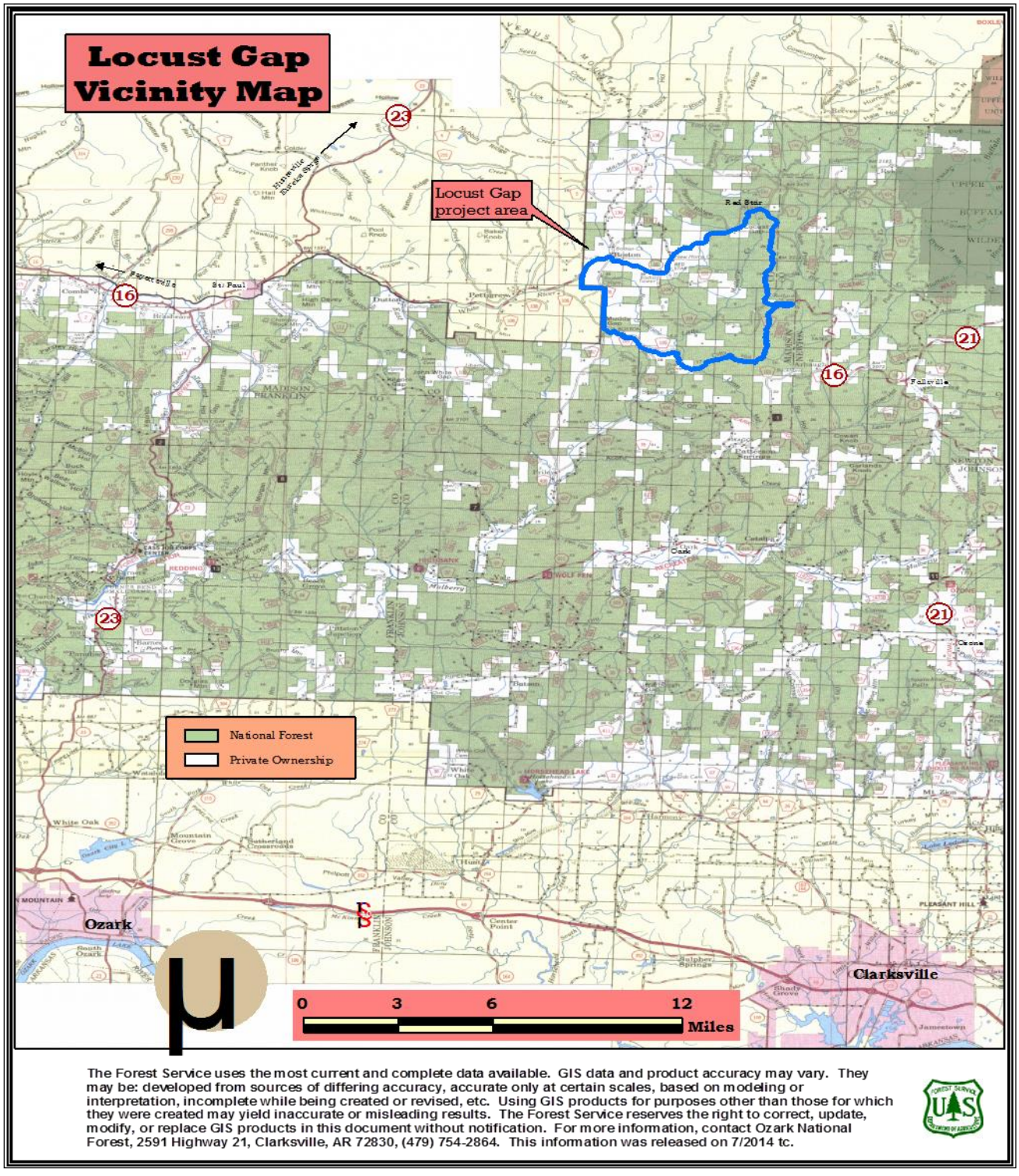

Figure 1. Vicinity Map

The Locust Gap Project area falls within the following management areas (MAs): Scenic Byway Corridor (1.H), Oak Woodland (3.B), Mixed Forest (3.C.), and Riparian Corridors (3.I.).

The purpose and need of this proposal would reflect the guidelines of these four designated management areas recognized within Locust Gap according to the Revised Land and Resource Management Plan (RLRMP) (also referred to as the Forest Plan throughout this EA) for the Ozark-St. Francis National Forests.

All work being proposed is on National Forest lands only. No work would occur on privately-owned land. However, the Forest Service would solicit cooperation with private landowners via Wyden/Stevens agreements, which allows the Forest Service to carry out prescribed burn treatments on private lands surrounded by or adjacent to federal land in areas where it would improve Forest Service burns.

Less than 6 % of hardwood acres are proposed for regeneration cutting to perpetuate this forest type and to create a variety of age classes to improve forest health, thereby, promoting diversity; thinning other forest stands is proposed to promote vigor and thriftiness of the remaining trees. Prescribed burning and herbicide/handtool treatments would follow harvesting/thinning of hardwood and pine to prepare the ground for seedfall or planting, and stimulate plant communities beneficial to wildlife. Timber products in the form of sawlogs, small roundwood, and firewood would be generated by these actions in the near term as well as providing for a future sustainable supply. Habitat diversity for animals and plants, including threatened, endangered, and/or sensitive species would be maintained or improved by the effects of the timber, wildlife, recreation, and access management. Also, fisheries habitat will be enhanced via riparian improvements. Reduction of wildfire risk by prescribed burning and mechanical fuels reduction is also proposed as well as closing roads no longer needed for land management. This proposal would maintain or improve the plant and animal diversity to meet overall multiple-use objectives as described in the RLRMP.

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

Activity	Number of Units	Approx. Acres Miles
Vegetation Management		
Pine Thinning followed by TSI	8 stands	169 acres
Oak Woodland Thinning	6 stands	297 acres
Hardwood Shelterwood followed by Site Preparation & Burning	14 stands	398 acres
Connected Treatments for Hardwood Shelterwood	14 stands	
Hardwood Timber Stand Improvement (TSI) – Midstory Treatment & Burning	25 stands	1,159 acres
Hardwood Pre-commercial Thinning (PCT)	15 stands	390 acres
Hardwood Thinning followed by TSI	24 stands	1,153 acres
Fire		
Prescribed Fire/Hazardous Fuels Reduction/Site Preparation/Wildlife Burning/etc… -Federal Lands	All stands	Up to 7,049 acres
Prescribed Fire –Hazardous Fuels-Private Lands*	Several	Up to 3,504 acres
Wildlife Management		
Fish Habitat Improvements (Large Woody Debris/Stream Bank Stabilization)	Little Mulberry Creek	Approx. 6 miles
NNIS Treatment	Documented occurrences throughout project area	Not to exceed 500 acres (annually)

Table 1 - Summary of Projects - Alternative 2 (Original Proposed Action) (Cont'd)

Activity	Number of Units	Approx. Acres-Miles
Road Work		
Road Reconstruction	(FS) 1459 W. Free Will, 1459 E. Free Will, 1460, 94276B, 94277A, 94277C	Approx. 10 miles
Road Construction	FS1463	Approx. 1 mile
Road Maintenance (Forest & County Roads)**	(FS) 1481, 1483, 1484, 1462, 1496, 94270C, 94276A, 94277B, 94278B	Approx. 10 miles
Road Decommissioning	(FS) 1481, 1483, 94270A, 94270B, 94270C, 94271A, 94271B, 94272A, 94272B, 94272C, 94278A, 94278F, 94278G, 94278J, and 3 unnamed roads	13 miles
Temporary Roads	1481, 94270A, 94270C, 94271A, 94271B, 1459 W. Free Will, 94272A, 94278A, 94278F, and 5 unnamed roads	7.3 miles
Gate Installation	1 (closing a portion of FS 1483)	
Cultural-Heritage Sites	25 total sites identified	2 sites recommended eligible for listing, 1 site recommended ineligible for listing, and 23 are undetermined

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

****Road maintenance includes both Forest Service and County roads.**

The original proposed action that was scoped aims to restore forest ecosystem health and sustainable forest conditions in an area which has been affected by oak decline and exclusion of fire. Vegetative and wildlife diversity would be increased, fuels accumulations would be reduced, forest products would be produced and watershed quality and dispersed recreation quality would be improved in the area. After many comments were made by the public, a new proposed action (Alternative 3) was developed by an interdisciplinary team (IDT). Alternative 3 is now the new proposed action the Pleasant Hill Ranger District is planning to implement. This alternative would also restore forest ecosystem health and sustainable forest conditions in the project area.

Along with the Alternative 1 (No Action), the new proposed action (Alternative 3) has been evaluated and is described below:

- Alternative 1 – A "No Action" alternative where the present/existing level of management would continue in the analysis area.
- Alternative 3 – Same as Alternative 2 with the following modifications:

    1) No foliar spraying.

2) Scale back Rx burning (Prescribe burn all of compartment 270 but limit all other burns to 300 acres/day or less). (Rx burns would still be on a 3- to 5-year interval rotation.

3) Compartment 270, stand 1 – implement midstory removal leaving larger trees in place along Hwy. 16 for visuals and a possible interpretive/hiking trail.

4) Remove large woody debris (LWD) option.

5) No new road construction (FS 1463).

6) Modify 0.7 miles of reconstruction on FS 1459 East to 0.7 miles of decommissioning.

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

- ***Part 1 - Introduction:*** This 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. It highlights implementing activities in management areas moving from current conditions to the desired conditions under the direction of the RLRMP. 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 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.

- ***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

The Pleasant Hill Ranger District's "order of entry" led to this project proposal. The RLRMP guides activities for a 10 to 15 year planning period and directs that all land types be inventoried within that timeframe. The Locust Gap Project area was due for inventory, treatment, and monitoring. Foremost, this analysis addresses forest health and diversity, as identified by the interdisciplinary team members. This source document is on file at the Pleasant Hill Ranger District office.

Purpose and Need for Action

The purpose of this initiative is to:

1. Move forest condition toward the desired future conditions described in the forest plan. (http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/FSM8_042809.pdf)

In doing so, the Forest Service will restore ecosystem health and sustainable conditions by:

- Reducing basal area (stand density) and restoring the historic/natural fire regime to diminish fire danger and benefit forest communities.

- Regenerate oaks to sustain hardwood communities.

- Increase plant and animal diversity.

- Reduce fuel loads in order to protect forest ecosystems and private property that are at risk.

- Improve forest health so that stands are more resistant to stress, insects and other pathogens caused by drought, overcrowded conditions and trees reaching older ages. This will be done by thinning overcrowded stands of trees.

- Protecting watershed integrity with responsible forest management via vegetation treatments that will ensure continued diversity and vigorous growth while maintaining high water quality.

- Protecting watershed integrity by closing and decommissioning unneeded roads, thus reducing sedimentation flow into stream channels. Further, riparian stand improvement measures would help ensure flood events are ameliorated by slowing high water and filtering debris and sediment to prevent scouring of streams.

2. Increase habitat potential for early-successional, disturbance-dependent species.

3. Manage dispersed recreational opportunities while protecting the environment.

4. Increase Forest visitor safety.

5. Provide forest products to industry and the public.

This action responds to the goals and objectives outlined in the 2005 Ozark-St. Francis National Forests Land and RLRMP for the Mixed Forest, Oak Woodland, Riparian Corridors, and Scenic Byway Corridor Management Areas and helps move the project area toward desired conditions described in that plan. The priorities described in the Forest Plan are as follow:

3.B OAK WOODLAND

- Restore and maintain a landscape mosaic of open oak woodland that mimics historical conditions.
- Provide optimal habitat for plants and animals.
- Create a setting for recreation that is visually appealing.
- Implement prescribed burns on 2- to 7-year intervals.
- Provide optimal habitat conditions for many species including management indicator species.

3.C MIXED FOREST

- Manage for pine and oak woodlands on the lower quality sites.
- Manage for medium density or balanced age classes on medium and high quality sites.
- Implement prescribed burns on 3- to 10-year intervals

1.H SCENIC BYWAY CORRIDORS

- Maintain or improve biological communities to provide attractive settings for visitors.
- Provide for the protection of rare communities and threatened, endangered, sensitive, and locally rare species.
- Preserve viewshed quality.
- Develop public view points and interpretive opportunities.
- Promote and manage the scenic byway for the traveling public and benefit of local communities.

3.I RIPARIAN CORRIDORS

- Maintain, restore, or enhance biological integrity of aquatic communities.
- Identify roads and trails that should be reconstructed or decommissioned to reduce sediment and improve watershed conditions.
- Include erosion and sediment control measures in all ground-disturbing project plans.
- Ensure floodplains properly function as retention storage areas for floodwaters.
- Maintain water quality within a range that ensures survival, growth, reproduction, and migration of aquatic and riparian wildlife species.

The following management prescriptions are needed and currently proposed to be implemented within the Locust Gap Project area:

Ecosystem Restoration and Promoting Sustainable Ecosystems

The project area was historically subject to a more frequent regime of vegetation disturbance from anthropogenic fire. The Ozark-St. Francis National Forests have study sites 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 it ranged from 2 to 3.1 years and for the period of 1881-1920 it 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 that 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 have 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 sustainability of ecosystem in the project area is in jeopardy because the area lacks these forest conditions. This absence is due to a century of fire suppression and lack of vegetation management. 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.

General guidance in the RLRMP guides the Forest Service to "Respond to land, resource, social and economic changes." Forest health and insect epidemics have become of paramount importance on the Ozark – St Francis NFs within the past few years. A red oak borer epidemic has 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. Preliminary field investigations indicate that the red oak component is being reduced by as much as 85% within the affected areas. The Pleasant Hill Ranger District was the hardest hit area of the entire forest. It is where the epidemic first started and where evidence of the epidemic still exists. Preventive action is limited, but it is thought the best hope lies in regeneration and thinning (harvest & salvage). This will accomplish two objectives: (1) it will reduce inter-tree competition and relieve the water stress on the remaining trees and help them repel some of the borers, and (2) the trees that are harvested will be able to begin stump sprouting which will help to provide a source of young oaks for the future.

Oak decline has been diagnosed as far back as the late 1980's (Evaluation of Oak Decline Areas in the South: Protection Report R8-PR 17 September 1989). Oak decline is a complex syndrome with multi-factor causal agents that lead to dieback symptomologies and mortality. The key symptom characterizing oak decline is progressive crown dieback followed by mortality which may take a period of years. Oak decline results from tree stressors that have: (1) long-term predisposing factors such as adverse climatic trends, poor site conditions, tree age or genetics; (2) short-term inciting factors like drought, late spring frost/freeze, insect defoliation, or discrete air pollution events; and (3) long-term contributing factors such as root disease, bark beetles, canker, or decay fungi. Any combination of these factors results in triggering an oak decline.

Returning a prescribed fire rotation mimicking historic (prior to 1920) fire return intervals following thinning/regeneration harvest would maintain open forest conditions with reduced inter-tree competition. The thinning of pine stands is also important in preventing disease attacks from southern pine beetles. These beetles have been spreading across the south in recent years due to the increasingly hot summers and mild winters. Infestations are now common in areas where the beetle was once relatively unknown. South Carolina, North Carolina and Kentucky have had tremendous outbreaks within the last five years. Shortleaf pine has been almost completely wiped out on the Daniel Boone National Forest in Kentucky. To date, only small infestations have been observed on the Ozark National Forest (Mt. Magazine Ranger District), yet southern pine beetles are common to the Ouachita Mountains and southern Arkansas. Once insect infestations start, it is too late to effectively treat large areas and many acres of trees die rapidly. Prevention is the control method of choice by thinning stands to reduce inter-tree competition and relieve moisture stress. By keeping the trees healthy, beetles are expelled from the trees and never reach epidemic proportions.

Watershed integrity is sustained by vegetatively mimicking the natural occurrences of stand manipulation via timber & wildlife management and prescribed fire.

Improve Wildlife Habitat and Benefit Disturbance-Dependent Species through Establishment of Early Seral Habitat.

The Forests provide a wide variety of habitats that support 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. Reestablishment of young forests ensures sustainability of that forest type for another cycle. 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; USDA 2001; USDA 2007 and NatureServe 2006). Population monitoring associated with these sources shows the status of these seven species as such:

- Deer populations have generally increased in the last two decades based on harvest data, but there has been a decline the past 3-4 years and it is possible that this reflects a lag time in response to the decline in early seral habitat and/or poor fawn recruitment on the National Forests.

- Black bear populations are increasing; however, to maintain quality habitat over time, there is a need to maintain early-seral habitat.

- 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. 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 upon open pine forest and woodlands. Populations of this species are stable, but available habitat is a limiting factor.

- Red-headed woodpeckers are dependent upon open oak woodlands. Populations of this species are stable to decreasing. Available habitat is a limiting factor.

For the Forests, the amount of early-successional forest habitat increased slightly from 1986 to 1991 to a total of approximately 1.0 percent forest wide. From 1991 to 2001 early-successional forest habitat declined forest wide to approximately 0.2 percent. The amount of early-successional habitat on the Forests is tied very closely to the amount of regeneration harvests the Forests conduct in a given year. This type of harvesting has declined over the years and this has driven the decline in early-successional habitat. **Currently, the analysis area is comprised of <1 percent of this early-successional forest habitat.**

Hunter (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 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 Reduce Off Highway Vehicle (OHV/ATV) Conflicts with Other Resource Values

Illegal OHV use in the project area (occurring off designated roads) is causing resource damage and conflicts with other resource uses. Closing and decommissioning roads in the project area will greatly reduce the negative impacts created from illegal OHV use and improve watershed integrity. The Forests' OHV policy designates particular routes on which it is legal to ride on National Forest roads.

The Need to Improve Forest Visitor Safety
Red oak borer-caused mortality and associated oak decline have increased the potential for falling trees/limbs to injure forest visitors. Additionally, ice storms within the last several years have created snags, broken tree tops, etc… which pose a threat to visitor safety. Thinning forest stands near recreation areas and implementing associated silvicultural treatments and prescribed fire will reduce potential hazards and improve visitor safety.

The Need to Provide Wood Products
Meeting the needs of improving wildlife habitat and promoting sustainable ecosystems will provide timber products to the public over the next few years as a by-product. General guidance in the RLRMP directs the Forest Service to protect and improve renewable resource quality while maximizing net public benefits. Specific direction contained in the RLRMP guides the Forest Service to "Provide a non-declining yield of forest products consistent with land capability, sustainability, protection needs and other resource values." (RLRMP, pp 2-27)

Alternative 2 (Initial Proposed Action):

This action proposed by the Forest Service would meet the purpose and need and includes several vegetation/habitat management actions. This alternative proposes:

- Even-aged management (EAM) on approximately 398 acres of hardwood forest (shelterwood) in 14 stands followed by site preparation & burning.

- Handtool/mechanical/herbicide/prescribed burn methods will follow EAM/uneven-aged management (UAM) harvests.

- Oak woodland thinning on marginal sites, approximately 297 acres in 6 stands.

- Pre-commercial thinning (PCT) in hardwoods, approximately 390 acres in 15 stands with handtools/herbicide/prescribed burn.

- Thinning on 169 acres of pine and 1,153 acres of hardwood forest. Timber Stand Improvement (TSI) measures of burning & handtool/herbicide treatments to follow.

- TSI of hardwood forest on approximately 1,159 acres in 25 stands.

- Non-native invasive species (NNIS) treatments will occur on as much as 500 acres annually with herbicide/handtools & burning.

- Hazardous fuel reduction on 7,049 acres of public land and as much as 3,504 acres of private land.

- Road maintenance of 10.6 miles, road reconstruction of 9.9 miles, decommissioning of approximately 12.5 miles, 7.3 miles of temporary roading, and installation of up to 1 gate.

Table 2 illustrates the mileage of road work to be implemented in the Locust Gap Project area.

Table 2. Comparison of Proposals

Activity	Proposed Initially (pre-scoping & scoping)	(Alt. 2)	Proposed Presently (Alt. 3)
Road Construction	1 mile	0 mile	0 mile
Temporary Roading	8 miles	7.3 miles	6.9 miles
Road Reconstruction	10 miles	9.9 miles	9.2 miles
Road Decommissioning	13 miles	12.5 miles	13.2 miles
Road Maintenance	12 miles	10.6 miles	10.6 miles
Gate Installation	1	1	1

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 goals and desired future conditions set forth in the RLRMP.

- Which alternative best meets the purpose of the initiative while producing the least adverse cumulative environmental effects.

- Which alternative best meets the six strategic goals of the Forest Service's 2005-2012 National Strategic Plan.

- Which alternative best meets legitimate concerns from the public.

Public Involvement

The Locust Gap Project was first introduced to the public in January 2014. The Forest Service, following an Interdisciplinary Team (IDT) meeting with Pleasant Hill Ranger District staff decided to initiate this project with a pre-scoping letter. This pre-scoping letter was an attempt to involve the public in helping with the development of proposals for the Locust Gap Project. It was sent to numerous citizens who own or live within the Locust Gap Project area as well as adjacent landowners. It was also sent to many of the citizens that have expressed interest in previous EAs. The pre-scoping letter was sent to several agencies as well, including the Arkansas Game and Fish Commission (AGFC) and the Arkansas Natural Heritage Commission (ANHC). The ANHC contacted Pleasant Hill

Ranger District to set up a meeting/field trip to talk about potential treatments of the different MAs. After discussion with ANHC and much feedback from the public, the staff was able to develop their management proposals. These proposals were based on some of the feedback received from the public and the RLRMP. The proposal was listed in the Schedule of Proposed Actions in January 2014 until present. The management proposals were then provided to the public and other agencies for comment during the initial 30-day scoping (comment) period beginning May 5, 2014, and published in the official newspaper of record, The Johnson County ***Graphic*** (Clarksville, Arkansas). Using the comments from the public, other agencies, and internal comments, the IDT developed a list of issues to address.

Issues

The Forest Service separates issues into two groups: significant and non-significant issues. Significant issues are 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 Eliminated From Detailed Study

An issue alternative of not using prescribed burning for hazardous fuel reduction, and wildlife browse production was considered. Past experience on the district (and confirmed by the latest scientific evidence) has shown that prescribed fire is needed to ensure pine seedlings are established and that adequate wildlife browse be maintained. It has also become increasingly clear that fire plays a major role in the perpetuation of the historic Ozark Oak-Hickory-Shortleaf pine forest. Therefore, under Alternative 3 prescribed burning would be scaled back to include burning Compartment 270 and then all other burns would be 300 acres or less per day.

Generally, prescribed burning will take place on a 3-10 year interval. Without fuels reduction burning, the chances of a wildfire will increase over time, and if a wildfire were to occur, and the fuel load within the forest was heavy, it is more likely that the wildfire would result in severe burn intensity, thus eliciting more adverse effects than slight to moderate intensity fire associated with intentional fuel reduction burning. All precautions will be taken to avoid any kind of property damage and risk to human health as per site specific burn plans, burn prescriptions and job hazard analysis.

Issues Studied in Detail

As for significant issues, the Forest Service identified seven topics raised during scoping and/or IDT meetings. These issues include:

Issue #1

Timber Harvest

The measurement indicator for this issue is: the percentage of pre-commercial vegetation management proposed including TSI and wildlife stand improvement (WSI) using hand crews and hand tools vs. percentage of commercial vegetation management.

Issue #2

Water Quality

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

Issue #3

Prescribed Burning

The measurement indicator for this issue is: acres of planned burning/day for fuel reduction, oak restoration, and wildlife/vegetation diversity.

Issue # 4

The Cumulative Effects of Herbicide use on Water Quality and its Likelihood of entering nearby streams and local Water Supplies.

The measurement indicator for this issue is: acres of planned application and management technique for herbicide use.

Issue #5

The Environmental Impact of Roadwork

The measurement indicator for this issue is: use proper mitigation measures to minimize erosion when implementing roadwork

Issue #6

Large Woody Debris (LWD) placement in sections of the Little Mulberry Creek

The measurement indicator for this issue is: utilizing LWD vs. natural recruitment of already existing down timber in stream channels

Issue #7

Access/Recreation/Visuals

The measurement indicator for this issue is: use the Scenery Treatment Guide to ensure visual integrity and objectives are met, leave larger trees along Hwy. 16 for visuals, create possible interpretive/nature hiking trail, and improve access to dispersed recreation opportunities.

The issues addressed in this EA 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 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 Locust Gap Project. It includes a description and map 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 on 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).

Alternatives

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 accomplished with the following consequences:

- Early-seral habitat would decline.
- In all likelihood, oak Decline (insect & disease) symptoms would continue unchecked for the foreseeable future.
- Reintroduction of fire disturbance regimes into fire-adapted ecosystems would not occur.
- The forest would continue to age, which may further exacerbate conditions favorable to insect and disease occurrences. A well-distributed mix of age-classes across the landscape would not be achieved.
- Vegetative diversity and quality wildlife browse would suffer due to more closed-canopy conditions. Loss of grasses and forbs will reduce populations of small mammals, insect/seed-eating birds, and larger game animals such as turkey and deer.
- Critical levels of fuel such as leaf litter, needle-duff layers, and fallen timber will continue to accumulate, increasing the threat of destructive wildfire occurrence.
- Wood products and revenue that help sustain the local economy would not be generated.
- Air quality would remain good; water quality could potentially decrease as natural sedimentation of unstable roads would continue to occur through bank/sheet erosion during heavy rain events.
- Recreation opportunities will 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.

- Opportunities to upgrade and stabilize the transportation system within the project area would be prolonged.

- Unstable roads will continue to contribute sediment to water sources.

- Threatened and endangered species that depend on disturbance (e.g., fire) may decrease.

- Game species populations would decrease.

- Oak and timber types would decrease over time.

ALTERNATIVE 2

Pine and Hardwood Thinning followed by Timber Stand Improvement (TSI) – Midstory Control & Burning: Thinning would increase growth of residual trees, reduce the susceptibility of the stand to insect and disease, and improve habitat for wildlife. The stands would be thinned to a target basal area of 50-70 ft2/acre, about 55- 75 trees/acre. Trees that are suppressed or have poor form would be removed. Trees of good form and/or close to the correct spacing would be favored over trees that are simply of larger size. The target spacing of trees would depend on the average tree diameter of the stand. Prescribed burning following thinning would provide beneficial effects for wildlife. Current timber types will be sustained over time. TSI treatments of the midstory using herbicide and/or handtools may be utilized to further reduce competition. Hardwood thinning is proposed on approximately 1,153 acres and pine is approximately 169 acres.

Oak Woodland Thinning: This prescription emphasizes restoration and maintenance of a mosaic of open oak woodland that mimics historical conditions. The purpose would be to provide habitat for associated plants and animals, some of which are rare and declining, and to create a setting for recreation that is visually appealing, plentiful in wildlife and not commonly encountered elsewhere.

Hardwood Shelterwood followed by Site Preparation & Burning: This prescription would sustain long-term forest health and provide for the succession of hardwood forests. These stands are mature; growth has slowed and the trees are beginning to decline. Removing some of the larger trees would open up the area and allow young productive trees to become established. After harvest, these stands would have site preparation treatments of herbicide/hand tool/mechanical methods and controlled burning to reduce competition of the desirable species. The objective of this shelterwood would be to open up the stand allowing sunlight to reach the forest floor while leaving an adequate amount of trees to provide seed. As the name implies, several trees would be left in the overstory to provide shelter to the developing regeneration on the ground. The mature hardwood left over from the harvests will remain until the new stands receive their first thinning. The combination of stump/root sprouts from oak species and the other desirable seedlings will establish the new stands. An average stand density-basal area of 30 ft2/acre (20-30 trees/acre) would be targeted. This treatment is currently proposed on approximately 398 acres.

Connected Treatments for the Hardwood Shelterwood Stands: If desired species adequately replenish the new stands by natural means, **release** measures may be implemented using hand tools/herbicide/Rx burning, if necessary, to reduce competing vegetation. This would occur within 3 to 7 years after harvest. If the desired species fail to adequately establish new stands by natural means, **planting & release** of oak species will be required.

Hardwood Timber Stand Improvement (TSI) – Midstory Treatment & Burning: This treatment would cover approximately 1,159 acres of mostly immature sawtimber, but do have a component of mature trees with dense midstory and understory of desirable/undesirable species. Removal of the undesirable midstory will allow oak and other desirable species currently in and underneath the midstory to be released and become competitive. The success of this treatment, via hand tool/herbicide means, would allow a regeneration harvest to be considered next entry. Undesirable species will be treated with herbicide. Some desirable species such as oak may be cut but not treated with herbicide and allowed to re-sprout. Prescribed burning may follow this treatment to further control unwanted competitors of oak.

Hardwood Pre-Commercial Thinning (PCT): This treatment would occur on approximately 390 acres and reduce the density of stands that have not yet reached commercial size. This will allow crowns and root systems to reach maximum potential. This will give the remaining trees a head start to reach adulthood in an optimum time and healthy condition. Hand tools, herbicides, mechanical applications, and power saws are all means that could be included in the follow-up vegetation treatments discussed above.

Salvage of Dead, Down, and /or Damaged Timber: The Pleasant Hill Ranger District is susceptible to natural occurrences such as severe drought, wildfire, tornadoes, windstorms, lightning strikes, insect and disease outbreaks, catastrophic ice storms, natural mortality, and human-caused events such as arson and residual material from implemented management activities (i.e. ponds, midstory reduction, thinning, and prescribed burning). These occurrences cause hazards for the public and have negative effects on the overall health of the forest. This action will allow the District Ranger to respond to situations within the Locust Gap Project boundaries where dead, down or damaged trees pose a threat to the public or the health and well-being of the forest in a consistent and timely manner. If the district waits until an incident occurs before making the decision to remove the dead, down or damaged trees through a salvage or firewood sale, a time lag of several months or more could pass before the decision would be implemented. In many cases this time delay is unacceptable because of hazards to the public and/or it could cause the value of the timber product to degrade significantly due to insect and fungal infestations of damaged trees.

Prior to conducting salvage and/or regeneration operations within the Locust Gap Project area boundaries, site-specific documentation for each salvage and regeneration action would be prepared and retained by the District. As a minimum, that documentation will have statement of heritage resource survey requirements and clearance type (categorical exclusion or project notification, or other written agreement between the Arkansas State Historic Preservation Office, affected Native American Tribes, and the Ozark-St. Francis National Forests) stand prescription cards with details of the current stand and a regeneration plan to return the affected area back to its desired future condition as well as a

statement of effects on proposed, endangered, threatened, or sensitive species (PETS). Documentation will include the location (compartment and stand), estimated area affected (acreage), a map of the impacted area(s), an estimated volume of timber to be removed, identification of the watershed containing the affected area, and identification of the management area within which the affected area lies and actions to be conducted. Each salvage site will be reviewed by the timber assistant and the timber sale administrator or other staff prior to commencement of salvage operations. The number of acres in which salvage operation activities may take place would not exceed 3,000 acres per event. Salvage and/or regeneration operations will be conducted within the project area boundaries following the guide lines from the Ozark-St. Francis National Forests Revised Land and Resource Management Plan.

Wildlife & Fishery Habitat Improvement

Gates: The current proposal would include one new gate installed in the Locust Gap Project area. This gate would be constructed following commercial timber harvest on FS road 1483. The intent of installing this gate would be to limit the area to walk-in hunting, wildlife viewing and other foot travel to help protect resource values.

Non-Native Invasive Species (NNIS) Treatment (Tree of Heaven): Based on biological evaluation field inventories there is potential for approximately 400 acres in the Locust Gap Project area to be impacted by varying levels of tree of heaven infestation. These occurrences of tree of heaven would be treated with herbicide under an existing National Environmental Policy Act (NEPA) EA and decision record. This decision was signed by the District Ranger in 2009, and allows the use of approved herbicides district-wide to control infestations of NNIS. Treatment of tree of heaven would be analyzed in the Locust Gap EA only for the purposes of determining cumulative effects. The previously authorized action of NNIS treatment would be analyzed for cumulative impacts to the environment in conjunction with new proposed actions for the Locust Gap Project area. NNIS treatment in Locust Gap would be prioritized based upon size of infestation and potential for continued spread.

Wildlife Prescribed Burning: Landscape scale prescribed burning for wildlife habitat improvement, ecosystem restoration, and fuels reduction would be completed in all of Compartment 270 on public lands. In addition, prescribed burning would be implemented in portions of Compartment 272 and Compartment 278. Knutson-Vandenberg (KV) retained receipts would fund prescribed fire on all acres possible within KV sale area boundaries surrounding pine and hardwood thinning units in these compartments.

Large Woody Debris (LWD) in Stream Channels: Chainsaw felling of trees into creek channels would be implemented in the Locust Gap Project area. Approximately 20 to 25 trees of 8" plus diameter, per mile would be felled into creek channels with chainsaws. This would serve to provide structure for fish, stabilize banks, reduce velocity of water flow and help create pool habitat for fish. This treatment would be implemented on approximately six miles of the Little Mulberry Creek and its tributaries located in the Locust Gap Project area. LWD would not be placed in creek channels within ½ mile upstream of the "Blue Hole" swimming area on the Little Mulberry Creek. In addition, at least ¼ mile of Little Mulberry Creek downstream of the "Blue Hole" would not have LWD placed in the creek channel.

Table 3. Alternative 2 - Forest Vegetation Management by Stand

Treatment	Compt.	Stand	Acres	Connected Actions
Pine Thinning	270	13, 17, 23		Midstory control (TSI)with herbicide/handtools; WL Burn
	271	14, 16		
	272	6, 12		
	279	19		
TOTAL		**8 stands**	**169**	
Hardwood thinning	270	11, 16, 19, 22		Midstory control (TSI) with herbicide/handtools; WL Burn
	271	5, 6, 19, 22, 32, 43		
	272	11, 21, 26		
	276	14, 20, 22, 24, 26, 29		
	278	11, 13, 15, 21, 26		
TOTAL		**24 stands**	**1,153**	
Hardwood Shelterwood	270	6, 26		Site prp: hantool/herb/mech, burn, release 2-5 yrs later
	271	3, 26, 40, 41, 42		
	272	2, 27		
	276	4, 9		
	277	1, 5		
	278	17		
TOTAL		**14 stands**	**398**	
Hardwood TSI (Timber Stand Improvement)	270	2, 4, 8, 9, 25, 33, 34, 35		Midstory control with herbicide/handtools; Burn
	271	1, 2, 12, 15, 18, 20, 23, 24, 31, 36		
	272	9, 25		
	277	4		
	278	8, 9, 14, 28		
TOTAL		**25 stands**	**1,159**	
Oak Woodland Thinning	270	1		Burning (CUS-control of understory), herbicide
	272	5, 8		
	278	3,16, 34		
TOTAL		**6 stands**	**297**	

Hardwood Pre-commercial Thin (PCT)	270	10, 12, 18		Handtools/herbicide/mech./powersaw & burning
	271	17, 21, 25, 29, 30		
	272	23		
	276	10, 13, 15		
	278	7, 10, 23		
TOTAL		**15 stands**	**390**	

Prescribed Fire and Mechanical Fuels Reduction

Prescribed Fire

All of the Forest Service land within the Locust Gap Project area (7,049 acres) would potentially receive low to moderate intensity prescribed burns to reduce hazardous fuels and wildfire risk, improve wildlife habitat, and for silviculture purposes. Knutson-Vandenberg (KV) retained receipt funded prescribed fire will be implemented on all acres possible within KV sale area boundaries surrounding pine and hardwood thinning units.

Prescribed fire treatments may occur on private lands located within the Locust Gap Project areas (approx. 3,504 acres), but ***only*** after consultation with landowners and a prescribed fire agreement under the Wyden Amendment (Section 334(a) of Public Law 105-83) and/or Stevens agreements in cooperation with the Arkansas State Forestry Commission. Should agreements with private landowners be signed, private lands would be burned by Arkansas Forestry Commission under prescription in conjunction with prescribed burns on public lands. Prescribed fire would be utilized for several purposes in the project areas.

Prescribed fire would serve to re-introduce fire into a fire-adapted ecosystem, promote oak regeneration in canopy openings created by red oak borer damage/oak decline, promote regeneration in shelterwood and seedtree harvest areas, maintain pine/hardwood stands in open conditions, increase herbaceous understory species density and diversity, improve habitat conditions for fire-dependent special-status plants, increase soft-mast production and reduce potentially hazardous accumulations of fuels on the forest floor, and improve wildlife habitat conditions. The entire project area would be burned on an approximate 3-10 year fire return interval, based on best available science regarding beneficial fire-return intervals for the project area. If Rx burning is not conducive, then mechanical fuel reduction will be applied if sufficient funding is available.

Roadwork

New Construction: Initially, during scoping approximately one mile of road was proposed to be constructed on private land. However, after further review and discussion of this road, it has been determined that no new construction would be needed.

Reconstruction: Approximately 9.9 miles of old, existing roads would be reconstructed. These roads are situated on somewhat stable templates that display signs of age where spots

of erosion are occurring and drainage crossings are crumbling. Reconstruction would help stabilize, thereby reducing erosion and sediment from reaching streams.

Maintenance: Approximately 10.6 miles of open and closed roads would receive maintenance in order to obtain suitable road conditions for hauling timber. County roads anticipated to be used are regularly maintained by their respective counties, along with Forest Service assistance. Closed roads would temporarily be opened during timber/silvicultural activities and immediately closed again with gates or mounds after all activities have been completed to reduce erosion caused from vehicle traffic and protect wildlife habitat.

Decommissioning: Approximately 12.5 miles of existing roads no longer needed for management or access would be decommissioned. This would entail restoring roads to a more natural state. Activities used to decommission roads would include, but are not limited to the following: re-establishing former drainage patterns, stabilizing slopes, restoring vegetation, blocking the entrance to the road, installing water bars (earthen mounds), and removing culverts. Decommissioning roads will be out-sloped and all natural drainages will be reconstructed. Unnamed and illegally accessed off-highway vehicles (OHV) trails present in the Locust Gap Project area may be closed using debris, rocks, earthen mounds, or gates.

Road decommissioning is defined by 36 CFR 212.1 as activities that result in the stabilization and restoration of unneeded roads to a more natural state. Several of these roads currently traverse natural fluvial systems and concentrations of water may result in possible resource damage. Priorities for decommissioning these roads include access, drainage, stability, erosion, and re-vegetation. These roads will be removed from the transportation system.

Temporary Roads: Approximately 7.3 miles of temporary roads would be needed to access timber stands. These roads would be blocked, and then rehabilitated with seeding and/or natural re-vegetation. Temporary roads would not be intended to be included as part of the forest transportation system as they are managed for short-term projects or activities, followed by decommissioning after use.

Access: Adjacent landowners whose property blocks access to Federal land will be contacted by the Forest Service. Neighbors of the forest will be asked to consider allowing entrance to these otherwise inaccessible areas for forest management and fire protection.

Table 4 explains the roads management planned in the Locust Gap Project.

Table 4- Locust Gap Project Roads Management

Road No.	Total Road Miles	Open Miles	Closure for >1Yr. Miles	Existing Road No Treatment	Closure Type	Closure Reason	Decom. Miles	Decom. Reason	Temp-Decom Miles	Recon. Miles	Temp Miles	Maint. Level	Maint. Req./Miles	Remarks / Mgmt Priority
1459 (West Free Will)	6	6								3.4	1.2	2		Post-haul reconstruction
1459 (East Free Will)	6	6								2.6		2		Post-haul reconstruction
1460 (Walnut Ridge)	1.6	1.6								1.6		2		Post-haul reconstruction
1462/ JO 4250	1.7	1.7										2	1.7	Pre-haul maintenance
1462 to private land	1.7	1.7										2	0.3	Pre-haul maintenance
1481 (Thorn)	1.6		0.8				0.4	Res.pro.	0.4			1	0.8	Decommission
1483	2.1		2.1		Gate	Res.pro.	0.4	Res.pro				2	1.7	Decommission
1484	0.5	0.5										2	0.5	Pre-haul maintenance
1496	3.7	3.7										3	3.7	Pre-haul maintenance
94270A	2.4		2.4				2.4	Res.pro			0.3	1		Temp/decommission
94270B	0.7		0.7				0.7	Res.pro				1		Decommission
94270C	1.1	0.1						Res.pro	0.5			2	0.6	Pre-haul maintenance
94270D	0.9	0.9		0.9								2		Not needed for treatment
94271A	0.8								0.8			1		Temp/decommission
94271B	1.0		1.0				0.6	Res.pro	0.4			1		Temp/decommission
94272A	0.4		0.4				0.2	Res.pro.	0.2			2		Temp/decommission
94272B	0.9		0.9				0.9	Res.pro				1		Decommission
94272C	0.9		0.9				0.9	Res.pro				1		Decommission
94276A	1.2	1.2		0.8								2	0.4	Pre-haul maintenance
94276B	1.2									1.1		2		Post-haul reconstruction
94276C	0.25	0.25		0.25								2		Not needed for treatment
94277A	1.7	1.7		1.0						0.7		2		Post-haul reconstruction
94277B	1.9	1.9		1.2								2	0.7	Pre-haul maintenance
94277C	0.9			0.4						0.5		1		Post-haul reconstruction
94278A	1.6		1.6				1.0	Res.pro	0.6			1		Temp/decommission
94278B	0.8	0.8		0.6								2	0.2	Pre-haul maintenance
94278C	0.4	0.4		0.4								2		Not needed for treatment

Table 4- Locust Gap Project Roads Management (Cont'd)

Road No.	Total Road Miles	Open Miles	Closure for >1Yr. Miles	Existing Road No Treatment	Closure Type	Closure Reason	Decom. Miles	Decom. Reason	Temp-Decom Miles	Recon. Miles	Temp Miles	Maint. Level	Maint. Req./Miles	Remarks / Mgmt Priority
94278D	3.2	3.2		3.2								2		Not needed for treatment
94278E	0.8		0.8	0.8								1		Closed/not needed for treatment
94278F	0.8		0.8						0.8			2		Temp/decommission
94278G	0.3		0.3				0.3					1		Decommission
94278J	0.4		0.4				0.4					1		Decommission
Unnamed (AR16 to 270-11)											0.5			Temp
Unnamed (Private landowner easement)									0.1					Temp/decommission
Unnamed (accesses 276-4)									0.1					Temp/decommission
Unnamed (AR16 to 270-1)									0.4					Alt. 3, stand will be dropped, therefore 0.4 miles of temp/de not be needed
Unnamed (Private landowner easement)											1.0			Temp
TOTALS							**8.2**		**4.3**	**9.9**	**3.0**		**10.6**	

SPECIAL USES

Historic & Current Conditions

There have been several special use permits/easements issued in the past within the vicinity of the Locust Gap Project area. Permits/easements were authorized to individuals that need "long-term" legal access to their private property utilizing roads across National Forest lands. Some permits were authorized for short periods of time, less than one (1) year. These types of temporary permits were authorized to commercially haul timber across National Forest land from private property. Other types of legal access were granted in the form of "utility" type permits for overhead electric power lines.

There are three (3) Forest Road Easements, two (2) Special Use Permits for an overhead electric powerline and other improvements within the project area.

No other types of permits or easement proposals are on file at this time. The proposed road plan for the Locust Gap Project area will not affect any current or future permitted uses.

A review of private in-holdings within the project area shows it to be fairly likely that the Forest Service will receive additional special use proposals in the future. This is based on the existing private in-holdings within the analysis area.

Easement negotiations are ongoing in order for the Forest Service to gain access to timber stands that were identified for treatment within the project area. The following roads were identified for possible negotiating:

- FDR 94277A – This road would provide access to Compartment 277.
- FDR 94277B – This road segment provides access to Compartment 277 traversing across two individual property owners.
- FDR 94277C – This road accesses Compartment 277.
- FDR 1462 – This road segment traverses across two individual property owners accessing Compartment 271.
- Unnamed road segment located in Section 21, T 14N, R 24W accessing Compartment 272.
- FDR 94276B – This road segment access Compartment 276.

Table 5 identifies the special use permits that have been identified within the Locust Gap Project.

Table 5. Special Use Permits

Auth. ID	Name	Road #	S-T-R
PLE 513601 (Easement)	**Boling Bros.**	**FDR 94270A**	**S-3 & 4 T 13N; R 24W**
PLE0062 (Easement)	**Private Landowner**	**MA 4255 Private Drive**	**S-26, T 11N; R 24W**
PLE0165 (SUP)	**Ozark Electrics**	**Overhead Electric Line**	**Various locations within the project area**
PLE0057 (Easement)	**Private Landowner**	**FDR 1462**	**S-32 T 14N; R 24W**
PLE517101 (SUP)	**Private Landowner**	**Improvements**	**S-29 T 14N; R 24W**

Other type uses that could occur within the area and would not be affected by any changes in the road system would include recreation events. These uses would be in agreement with the types of non-commercial uses already occurring in the project area. They would be reviewed on an individual basis as proposals were received.

The Locust Gap Project area is compatible with the management of special uses in the area. A review of private in-holdings within the project area reveal it to be moderate in that the Forest Service will receive additional special use proposals for access in the future. (This is based on the existing private in-holdings within the analysis area). Special Use Permits for other activities such as commercial logging and recreation events is expected to continue. These uses would be in agreement with the types of occurring commercial and non-commercial uses already in the project area. Any new special use proposals would be reviewed on an individual basis when they are received.

Based on this analysis, there should be no significant direct, indirect, or cumulative effects to human health and the physical environment from the administration of special use permits or the proposed reciprocal easements in the project area.

MINERALS

The majority of the federal minerals in the project area have not been leased, or the few parcels that were leased expired in 1980-1982. Leases could be offered up if interest were brought forward to the Bureau of Land Management (BLM) Office. Based on current activities and future projections for the area, it is not anticipated that any interest will be expressed in the next 10-15 years. This area lies on or just outside of the Fayetteville Shale Play border and this is one factor that contributes to the

low likelihood of mineral development. No proven gas reserves are in the area and no infrastructure to support future development currently exists.

ALTERNATIVE 3

PROPOSED ACTION

Same as Alternative 2 but Eliminate Foliar Spraying; Burn all of Compartment 270, but all other burns limited to approximately 300 acres/day or less; implement midstory removal in Compartment 270, Stand 1; Construct interpretive/nature hiking trail; Eliminate LWD placement; No new construction of road; and Replace reconstruction with decommissioning of 0.7 miles on FS road 1459 on east side of Blue Hole.

This alternative differs from Alternative 2 in 6 ways.

1. The use of foliar spraying would be eliminated from wide scale herbicide use and replaced by a cut-stump method approach.

2. Prescribed burning ignitions would still take place in Compartment 270, however all other burns would be limited to approximately 300 acres/day or less.

3. Compartment 270, Stand 1 would receive a midstory removal leaving larger trees in place along State Highway 16 for visuals. There would also be potential to construct an interpretive/nature trail if funding and partnership becomes available.

4. Eliminate LWD placement due to comments received from the public.

5. Eliminate new construction of roads.

6. Approximately 0.7 miles of FS road 1459 east of the Blue Hole would be decommissioned rather than reconstructed.

This alternative was developed in response to public comments which relate to the use of herbicides and its perceived effects on the environment, prescribed burning and the concerns of smoke and erosion, visuals along scenic byway corridor management area, and growing concern of the use of LWD placement. With implementation of Alternative 3, all other potential management actions would be the same as those described for Alternative 2.

FOREST WIDE STANDARDS AND MITIGATION MEASURES

For each alternative, 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 (Forestwide Standards), page 3-27 (Management Area 1.H), page 3-35 (Management Area 3.B.), page 3-35 (Management Area 3.C), and page 3-35 (Management Area 3.I).

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.

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.

2. Logging slash would be placed above the ordinary high water mark of any stream (State BMP).

3. 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)

4. Maximum even-aged or two-aged regeneration stand size will be limited to 80 acres for pine and 40 acres for hardwood. These acreage limits do not apply to areas treated as a result of natural catastrophic conditions such as fire, insect or disease attack, or windstorm. Areas managed as permanent openings (e.g., meadows, pastures, food plots, rights-of-way, and savannas) are not subject to these standards and are not included in calculations of opening size, even when within or adjacent to created openings. (RLRMP, p. 3-1)

5. Openings created by even-aged and two-aged regeneration treatments will be separated from each other by fully stocked stands of at least 10 acres in size with a minimum of 330 feet in width. A regeneration area will no longer be considered an opening when the certified reestablished stand has reached an age of five years. (RLRMP, p. 3-1)

6. Use logging systems that meet silvicultural prescription objectives. Use cable-yarding systems on sustained grades above 35 percent. Limit excavated skid trails to protect other resource values. Separate skid trails by at least 200 feet unless drainage patterns prevent separation. Keep excavated skid trails below 30 percent grade. (RLRMP, p. 3-1)

7. When artificially regenerating pine, use genetically improved seedlings from selective breeding programs (when available). (RLRMP, p. 3-1)

8. In stands designated for pine management, use silvicultural treatments that allow a hardwood component up to 30 percent. (RLRMP, p. 3-2)

9. In stands designated for hardwood management, use silvicultural treatments that allow a conifer component up to 30 percent. (RLRMP, p. 3-2)

10. 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)

Timber harvesting on lands suitable for timber production must be done under a regeneration harvesting method where adequate stocking of desirable trees is expected to occur within five years of final harvest cut. (Five years after final harvest means five years after clearcutting, five years after final overstory removal in shelterwood cutting, five years after the seed tree removal cut in seed tree cutting, or five years after selection cutting.) These standards apply to both artificial and natural means of stand regeneration. Where natural means are used and stand re-establishment has not been accomplished within three years after committing a stand to regeneration, the stand is re-examined for further treatment needs. Table 3-1 shows the adequate stocking levels following the third year. Levels are guides to determine correct stocking for a given site. Acceptable stocking for hardwood stands is met by achieving stocking levels in the following species: oak, hickory, ash, cherry, walnut, and pine. Pine stocking is limited to 30 percent of the stand composition.

Table 6. Adequate Stocking Levels Following the Third Year

Site Index	Trees Per Acre			
	Lower Level	Target Level	Upper Level	Woodland
Pine				
50	150	500-700	900	75
60	200	500-700	900	75
70+	300	500-700	900	75
Hardwood				
All	150	250-350	500	75

11. 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)

12. 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)

13. 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)

14. 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 dbh (6”dbh) except those that are immediate hazards. If multiple 6-inch or greater stems are encountered, which are competing for moisture, nutrients, and growing space, 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)

15. 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)

16. 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)

17. 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).

18. At stream crossings, seed and mulch cut and fill slopes within 50 feet slope distance within 5 days after construction of temporary roads (RLRMP, p. 3-11).

19. Apply gravel at temporary road crossings for 35 feet on both sides of the stream channel, when the risk of soil erosion is present and where the crossing substrate requires hardening. (RLRMP, p. 3-11).

20. On temporary roads, apply gravel on steep grades exceeding 10 percent slope. (RLRMP, p. 3-11).

21. Soil disturbances within streamside management zones (SMZs) would be treated with erosion control measures within five days. (RLRMP, p. 3-11).

22. No mechanical site preparation (excluding mulching) is done on sustained slopes over 35 percent or on slopes over 20 percent when soil erosion hazard is classified as “severe.”

23. 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 Table 7 based on the percent of the adjacent slope. (RLRMP, p. 3-12):

Table 7. Minimum SMZ percent comparison

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. (LRMP, p. 3-12).

24. 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).

25. 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)

26. 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)

27. 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)

28. Soil and debris would not be deposited in wetlands, springs, or seeps. (RLRMP, p. 3-13)

29. 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)

30. 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)

31. 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)

32. 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)

33. 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)

34. Projects will be designed to meet the assigned scenic integrity objectives (SIO) as defined in Appendix G. (RLRMP, p. 3-14)

35. Where possible, locate log decks and borrow areas out of sight of roads and trails in areas that have high or very high SIOs. (RLRMP, p. 3-14)

36. 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)

37. Close or obliterate all temporary roads. (RLRMP, p. 3-16)

38. Temporary roads should have a grade which does not exceed 20 percent for lengths more than 200 feet. (RLRMP, p. 3-16)

39. 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)

40. 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)

41. 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)

42. 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)

43. Herbicide treatment areas will not be prescribed burned for at least 30 days after application. (RLRMP, p. 3-20)

44. In any prescribed burning, the duff layer will remain present on 80 percent of the burn area. (RLRMP, p. 3-20)

45. Appropriate erosion control strategies will be applied to fire lines in order to minimize soil erosion. (RLRMP, p. 3-20)

46. 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)

47. 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)

48. 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)

49. Management activities are designed to meet or exceed the assigned Scenic Integrity Objectives. (RLRMP, p. 3-27)

50. 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

51. 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)

52. No log landings are allowed within 100 feet of riparian corridors. (RLRMP, p. 3-37)

53. Skid trails must use designated crossing within 100 feet of riparian corridors. (RLRMP, p. 3-37)

54. Logging and roadwork would be restricted during wet soil conditions to minimize resource damage.

55. Protect the visual resource by stand shaping and irregular boundaries in the proposed shelterwood stands as needed to achieve the visual quality objective. Take advantage of any opportunities to leave groups of hardwoods in pine regeneration areas.

56. 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.

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.

57. A review of listings and locations of all known occurrences of proposed, endangered, threatened, or sensitive species (PETS) has been conducted. 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.

    Timber harvest activities would leave, on average, a minimum of six roost trees, snags, or potential roost trees per acre as per the 1998 U.S. Fish and Wildlife Service Biological Opinion for the Indiana Bat (U.S. Fish and Wildlife Service, 1998).

    If Ozark chinquapin were located in a stand to be treated with herbicide, the trees would be placed in a 60-foot buffer, inside which no treatment with herbicides or handtools would occur.

58. In pine stands mast producing trees 10.0" diameter or larger at 4.5' height above ground level would not be treated during site preparation unless otherwise approved by a wildlife biologist or technician.

HERBICIDES (Alternative 2)

59. During site preparation, release, and pre-commercial thinning in all alternatives, treatments with handtools and/or herbicide would not be done within 100 feet of private land.

60. 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).

61. 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 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).

62. 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).

63. Weather is monitored and the project is suspended if temperature, humidity, and/or wind meet the criteria shown below in Table 8. (RLRMP, p. 3-4).

Table 8. Comparison of Project Weather Monitoring

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

64. Each Contracting Officer's Representative (COR), who must ensure compliance on contracted herbicide projects, is a certified pesticide applicator. (RLRMP, p. 3-5).

65. 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).

66. 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).

67. 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).

68. 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).

69. 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)

70. 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.

71. Edible berries would not be treated with herbicide.

72. Herbicide application would be suspended by the COR or inspector if rainfall is heavy enough to cause movement of herbicide from target species.

73. Notice signs will be clearly posted on herbicide-treated areas.

74. 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.

75. 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 LRMP 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.

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 Table 9.

Table 9. Comparison of Alternatives' Effects.

	Alternative 1	Alternative 2	Alternative 3
Soil Resources	Natural erosion continues; unmaintained roads continue to erode	Total expected temporary reduction of soil productivity would be 163 acres (8.1% of the harvested area) Fireline construction resulting in temporary loss of soil productivity = 12 acres (0.2% of burned area)	Total expected temporary reduction of soil productivity would be 160 acres (8.1% of the harvested area) Fireline construction resulting in temporary loss of soil productivity = 12 acres (0.2% of burned area)
Water Resources	Disrepaired roads contribute to stream sediment; 222 % increase Concern level = low	218% increase in sediment within the 6th level watershed; concern level = low	217% increase in sediment within the 6th level watershed; concern level = low
Air Resources	No change from current conditions	Short term direct effects include: Daily (~3500 ac.) emission volumes: 15,951 tons of CO^2; 638 tons of particulate matter	Short term direct effects include: Daily (~1,400ac.) emission volumes: 6,404 tons of CO^2; 256 tons of particulate matter
Road Access	Roughly 50 miles of roads in and around the analysis area. About 22 miles of open road.	12 miles of maintenance, 10 miles of reconstruction, 13 miles of road decommission, 8 miles temporary, 1 mile new construction	12 miles of maintenance, 10 miles of reconstruction, 13 miles of road decommission, 9 miles temporary, 0 miles new construction
Vegetation Resources	As forest ages, it will become more vulnerable to outside elements; decrease in early-seral veg. = decrease in biodiversity	Even-aged management= 398 acres (5.5% of project area), Thinning= 1,322 acres; indirect/cumulative effects = increase in biodiversity, more benefits to oak regen. from Rx fire	Same as 2 but replacing foliar herbicides with handtools would slow regeneration of desirable species. Undesirable species could out-compete desirable species.
Wetlands & Riparian Areas	No change from current conditions	With road decommissioning, maintenance, and reconstruction, water quality would improve	With road decommissioning, maintenance, and reconstruction, water quality would improve

Table 9. Comparison of Alternatives' Effects. (Cont'd)

	Alternative 1	Alternative 2	Alternative 3
Heritage Resources	Previously recorded sites will continue to deteriorate; no additional surveys would be conducted; no sites would be addressed for their National Register of Historic Places Eligibility	25 new sites discovered, two of them are recommended eligible for listing in the National Register of Historic Places; more sites may yet be found. If prescribed mitigation measures are properly implemented, project activities would not be expected to adversely affect cultural resources. Implementation of project activities would be expected to benefit cultural resources over time by increasing opportunities for monitoring sites.	25 new sites discovered, two of them are recommended eligible for listing in the National Register of Historic Places; more sites may yet be found. If prescribed mitigation measures are properly implemented, project activities would not be expected to adversely affect cultural resources. Implementation of project activities would be expected to benefit cultural resources over time by increasing opportunities for monitoring sites.
Wildlife Resources	Short term early successional habitat in regenerated stands would not occur. Negative indirect impacts to wildlife species. No benefits from Rx Burning	Thinning would yield positive indirect impacts to wildlife, increased abundance of soft mast species; increased wildlife benefits from increased Rx fire, increased positive indirect impacts to hardmast producing species and herbaceous vegetation then use of foliar herbicide application.	Less herbaceous vegetation abundance and diversity for wildlife due to stump sprouts as a result of no foliar herbicide application. Reduction of oak/pine regeneration with planned method of herbicide use. Decreased wildlife habitat improvement then reduction of Rx fire.
TES	Detrimental effects to species needing open habitats.	Benefit to species which require open and/or fire-dependent habitats; implementation of this proposed project may benefit Ozark big-eared bat, Gray bat, Indiana bat, and Northern long-eared bat by providing habitat improvement.	TES bat species would not benefit as much due to decreased vegetation effects/responses as well as prey decreases with reduced herbicide and Rx fire use.

Table 9. Comparison of Alternatives' Effects. (Cont'd)

	Alternative 1	Alternative 2	Alternative 3
Human Health	Potential effects of injury and damage to personal property in oak decline areas remain; mainly on travelways and camping/hunting sites. Risk to private property and safety is higher due to higher hazardous fuels accumulations	Risks of injury/damage to personal property in oak decline areas reduced; risk of worker injury rises due to timber harvest, TSI, and burning; risks of smoke effects to neighbors increases	Risks of injury/damage to personal property in oak decline areas reduced; risk of worker injury rises due to timber harvest, TSI, and burning; risks of smoke effects to neighbors increases
Social & Economic Factors	There would be no economic benefits to the local communities resulting from jobs created by timber sales or money to be used for wildlife habitat needs (KV money).	Activities proposed would affect the local economy by supplying timber for local mills, employing loggers to harvest timber, employing people to do site preparation, release, and wildlife habitat improvement work. Revenue generated for roads/schools	Activities proposed would affect the local economy by supplying timber for local mills, employing loggers to harvest timber, employing people to do site preparation, release, and wildlife habitat improvement work. Revenue generated for roads/schools
Recreation	This alternative will not change the recreation use (OHV driving, camping, hiking, mountain bicycling, or fishing) in the project vicinity.	Short-term browning of vegetation from herbicide use and burning could occur. More visually-penetrating views into forest for motorists… more occasions for wildlife viewing.	Short-term browning of vegetation from burning could occur. More visually-penetrating views into forest for motorists…more occasions for wildlife viewing.

1. Water Resources

Significant Issues Related to the Resource

Issue # 2, 4, 5, & 6

2 – Water Quality

4 – The cumulative effects of herbicide use on water quality and its likelihood of entering nearby streams and local water supplies

5 – The environmental impact of roadwork

6 – Large Woody Debris (LWD) placement in sections of the Little Mulberry Creek

Existing Condition

Watersheds in the United States are divided into progressively smaller units known as hydrologic units, recognized by the United States Geological Survey (USGS) - as regions, sub-regions, basin, and sub-basin units. This hierarchical division of watershed boundaries is useful for assigning address-like codes to drainage basins. This project area (Figure 2) falls within the Arkansas-White-Red region (11), the Lower Arkansas sub-region (1111), the Lower Arkansas-Fourche La Fave basin (111102), and the Frog-Mulberry sub-basin unit (11110201). The Ozark-St. Francis National Forests further classify land areas into progressively smaller units: watersheds and sub-watersheds. The proposed project areas fall within the Headwaters Mulberry River watershed (1111020106) and at the smallest scale, the proposed project occupies the northern portion of the Upper Little Mulberry Creek sub-watershed (111102010601). This sub-watershed, or 6th level Hydrologic Unit Code (referred to as a watersheds), will serve as the analysis boundary for the proposed project with respect to water resources. The proposed project area as discussed in this section of the document will consist of the compartment boundaries where activities are proposed.

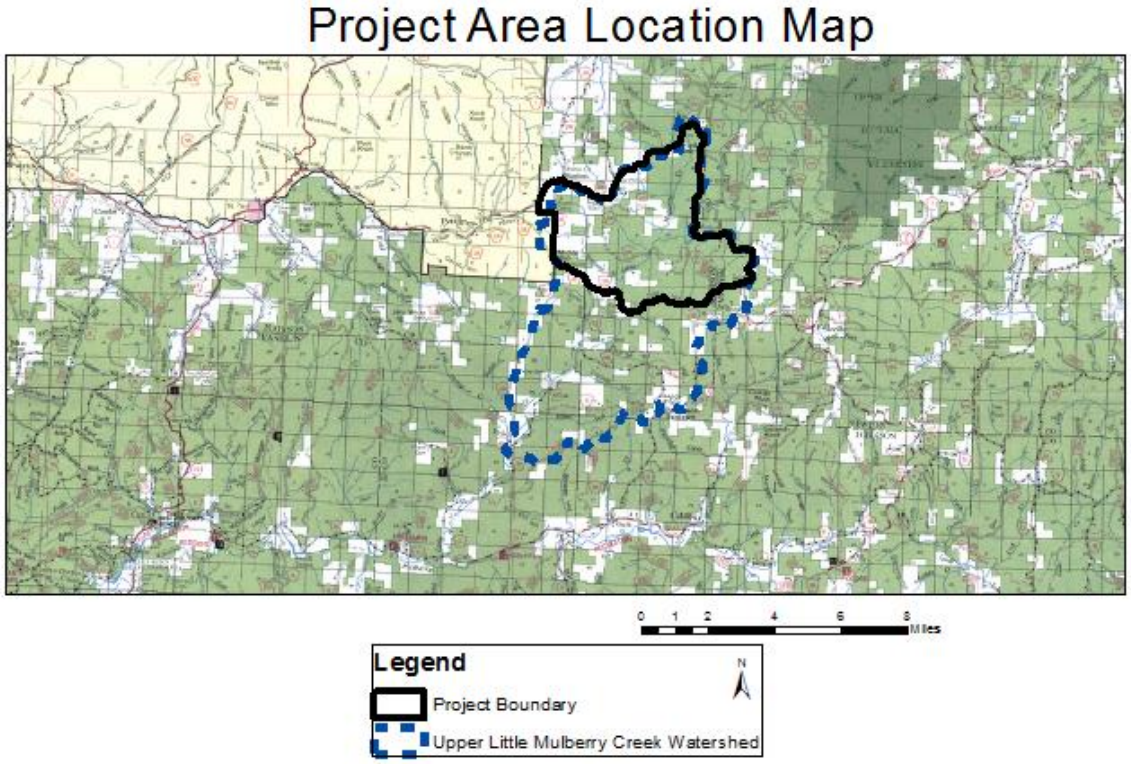

Figure 2. Project area watersheds

The project area and the sub-watershed analysis area support streams and rivers that have a dendritic drainage pattern. Dendritic drainage patterns typically have branching tributaries, which can concentrate precipitation across a wide area into one main stream channel. There are approximately 53.7 miles of streams within the analysis area, 26.7 miles of which occur in the proposed project area. The primary streams that are found in the project areas are: Little Mulberry Creek and several unnamed tributaries. Beech Hurricane Creek borders the

project area on the southwestern edge. The creeks and tributaries flow south and join the Mulberry River approximately 11 miles downstream of the protection area due to the use of the Mulberry River by the Cass Job Corps Center. The protection area is the location in which the state's Source Water Assessment Program analyzes potential threats to public water sources. This is the first step in analyzing whether a source of potential contamination may affect public water systems by delineating the surface drainage area above the water intake. No negative effects are anticipated on the water system from this project. The Arkansas Department of Environmental Quality (ADEQ) maintains a monitoring station (ARK0143) on Little Mulberry Creek at the southern end of the proposed project area and another near Friley (ARK0144) at the southern end of the watershed.

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 CFS and 7-day low flows of 1.4 CFS for a 2-year recurrence interval.

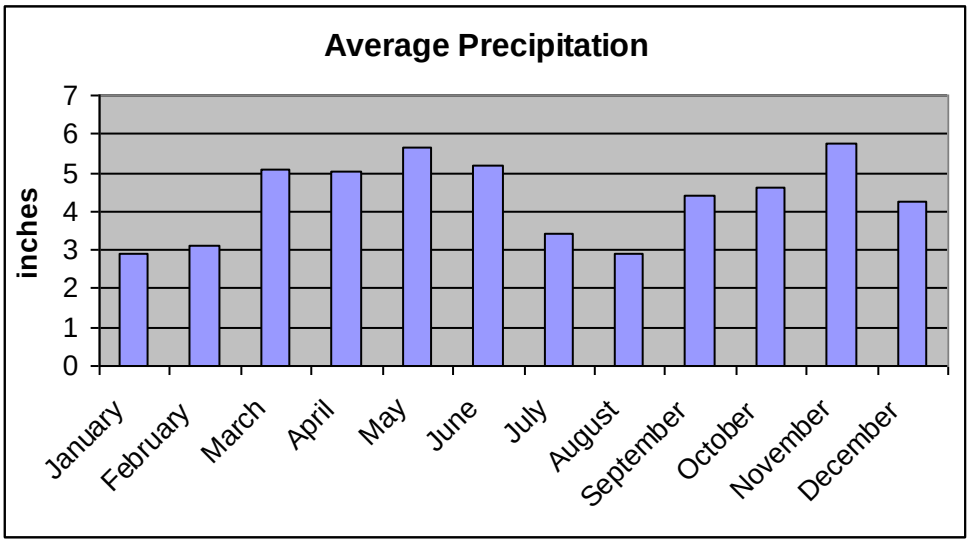

Figure 3. Comparison of Average Precipitation/Month

Climate information obtained for the project area was derived from information for the town of Ozone, AR (NRCS-Climate Product). The bars on Figure 3 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.

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.

Within the watershed analysis areas approximately 70.3 percent (or 19,271 acres) of the area is administered by the Forest Service. This leaves a sizable area of the land within the watershed as privately owned, roughly 29.7 percent or 8,155 acres. Land use within the area is approximately 96 percent forested. The balance of the watershed land uses are mainly agricultural type land uses.

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).

There are approximately 65 acres of floodplain within the project area. These occur in narrow strips, mainly along the Little Mulberry Creek. Approximately 123 miles of roads exist in the analysis area and 58 miles in the proposed project area. This results in a road density of 2.87 miles per square mile for the analysis area and 3.03 miles per square mile for the project area.

The Proposed Project is located in both the Boston Mountain ecoregion as identified by the EPA (2003) as a revision of work produced by Omernick (1987). These are the same ecoregion divisions recognized by the state for use in defining water quality standards. Thus, water quality standards for the project area, and the sub-watershed analysis area for this project, are determined by the Arkansas Pollution Control and Ecology Commission Regulation 2 – Water Quality Standards for Surface Water (2014). The designated uses assigned to the surface waters in the project area are as follows: for all waters, secondary contact recreation, domestic, industrial and agricultural water supply, seasonal stream fisheries. For surface water where the watershed is greater than 10 mi^2, and all lakes and reservoirs, the designated uses are the same as above but include primary contact recreation

and the perennial fisheries. The streams within the project area drain south into the Mulberry River and eventually into the Arkansas River.

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 have a much lower concentration of these constituents. This data does not isolate the direct or transient effects of timber harvest on nutrients, but it does illustrate the water quality impacts of alternative land uses in the Ozarks and surrounding Arkansas landscapes.

Direct and Indirect Effects

Alternative 1

Selection of the No Action Alternative will result in no direct effects because no activities would be conducted for this project. The current trends and conditions are expected to continue. Indirect effects will continue to result from the existing conditions of the project area. The effects of vegetation on water yield within the watershed will continue through evapotranspiration processes. Roads that do not receive necessary maintenance will continue to pose a chronic threat to water quality as problem erosion areas will continue to exist, or worsen.

Roads are the most common source of accelerated erosion on National Forest lands. Roads generate sediment from the erosion of excavated surfaces, ditches, and road maintenance operations. Raw ditch lines and roadbeds would be a continual source of sediment, usually due to lack of maintenance, inadequate maintenance, excessive ditch line disturbance, or poorly timed maintenance. As a result of this alternative, roads in need of maintenance and reconstruction will not receive the necessary upgrades to minimize resource damage. Unpaved roads paralleling and crossing streams will continue to pose specific risks to water quality as they often maintain linkages with the stream channel.

Activities associated with any other projects being conducted within the analysis area would affect any cumulative effects. The Lynn Hollow Project was started within this watershed in 2013 and has activities planned through 2020. Activities associated with both of these projects were taken into account when analyzing possible effects.

Alternatives 2 & 3

The main issue with respect to forest management activities and water quality is effects to water quality that may result from the proposed project; changes to water quality should not exceed the standards determined for the identified designated uses. The activities which may elicit direct and indirect effects are those of vegetation management; silvicultural site preparation; road construction, reconstruction, and decommissioning; and prescribed burning.

In a summary of silviculture activity effects in the Ozark-Ouachita Highlands, Lawson (1985) documented the amount of sediment produced from small watersheds in the undisturbed state and that produced as a result of vegetation management practices. The

undisturbed sites produced about 13.8 lbs/acre of sediment with 70 percent of this amount attributed to large precipitation events. A seed-tree harvest produced more than twice as much sediment, 31.3 lbs/acre during the first year after harvest. Three years after the treatment the erosion rates were similar to those of the undisturbed state. Another study by Lawson and Hileman (1982) investigated the effects of the seed-tree removal and site preparation burning. The results indicated that there were no statistically significant differences in stream turbidity between seed-tree removal sites and undisturbed control sites. Thus, seed-tree silvicultural practices in Arkansas will result in the production of sediment, but at levels below those found on typically managed forest lands of the eastern U.S. Therefore, the vegetation management practices proposed for this project would result in temporary increases of sediment but at relatively low levels for a short duration.

Using paired watershed studies for regions of the United States, effects of silviculture practices on annual average stream discharge was depicted by Stednick (1996). In this study, the actions necessary for producing measurable increases in water yield from forests in Arkansas was determined to be a 50 percent reduction in basal area across an entire watershed. This level of vegetation harvest would result in an increase of roughly 6 inches above normal runoff values for the first year. The recovery period for water yield to return to pretreatment level was found to be a function of vegetation re-growth. For Arkansas, this means that water yields should return to pretreatment level quite rapidly; however, changes to peak flow and storm flow timing may continue if drainage patterns are altered by activities such as road construction. Any changes to runoff timing should not result in impacts to current water uses or quality. Additional studies in the Missouri Ozarks by Stettergren and Krstansky (1987) indicate that for small watersheds where a regeneration treatment has occurred, slightly higher storm flows and peak discharges have been noticed; however, the absolute amounts of increased yield were not of notable quantities. This study also noted that the time to peak and total flow duration was unchanged.

The included watershed is approximately 96 percent forested but harvest is proposed over only 8.7 percent. The Proposed Action will reduce the basal area by less than 50 percent, so the proposed harvest is not expected to notably affect water yield.

In Alternative 2, the proposed riparian work and the addition of large woody debris (LWD) to streams in part of the project area will serve to increase the stream roughness coefficient both within the channel under normal flow conditions and outside the main channel during high water events. Increasing the roughness slows the water velocity, helping to protect stream banks and flood plains from erosion. A lower velocity also encourages deposition of sediment from the water.

Long term implications of nutrient loading after timber harvest for streams in the south were described in a study by Lynch and Edwards (1990). In this study, BMPs were used that include 100-foot wide perennial buffers, logging slash removed from streams, sale units monitored by a responsible party, operations ceased during wet weather, roads laid out by a professional, roads did not exceed 10 percent grade, culverts were used to cross perennial streams and removed when done, water bars utilized, roads gated, and filtration strips maintained. The results indicated that nutrients will not exceed water quality standards and that only during the treatment year would nutrients show a statistically significant increase. An important conclusion was the demonstration of the effectiveness of BMPs for controlling nutrient export.

Forest management options typically include the use of chemical pesticides in the form of herbicides to control unwanted or inappropriate vegetation growth. The use of chemicals has the potential to affect stream habitats directly (through acute or chronic toxic effects) or indirectly (as a result of changes to the composition of plant communities). Direct effects depend on two factors, the toxicity of the herbicide and the level of exposure. Toxicity varies among the products used, where common chemicals such as glyphosate are only slightly to non-toxic to aquatic organisms to chemicals such as triclopyr ester which pose a greater risk to fish and invertebrate toxicity.

Exposure is determined by such conditions as application rate, chemical behavior in the environment and biological factors. Many chemicals used in forestry applications break down fairly rapidly under normal conditions, usually within several weeks. Chemicals can enter water, overland flow and leaching. The most significant transport pathway would be direct application, drift, and mobilization during periods of heavy precipitation and overland flow. The most effective means for reducing this likelihood is to maintain a buffer between the treatment area and waterbodies, and to plan appropriately for application time frames.

Herbicide application to control competing vegetation does not disturb the nutrient rich topsoil layer, does not create additional bare soil, and does not adversely affect watershed condition when used responsibly (Nearly and Michael, 1996). By utilizing herbicides, the organic matter is left in place and off-site soil movement does not increase the loss of nutrients following harvest activities compared to the other types of management practices. (Maxwell and Neary 1991) concluded in a review that the impact of vegetation management techniques on erosion and sedimentation of water resources occurs in this order: herbicides < fire < mechanical. They also concluded that sediment losses during inter-rotation vegetation management could be sharply reduced by using herbicides and moderate burning instead of mechanical methods and heavy burning.

When herbicide fate is measured in runoff water, two common outcomes are apparent. First, measured peak concentrations are of short duration. Second, the highest concentrations occur when buffer strips are not used on streams or where the streams were accidentally over flown during aerial application (Neary and Michael, 1996). No aerial applications are planned for this project. Glyphosate has been frequently used in forest ecosystems because of its low mobility. It is readily immobilized by organic matter in the forest floor. Most studies have measured peak glyphosate concentrations in stream flow at or below 10 milligrams per cubic meter (mg/m3) (an order of magnitude below the EPA established Health Advisory Level ([HAL]). As seen with other herbicide data, the highest glyphosate peak concentrations occur when buffer strips are not used as a BMP (Neary and Michael 1996).

Picloram and Triclopyr are also common herbicides used in forestry applications. In a review of studies looking at stream flow fate of these herbicides, a similar pattern is noted as with other herbicides, that the highest peak concentrations are found when buffer strips are not utilized as BMPs. When buffer strips are employed as a mitigation measure, peak concentrations of these chemicals have not been found to exceed 40 mg/m3, below the Reference Dose (RFD) of both Triclopyr and Picloram. Some agricultural crops can be affected by Picloram levels < 50 mg/m3 (Neary and Michael 1996). Where buffer strips are used or other mitigation techniques are employed, forestry herbicides generally do not pose a

threat to water quality. Peak concentrations are usually low (< 100 mg/m3) and do not persist for long periods of time (< 6 mos.) (Neary and Michael 1996).

Forestry use of herbicides poses a low pollution risk to groundwater because of its use pattern. Herbicide use in forestry is likely to occur only once or twice over rotations of 25 and 75 years. The greatest potential hazard to groundwater comes from stored concentrates, not operational application of diluted mixtures (Neary and Michael 1996). Regional, confined, groundwater aquifers are not likely to be affected by silviculture herbicides (Neary 1985). Surface unconfined aquifers in the immediate vicinity of herbicide application zones have the most potential for contamination. It is these aquifers which are directly exposed to leaching of residues from the root zone. The only known groundwater contamination incidents of any importance (contamination of bedrock aquifers, persisting > 6 mos., concentrations in excess of forestry herbicides were used, involved extremely high rates of application, or spills after the contamination. These situations are definitely not typical of operational use of forestry herbicides. Proper handling precautions during herbicide transport, storage, mixing, loading and clean-up are extremely important for preventing groundwater contamination (Neary and Michael 1996).

Although short-term, low-level stream contamination has been observed for ephemeral to first-order streams draining studied sites, levels of herbicides in these streams have been neither of sufficient residence time to cause observable impacts on aquatic ecosystems (Michael, et al., 2000). These studies have, with a few exceptions, confirmed the absence of high levels of contamination of surface water. Thus, herbicides used properly can help protect water quality in the reduction of sediment in streams while accomplishing forest management goals. It is imperative that pesticides, unless clearly labeled for aquatic uses, must not be applied directly to water, and pesticides should be used around water resources which are particularly sensitive only after careful considerations of the ramifications (Michael, et al. 2000).

From a review of literature surrounding herbicide application and use on forest lands, and monitoring conducted on the Ozark-St. Francis NFs, it has been determined that the selection of this alternative could potentially result in low levels of herbicide residues entering waterbodies within the project area (SO unpublished reports). The OSFNFs utilize standards for herbicide application which require buffers between treated vegetation and waterbodies, as well as standards to ensure that drift and direct application to water bodies do not occur. This alternative includes the use of BMP practices and monitoring to ensure environmental quality is maintained.

When used for site preparation, herbicides are not broadcast but applied by direct injection, or foliar spray. For these purposes, herbicide use is infrequent (1-2 times per 100 yrs.) and direct application methods would minimize off-site movement. Forest-Wide Standards for herbicide application will be followed as well as appropriate BMPs designed to limit risk to water quality. Monitoring for herbicides used on the forests has been a continuous policy on OSFNFs for over 10 years. Results from this monitoring have not documented any significant concentrations of herbicides off-site from their application (unpublished reports).

The third alternative includes elimination of foliar herbicides, adjusted use of prescribed fire, leaving larger trees in place along State Highway 16, elimination of LWD placement, changing the one mile of new road construction to a temporary road, removing the proposed

0.7 miles of reconstruction and adding the 0.7 miles to decommission, and the potential construction of an interpretive/nature hiking trail south of the Headwaters School. Of these activities, only the adjustments to LWD and road construction affect sediment production for this project. As discussed above, the addition of LWD to streams will provide roughness and promote deposition of sediment while protecting the stream banks from erosion by slowing the water velocity both within the stream channel and on the floodplain. Without this needed roughness, stream banks are less protected and more subject to erosion during storm events. Within the Aquatics Cumulative Effects model used to quantify sediment loads, erosion due to construction of a Level D road is listed as 16 tons per mile. Erosion from construction of the same length of temporary road is listed as 4 tons per mile. Although the end result discussed below is that either this alternative or the proposed alternative indicates low risk to the watershed, the third alternative does decrease the erosion from roads.

Roads are the most common source of accelerated erosion on National Forest lands. Road-generated sediment may result from the erosion of cut and fill slopes, ditches, road surfaces, and road maintenance operations. Unpaved roads paralleling and crossing streams pose specific risks to water quality as they often maintain direct linkages with the stream channel. Roads result in three primary effects on forested lands. They can intercept rainfall directly, concentrate flow, and divert or reroute water from traditional hydrologic pathways. Through these actions, road systems mimic the stream channel network, effectively increasing the drainage density of streams in the landscape. This may result in modifications to the timing of water delivery to stream systems; however, this is not expected to be a measurable difference from current conditions. The activities of the proposed action will work toward 'disconnecting' the road system from the stream network.

Reconstruction of approximately 9.9 miles of road stated in Alternative 2 or 9.2 miles under Alternative 3 are proposed along with up to 7.3 miles of temporary road as stated in Alternative 2 or 6.9 miles stated in Alternative 3 are proposed for this project. Road construction in areas near streams could be responsible for large sediment delivery rates to the streams if proper BMPs are not followed and heavy rainfall events occur during construction. Guidance provided in the RLRMP and the Arkansas Forestry Silviculture BMP manual outline the mitigation measures necessary to conduct these activities while controlling contributions to non-point source pollution. Approximately 12.5 miles of road are proposed for decommissioning under Alternative 2 and 13.2 under Alternative 3 as part of this project, resulting in a decrease of potential sediment due to an overall decrease in road density for the watershed. The remainder of the road work is maintenance, which when properly conducted, should result in a net decrease in sediment production, thus a benefit.

The main effect of burning on water quality is the potential for increased runoff of rainfall. Runoff may carry suspended soil particles, dissolved inorganic nutrients, and other materials into adjacent streams and lakes, reducing water quality and degrading fish habitat (Wade and Lundsford 1989). However, most studies in the South indicate that effects of prescribed fire on water quality are minor and of short duration when compared with effects of other forest management practices. For example, Neary and Currier (1982) reported no adverse effects to water quality after a severe wildfire in heavy fuels in the Blue Ridge Mountains of South Carolina. In the Georgia Piedmont, low-intensity fires have had little effect on hydrologic properties of soils (Brender and Cooper 1968) and streamwater quality (Douglass and Van Lear 1983). Even where sedimentation and dissolved nutrients increase in stream water in response to wildfires in the Blue Ridge Mountains resulted in a threefold increase in NO3,

resulting concentrations were still low (0.012 mg N per liter). After a site-preparation burn in north Mississippi, Ursic (1970) reported that although sediment levels on burned watersheds were several-fold greater than those of control plots, sediment output was only about 0.5 ton per acre per year. Phosphorus and major cations often increase in stream flow and the soil solution after damaging surface water or site productivity (Tiedemann and others 1979). Van Lear and Waldrop (1988) concluded that properly conducted site-preparation burns cause minor nutrient loss and stream sedimentation compared with those resulting from mechanical methods of site preparation. Rapid vegetation regrowth in this part of the country quickly protects any disturbances to the landscape.

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; these effects have been shown from past research to be minimal and short-lived in this part of Arkansas. The most likely effects from these alternatives, beyond current conditions, are a short-term increase in sediment resulting mainly from road activities and minimal increases in water production. 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. Road stabilization through maintenance and construction, erosion control through re-vegetation of disturbed ground, and streamside management zones around surface water features are typical measures used to ensure the mitigation of adverse effects which may occur.

Cumulative Effects

For this analysis, the cumulative effects to water resources will be bound by the 6th level watershed in which the project is located (see Current Conditions). Cumulative effects result from practices which occur throughout the watershed, on both private and public lands. Activities and land uses identified for areas not administered by the Forest Service were determined from publicly available data. The major non-point source pollution concern that arises from Forest Service activities is that of soil erosion which can potentially result in increased sedimentation of aquatic habitats or threaten water quality as turbidity.

The cumulative effects analysis estimates sediment yield from both public and private lands, the existing road network, and from expected current and future activities. Current and future sediment yield is compared to estimates of an undisturbed landscape (or past condition). An undisturbed landscape is described as an entirely forested watershed without roads. Sediment increases are then calculated as a percent above the undisturbed amount. This value is compared to potential risk values for identifying levels of concern for watershed conditions. These risk indicator values were empirically determined using a relationship between sediment values and the condition of the fisheries from select locations across the area.

The cumulative effects analysis assumes that particular activities occur on public and private lands. The assumption is made that all the activities on public lands as described under each alternative, will occur during a one year time frame, or as an instantaneous event. In practice, these activities are usually spread over a number of years, thus amortizing the potential effects over the life of any resulting projects. Assumptions are included in the

determination of the potential risk indicator values; these values were determined on a smaller-scale, ecoregion basis, using community-based fish information. Different guilds within the fish communities were analyzed for predictive patterns of response to sediment loading. The most responsive patterns were used to set the risk level values. This allows for a determination of the 'worst case' scenario, providing a conservative understanding of effects to the water resources and designated use fisheries.

There are two risk values for every sixth-level watershed; the first separates the low and moderate concern level and the second separates the moderate and high concern level. A low concern indicates a minimal risk to water quality, or no expected adverse effects to water resources or the designated uses. A moderate concern indicates that care should be taken designing and implementing the project to avoid adverse effects and that additional aquatic monitoring should occur prior to project implementation. Proper application of all forest plan standards and Arkansas BMPs should be verified for implementation. Assuming these guidelines are correctly applied, this project would result in minimal risks to water quality; if these standards are not applied, then a greater risk to water quality results. A high concern signals that the water resources may be threatened by the current or future state of the watershed. Proposed activities should only be conducted with the application of appropriate forest plan standards and BMPs. Short-term adverse effects to water resources may result from activities captured in the effects analysis, both on public as well as private lands. Additional monitoring is necessary to determine that no adverse effects to the water resources are the result of Forest Service activities; this includes monitoring for adequate BMP compliance.

The water resource cumulative effects analysis was completed based on the activities described in this document. All supporting material for this model has been included in the project planning files. The results of this analysis are displayed in Table 10. This analysis indicates that the watershed analysis area has a low concern level. As a result of the No Action Alternative, sediment increases slightly but the concern level remains Low. Sediment increases for the No Action Alternative because roads that would be decommissioned in the Proposed Alternative remain in place. Under either of the proposed alternatives the concern level remains Low and sediment decreases from the current condition due to elimination of 13 miles of unneeded roads.

Table 10. Results of the Water Resources Cumulative Effects Analysis

Percent increase of sediment above undisturbed conditions								
	Current		Future					
Hydrologic Level			Alternative 1		Alternative 2		Alternative 3	
6th level Watershed Analysis Area	% increase	Concern Level	% increase	Concern Level	% increase	Concern Level	% increase	Concern Level
111102010601 Upper Little Mulberry Creek	220	Low	222	Low	218	Low	217	Low

The cumulative effects analysis indicates minimal risks to the water resource's current condition. The activities proposed by the Forest Service for the Proposed Action and alternative road construction alternative will result in a decrease in sediment production from the landscape. Additionally, it should be possible to schedule these activities over time instead of instantaneously as predicted by the analysis, thus further reducing the possibility of acute effects. 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 # 1 & 5

1 – Timber Harvest

5 – The environmental impact of roadwork

Existing Condition

The analysis area for soils will be Compartments 270, 271, 272, 276, 277, and 278. The project area is located on the southern side of the Ozark Plateau in a heavily dissected section called the Boston Mountains. Project area elevation varies from about 1240 feet at the southern tip of the project area on Beech Hurricane Creek and Clifty Hollow to 2480 feet near Red Star at the northern end of the project area. Several types of topography exist in this Boston Mountain section. Most of the timber harvest would occur 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 to narrow to very narrow alluvial areas along Beech Hurricane Creek, Little Mulberry Creek, and Clifty Hollow. Most of the mountain tops and creek bottoms and some wider benches now or have been under cultivation or in pastures, and some are still under private ownership. Project area topography varies from 0-3 percent slope on mountain tops, benches, and creek bottoms, to fairly steep 40-60 percent on the 200 to 300 foot slopes between the benches and just above the stream bottoms.

Soils are mostly well drained and range from shallow to deep. There are some small areas of poorly drained hydric soils in depressions on the floodplains along Little Mulberry Creek, Beech Hurricane Creek and Clifty Hollow.

There are some stumps and dim skid trails in previously harvested stands, but the soils and stands have mostly recovered from previous soil disturbance. Most of the soils have 100% consisting of leaf litter, twigs, limbs, logs, gravel, stones, and have an intact root mat. Soils

in the road beds have some ground cover protecting them, but are mostly bare and eroding in some sections.

The potential disturbance for the soil resource was estimated using coefficient developed from soil disturbance monitoring done on the Ozark-St. Francis National Forests during 1993-2007. Estimates of temporary loss of soil productivity assume that all of the proposed activities would occur within one year. This is a worst-case assumption, which is highly unlikely to occur, but it demonstrates the maximum potential soil productivity is expected to occur within 20 to 25 years based on monitoring done on the Mt. Magazine Ranger District in 1981 and 2001.

Direct and Indirect Effects

Alternative 1

The roads proposed for reconstruction, maintenance, and decommissioning will continue to erode.

Alternative 2 & 3

Approximately 7 percent (143 acres) of the harvested area would sustain a temporary reduction in soil productivity due to harvesting operations. An additional 14 acres (<1% of the harvest area) would sustain a temporary reduction in soil productivity due to temporary road construction. Soil productivity would be lost on up to five acres due to road reconstruction. Approximately 12 acres of the harvested area would sustain a temporary reduction in soil productivity due to fireline construction. A slight increase in temporary reduction in soil productivity is anticipated with the implementation of Alternative 3. This is due to creating smaller burn blocks (300 acres/day or less) which would increase the number of miles of fireline needed to properly maintain and manage each prescribed burn. This is not expected to cause any negative long-term or adverse effects. Thirteen miles of road are proposed for decommissioning which will return approximately 22 acres of soil to a productive state.

Total expected temporary reduction of soil productivity would be 163 acres (8.1% of the harvested area), including skidding, temporary road construction, and road construction and reconstruction. Fireline construction would add approximately 12 acres to the estimated soil disturbance (0.2% of the area proposed for burning). Road decommissioning would reduce the net acreage of soil disturbance to 153 (7.2%). Temporary roads, 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. Road reconstruction will stabilize roads and prevent loss of productivity on soils adjacent to these roads and will reduce erosion and sedimentation. Road maintenance would also prevent the loss of productivity on soils adjacent to the roads by helping to control runoff. Less than 15 percent of an activity area can sustain a reduction in soil productivity, according to the LRMP standard. If more than 15 percent of the activity area sustains a reduction in soil productivity, mitigation measures must be installed. The documentation for temporary reduction in soil productivity can be found in the Analysis File.

The use of herbicides would have no impact on 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 herbicides 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 SERA 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 SERA 2011]). Persistence in soils is about two months or less.

Picloram is extremely soluble in water. Hexachlorobenzene is a contaminant in picloram much less soluble in water. Hexachlorobenzene is highly persistent in soil with metabolic half-lives of about 3 to 6 years. Conversely, hexachlorobenzene is relatively volatile and is expected to dissipate rapidly from soil surfaces (SERA 2011). Studies on soil microorganisms suggest that both picloram and picloram metabolites may impact soil microorganisms. Although picloram could have an effect on soil microorganisms, the consequences of such effects are not clear. No field studies linking adverse effects on soil microorganism with detectable adverse impacts on soil productivity have been encountered (SERA 2011). Picloram chemically attaches to clay particles and organic matter. Breakdown caused by sunlight and microorganisms in the soil are the main ways in which picloram degrades in the environment. Picloram will dissipate more quickly in warm, wet weather. Alkaline conditions, fine textured clay soils, and a low density of plant roots can increase the persistence of picloram. Carbon dioxide is the major end product of the breakdown of picloram in the soil. The half-life of picloram in soil is reported to vary from one month under favorable conditions to more than four years in arid regions (USDA 1989). At high application rates, picloram may inhibit microbial activity (Kryszowska et. al. 1994 [cited in USFS PNW Region 2000]). At a level of 10 ppm in sandy loam soil, picloram caused transient decrease in nitrification after two but not three weeks of incubation and no effect on ammonia formation or sulfur oxidation (Tu 1994 [cited in USFS PNW Region 2000]). The decrease in nitrification was relatively mild and does not portend a substantial or prolonged impact on microbial activity. Bacteria and fungi can utilize picloram as a single source of carbon and nitrogen. It increases the number of ammonifying bacteria (Spiridonov, Smokhalov, and Rudakov 1981, [cited in Brown et. al. 1990]). The warm weather at the time of application, the high density of plant roots, and the acidic soil conditions are expected to rapidly breakdown the picloram.

Triclopyr is absorbed by plant roots, but it is not considered effective as a soil-applied

herbicide. Triclopyr is absorbed primarily to organic matter particles in soil. The organic matter content is the primary factor in the degree of soil absorption. 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-life for triclopyr formulation are 0.2 days for triclopyr butoxyethyl ester (BEE); 14 days for ticlopyr acid; and 69 days for 3,5,6-tricloro-2-pyridinol (TCP) which is 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). Clearly 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, three 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 affect 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 halftime in soils ranges from 5.9 to 8.1 years (SERA 2011a).

Imazapic's effect on soil invertebrates and soil microorganisms 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 halftime in soils ranges from 106 to 113 days (SERA 2004).

Approximately seven percent (140 acres) of the harvested area would sustain a temporary reduction in soil productivity due to harvesting operations. An additional 15 acres (<1% of the harvest area) would sustain a temporary reduction in soil productivity due to temporary road construction. Fireline construction would add approximately 12 acres to the estimated

soil disturbance (0.2% of the area proposed for burning). Road decommissioning would reduce the net acreage of soil disturbance to 149 acres (7.2%). Temporary roads, 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. Road reconstruction would stabilize roads and prevent loss of productivity on soils adjacent to these roads and would reduce erosion and sedimentation. Road maintenance would also prevent the loss of productivity on soils adjacent to the roads by helping control runoff. Less than 15 percent of an activity area can sustain a reduction in soil productivity, according to the LRMP standard. If more than 15 percent of the activity area sustains a reduction in soil productivity, mitigation measures must be installed. The documentation for temporary reduction in soil productivity can be found in the Analysis File.

Herbicide effects on soils would be the same as those described for Alternative 2.

Prescribed fire effects on soils would slightly alter due to the increased firelines needed for the smaller burn blocks but would not be a significant difference from those described for Alternative 2.

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 (RLRMP 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 2003). 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 under burns are usually light to moderate, so their effect on erosion is generally negligible (RLRMP 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).

Cumulative Effects

For Alternative 2, there is a potential for additional temporary loss in soil productivity in the stands that were previously thinned and proposed for shelterwood harvests. Two hundred thirty-three acres of the units that were thinned in the past have mostly recovered from soil disturbance, but have about 14 acres of soil disturbance (6%). Twenty-one acres of additional temporary loss of soil productivity is estimated for these units due to the proposed shelterwood harvest (9%). The existing and estimated additional temporary loss in soil productivity equals 35 acres, which is 15 percent of the harvested area. The cumulative effects are not significant. Existing and estimated temporary loss in soil productivity is expected to be within the RLRMP standard. Erosion control will be done on skid trails in the harvested areas to speed the recovery of soil productivity.

For Alternative 3, there is a potential for additional temporary loss in soil productivity in the stands that were previously harvested and are proposed for thinning harvests. Fifty-eight acres of the units that were harvested using the group selection method in the past have mostly recovered from soil disturbance, but have about two acres of soil disturbance (4 %). Four acres of additional temporary loss of soil productivity is estimated additional temporary loss in soil productivity equals six acres, which is 10 percent of the harvested area. The cumulative effects are not significant. Existing and estimated temporary loss in soil productivity is expected to be within the RLRMP standard. Erosion control will be done on skid trails in the harvested areas to speed the recovery of soil productivity.

There is a potential for additional temporary loss in soil productivity in the stands that were previously thinned and are proposed for shelterwood harvests. Two hundred thirty-three acres of the units that were thinned in the past have mostly recovered from soil disturbance, but have about 14 acres of soil disturbance (6%). Twenty-one acres of additional temporary loss of soil productivity is estimated for these units due to the proposed shelterwood harvest (9%). The existing and estimated additional temporary loss in soil productivity is expected to be within the RLRMP standard. Erosion control will be done on skid trails in the harvested areas to speed the recovery of soil productivity.

There is a potential for additional temporary loss in soil productivity in the stands that were previously thinned and are proposed for thinning harvests. Fifty-two acres of the units that were thinned in the past have mostly recovered from soil disturbance, but have about three acres of soil disturbance (6%). Three acres of additional temporary loss of soil productivity is estimated for these units due to the proposed thinning harvest (6%). The existing and estimated additional temporary loss in soil productivity equals 6 acres, which is 12 percent of the harvested area. The cumulative effects are not significant because the existing and

estimated temporary loss in soil productivity is expected to be within the LRMP standard. Erosion control will be done on skid trails in the harvested areas to speed the recovery of soil productivity.

3. Climate Change

Existing Condition

Research and analysis of evidence dating many years ago show intervals of warming and cooling on earth. The current warming trend is particularly important because it is proceeding at an unusual rate. Assessments by the Intergovernmental Panel on Climate Change (IPCC) suggest that the Earth's climate has warmed between 0.6 and 0.9 degree Celsius over the past century and that human activity affecting the atmosphere is "very likely" an important driving factor. (USDOE, Energy Information Administration 2008)

The following information is from the National Climatic Data Center (NCDC) website (http://lwf.ncdc.noaa.gov/oa/climate/gases.html): Many chemical compounds present in Earth's atmosphere behave as greenhouse gases. These are gases which allow direct sunlight (relative shortwave energy) to reach the Earth's surface unimpeded. As the shortwave energy (that in the visible and ultraviolet portion of the spectra) heats the surface, longer-wave energy (heat) is reflected to the atmosphere. Greenhouse gases absorb this energy, thereby allowing less heat to escape back to space, and 'trapping' it in the lower atmosphere. Many greenhouse gases occur naturally in the atmosphere, such as carbon dioxide, methane, water vapor, and nitrous oxide, while others are synthetic. Those that are man-made include the chlorofluorocarbons, hydrofluorocarbons and perfluorocarbons, as well as sulfur hexafluoride. Atmospheric concentrations of both the natural and man-made gases have been rising over the last few centuries. As global population increases and reliance on fossil fuels (such as coal, oil and natural gas) is firmly solidified, emissions of these gases continue to rise. While gases such as carbon dioxide occur naturally in the atmosphere, through our interference with the carbon cycle, we artificially move carbon from solid storage to its gaseous state, thereby increasing atmospheric concentrations (NCDC 2009).

The principal greenhouse gases that enter the atmosphere because of human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases (USEPA 2009). Atmospheric carbon dioxide concentration is now higher than at any time in the past 10 million years (Kennedy and Hanson 2006). Humankind has altered the natural carbon cycle by burning coal, oil, natural gas and wood and since the industrial revolution began in the mid-1700s, each of these activities has increased in scale and distribution. Prior to the industrial revolution, concentrations were fairly stable at 280 ppm. Today, they are around 370 ppm, an increase of well over 30 percent (NCDC 2009). In 2006, carbon dioxide emissions from the United States accounted for about 20 percent of the amount added to the atmosphere globally. Fuel combustion accounted for 94.0 percent of U.S. carbon dioxide emissions in 2007; this figure represents approximately 85.4 percent of the nation's total greenhouse gas emissions that year. Changes in land use and forestry practices can also emit carbon dioxide through conversion of forest land to agricultural or urban use or can act as a sink for carbon dioxide (USEPA 2009).

Numerous processes collectively known as the "carbon cycle" naturally regulate concentrations of carbon dioxide in the atmosphere. Natural processes, such as plant photosynthesis, dominate the movement ("flux") of carbon between the atmosphere and the land and oceans. Carbon sequestration is the process by which atmospheric carbon dioxide is taken up by trees, grasses, and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage and roots) and soils. The sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide to the atmosphere, such as deforestation, forest fires and fossil fuel emissions. Carbon accumulation in forests and soils, however, eventually reaches a saturation point, beyond which additional sequestration is no longer possible. This happens, for example, when trees reach maturity, or when the organic matter in soils builds back up to original levels before losses occurred (USEPA 2009). While natural processes can absorb some of the net 6.2 billion metric tons (7.2 billion metric tons less 1 billion metric tons of sinks) of anthropogenic (human-caused) carbon dioxide emissions produced each year (measured in carbon equivalent terms), an estimated 4.1 billion metric tons are added to the atmosphere annually. This positive imbalance between greenhouse gas emissions and absorption results in the continuing increase in atmospheric concentrations of greenhouse gases. (USDOE, Energy Information Administration 2008)

In computer-based models, rising concentrations of greenhouse gases produce an increase in the average surface temperature of the Earth over time. Rising temperatures may, in turn, produce changes in precipitation patterns, storm severity, and sea level commonly referred to as "climate change" (USDOE, Energy Information Administration 2008). Projected climate change impacts include air temperature increases, sea level rise, changes in timing, location and quantity of precipitation and increased frequency of extreme weather events such as heat waves, droughts, and floods. These changes will vary regionally and affect renewable resources, aquatic and terrestrial ecosystems, and agriculture. Changes in temperature and precipitation will alter the growth patterns and distribution of plant and animal species. There are uncertainties regarding the timing and extent magnitude of climate change impacts, but continued increases in human greenhouse gas emissions will likely lead to increased climate change.

Direct and Indirect Effects

Alternative 1

It is currently not possible to predict the actual effects of a project on global climate change, so a baseline comparison cannot be made using the No Action Alternative relative to climate change.

Much of the project area is currently susceptible to climate change events such as prolonged drought due to the stressed conditions of individual trees. Tree crowns and roots have little or no room to expand and stems in crowded stands compete for water and nutrients. Under these conditions, trees are much more likely to die due to added stress from climate change events. If overstory trees die, sustainability of overstory tree species would be in question due to the lack of advanced oak and pine regeneration in the understory.

Because fuel loads within the proposed project area would not be reduced, the potential for an uncharacteristically severe wildfire will persist and increase as fuels are added to the

forest floor through natural processes. In such an event, the quantities of carbon dioxide and other greenhouse gas emissions released into the atmosphere would be expected to be greater than those that would have been released under the controlled conditions of a prescribed burn or in an area where fuel reduction treatments had been conducted. The actual quantity of emissions released would depend on the acreage burned, tons of fuel consumed and the amount of time required to suppress the wildfire.

Harvest of trees that have reached or passed maturity will not occur. The ability of those trees to sequester additional carbon from the atmosphere will continue to be less than that of younger stands of trees. No wood products such as wood flooring, furniture and lumber that would store carbon will be obtained from the proposed project area.

Alternatives 2 & 3

Forests and soils have a large influence on atmospheric levels of carbon dioxide. The carbon stored in live biomass, dead plant material and soil represents the balance between carbon dioxide absorbed from the atmosphere and its release through plant respiration as well as decomposition and burning.

With these alternatives, some of the carbon currently sequestered in vegetation and soils will be released back to the atmosphere. In the short-term, greenhouse gas emissions and alteration to the carbon cycle will be caused by hazardous fuel reduction activities, harvests and thinning overstocked stands. In the long term, however, these actions will also increase the forest's ability to sequester additional carbon, improve the forest's resilience to the potential impacts of climate change and decrease the potential for uncharacteristically severe wildfires. Harvest will remove some of the mature stems with diminished ability to sequester additional carbon; some of the carbon sequestered in harvested stems will continue to be stored in manufactured wood products. Residual stems and regeneration in the proposed project area will continue to sequester and store carbon.

Wildfires may still occur in the proposed project area; however, because fuel loads will have been reduced with these alternatives, 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

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.

4. Air Resources

Significant Issues Related to the Resource

Issue #3

Prescribed burning

Existing Condition

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 Revised 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 4, 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.

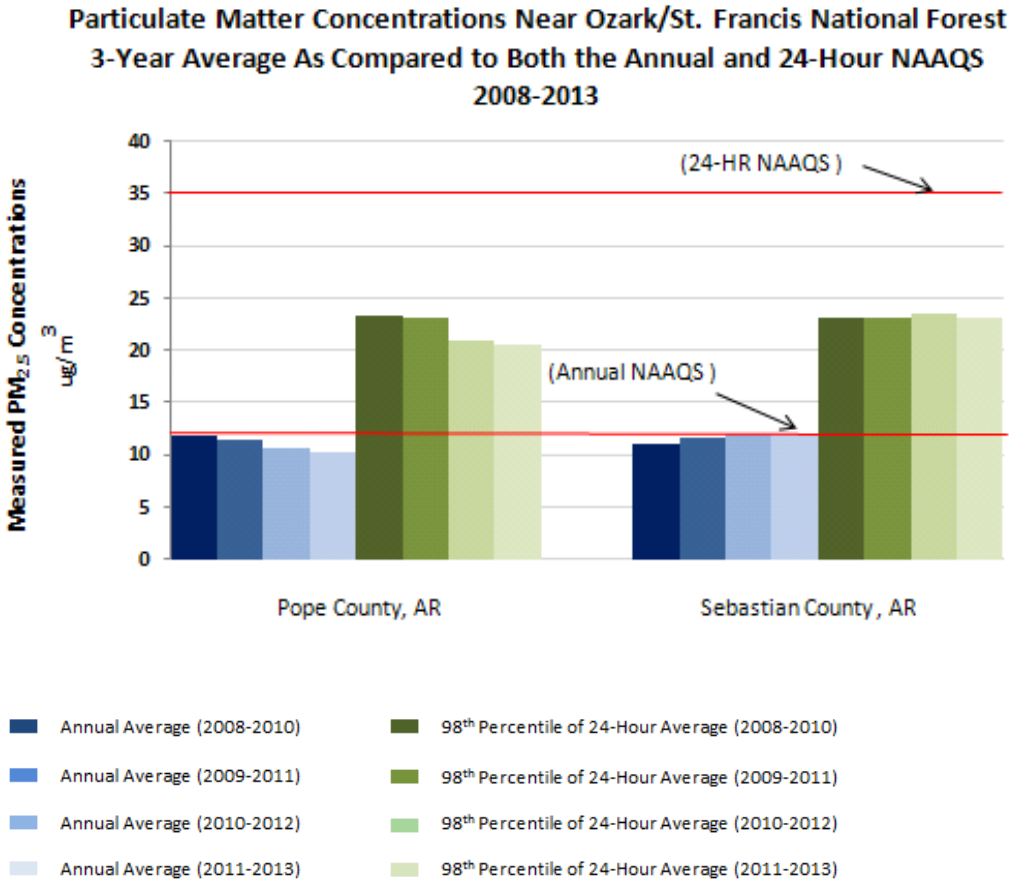

Figure 4. Particulate Matter Concentrations near the Ozark-St. Francis National Forests

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 5 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.

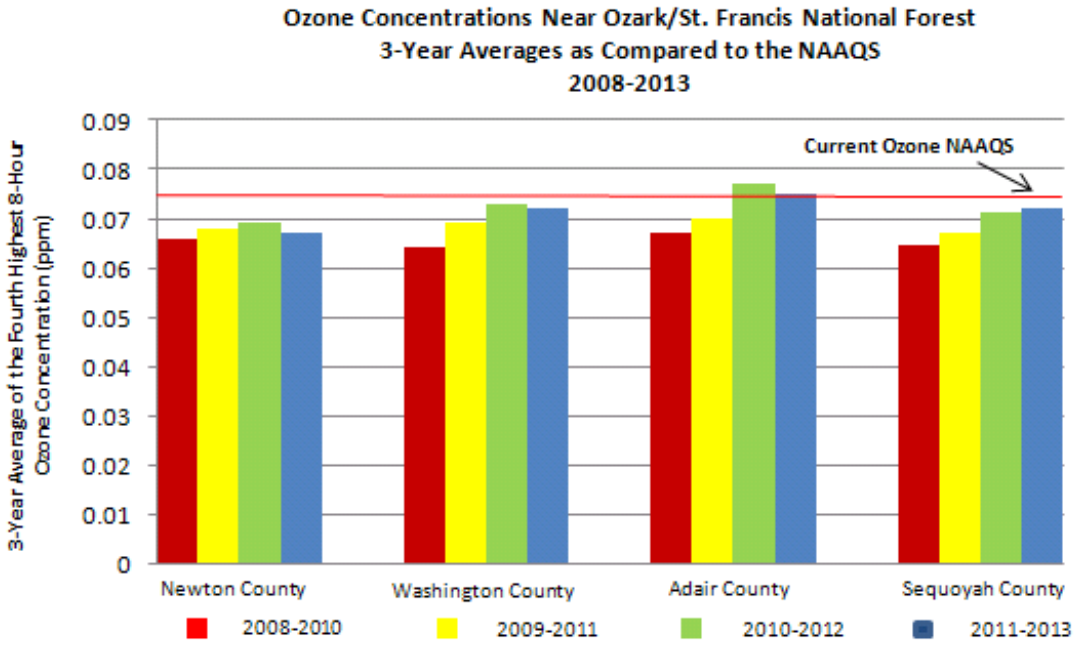

Figure 5. Ozone Concentrations near Ozark-St. Francis National Forests

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 6.

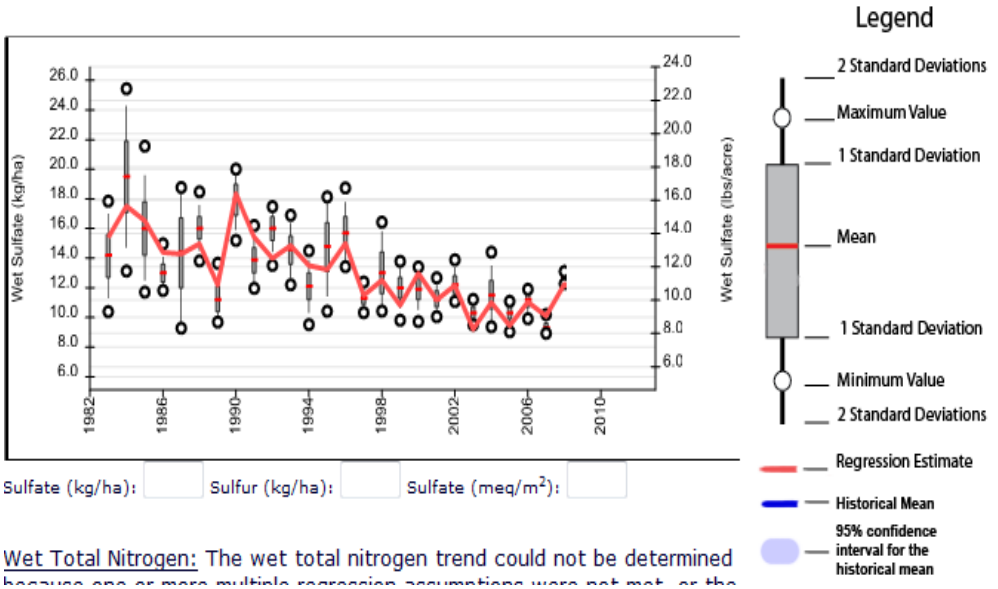

Figure 6. Wet Total Sulfate

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 7 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.

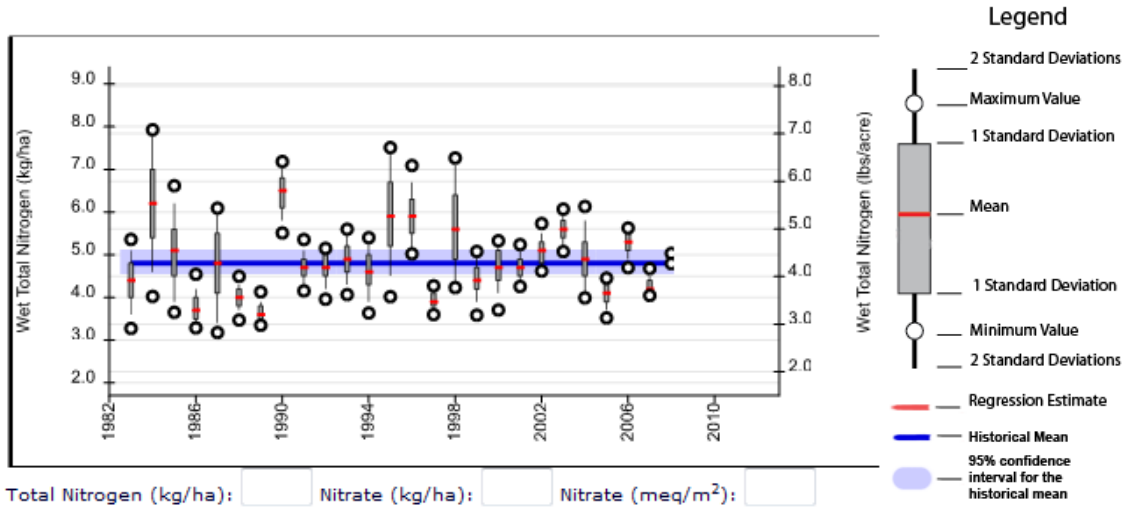

Figure 7. Wet Total Nitrogen

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 11 shows the number of proposed new or modified sources that were reviewed over the past five years.

Table 11. 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 8 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 8 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 8. 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).

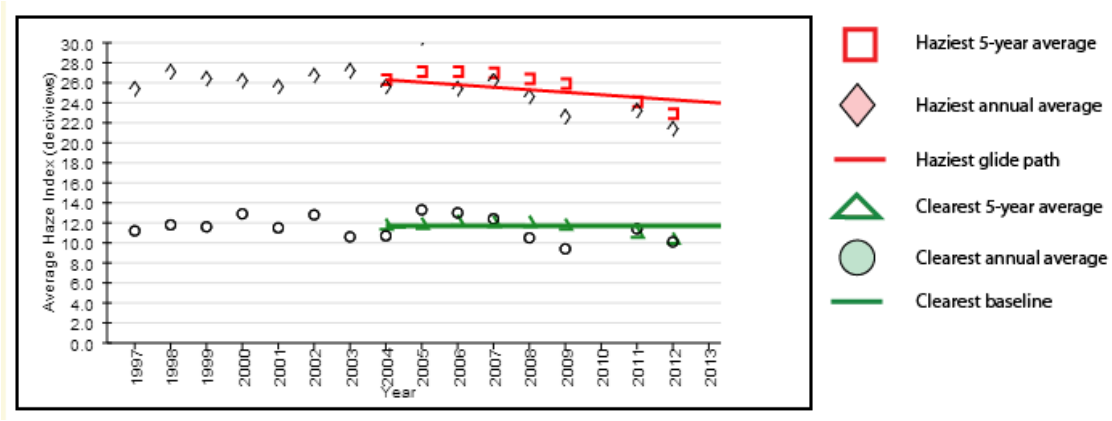

Figure 8. Haze Index Results

Fire

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 12), 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 12. 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 13). 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 farily constant the last few years. We would expect this trend to continue.

Table 13. 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.

The Clean Air Act requires the EPA to establish NAAQS for six pollutants considered harmful to public health and the environment: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. The standards were set at the level required to provide an ample margin of safety to protect the public health. An attainment area is a geographic area in which levels of criteria air pollutant meet NAAQS for the pollutant. Under the CAA, any area that violates NAAQS for any of the six criteria pollutants as few times as once per year and as often as four times over a three-year period is classified as a "nonattainment" area. The proposed project area lies within Madison County Arkansas. Currently, the levels of all six criteria pollutants are at or below the NAAQS (attainment) in this county.

Direct and Indirect Effects

Alternative 1

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.

Alternatives 2 & 3

Prescribed burning proposed in these alternatives 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 may 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 needed 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.

Table 14 lists the estimated amounts of CO_2 resulting from the prescribed burning proposed by Alternatives 2 and 3. 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 14. Daily total emissions released during Alt. 2 & 3 site prep, thinning, and non-harvest hazardous fuel reduction prescribed burning.

Compound Emitted	Estimated Release (U.S. Tons)*	
	Alternatives 2	Alternative 3
Carbon Dioxide (CO_2)	15,951	6,404
Carbon Monoxide (CO)	1,659	666
Water Vapor	6,380	2,562
Particulate Matter	638	256
Hydrocarbons	160	64
Nitrogen Oxides	29	12
TOTAL	**24,817 tons**	**9,964 tons**

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

Alternative 2 has more total emissions/day (based on approx. 3,500 acres/day) but lasts for only 2 days; Alternative 3 has less volume of emissions/day but must be burned for over 5 separate days. This does not take into account the private land acreage that is within the project boundary. Some or a large majority of these lands may be burned, depending on private landowner cooperation with NF prescribed burning agreements.

Cumulative Effects

The global effects of prescribed burning are discussed in the VMEIS. The effect of prescribed burning on climate change is dependent on a pool of knowledge yet to be formulated.

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.

5. Herbicides

Significant Issues Related to the Resource

Issue #4

The cumulative effects of herbicide use on water quality, especially foliar spraying and its likelihood of entering nearby streams and local water supplies.

Existing 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 the action alternatives 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 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 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 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, and 2011). Worksheets associated with the SERA risk assessments were completed for all proposed chemicals. When 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 Hazard Quotients (HQs) were projected to be below the Forests' maximum acceptable standard of 1. 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 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.

Glyphosate is not soil active and has low toxicity to animals. Glyphosate studies show that 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 upon 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 HQs for humans and terrestrial wildlife are less than 1.0. HQs for many aquatic species are greater than 1 (see Process Record for specific numbers). These higher HQs (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 negate hazard quotients > 1.

Hexazinone 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 mitigates this potential.

Contact with hexazinone may cause corneal opacity or clouding of the eye and skin irritation/rash on the skin. 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). 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 HQs for workers, the general public and wildlife. All HQs 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 negates these HQs > 1.

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

All HQs 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). These HQs > 1 are not of concern for the following reason:

- 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 an 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 HQs for wildlife related to use of granular formulations of hexazinone were less than 1, with the exception of HQs for some aquatic organisms (see Process Record for specific numbers). These higher HQs (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 negate HQs > 1.

All HQs for wildlife related to use of liquid formulations of hexazinone were less than 1, with the exception of the HQs for long term exposure of a large mammal on site, and with the exception of HQs for some aquatic organisms (see Process Record for specific numbers). These HQs > 1 are not of concern for the following reasons:

- The scenario assumes a diet composed of 100 percent contaminated vegetation or insects from the treated site which is highly unlikely.

- The long term HQs assumes that vegetation is consumed on the same site for 90 days which is also unlikely.

Higher HQs (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 negate HQs > 1.

Imazapic is weakly adsorbed in basic soils, but absorption 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 HQs for workers, the general public and wildlife. All HQs for humans and terrestrial wildlife are less than 1. HQs for some aquatic organisms are greater than 1 (see Process Record for specific numbers). These higher HQs (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 negate HQs > 1.

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 HQs for workers, the general public and wildlife. All hazard quotients for humans and terrestrial wildlife are less than 1. HQs for some aquatic organisms are greater than 1 (see Process Record for specific numbers). These higher HQs (suggesting risk to these species) were modeled from generally central and upper field solution concentrations representing both accidental or deliberate exposure to the chemical and long term exposure. Forest wide standards preclude application of herbicide not labeled for aquatic use near of 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 negate HQs > 1.

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** are 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 eyes (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 HQs for workers, the general public and wildlife. Both ester and amine formulations of this chemical were investigated.

All HQs 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 HQs > 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 HQs would be mitigated by changing protective clothing and washing following contamination as directed by policy.

HQs 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. These HQs > 1 for workers – taken from very conservative modeling are tempered 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).

HQs 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 upon use of herbicides near water.

- Adherence to Forest 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 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.

HQs 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 HQs are associated with both the central and upper application levels of field solution concentrations (see Process Record for specific numbers). These HQs> 1 for the general public – taken from very conservative modeling are tempered 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 general 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 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).

- The typical hazard to the general public may often be negligible because significant levels of exposure are not likely. For the general 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).

HQs 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). These HQs > 1 for the general public – taken from very conservative modeling are tempered 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).

- 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.

- 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 general 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).

HQs 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 HQs 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 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 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.

HQs 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 HQs are associated with both the central and upper application levels of field solution concentrations (see process record for specific numbers). These HQs ≥1 for terrestrial wildlife – taken from very conservative modeling are tempered by the following:

- For both the acute and chronic exposure scenarios, the assumption is made that 100 percent 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.

- 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 HQs 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 HQs 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 percent of the diet is contaminated. If larger mammals avoid treated areas, the proportion of the contaminated diet could be much less than 100 percent. As the proportion of the diet that is contaminated decreases, the consequent HQs will also decrease (SERA 2011).

HQs are ≥ 1 for scenarios modeled for some aquatic organisms. These upper bounds HQs 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 HQs 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). These HQs ≥ 1 for aquatic organisms – taken from very conservative modeling are tempered 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/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 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 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 Arkansas Forestry Best Practices 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. Timber stands occasionally may 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. 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 the leaf's surface. 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
- JLB Oil- processed petroleum oil and limonene emulsifiers

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

Direct and Indirect Effects

Alternative 2 & 3

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. Application methods, including direct 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 and cleanliness 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 HQs ≥ for non-accidental acute exposure (single exposure for both triclopyr (amine and ester formulations) and hexazinone shows these situations are unlikely.

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 BMPs.

Adverse, indirect effects to management indicator species (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, BMPs and Forest-Wide Standards will be used.

Cumulative Effects

There are likely to be few negative cumulative effects to humans, wildlife or plants over time as a result of implementing Alternatives 2 or 3. 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 a previous NEPA analysis to apply herbicide districtwide on up to 500 acres annually to treat non-native invasive species (NNIS). Realistically, for the reasonably foreseeable future this may amount to 200 acres of herbicide treatment in the analysis area for NNIS over the next 5 years. The only other known herbicide use on the Ozark National Forest involves the utility line corridor in which herbicide is used to keep vegetation away from the electric lines. In addition, 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 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, herbicide mitigation measures and BMPs. Proposed herbicide use would have beneficial effects on species using early-successional habitat by allowing creation and maintenance of wildlife openings, reduction of overstory and midstory canopy in wildlife stand improvement (WSI) areas, and promoting oak and pine regeneration through timber stand improvement (TSI) cultural practices.

Implementation of Alternative 3 (no foliar spraying-reduced Rx burning) would not provide the level of indirect benefits to wildlife as would be expected with implementation of Alternative 2. Reduction of herbicide use would reduce the levels of early successional habitat, reduce diversity of herbaceous species in woodland restoration areas and reduce the promotion of oak/pine regeneration – below levels which would be expected with implementation of Alternative 2.

6. Forest Improvements (Road Access):

Significant Issues Related to the Resource

Issue #2, 5, & 7

2 – Water Quality

5 – The environmental impact of roadwork

7 – Access/Recreation/Visuals

Existing Condition

Approximately 58 miles of roads exist within and around the Locust Gap Project area; county roads comprise approximately 11 miles around and within the Locust Gap analysis area. These roads are regularly maintained by the county and Forest Service. Existing road locations shown on the maps have been identified using Global Positioning System (GPS) equipment. Currently, the total road density is 3.03 miles of road/square mile. Road density under National Forest jurisdiction is 2.3 miles/square mile.

Direct and Indirect Effects

Alternative 1

Primary arterial roads would be maintained at their current level. However, revenues from timber sales would not be generated to aid in road maintenance.

Several 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 (open roads) and are maintained for the public to reach private residences or allow for administrative access. However, forest interior roads classified as Maintenance Level 1 (closed roads) in need of maintenance or rehabilitation would continue to erode and contribute to sedimentations of creeks and streams.

Alternatives 2 & 3

A Road Analysis Process (RAP) was completed for this project to inform this environmental assessment. It identified and considered values associated with or impacted by the existing road system and all proposed roadwork. Consideration was given to long-term road funding opportunities and obligations.

Proposed timber harvesting activities will require reconstruction and maintenance of open and closed roads. Descriptive statements of the road work that would be conducted are given on pages 22 and 23 of this EA. Specific locations of the construction work were determined using GPS equipment. The effects of roadwork 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.

All roads proposed for this project will average less than 10 percent slope, with some short sections slightly greater than 10 percent.

Maintenance on approximately 10.6 miles of open and closed roads will be performed in this project to get the roads in a suitable condition for hauling timber across them. Maintenance consists of spot blading and graveling. County roads that would be used are regularly maintained by their respective counties. Special cooperative agreements are in place to assist in any required maintenance resulting from logging operations. Several Maintenance Level 1 and 2 roads that were previously closed will be re-closed with gates/berms to reduce erosion and protect resources. The Forest Service Manual states that Maintenance Level 1 roads are to be closed to motorized traffic when management activities are complete.

Reconstruction on approximately 9.9 miles of roads under Alternative 2 or 9.2 miles under Alternative 3 is proposed (1459 West, 1459 East, 1460, 94276B, 94277A, and 94277C). These roads are not maintained on a regular basis thus would require more work than the roads that receive maintenance. Up-grading these roads by installing culverts, wing-ditches, gravel, and rolling dips will stabilize them, thus minimizing sediment delivery to streams and drainages. Due to concerns from the public, a small portion (approx. 0.7 miles) of FS 1459 East would be removed from the original proposed reconstruction of Alternative 2 and changed to decommissioning of 0.7 miles. This section of road east of the Blue Hole would not be needed for accessing timber stands.

Approximately 12.5 miles of existing roads under Alternative 2 or 13.2 miles under Alternative 3 no longer needed for management or access are proposed for decommissioning. Decommissioning involves restoring these roads by allowing them to blend back in to the general forest area. Activities used to decommission a road include, but are not limited to the following: re-establishing former drainage patterns, out sloping and stabilizing all road sections, restoring vegetation, blocking the entrance of the road, installing water bars (earthen mounds), and removing culverts. These activities are designed to completely eliminate the road bed by restoring natural conditions. Unnamed and unauthorized accessed OHV trails that are present in the project area may be closed using debris, rocks, earthen mounds, or gates.

Approximately 7.3 miles of temporary roads under Alternative 2 or 6.9 miles under Alternative 3 would be needed to access timber stands. These roads would be blocked and rehabilitated with seeding and/or natural re-vegetation. Temporary roads are not intended to be included as part of the forest transportation system but rather managed for short-term projects or activities and will be decomminssioned after use.

An inventory of all existing roads was completed and locations were obtained using GPS equipment. Several unauthorized trails were identified as well as old road templates not presently being used for administration purposes. Some of these have been decommissioned and/or closed in the past, but are still being used as illegal OHV trails.

Cumulative Effects

The density of open roads would decrease under both alternatives as all presently-closed roads will be re-closed upon completion of the project. Currently, total road density of roads per square mile is about 3.03 miles length/mile². Under Alternatives 2 & 3, the road density decreases to 2.3.

The auditory and visibility impacts of road-using equipment should be relatively short-lived with very little effect on the environment. Re-closure and decommissioning of roads would reduce erosion and improve water quality in the project area.

Based on the watershed analysis that evaluates roads' contribution of erosion and sediment in these two alternatives, rates of delivery are considered low risk.

7. Heritage Resources

Existing Condition

The National Historic Preservation Act of 1966 (NHPA), as amended, 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 (SHPO) 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.

A cultural resource review and inventory was conducted during the planning process for this proposed project to identify historic properties. The findings of this survey were reported to the Arkansas SHPO and relevant-federally recognized Tribes as Project No. 14-10-04-01. Review and comments are pending.

Twenty-five archeological sites have been identified in or near the project area as a result of cultural resources inventory surveys. Two sites are recommended eligible for nomination to the National Register of Historic Places. One site is recommended ineligible for listing. Eligibility recommendations for the remaining 23 sites are undetermined, and these require additional field and/or archival research before recommendations can be made. The 25 sites include two prehistoric sites and 23 historic sites that are the remnants of late 19th and early 20th century occupation in this area. Sites recommended eligible for nomination for listing include a historic cemetery and rock cairns possibly with prehistoric context. 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 Chapter 2.

Site Locations Not Yet Known. Cultural resource surveys may not be complete for certain activities because additional planning may be required prior to implementation. These activities may include, but are not limited to:

- Burn boundary and fireline construction locations outside areas already inspected/tested
- Temporary roads, skid trails, and log landings outside areas already inspected/tested
- Road construction, maintenance, conversion, or decommissioning activities involving ground disturbance occurring outside areas already inspected/tested

As necessary, these areas will be inspected/tested and consultation will be completed prior to implementation.

There may be American Indian sacred sites or landscapes currently unknown to the Forests. The Forests 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 Ozark-St. Francis National Forests are carved out of ancestral American Indian lands. American Indians' historical and spiritual connections to the land have not been extinguished despite changes in title. Respecting, honoring, accommodating, and protecting American Indian sacred sites is part of our commitment to restore forests and reserves.

EFFECTS OF ALTERNATIVE ACTIONS

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 timber harvesting and associated log landings, skid trails and temporary roads, prescribed burning, and associated fireline construction, road maintenance or reconstruction where ground disturbance takes place outside existing right-of-way area, and pond construction for wildlife water source.

Proposed activities that do not have potential to affect cultural resources and, therefore, are not considered undertakings for purposes of this project include: Non-commercial thinning, timber stand improvements, on-going maintenance of existing Forest roads or reconstruction of previously surveyed roads where ground disturbance does not take place outside existing road prisms and existing drainage features, rehabilitation/closure of temporary roads, log landings, and skid trails using non-ground disturbing methods, road decommissioning using non-ground disturbing methods, and non-native invasive plant species control using non-ground disturbing methods.

In general, proposed project activities have the potential to affect cultural resources by encouraging increased visitor use to those areas of the Forests 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.

Direct and Indirect Effects

Alternative 1

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 the No Action Alternative (Alternative 1), historic properties would continue to degrade.

Cumulative Effects

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 Forests.

Direct and Indirect Effects

Alternative 2 & 3

Proposed access changes, soil restoration work, and opening of forested areas resulting from vegetation management could 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, prescribed fire, road management, and some wildlife management activities. However, if the prescribed mitigation measures discussed in Chapter 2 are properly implemented, project activities would not be expected to adversely affect cultural resources.

Cumulative Effects

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.

Protection Measures for Historic Properties - All Action Alternatives
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: Historical Properties Avoidance during Project Implementation
Avoidance of historic properties will require the protection from adverse effects resulting from the undertaking. Mitigation measures include establishing clearly defined boundaries and buffers around historical properties where activities might produce adverse effects. In addition, proposed new roads, temporary roads, log landings, and skid trails will be routed 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 firelines 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 a 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 and relevant federally-recognized Tribes, 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; and

(3) The agreed-upon mitigation measures will be implemented prior to initiation of activities having the potential to adversely 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, relevant federally-recognized Tribes, and the ACHP (if appropriate), to determine proper 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 and relevant federally-recognized Tribes' approval.

8. Vegetation Resources and Vegetation Diversity

Significant Issues Related to the Resource

Issue #1

Timber Harvest

Existing Condition

The Locust Gap Project area is situated within the Boston Mountain eco-region located in the central part of the Ozark National Forest. Historically, the lands that are now the Ozark National Forest consisted of fire-dependent woodland and forest ecosystems with well-developed herbaceous understories. There was a more frequent regime of vegetation

disturbance from anthropogenic fire than what has been common since the early 1900's. Early travelers in the Ozarks reported that Native Americans burned the woods on a regular basis. Frequent fire in forest/woodland ecosystems would invariably have produced open, less dense stands with a higher proportion of vegetation adapted to fire. Mean fire-return interval from 1680-1820 ranged from 4.6 to 16 years, from 1821-1880 mean fire-return interval ranged from 2 to 3.1 years and for the period of 1881-1920 it ranged from 1.4 to 5 years. From 1921-2000 mean fire-return interval for these area ranged from 62-80 years (Guyette and Spetich 2003).

Native American fires and natural 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 (2001):

> 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.

Review of 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 4 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. Up until the last 10-15 years, wildfires have largely 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 American beech to become more common in the understory. These species would likely become more dominant in future stand composition while oaks, which are shade-intolerant and fire-tolerant, would decrease.

Displacement of anthropogenic fire, creation of barriers to fire such as roads, and a long standing policy of fire suppression have led to higher forest health risks and problems due to abnormally dense forest conditions and unsustainable ecosystems. 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.

Most of the Ozarks, prior to National Forest acquisition, was extensively harvested for lumber and barel staves during the early 1900's. Much of the hardwood forestlands were heavily logged for railroad ties and barrels in the early part of the 20th century. Small

acreage farms were settled along floodplains 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. 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. Heavy cutting from the late 1800's to the 1930's combined with land clearing and periodic burning by settlers, the occasional lightning, Native American fires described above, and cattle/hog use greatly influenced 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-St. Francis National Forests within the past decade. A red oak borer epidemic materialized with affected acreage going from 19,000 acres in 1999 to around 300,000 acres in 2001. Preliminary field investigations indicate that the red oak component of the forests was being reduced by as much as 85 percent within the affected areas. Incidents of infestation leveled off in 2004-2005 and have continued to decline. A Jumping Gall Wasp population eruption occurred in spring 2010. It affected white oaks across the forests by defoliating the leaves. Mild drought conditions followed that summer, and then severe drought in 2011-2012 killed several stands of white oak and continues to negatively affect forest conditions into 2014.

The Ozark NF has had oak decline diagnosed as far back as the late 1980's (Evaluation of Oak Decline Areas in the South: Protection Report R8-PR 17 September 1989). Oak decline is a complex syndrome with multi-factor causal agents that lead to dieback symptomologies and mortality. The key symptom characterizing oak decline is progressive crown dieback followed by mortality which may take a period of years. Oak decline results from tree stressors that have: (1) long-term predisposing factors such as adverse climatic trends, poor site conditions, tree age or genetics; (2) short-term inciting factors like drought, late spring frost/freeze, insect defoliation, or discrete air pollution events; and (3) long-term contributing factors such as root disease, bark beetles, canker, or decay fungi. Any combination of these factors results in triggering an oak decline event (Oliveria, Department of Agriculture Forest Health Protection scientist, July 2014).

Continuing with Oliveria, he offers the following management considerations that might have a positive impact on the health and productivity of Ozark hardwood stands.

- Consider regeneration in stands showing decline symptoms as thinning may increase the severity of oak decline. This occurs when *Armillaria spp.* in infected residual roots and stumps continue to contribute to more infection of remaining trees. Also, changes in the soil moisture regime due to compaction and heating of the forest floor contribute additional stress.

- Consider reducing the rotation age of the dominant oak species in these stands. Older trees have less vigor and by 80 years of age have contracted the root rot that is causing the dieback and mortality.

- Consider earlier, heavier thinning to 40-50 basal area. These sites are site [index] 70 at best and have inclusions that are much less fertile. The lack of fertility is a limiting

factor in how well the trees maintain vigor. You would increase vigor by thinning the trees heavier at an earlier age…

- Try to thin stands each time they [stands' basal areas] exceed the site index due to growth of the trees in the stand. In order to maintain maximum vigor, stands need to be kept around 50 basal area.

Vegetative management to reduce density would serve to lower the risk to possible future insect/disease outbreaks. The most effective preventive strategy is to use regeneration, thinning, and salvage harvests that would reduce inter-tree competition and relieve water stress on remaining trees. The stump sprouts from cut trees would help provide a source of young oaks for the future stand.

Another forest health issue in the project area includes non-native invasive species such as Nepalese brown top grass, Chinese lespedeza, mimosa, and tree-of-heaven (*Ailanthus*). These forest health issues and their treatments are covered in detail in a district-wide EA done in 2009 called Pleasant Hill Wildlife Habitat Improvement Projects.

Timber harvesting, land clearing, and other uses (especially hog and cattle grazing) from pioneer days to present have developed a somewhat diverse and fragmented ecosystem across the Locust Gap Project vicinity. Farming continues on some private lands with the maintenance of pasture and some crop acreage on the mountaintops and along the Little Mulberry Creek. Streams and drains within the project area have riparian ecosystems of varying widths which provide additional vegetative diversity. Privately-owned land comprises significant blocks around the project area. This area varies from improved pastures to heavy woods.

The compartments for which vegetation was analyzed contain approximately 7,049 acres of National Forest land, of which 5,440 acres are suitable timber-producing lands. The project area consists of pine timber types (3%) and hardwood timber types (97%). Currently, the project area does not have a balanced age-class with 82 percent of forest stands being over 80 years old (Table 15) and less than 2 percent being younger than 20 years old. Table 15 exhibits the age-class distributions on public lands in the Locust Gap Project.

Table 15. Current Age-Class distribution in Locust Gap project area on Public Land.

Timber Type	Ages-Classes							Total Acres (USFS)	%
	0-10	11-20	21-40	41-60	61-80	81-100	101+		
Pine Acres	0	0	0	207	0	0	0	207	3
Hardwood Acres	9	33	429	39	538	3466	2328	6842	97
Total Acres	**9**	**33**	**429**	**246**	**538**	**3466**	**2328**	**7049**	
% of Total Acres (USFS)	<1	1	6	3	8	49	33		

Note: Total acreages may vary slightly from those mentioned previously based on rounding computations.

Current conditions and characteristics of stands proposed for timber harvesting and other silvicultural activities are listed in Appendix B.

There are approximately 1,609 acres (23%) that have been designated for old-growth forest management status.

Direct and Indirect Effects

Alternative 1

Alternative 1 would allow another 156 acres (2% - acres of 61-80 yrs. old) to move up into the >80 year old age-class, comprising a total of 84 percent of the Project Area. The health of dense, older timber stands needing treatment would continue to decline and they would become more susceptible to insects and disease. Potential productivity and/or wood volume would decrease as a result of increased competition and mortality. This alternative would not meet the desired future condition as listed in the Forest Plan and would forego the opportunity to restore oak and pine forestlands. This alternative does not address the stated purposes and needs of this project.

There would be a cumulative effect of late-successional, shade-tolerant species (such as maple and beech) replacing the early-successional, more shade-intolerant species (such as oaks) at all canopy levels and in the understory. Old fields that have been planted with pine and naturally-occurring pine areas would eventually be replaced by hardwood that currently exists in the understory/midstory of these stands. Most of the timber and wildlife outputs identified in the RLRMP would not be gained in the Locust Gap Project.

Alternative 2 & 3

The effects of Hardwood Shelterwood harvests would be the replacement of mature even-aged stands with immature even-aged stands containing stump-sprouts, naturally-seeded saplings and seedlings. A partial component of the original mature stands will be retained for genetic stock and to give shelter to the young, natural regeneration. These harvest methods meet the guidelines and objectives set out in the RLRMP. They are appropriate methods because the hardwood trees have reached mature age, exhibit good acorn-bearing characteristics, and are located on soils suitable for natural regeneration. Artificial regeneration (planting) would occur if desired stocking levels are not met by natural means.

Treating some of the remaining non-merchantable hardwood/pine with herbicides in the shelterwood areas that are not needed for wildlife and other purposes will let light reach the forest floor, and allow stump/root-sprouting and acorns to germinate in these areas. In the short-term, the stands will be more open and early-seral vegetation will develop across the area. Within 10 years, the understory will be very dense and emerging into midstory status.

The effects of Timber Stand Improvement (1,159 ac.) and Pre-commercial Thinning (390 ac.) treatments in hardwood using hantools and/or herbicide would allow favored trees to gain dominance or get a good growth jump to stay ahead of its competitors. Stocking (density) would be reduced to eliminate competition of desirable species, allow more growing room for the remaining trees, and would allow more light penetration for more herbaceous vegetation. Forest-Wide Standards and mitigation measures mentioned on pages 26 through 35 would be followed during implementation of timber treatments using herbicides near streams (e.g., Little Mulberry Creek) in order to avoid negative impacts.

Additional discussion regarding vegetation management near Wild and Scenic Rivers can be found in Section 13 of the EA, Management Areas, Scenery Management and Recreation. The effects of the follow-up burning would replace woody, brushy vegetation with more desirable regeneration that would fully occupy the sites.

Pine thinning would occur on 169 acres and hardwood thinning on 1,153 acres. Its effects would increase vigor and growth of residual trees, reduce the susceptibility of the stand to insect and disease, and improve habitat for wildlife. Densities would be reduced for more penetrating views; more herbaceous and brushy vegetation would ensue for more wildlife species benefits, especially after midstory control measures of TSI (handtool/herbicide) and burning occur.

The stands would be thinned to a target basal area of 50-60 ft^2/acre. Trees that are suppressed or that have poor form would be targeted for removal. Trees of good form and/or close to the correct spacing would be favored over trees that are simply of larger size. The target spacing would depend on the average diameter of the trees of the stand. Thinning allows more light to the forest floor, thereby, increasing herbaceous vegetation.

The effects of hardwood TSI in 25 hardwood stands, roughly 1,159 acres, would be similar to the harvest thinning of the pine and hardwood mentioned above. Stocking levels will be reduced to allow light penetration to the forest floor to initiate more herbaceous vegetation and to alleviate competition for light and moisture of the remaining trees.

The effects of Oak Woodland Thinning on approximately 297 acres would open the stands even more than the pine and hardwood thinning. The stocking levels would be reduced to approximately 40 ft^2/acre so that more grass-like species could be established. This would also bring back forest conditions reminiscent of the pre-settlement era.

The estimated hardwood volume produced by these alternatives would be 3,285 CCF of sawtimber and 6,555 CCF of poletimber. The estimated pine volume produced would be 1,200 CCF of sawtimber and 490 CCF of poletimber (CCF=one hundred cubic feet).

The effects of prescribed burning on federal land and private land (with landowner's consent) will be the replacement of brushy and woody vegetation in the understory to a more grass and forb composition, benefiting quail, deer, and neo-tropical migratory birds, on balance. Oak and pine regeneration would be encouraged, fuel accumulations would be reduced, risk of wildfire would decrease, and an increase in favorable habitat for historical fire-tolerant vegetation species would occur.

The effects of eliminating non-native invasive species (NNIS: <500 acres) would restore natural, historically endemic vegetation, as well as faunal and avian species that once thrived in pre-settlement times.

The effects of creating scattered wildlife openings (6 areas = 43 acres) by dozer/herbicide would be the replacement of a moderately-dense overstory with a variety of grasses and forbs that would be suitable for forage by ground-dwelling animals.

Cumulative Effects

The cumulative effects from all actions proposed in Alternatives 2 & 3 on vegetative diversity of the project area, relative to the No-Action Alternative (Alternative 1), are shown in Table 16.

Table 16. Treatments Affecting Vegetative Diversity Changes under Alternative 2 & 3 Timber Harvesting Actions (Acres)

Forest Type	Within-Stand Diversity (Thinnings)	Between-Stand Diversity (Even-Aged Management)
Hardwood	1,153	398
Pine	169	0

Implementation of Alternative 2 is not expected to have a negative cumulative impact on vegetation. The forest condition would be improved and left in a more sustainable condition. Risk of insect/disease outbreaks would decrease and growth of residual trees would increase. Also, potential old-growth would not decrease in the project area.

The effects of implementing Alternative 3 would be similar to the effects mentioned above for Alternative 2. One change, though, is that Alternative 3 excludes the use of foliar application of herbicide. Eliminating the use of foliar herbicides and replacing it with a less-effective method (i.e., herbicide applied directly onto cut stumps or by a streamline-to-bark application, or even handtools) could slow the process of regenerating the desirable species. However, using herbicides is always more effective than using handtools because it lasts longer and does not require repeated applications. Additionally, herbicides severely retard stump-sprouting. When only using handtools to cut undesirables, stump-sprouting will almost always occur, thus causing the desirable species to struggle against formidable competition for sunlight.

Alternative 3 also proposes less Rx burning per day, but will require more burning days. Smoke and fireline management will be easier and more controllable. However, additional miles of fireline may be needed to restrict burning size; this may contribute more sediment into water sources, endangering aquatic biota.

The other change from Alternative 2 for Alternative 3 is Compartment 270, Stand 1 (71 acres); it will not be commercially thinned as Oak Woodland, but will have a mid-story treatment classified as TSI. This activity will actually resemble a thinning (with the same effects), but no commercial harvest with attendant road-building would be done.

Cumulative Effects

Based on this analysis, the implementation of Alternative 3 could have a negative cumulative impact on human worker resources because of more intensive use of herbicide/handtool work and more sediment loss due to additional firelines.

9. Wildlife Resources

Significant Issues Related to the Resource

Issue #6

Large Woody Debris (LWD) placement in sections of the Little Mulberry Creek

Existing Condition

Wildlife, fish and plant species and their habitats in the project area are managed in cooperation with the Arkansas Game and Fish Commission (AG&F), 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 on National Forest lands. 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 (carbon sources & other nutrients that come from outside the native aquatic system) food chain.

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

Wildlife habitat has been altered by the oak decline phenomenon, particularly the red oak borer infestation. Progression of oak decline on the District is resulting in habitat changes which could include a long-term 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.

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.

Table 17. MIS Species, Habitat Requirements and Population Trends

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 as well as insects for young poults.	stable to decreasing* (increased poults 2012)
Prairie warbler	ecological indicator	regenerating forest communities, old fields, oak woodlands (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
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

Note: Information from AGFC Harvest Data

Sixteen species were selected as MIS for the Ozark-St. Francis National Forests. 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 17 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 17 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 Table 17 (Taylor 2013) 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, private land pastures, 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 40+ 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). Currently, approximately 6,371 acres (90%) of the hardwood stands in the project area are composed of age classes from 41 – 100+ years in age. These age classes are comprised of mast producing trees.

All stands composed of pine forest types in the project area are currently in the age class 41-60 years of age. These stands are represented on all aspects and ridge tops.

At present, approximately less than 1 percent of the public lands in the project area (forest and woodlands) are in an early seral condition (1-10 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.

Table 18. Forest Age Class Distribution by Alternative (public lands)

Age Classes (years)	Alternative 1 (acres/% total)	Alternatives 2 &3 (acres/% total)
grass/forb*	0/0%	0/0%
1-10	9/1%	407/6%
11-20	33/1%	33/1%
21-40	429/6%	429/6%
41-60	246/3%	246/3%
61-80	538/8%	538/8%
81-100	3,466/49%	3,337/47%
101+	2,328/33%	2,059/29%

Note: Some grass/forb habitat is found on existing road and utility right of ways

With implementation of Alternatives 2 or 3, approximately 398 acres would be converted, through harvest and subsequent regeneration, from the 81-100+ year age classes to the 0-10 year age class. Implementation of the shelterwood regeneration system would result in 6 percent of the public land-base within the project area compartments in early successional forest habitat, as opposed to <1 percent under current conditions. Approximately 1,619 acres would be restored to woodland condition through thinning in the 61-100 year age classes. Browse and early-successional habitat would be provided in these regeneration areas and thinned woodlands for a variety of wildlife species, especially when combined with prescribed fire. 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.

Implementation of Alternative 2 or 3 would result in an approximate 6 percent reduction of forest habitat that is greater than 81 years old (federal lands). Following implementation of either alternative, approximately 76 percent of the forested (both pine and hardwood) public land base within the project area compartments would remain in the 81-100+ year age classes. With implementation of Alternative 2 or 3, and taking into consideration recruitment of stands from the 61-80 year age class (approximately 538 acres or 8% of project area land base) as well as examination of distribution of stand age classes, fragmentation of interior forest habitat is not anticipated.

Direct and Indirect Effects

Alternative 1

Currently approved management actions would be maintained under Alternative 1.

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. Findings of this paper are summarized here.

Timber Harvest and Wildlife Habitat Improvement: Effects of implementation of the No Action Alternative are described in (Taylor 2013) 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 with closed-canopy conditions would occur. Thinning to help restore woodland conditions and to improve herbaceous diversity would not occur. Short term early successional habitat in regenerated forest stands would not occur, thereby, causing negative indirect effects to disturbance-dependent and early successional obligate wildlife species. Lack of thinning and regeneration harvest 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. Regeneration silvicultural treatments would not be implemented to provide age class diversity and maintain oak in the ecosystem as a source of hard mast for wildlife species. 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. Current forest timber types would decline.

Timber Stand Improvement Practices: TSI practices; silvicultural release and pre-commercial thinning practices; and planting of hardwoods in oak failure areas would not occur. Lack of improvement of stands containing beneficial tree species for wildlife would not occur, thereby, causing indirect adverse impacts.

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; and maintaining other fire-dependent or adapted species and habitats would not occur. Lack 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: Without use of this tool, benefits to oak/pine regeneration would not occur. Herbicide use (foliar, hack and squirt, or cut stump treatment) provides longer lasting beneficial impacts to creating and maintaining early-successional habitat than can be expected with use of only mechanical means and prescribed fire. Benefits to species requiring early-successional habitat through use of herbicide would not occur. Herbicide use is also important for benefiting oak/pine regeneration, thereby, providing for these species presence in the ecosystem in the long term. Without use of this tool, benefits to oak/pine regeneration would not occur.

Road Work: Road maintenance, road decommissioning and closure of roads to administrative use only would not occur. The No Action Alternative would not serve to disconnect the road system from the stream network. Road maintenance at levels expected to occur with the action alternatives would not occur, thereby, allowing entrainment of sedimentation to continue in creeks from poor quality roads. This would cause adverse indirect impacts to water quality and aquatic species. Open road density in the project area would remain status quo, thereby, allowing potential erosion to cause adverse indirect impacts to water quality and aquatic species. Gating to eliminate vehicle access and protection of an important resource value in the project area would not occur.

Aquatic Species/Habitat: Aquatic habitat for fish would not be improved because placement of large woody debris (LWD) in stream channels. In most cases, LWD in streams would not meet desired conditions for fish and wildlife as specified in the Forest Plan (USDA 2005). This would cause indirect adverse effects to aquatic species which may be currently limited through lack of habitat.

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.

Habitat components within the Project Analysis area 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, and OBJ. 15 respectively) would not be met in the Project Analysis area with implementation of the No Action Alternative. The objective for insect and disease management through thinning and regeneration of oak and pine (OBJ. 8) would not be met in the Project Analysis area.

Alternatives 2 & 3

Effects to wildlife and MIS from implementation of the 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. Findings of this paper are summarized here.

Timber Harvest and Wildlife Habitat Improvement: Effects of implementation of the action alternative are described in (Taylor 2013) relation to the subsections Early Successional Habitat, 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 to improve herbaceous diversity would cause positive indirect impacts to wildlife. Short-term early-successional habitat in regenerated forest stands would occur, thereby causing positive indirect effects to disturbance-dependent and early successional obligate wildlife species. Use of thinning and regeneration harvest 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. Regeneration silvicultural treatments would provide age class diversity and maintain oak in the ecosystem as a source of hard mast

for wildlife species. Regeneration silvicultural treatments would also provide early seral stage browse for species requiring this habitat component. Oak species would be expected to be maintained as a component of the forest ecosystem in the long term. These alternatives 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). Current timber types would be sustained over time.

Timber Stand Improvement Practices: These practices, which include release, pre-commercial thinning and tree planting, are beneficial to wildlife in the long term. These practices provide indirect beneficial effects to wildlife by insuring long term perpetuation of hard mast-producing trees and shortleaf pine in the ecosystem. Benefits to wildlife would be expected to be greater with implementation of Alternative 2 as opposed to Alternative 3 (reduced herbicide use).

Prescribed Fire: Implementation of prescribed fire may cause some direct mortality to small mammals and herpetofauna in the 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 forests 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). 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. 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; these are related events that have shaped the composition of oak ecosystems for millennia (Van Lear 2000).

Short term, negative, direct effects to wildlife may occur through use of prescribed fire. However, long term, positive direct effects would be realized through habitat improvement for a variety of wildlife species. Implementation of Alternative 3 (reduced prescribed fire) would provide less benefit to wildlife, understory vegetation diversity and oak/pine ecosystems than Alternative 2.

Herbicide Use: Herbicide use is an important tool often used in woodland restoration thinning to prevent sprouting of woody species and, therefore, allowing for greater understory herbaceous vegetation abundance and diversity. In addition, herbicide use for TSI is an important tool for reducing competition with selected hard and soft mast producing tree species. Furthermore, herbicide is a tool of great importance in ensuring that oak and pine regeneration is adequate following use of shelterwood and seedtree regeneration systems. Woodland restoration thinning, TSI and successful regeneration of oak species and shortleaf pine would produce greater vegetation diversity and associated positive effects to wildlife with use of herbicide. Increased use of herbicide as provided in Alternative 2 would improve these management actions and produce better habitat conditions for wildlife than would implementation of Alternative 3 (reduced herbicide use).

Road Work: No negative long-term impacts to wildlife would occur through proposed road reconstruction, road maintenance or temporary roading. Closure of roads following use with gates/mounds would reduce disturbance to wildlife. Reconstruction and maintenance of roads would lead to improved water quality by reducing existing erosion through use of improved road design features. Application of BMPs and Forest-Wide Standards (FW-72 – FW-76, FW-78, FW-79, FW-81, FW-82, and FW-87 – FW-90) will be utilized for all road related work (USDA 2005). Unmaintained and unauthorized non-system roads are one of the most common sources of accelerated erosion on National Forest lands. The Proposed Action would serve to assist in "disconnecting" the road system from the stream network. Road maintenance would help preclude entrainment of sedimentation in creeks from poor quality roads. This would cause positive indirect impacts to water quality and aquatic species. Open road density in the project area would in most cases be reduced by road decommissioning and closure of roads with gates – allowing administrative access only. This would serve to reduce potential erosion, providing positive indirect impacts to water quality and aquatic species. Gating areas, including some large blocks, would provide habitats for species sensitive to human disturbance and provide opportunity for more remote wildlife-related recreation opportunities.

Aquatic Species Habitat Improvement: Implementation of Alternative 2 would benefit native fish populations providing additional quality habitat through introduction of LWD for cover. LWD placed in streams would meet desired conditions for fish and wildlife as specified in the Forest Plan (USDA 2005). Introduction of LWD into streams would provide direct beneficial impacts to aquatic species.

Cumulative Effects

In summary, Alternatives 2 and 3 are predicted to have negative short-term impacts on 9 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 EA would be of long term benefit to MIS that rely on forest ecosystems, particularly oak/pine ecosystems, for habitat. In summary, Alternatives 2 and 3 are predicted to have positive long- term effects on 15 of 15 MIS 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).

Alternative 2 prescribes greater herbicide use and prescribed fire use than Alternative 3. In addition, Alternative 2 prescribes the use of LWD placement in stream channels. Therefore, implementation of Alternative 2 is expected to have increased benefits to MIS (a variety of wildlife species) than would implementation of Alternative 3.

10. Threatened, Endangered, Sensitive (TES) Species

Existing Condition

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:

- 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's current list of endangered, threatened, and proposed species for Arkansas as of October 25, 2012, (USDI 2012), the forest-wide list as of February 7, 2013, and the current Southern Region Sensitive Species list for the Forest, dated August 8, 2007 (list attached as Appendix A in BE).

- Consulting element occurrence records (EORs) for TES species as maintained by the Arkansas Natural Heritage Program (ARNHP).

- Consulting with individuals in the private and public sector who are knowledgeable about the area and its flora and/or fauna.

- Reviewing sources listed in the reference portion of this report.

- 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 OSFNFs. 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 compiled to produce a site-specific before this project (Taylor 2014).

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:

- Are found to be located in the activity area (OAR code "5"),
- 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"), and
- Known aquatic species known or suspected downstream of the project/activity area, but where project effects will be immeasurable or insignificant (OAR code "7").

As a result of this process, Table 19 shows the following species occur as documented by field surveys or may potentially occur in the activity area based on habitat observations:

Table 19. Results of Field Survey and Species that occur or could occur in the project area

OAR Code	Scientific Name	Common Name	Taxa	Status
7	*Notropis ozarcanus*	Ozark Shiner	Fish	Sensitive
7	*Percina Nasuta*	Longnose darter	Fish	Sensitive
6	*Haliaeetus leucocephalus*	Bald eagle	Bird	Sensitive
5	*Corynorhinus townsendii ingens*	Ozark big-eared bat	Mammal	Endangered
6	*Myotis grisescens*	Gray bat	Mammal	Endangered
6	*Myotis leibii*	Eastern small- footed bat	Mammal	Sensitive
6	*Myotis septentrionalis*	Northern log-eared bat	Mammal	(P) Endangered
6	*Myotis sodalis*	Indiana bat	Mammal	Endangered
7	*Cumberlandia monodonta*	Spectaclecase mussel	Mussel	Endangered

6	*Lirceus bicuspicatus*	An isopod	Isopod	Sensitive
6	*Orconectes williamsi*	Williams' crayfish	Decapod	Sensitive
7	*Paduniella nearctica*	Nearctic paduniellan caddisfly	Insect	Sensitive
5	*Amorpha Ouachitensis*	Ouachita leadplant	Plant	Sensitive
OAR Code	**Scientific Name**	**Common Name**	**Taxa**	**Status**
6	*Callirhoe bushii*	Bush's poppymallow	Plant	Sensitive
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
6	*Dodecatheon frenchii*	French's shooting star	Plant	Sensitive
6	*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

Table 19 shows two fish species (Ozark shiner and longnose darter), one mussel species (spectaclecase mussel) 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 19 shows one mammal species (Ozark big-eared bat and four plant species (Ouachita leadplant, Ozark chinquapin, Southern lady's slipper, and Ozark spiderwort) were identified within the analysis area (OAR "5").

Fourteen 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 (bald eagle), 4 mammal species (gray bat, Eastern small-footed bat, Northern long-eared bat and Indiana bat), 1 isopod species (lirceus isopod), 1 crayfish species (William's crayfish) and 7 plant species (Bush's poppymallow, Moore's larkspur, French's shooting star, small-headed pipewort, 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:

- Data on species/habitat relationships.
- Species range distribution.
- Occurrences developed from past field surveys or field observations.

- 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 19 above are described in the BE for the Locust Gap Project (Taylor 2014).

A site specific water quality analysis was completed for the Locust Gap Project area (Monk 2014). These water quality analyses are based on modeling developed for use on the Forest (Klingenpeel & Crump 2005) and were applied to all proposed management actions associated with the Locust Gap Project area. This modeling and sedimentation analysis was utilized for determination of effects to aquatic resources from implementation of the proposed projects. The cumulative effects analysis indicates minimal (low) risks to the water resource's current condition. The activities proposed by the Forest Service for the Proposed Action will result in additional sediment production from the landscape, but from a watershed perspective, contribute only a small (if any) increase to the overall estimated sediment yield of project area streams. The Proposed Alternative(s) results in a slight increase in the percentage of possible sediment contributions to streams but result in no change in the concern level. Additionally, it should be possible to schedule these activities over time instead of instantaneously as predicted by the analysis, thus, reducing the possibility of acute effects. 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 aquatic beneficial uses (Monk 2014).

Based upon the site-specific water quality analysis for the Locust Gap Project - the minor sediment increase from the Alternatives 2 and 3 are expected to be insignificant in comparison to the existing sediment load of Little Mulberry Creek, Beech Hurricane Creek and their tributaries, and will not have significant effect on habitat for fish or other aquatic life. There will be no negative direct, indirect or cumulative effects to aquatic species from implementation of management activities associated with this project proposal. No significant impacts (from loss of water quality) would result from implementation of this project that would push aquatic species closer toward federal listing under the Endangered Species Act, or cause loss of viability for these species. There are no foreseeable activities in the area that would directly or indirectly affect Ozark shiner, longnose darter, spectaclecase mussel, lirceus isopod, Williams' crayfish and Nearctic paduniellan caddisfly or cause additive or synergistic adverse cumulative impacts in conjunction with the Proposed Action or Alternatives due to sedimentation. Therefore, there will be no negative direct, indirect or cumulative effects to these species as a whole from management activities associated with this project due to sedimentation.

Individuals of the species *Lirceus bicuspicatus* (lirceus isopod) may be directly impacted in upland areas away from Little Mulberry Creek, Beech Hurricane Creek and their tributaries. Effects to individuals in these locations would be from direct physical disturbance. However, the proposed actions are not likely to cause a trend to federal listing under the Endangered Species Act and won't cause a loss of viability for this species. There are no foreseeable activities in the area that would indirectly affect the Lirceus isopod in a negative manner or cause additive or synergistic adverse cumulative impacts to this species. Therefore, there will be no negative direct, indirect or cumulative effects to this species as a whole from management activities associated with this project.

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

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

No negative adverse effects would occur to Region 8 Sensitive Species (Ozark shiner, longnose darter, 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 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. These sensitive species include Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Moore's larkspur, small-headed pipewort, ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad and Ozark cornsalad.

Determination of Effects –Alternatives 2 and 3 (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 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."

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 for implementation of the Locust Gap 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, 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 Locust Gap Project would benefit sensitive species which require open (unshaded) and/or fire dependent habitats. These sensitive species include Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, 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).

11. Human Health Factors

Significant Issues Related to the Resource

Issue # 4

The cumulative effects of herbicide use on water quality and its likelihood of entering nearby streams and local water supplies

Existing Condition

At the present time, there is a risk of wildfire in the project area which potentially could affect human health factors. There are other human health risks for forest workers and visitors, primarily dead, dying or aging trees that create risk to human health from falling material. Falling trees and limbs on public lands can cause injury to National Forest visitors and can cause damage to personal property. Furthermore, portions of the Locust Gap Project area have been affected by ice storm damage. The combination of Forest fuel accumulations and the interspersion of private lands/property within the analysis area could lead to potential for negative effects to human health and property from wildfire. The increasing amount of oak decline is another risk that could potentially affect human health in this area. With no action being taken, the oak decline will continue to progress, thus increasing the number of dead and dying oaks in the forest. This poses a serious threat to forest visitors sightseeing from a vehicle, hiking, biking, or hunting. Dead trees and/or heavy branches are more likely to fall at any moment which could cause injury or death to these types of dispersed recreation users.

Direct and Indirect Effects

Alternative 1

There would be no change from the existing condition regarding risks to worker health from the use of herbicides, manual/mechanical vegetation treatments or prescribed fire. Risks to human health and safety from falling limbs and trees associated with oak decline and storm damage would increase due to rot, decay, and wind-throw. Currently, herbicide use is authorized in the Locust Gap Project area for use in reduction/eradication of NNIS.

Potential accidents to workers completing manual/mechanical vegetation treatments and prescribed fire would be less with implementation of Alternative 1.

Without the use of prescribed burning, the chances of a large wildfire would increase over time. In areas of moderate to heavy fuel accumlations it is more likely that a wildfire would result in severe fire intensity, thus eliciting more adverse effects than the slight to moderate intensity fire associated with intentional prescribed burning. Therefore, potential negative impacts to public human health would be greater with implementation of Alternative 1.

Alternatives 2 and 3

There is a perception by the public that any use of herbicides on the Forests is unsafe. Herbicide is used in accordance with Forest-Wide Standards as described in the RLRMP 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 (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

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 RAs, a HQ of 1 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 HQs > 1.0 related to drift, accidental spills, worker exposure and run-off.

All herbicide application mitigation measures (as specified in this EA) and Forest-Wide Standards for herbicide application will be applied. These mitigation measures will greatly reduce the chance of workers being exposed and very slight risk for any public exposure to these compounds.

Glyphosate typical HQs associated with both foliar and cut surface application of this chemical at an application rate of 1.0 lbs/acre for humans are less than 1.0.

Hexazinone typical HQs associated with ground application of this chemical at an application rate of 2.0 lbs/acre for humans are less than 1.0, with the exception of chronic/longer term exposure related to an adult female ingesting contaminated fruit, or coming into contact with contaminated vegetation – both from foliar application (see Process Record for specific numbers). These upper bound HQs are not a concern because:

- Herbicide application areas are signed.
- Hexazinone has a moderate half-life of approximately 90 days.
- The risk assessment scenario assumes that contaminated fruit is eaten 90 days in a row.
- Blackberries, the only types of fruit likely to be available in any substantial quantity within treatment areas, are not ripe for such a long period.
- The risk assessment scenario assumes that the person remains within a treatment area for 90 days in direct contact with the chemical.

- Hexazinone will be applied in a spot grid pattern on the soil, not applied as a foliar spray.

For Imazapic and Imazapyr, none of the HQs calculated for risk scenarios to workers or the general public were above 1.0.

Triclopyr Amine and Triclopyr Ester have low bioconcentration potential and single dose toxicity to mammals is low although prolonged or repeated exposure may cause skin irritation in mammals (MSDS dated 1/17/2001). Typical HQs associated with both foliar and cut surface application of triclopyr appled at a rate of .36 to .48 lb/acre for humans are less than 1.0, with the exception of acute exposures related to a child drinking contaminated water from a chemical spill, an adult female consuming contaminated vegetation or fruit, as well as chronic/longer term exposure related to an adult female ingesting contaminated vegetation for 90 days (see Process Record for specific numbers). These upper bound HQs are not a concern because:

- Herbicide application areas are signed.
- Triclopyr will be applied by hand application on cut surfaces or specific foliage.
- Triclopyr has a moderately short half-life on average of 30 days.
- The risk assessment scenario assumes that the person remains within a treatment area for 90 days in direct contact with the chemical.
- The amount of non-target vegetation subject to spray deposition is very small and humans are less likely to come in contact with targeted treated vegetation, and even less likely to come in contact with chemical from cut surface application in woodland restoration areas.
- Adherence to Forest-Wide Standards, mitigation measures, chemical label application and handling guidelines and BMPs will severly limit the possibility of spills of concentrated chemical into surface water.

There is a risk of worker injury during the completion of manual/mechanical vegetation treatments, and prescribed fire. Proper use of PPE, adherence to job hazard analyses and safety practices mitigate this risk. Risk to the public from these types of work is minimal. However, with proper handling/transport methods, use of signing in application areas (where required), use of proper application methods and equipment, and use of required PPE, risk of herbicide exposure to workers and the public is mitigated with implementation of Alternative 2 or 3.

Removal of dead and/or aging trees through thinning operations and fireline preparation will make the forest safer for forest visitors, through reducing the incidence of falling snags and limbs.

Use of prescribed burning will lessen potential wildland fire occurrence, wildland fire severity and unplanned smoke emissions. Strict adherence to FEIS and RLMRP guidelines, a site-specific burning plan and Arkansas Voluntary Smoke Management Guidelines will limit the area where 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 Alternative 2 would occur over several days. Individual ignitions would generally be limited to 500 to 3,000 acres daily. Annually, ignition in the project 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 3,000 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.

In addition to following Arkansas' State Department of Environmental Quality smoke guidelines, the Forest Service has developed a third alternative to address public concern alleviating the use of prescribed fire. Alternative 3 would still allow carrying out a large scale burn encompassing Compartment 270, but all additional ignitions would inlude 300 acres/per day or less. There would be less total emissions/day under Alternative 3, however additional days would be needed in order to meet management objectives of prescribed burning. This would mean more days of smoke being released into the atmosphere which can increase the risk of respiratory damage and temporary impairment of visibility. Therefore Alternative 3 could have higher potential of negative affect on human health and safety than Alternative 2, due to smoke issues.

Smoke concentrations from prescribed burning can be a very serious matter, particularly near homes of people with respiratory illnesses, near health-care facilities, or on roadways. Human health effects related to particulate matter in smoke include aggravation of respiratory or cardiovascular illnessess and changes in lung function, structure, and immunity capability of the body. Site specific burn guidelines and compliance with Arkansas Voluntary Smoke Management Guidelines provide daily smoke/particulate matter emissions, smoke sensitive targets to avoid, and mitigation required to limit negative effects of burning on human health and safety 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.

Based upon the analyses, 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. For additional information regarding smoke emissions from prescribed fire refer to the "Air Resources" section of this EA.

12. Social and Economic Factors

Existing Condition

The project is located in rural northwest Arkansas. The income levels are primarily moderate to low, and many local residents derive their income from harvesting timber and/or processing timber products. Local communities benefit from the taxes generated by timber activities. These benefits include social services such as law enforcement activities, safe drinking water, road maintenance/construction/reconstruction, and public school systems. These services contribute to an enhanced standard of living to the public within the area.

On October 30, 2000, Congress signed into law the "Secure Rural School and Community Self-Determination Act of 2000" commonly known as Payments to States (Public Law 110-343). The Act addressed the decline in revenue from timber harvests in the last several years on Federal land, which has historically been shared with counties. These funds have been used by counties for schools, roads, and emergency activities.

In 2012-2013, the Secure Rural Schools and Community Self Determination Act of 2000 was reauthorized in Public Law 110-343. This allows counties to choose either 25 percent of the state's 7-year rolling average, or to receive a share of the state payment using a "formula" that uses several factors such as acres of Federal Land, previous payments, and per capita personal income. Counties must make an election by September 30th of each year.

Direct and Indirect Effects

Alternative 1

This alternative proposes no timber management activities. Therefore, there would be no economic benefits to the local communities resulting from jobs created by timber sales or money to be used for wildlife habitat needs (KV money).

Alternatives 2 & 3

Activities proposed would affect the local economy by supplying timber for local mills, employing loggers to harvest timber, employing people to do site preparation, TSI/PCT, and wildlife habitat improvement work.

The revenues derived from the selling price of timber would contribute to school and road funds in Madison County, in accordance with PL 112-141. At the time of the Locust Gap Project economic analysis, hardwood sawtimber sold for $54.53/CCF, hardwood pulpwood sold for $13.81/CCF, pine sawtimber sold for $63.03/CCF, and pine pulpwood sold for $22.53/CCF. These figures reflect an average from several timber sales recently sold on the OSFNFs. Table 20 lists the Present Value of implementing Alternatives 2 & 3.

Table 20. Economic Report on the forest product revenues generated by Alternatives 2 & 3.

	Alternative 1	Alternative 2	Alternative 3
Timber Volume (CCF)	0	11,530	11,410
PV Timber Revenue	$0.00	$536,331.30	$535,778.90
Costs		$532,266.22	$533,215.22
Benefit/Cost Ratio		1.01	1.00

Due to budget constraints and changes as well as current market values, the costs associated with projects being implemented several years out may change somewhat and would always need to be reviewed and weighed accordingly. Of course the most important component, is the overall need to improve forest health and enhance watershed conditions in this area. This will ensure that the project area will move from current conditions to the desired future conditions as stated in the 2005 Revised LRMP.

Cumulative Effects

Alternative 2 and 3 has a positive effect on the local economy in which it would provide revenue to the counties/schools and provide for local jobs. Economic benefits would also be realized through creation/improvement of wildlife and fisheries habitat. Benefits to the public would be realized through reduction of fire hazard and potential loss/damage to personal property through implementation of fuels reduction burning. Reduction in fuel loading would serve to reduce potential wildfire spread and severity, thereby, reducing costs associated with fire suppression which far exceeds costs per acre for prescribed burning. Decommissioning and closure of roads would create social benefits by reducing erosion and sedimentation. This would also serve to reduce the proliferation of illegal OHV use.

13. Management Areas, Scenery Management and Recreation

Significant Issues Related to the Resource

Issue #7

Access/Recreation/Visuals

Existing Condition

The Locust Gap Project area receives several types of recreational use primarly due to its scenic values and access availability to the Little Mulberry Creeks “Blue Hole”. The Blue Hole is an area where many locals frequently visit. Other recreation use in the area is strictly dispersed such as: hunting (deer, squirrel, turkey, and bear), pleasure driving, hiking, fishing, and horseback riding. No designated OHV trails exist in the Locust Gap Project area.

Recreation

The project area is classified as “Roaded Natural,” “Semi Primitive Motorized,” and “Semi Primitive Non-Motorized” in the Recreation Opportunity Spectrum (ROS) designations.

ROS is a method for classifying types of recreation experiences available, or for specifying recreation experience objectives desired in certain areas. Classes are Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Rural, and Urban.

Roaded Natural settings are located within a half mile of a road and usually provide higher levels of development such as campgrounds, picnic areas, and access points. It is defined as an area characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities. The recreation opportunity experience level provided would be characterized by the probability for equal experiencing of affiliation with individuals and groups and for isolation from sights and sounds of humans. Opportunities for both motorized and non-motorized forms of recreation resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities.

Semi-Primitive Motorized is an area characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Interaction between users (or concentration of users) is low, but there is often evidence of other users. The area is managed in such a way that minimum onsite controls and restrictions may be present but is subtle. The recreation experience opportunity level provided would be characterized by the high, but not extremely high (or moderate) probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. (The opportunity to have a high degree of interaction with the natural environment.) Motorized use is permitted.

Semi-Primitive Non-Motorized is an area characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Interaction between users (or concentration of users) is low, but there is often evidence of other users. The area is managed in such a way that minimum onsite controls and restrictions may be present but is subtle. The recreation experience opportunity level provided would be characterized by the high, but not extremely high (or moderate) probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. (The opportunity to have a high degree of interaction with the natural environment.) Motorized use is not permitted.

Recreation use in and around the Locust Gap Project area is moderate to high, with highest use periods during the spring, early summer and fall seasons. Use consists of horseback riding, hiking, fishing, boating, swimming, camping, picnicking, sightseeing, hunting, and mountain bicycling. The project area has several scattered dispersed recreation use sites.

Dispersed camping and hunting of game species such as deer, turkey, bear, and squirrel are common in area.

If funding becomes available and the trail is approved under the forests trail priority list, an interpretive/nature hiking trail could potentially be constructed south of the Headwaters School and State Highway 16 located in Compartment 270, Stand 1. The hiking trail would more or less be deemed a nature trail focusing on the tree and plant species native to the area and conservation and environmental education. Panel displays or wooden signs could be used to describe a tree or plant species or other environmental features along the trail. The trail would be no more than 1 mile in length and open to the public year around.

Off Highway Vehicles

OHV use is now restricted to Forest designated roads and trails. High-use areas are managed within capacities in order to maintain the quality of experiences. Facilities that provide access to the OHV system are created in conjunction with the development of the overall OHV system. Recreational OHV visitors are informed where designated routes are, what types of vehicles are allowed, and what seasons they are allowed.

Currently, no OHV routes exist in the Locust Gap Project area.

Aesthetics and Management Area's

Scenery Management
The Forest Plan states that the desired condition for scenery management as the biological, physical, and cultural features of landscapes that provide for a "sense of place" as defined in the Landscape Character descriptions are intact. Landscapes possess a vegetation pattern and species mix that is natural in appearance. Built elements and landscape alterations complement the lines, forms, colors, and textures found in the landscape.

Definitions of Scenic Integrity Objectives:

Very High	**VH:** (Unaltered-Preservation) Scenic integrity refers to landscapes where the valued landscape character "**is**" intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.
High	**H:** (Appears Unaltered-Retention) Scenic integrity refers to landscapes where the valued landscape character "**appears**" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
Moderate	**M:** (Slightly Altered-Partial Retention) Scenic integrity refers to landscapes where the valued landscape character "**appears slightly altered**." Noticeable deviations must remain visually subordinate to the landscape character being viewed.
Low	**L:** (Moderately Altered-Modification) Scenic integrity refers to landscapes where the valued landscape character "**appears moderately altered**." Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles outside the

landscape being viewed. They should not only appear as valued character outside the landscape being viewed, but also compatible or complimentary to the character within.

The majority of the project area has a SIO of Low to High. The areas of SIO of High are concentrated along the Scenic Byway Corridor Management Area or State Highway 16.

The project area has visual diversity, with several areas of private ownership across the proposed project area, which consists of homes, weekend cabins, pasture for livestock, crops and private forested areas. Viewing from state highways, county roads and other primary forest roads consists mostly of steep mountains with mixed hardwoods, some pine on ridge-tops and drainages, and some areas of open pasture land.

Scenic Byway

The Forest Plan states that the desired condition for Scenic Byways Corridors is that areas provide exceptional opportunities for motorized recreation, especially scenic driving. The views along the different byways vary, and include a variety of landscape characters, ranging from natural appearing to pastoral, historic, and cultural. They provide colorful accents and interesting textures, which change with the seasons. Visitors enjoy viewing wildlife in the occasional openings scattered through the Forests. Water or geographic features as well as cultural landscapes (such as hay fields, grazing livestock, and the occasional rustic cabin) provide scenic diversions to the predominately-forested landscape. Road corridor improvements and interpretive facilities are evident changes to the natural environment. These manmade alterations fit well with the character of the surrounding landscape. Other management activities are not evident to the average visitor. State Highway 16 is not considered an official scenic byway, however according to the RLRMP (USDA 2005); the public land surrounding the highway is categorized and to be managed as Scenic Byway Corridor Management Area.

The management area is relatively difficult to access due to the remoteness, poor road conditions, and lack of access. Road construction will consist of using temporary roads, road maintenance and re-construction, as well as decommission after the project has been completed.

Vegetation is influenced both by natural processes and humans. Biological communities are maintained or improved to provide an attractive setting for visitors while providing for the protection of rare communities and threatened, endangered, sensitive, and locally rare species. Forest management activities maintain the natural characteristics that make the area scenic. Commercial timber harvest is appropriate to maintain the long-term goals of a diverse and vigorous forest with sensitivity to dispersed recreation and scenic values. Vegetation management operations would focus on what is retained in the stand, not on wood fiber production. Practices are visually subordinate to the surrounding landscape. Prescribed fire and other management treatments are appropriate vegetative management tools available to be used to enhance the byway corridor in conjunction with other resource values.

These corridor management areas are characterized by a predominance of mid- and late-successional forests. Forest structure varies according to ecological factors, but largely

consists of a mature overstory; a fairly open midstory; and a well-developed herbaceous and shrubby understory. Understory vegetation includes a variety of native deciduous and evergreen flowering trees, shrubs, and wildflowers. Even-aged, two-aged, and uneven-aged forest communities along with medium and small patches of late successional to old-growth forest communities continue to develop throughout the area.

Wild and Scenic Rivers

Although the Little Mulberry Creek has not been designated as a Wild and Scenic River, it is a major tributary to the Mulberry Wild and Scenic River. The Little Mulberry Creek is located in Madison County of the Locust Gap Project area. A commonly used destination on the Little Mulberry Creek is the Blue Hole. This area located within the project area, receives high use from visitors year around. Camping, swimming, and fishing are the primary forms of recreation in and around the Little Mulberry Creek. Canoeing is not considered the most common type of recreation on the Little Mulberry but it does occur occasionally. Most of the canoeing takes place south of the project area close to where it flows into the Mulberry Wild and Scenic River.

The surrounding area of the Little Mulberry provides a mix of habitats and successional stages for a wide variety of species that favor, or are tolerant of, habitat edges and human disturbance. Habitat associations being emphasized include mid-to-late successional deciduous associates and bottomland forest associates. Habitat conditions beneficial to mixed mesic associates and mix xeric associates (primarily xeric oak and xeric oak-pine habitats) are provided. These conditions provide suitable habitat for eastern wild turkey and marginal habitat for ruffed grouse. Management and protection of rare communities and species associates is provided along with management and protection measures for population occurrences for threatened, endangered, sensitive, and locally rare species.

Direct and Direct Effects

Alternative 1

Aesthetics and Management Areas

There would be few short-term changes; however, as ecosystems in the project area progress, hardwoods would be expected to be an increasing component in the areas now dominated by pine; 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. Neither the ROS nor the SIO designations will be changed under this alternative.

Current issues of Oak Decline would continue to progress throughout the project area. This will cause a change in the visual aspects of the area. Visitors will tend to see more dead or dying oaks as current conditions worsen. This will also cause more fuel buildup and increase the chance of larger wildfires. Visitors may see an increase in wildfires and more wildfire damage in the area as the current situation continues.

Road conditions would continue to deteriorate due to motorized vehicles using roads to gain access in to the project area. Eventually roads would become impassable and the potential

for users to create unauthorized new trails attempting to divert from impassable areas would most likely occur. The outcome of users creating new trails would result in heavy resource damage and increase the erosion rate thus having a direct effect to the water quality. Furthermore, an interpretive/nature trail would not be considered for the project area.

The No Action Alternative would not allow management areas to move toward their desired future conditions.

Recreation

There are abundant opportunities for the public to use and enjoy the Ozark-St. Francis National Forests. Activities include boating, swimming, hunting, fishing, rock hounding, and sightseeing.

This alternative will not change the recreation use (unauthorized OHV driving, camping, hiking, mountain bicycling, fishing, or swimming) in the project vicinity.

Dispersed camping and hunting would be affected in the long term under this alternative. Alternative 1 provides no activities that maintain or increase habitat on public lands. 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.

Alternative 2 & 3

Aesthetics and Management Area's

Drivers and forest users along state highways, county, and forest roads will notice more browning of vegetation from harvest, herbicide and burning activities during the initial work and the first growing season. However, long-term benefits are numerous as these activities will increase visuals and help create lush habitat for many wildlife species including game species such as the white-tailed deer and eastern turkey. Additionally, the forest will become more resilient to drought, insect infestations, and disease with fewer trees per acre.

Vegetation management in the Forests would allow views that 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 understory species. Tree removal will be varied in the near foreground to avoid uniform spacing and a tree-farm appearance. Slash clean-up in certain areas or prescribed fire (which would greatly reduce slash) in the first 200-300 feet in areas seen from travel ways and concentrated use areas will be completed.

Visitors to all areas of the proposed project area may smell and see smoke during burning. Blackened trees and ground for the first season would be visible until the next spring green-up. Some browning of vegetation from harvest activities during the initial work and first season in stands along county and forest roads may exist. They may also notice an increase in log truck traffic during the logging operations, (***note: only 4% to 6% of the Locust Gap Project area is being considered for commercial thinning.)*** In the background, National Forest land will continue to offer viewers a variety of forest types from pines to hardwoods.

All of the proposed actions are consistent with the Forest Plan's Scenery management and desired conditions and no long-term adverse effects are anticipated.

Recreation

During prescribed burning and vegetation management activities, area closures would be implemented to improve visitor safety. At the conclusion of management activities and prescribed burning, certain roads could be closed, blocked and seeded. These activities would have no long-term negative effects on the dispersed recreation activities except with the use of closures on user-created trails.

Recreation users may notice signs saying, *"This road is temporarily open for logging activities and will be closed to vehicle use when logging is completed."* These signs would be placed on all closed roads reopened for this project. These roads would then be reclosed after project completion by either seeding the roadbed, gates and/or other closure structures. Roads closed with gates or earthen mounds would allow foot travel for hunters to access more secluded hunting spots. Roads that are closed may be used by hikers to access the interior of the project area. Reclosing roads would reduce the number of miles of roads on which users can drive motorized vehicles. Due to the implementation of the motor vehicle use policy, vehicles are allowed to drive only on designated routes within the project area. Forest-wide designated motorized use routes would be managed to maintain a high-quality experience.

The proposed vegetation management and wildlife activities would improve hunting opportunities around the dispersed hunting camps and adjacent private lands. These vegetation treatments would also improve wildlife and bird viewing.

Hunters are frequently drawn to certain vegetation management activity areas because of visibility; deer are attracted to them also. Early seral-stage vegetation will increase in the commercially-harvested areas, areas of wildlife stand improvement and wildlife openings. The TSI, woodland thinning, and burning areas also attract hunters. Hunting opportunities would increase with this proposed action.

Campers at dispersed sites would notice logging traffic, hear chainsaws, and see forest stands as timber-related and wildlife improvement activities occurred. Campers may see some short-term effects from other activities such as brown leaves in the prescribed burned and herbicide-treated areas, as well as areas where TSI/PCT work would be taking place. After the green-up of more beneficial ground vegetation, the opportunity of successful wildlife sightings and viewing may improve.

Maintaining a system of roads in the project area would allow outdoor enthusiasts to continue to enjoy the forest on foot and allow hikers access to areas for dispersed camping and hunting. Vegetation management, silvicultural treatments, riparian enhancements, and wildlife habitat improvements proposed in the action alternative should increase numbers of both game and non-game species, so the recreational use in the form of wildlife viewing and hunting should improve.

Alternative 3 proposed the possible construction of an interpretive/nature hiking trail. Volunteer groups would be encouraged to establish a cooperative agreement with the Forest

Service to help construct and maintain the interpretive/nature trail to Forest Service standards. If standards are not met, the trail could potentially be closed due to lack of funding.

Another addition to Alternative 3 not proposed in Alternative 2 would be the implementation of either a pre-commercial thinning or midstory removal leaving larger trees in place along State Highway 16 for visuals.

Cumulative Effects

Alternative 2 would not change any of the non-consumptive recreation use (camping, hiking, and mountain bicycling,) in the project area. User-created OHV trails would be reduced through planned road decommissioning and closure of roads. With the implementation of LWD, there would be an added risk as LWD could potentially become submerged below the surface out of view from canoers and kayakers. Canoes and kayaks could come into contact with LWD causing them to dump over and/or become pinned between the LWD and canoe or kayak. During high flood events, LWD could break loose from the bank and become hung up downstream in new locations unknown to the public posing a risk to canoers or kayakers.

Based on the analysis, nothing in Alternative 2 would significantly affect any attributes which might make all or part of the vicinity suitable for proposal as a special interest area for dispersed recreation or scenic quality. This alternative complies with the RLRMP.

The effects for Alternative 3 would be the same as the effects for Alternative 2 with the exception of no foliar herbicide application and the potential construction of an interpretive/nature trail if funding and partnership became available. Also, the LWD component would be removed from this alternative. Additionally larger trees would be left in place along State Highway 16 for visual quality using TSI method. Drivers and forest users along county and forest roads may have more occasions to notice browning of vegetation from repeated mechanical or handwork to replace some of the herbicide activities. Repeat hand treatments may be necessary to obtain the same effect that foliar herbicide, in combination with burning, would accomplish. Additionally, there would be an increase in seeing crews and equipment to accomplish the work that is normally completed with the use of broadcast herbicide. The elimination of foliar herbicide use would not allow the levels of quality wildlife habitat to be created as would be expected with implementation of Alternative 2.

Part 4 – Consultation and Coordination

A complete list of the interested citizens and neighbors of the forest is located in the Locust Gap Project file. The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

ID TEAM MEMBERS:

Name	Position	Office
James Bicknell	Special Uses/Lands	Pleasant Hill Ranger District
Mary Brennan	Zone Archaeologist	Pleasant Hill/Boston Mountain Ranger Districts
Tom Cravens	Forester	Pleasant Hill Ranger District
Napolean Reed	Forester	Pleasant Hill Ranger District
Matt Pfeifler	Recreation/NEPA Coordinator	Pleasant Hill Ranger District
Jeremy Eubanks	Timber Management Assistant	Pleasant Hill Ranger District
Pat Kowalewycz	District Ranger	Pleasant Hill Ranger District
Dan Martin	Fire Management Officer	Pleasant Hill Ranger District
Greg Taylor	Wildlife Biologist	Pleasant Hill Ranger District
Steve Duzan	NEPA Coordinator	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR.
Keith Whalen	Fisheries Biologist	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR
Len Weeks	Forest Soil Scientist	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR
Rick Arnold	Engineering Technician	Pleasant Hill Ranger District
Rick Monk	Forest Hydrologist	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR
Dylan Farnam	Timber Sales Administrator	Pleasant Hill Ranger District
Tina Rotenbury	GIS	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR

FEDERAL, STATE, AND LOCAL AGENCIES:

Name	Position	Office
Melvin Tobin	Fish & Wildlife Biologist	U.S. Fish and Wildlife Service, Conway, Arkansas
Various Persons	Deputy State Historic Preservation Officer	Department of Arkansas Heritage
Terry Caston	Engineering Technician	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR

NATIVE AMERICAN TRIBES/NATIONS:

Name	Location
Caddo Indian Tribe of Oklahoma	Binger, Oklahoma
Cherokee Nation of Oklahoma	Tahlequah, Oklahoma
Osage Nation	Pawhuska, Oklahoma
Quapaw Tribe of Oklahoma	Quapaw, Oklahoma
Tunica-Biloxi Tribe of Louisiana	Marksville, Louisiana
United Keetoowah Band of Cherokee Indians	Tahlequah, Oklahoma
Jena Band of the Choctaw Indians	Jena, Louisiana

Part 5 – Appendices

APPENDIX A –
Forest Type and Condition Class Codes

Forest Types (first 2 digits of the 4 digit code-- **XX**xx)
(species listed by occurrence in stand)

11 - Eastern Red Cedar and Hardwood
12 - Shortleaf Pine and Oak
13 - Loblolly Pine and Oak
25 - Yellow Pine
31 - Loblolly Pine
32 - Shortleaf Pine
35 - Eastern Red Cedar
43 - Oak and Eastern Red Cedar
44 - Southern Red Oak and Yellow Pine
47 - White Oak, Black Oak and Yellow Pine
48 - Northern Red Oak, Hickory and Yellow Pine
49 - Bear Oak, Southern Scrub Oaks and Yellow Pine
51 - Post Oak and Black Oak
53 - White Oak, Red Oak and Hickory
54 - White Oak
55 - Northern Red Oak
63 - Sugarberry, American Elm and Green Ash
68 - Sweet Bay, Swamp Tupelo, Red Maple
69 - Beech, Magnolia
72 - River Birch and Sycamore

Stand Condition Class (last 2 digits of the 4 digit code--xx**XX**)
Even-aged Management Codes:
01 - In regeneration
02 - Damaged Poletimber
03 - Damaged Sawtimber
04 - Forest Pest Infestation
05 - Sparse Poletimber
06 - Sparse Sawtimber
07 - Low Quality Poletimber
08 - Low Quality Sawtimber
09 - Mature Poletimber
10 - Mature Sawtimber
11 - Immature Poletimber
12 - Immature Sawtimber
13 - Adequately Stocked Seedlings and Saplings
14 - Inadequately Stocked Seedlings and Saplings
15 - Non-stocked
0000 - Pastures or other Special use areas
Uneven-aged Management Codes:

16 - Group Selection Management (Hardwood)
17 - Individual Tree (Single-tree) Selection Management (Pine)

APPENDIX B –
CHARACTERISTICS OF FOREST STANDS

The following table shows the characteristics of forest stands that are to receive silvicultural treatments in the Locust Gap Project.

Characteristics of Forest Stands in the Locust Gap Project

Compt.	*Stand*	*Forest Type**	*Condition Class**	*Age Year*	*Pine Basal Area (sq.ft./acre)*	*Hardwood Basal Area (sq.ft./acre)*	*Site Index*	*SIO*
270	1	53	07	1915		80	55	H
	2	53	12	1915		80	60	H
	4	53	11	1922		75	55	H
	6	53	10	1910		95	65	H
	8	53	12	1930		80	65	H
	9	53	12	1924		95	68	L
	10	53	13	1983		0	70	H
	11	53	12	1925		85	60	H
	12	53	11	1983		50	70	H
	13	32	12	1963	120		70	H
	16	53	10	1910		86	60	M
	17	32	12	1963	120		70	M
	18	53	13	1984		0	70	VL
	19	53	12	1915		90	70	VL
	22	53	12	1928		96	60	L
	23	32	12	1963	150		70	M
	25	53	12	1925		103	60	M
	26	53	10	1922		86	69	M
	33	53	12	1926		80	60	H
	34	53	12	1915		80	62	H
	35	53	12	1925		87	60	H
271	1	53	12	1930		70	60	M
	2	53	12	1940		69	70	M
	3	53	10	1906		65	70	M
	5	53	10	1920		115	68	M
	6	53	10	1917		85	60	M
	12	53	12	1927		86	80	M
	14	32	12	1960	67		60	M
	15	53	12	1930		75	70	M
	16	32	12	1962	90		70	M
	17	53	13	1983		20	70	M
	18	53	12	1925		72	70	M
	19	53	10	1905		88	70	M
	20	53	12	1933		93	70	M

	21	53	13	1984		0	70	M
	22	53	10	1880		142	60	M
	23	53	12	1930		56	60	M
	24	53	12	1940		70	80	M
	25	53	13	1984		0	70	M
	26	53	10	1913		65	80	H
	29	53	13	2000		30	80	M
	30	53	13	1984		0	80	H
	31	53	11	1978		0	65	M
	32	53	10	1905		88	70	M
Compt.	***Stand***	***Forest Type***	***Condition Class***	***Age Year***	***Pine Basal Area (sq.ft./acre)***	***Hardwood Basal Area (sq.ft./acre)***	***Site Index***	***SIO***
271	36	53	12	1940		69	70	M
	40	53	10	1920		77	70	M
	41	53	10	1920		76	70	M
	42	53	10	1922		86	65	M
	43	53	12	1927		91	60	M
272	2	53	10	1920		56	60	H
	5	53	11	1930		50	60	H/M
	6	32	12	1969	90		80	H
	8	53	11	1930		70	57	M
	9	54	12	1932		70	60	H
	11	53	12	1930		70	60	M
	12	32	12	1971	130		65	M
	21	53	10	1918		85	60	H
	23	53	11	1971		30	60	H
	25	53	12	1928		75	60	M
	26	53	10	1910		98	60	M
	27	53	10	1910		75	60	H/M
276	4	53	10	1905		100	70	H
	9	53	10	1902		112	60	M
	10	53	11	1977		40	60	M
	13	53	11	1977		40	70	M
	14	53	10	1911		69	68	M
	15	53	13	1986		0	70	M/L
	19	32	12	1963	190		70	M
	20	53	10	1908		88	60	M
	22	53	10	1912		76	60	M
	24	53	10	1903		68	70	H
	27	53	12	1933		68	70	H/M
	29	53	12	1927		100	65	L
277	1	53	10	1903		88	80	H/M
	4	53	12	1927		84	70	M
	5	53	10	1900		94	60	M
278	3	53	08	1941		70	58	H/L
	7	53	13	1986		0	70	L

	8	53	12	1920		35	60	M
	9	53	12	1930		54	70	M
	10	47	11	1977		90	70	M
	11	53	12	1930		84	70	M
	13	53	12	1926		80	69	M
	14	53	12	1928		70	60	M
	15	53	10	1915		107	65	M
	16	53	09	1915		80	55	M
	17	53	10	1888		75	70	M/L
	21	53	12	1928		120	70	M
	23	53	13	1987		0	70	M
	26	53	12	1929		100	70	M
	28	53	12	1910		77	70	M/L
	34	53	08	1924		75	58	M

APPENDIX C - References
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