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# Environmental Assessment

## Cougar Project

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

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## SUMMARY

The Ozark National Forest is proposing to manage vegetation to improve forest stands, enhance wildlife habitat, and improve recreational opportunities in the **Cougar** project. The actions we are proposing include enhancing wildlife & 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** in an area bounded by Mulberry River Road (Hwy. 215) on the north, Highway 103 on the west, Forest roads 4432C and 1425 on the east, and JO4290 and Forest road 1435 on the south. Activities which are proposed on private land would occur only with the permission of the landowner. The Forest Service will enter into negotiations with those landowners for R.O.W. easements and prescribed burning.

Pine and hardwood stands are recommended for regeneration cutting to perpetuate this forest type and to create a variety of age classes, 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 wildlife benefits. 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 of timber products. 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. Reduction of wildfire risk by prescribed burning 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 Revised Land and Resource Management Plan.

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

| Activity | Number of Units | Approx. Acres-Miles |
|---|---|---|
| **Vegetation Management** | | |
| Pine Thinning | 23 stands | 712 acres |
| Pine Shelterwood Harvest w/site prep, TSI* & Burn | 10 stands | 192 acres |
| Pine TSI & Burning | 2 stands | 52 acres |
| Pine Seedtree | 12 stands | 360 acres |
| Pine Pre-Commercial Thinning (PCT) | 1 stand | 30 acres |
| Connected Treatments for all Pine Shelterwood & Seedtree Stands (if needed) Planting and Release of Shortleaf pine | To be determined | Up to 552 acres |
| Pine PCT followed by Planting | 1 stand | 98 acres |
| Hardwood Thinning followed by TSI | 1 stand | 21 acres |
| Hardwood Shelterwood Harvest w/site prep, TSI & Burn | 2 stands | 49 acres |
| Hardwood Shelterwood Harvest w/pre-harvest TSI | 6 stands | 107 acres |
| Connected treatments for all Hardwood Shelterwood stands Planting and Release of Oak Species (if needed) | To be determined | Up to 156 acres |
| Oak Woodland Restoration | 2 stands | 37 acres |
| Hardwood TSI-midstory treatment with handtools | 1 stand | 2 acres |
| Hardwood TSI-midstory treatment with herbicide | 11 stands | 227 acres |
| Hardwood PCT with handtools | 1 stand | 23 acres |
| **Fire** | | |
| Prescribed Fire/Hazardous Fuels Reduction/Site Preparation/Wildlife Burning/etc… -Federal Lands | All stands | Up to 4,140 acres |
| Prescribed Fire –Hazardous Fuels-Private Lands* | Several | Up to 2108 acres* |
| **Wildlife Management** | | |
| Wildlife Stand Improvement (WSI) | 1 stand | 20 acres |
| Wildlife Openings-Reconstruction | 9 openings | ~14 acres |
| Wildlife Openings-New | 3 openings | 6 acres |
| Fish Habitat Improvements (Large Woody Debris/Stream Bank Stabilization) | Washita Creek<br>Bull Creek | 2.6 miles |
| Fish Pond Improvement (Bear Branch Pond) | C. 344/4 | 1acre |
| Wildlife Pond Reconstruction | C. 337/30 | ¼ acre |
| **Road Work** | | |
| Road Reconstruction | 2 sections | 1.75 mile |
| Road Construction | 1 section | Possibly 0.75 mile |
| Road Maintenance (Forest & County Roads)** | 18 rd. sections | 21.5 miles** |
| Road Decommissioning | 7 rd. sections | 5.3 miles |
| Temporary Roads | ~15 | 6.5 miles |
| Gate Installation | 5 | |
| **Other** | | |
| Cultural-Heritage Sites | 6 sites on both private and federal lands | 5 sites on private land/all 6 sites not eligible |

***Prescribed Fire-Private Lands – pending landowner approval through Wyden and Stevens Agreements only.**
****Road maintenance includes both Forest Service and County roads.**

The proposed action aims to restore 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.

In addition to the proposed action (alternative 2), the Forest Service also evaluated the following alternatives:

- Alternative 1 – A no action alternative where the present/existing level of management would continue in the analysis area
- Alternative 3 – Alternative 2 excluding herbicide use in addition to reduced burning

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 impacts that would result from the proposed action and alternatives. The document is organized into five parts:

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

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

### Background

The Pleasant Hill Ranger District's "order of entry" led to this project proposal. The Revised Land and Resources Management Plan (RLRMP-2005) guides activities for a ten to fifteen year planning period and directs that all land types be inventoried within that timeframe. The Cougar project area was due for inventory 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. Restore ecosystem health and sustainable conditions by:
    - Reducing basal area and restoring the historic/natural fire regime.
    - Benefit/increase oak regeneration.

- 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 by reducing overcrowded conditions.
- 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.

2. Increase habitat potential for early successional, disturbance-dependent species.
3. Increase Forest visitor safety.
4. Provide forest products to the public.

This action responds to the goals and objectives outlined in the 2005 Ozark-St. Francis National Forests Land and Resources Management Plan (the Revised Forest Plan) for the Mixed Forest Management Area, and helps move the project area toward desired conditions described in that plan. The priorities described in the Forest Plan are as follow:

- Manage for pine and oak woodlands on lower sites.
- Manage for medium density or balanced age classes on medium to high sites.

This action is needed for the following reasons:

**Ecosystem Restoration and Promoting Sustainable Ecosystems**

The project area was historically subject to a more frequent regime of vegetation disturbance from anthropogenic fire. This area is within miles of 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 ranged from 2 to 3.1 years and for the period of 1881-1920 ranged from 1.4 to 5 years. From 1921-2000 mean fire return interval for these study sites ranged from 62-80 years (Guyette and Spetich, 2003). Anthropogenic fire is documented to have played a major role in shaping ecosystem structure in the Ozark Highlands. Documented presence of native peoples in the area prior to the earliest fire scars recorded in this study point to a fire regime with return intervals similar to 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 Forest consisted of fire-dependent woodland and forest ecosystems with well-developed herbaceous understories. Currently, the ecosystem in the project area is considered unhealthy because the area lacks these forest conditions. This absence is due to 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 LRMP 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 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 District is 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: first, it will reduce inter-tree competition and relieve the water stress on the remaining trees and help them repel some of the borers, and second, 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. Instigating 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 5 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 (Magazine 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 Forest provides a wide variety of habitats that supports a diversity of wildlife species. One of the two most important is the early-successional habitat, (0-10 years old). Five of the Management Indicator Species (MIS) from the LRMP are dependent upon early-successional habitat. Two MIS are dependent upon open forest conditions/woodlands.

These disturbance-dependent MIS species population trends have been analyzed utilizing a variety of sources (AGFC 2001, 2006 & 2007,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 Forest.
- 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 Forest, the amount of early-successional forest habitat increased slightly from 1986 to 1991 to a total of approximately 1.0% forest wide. From 1991 to 2001 early-successional forest habitat declined forest wide to approximately 0.2%. The amount of early-successional habitat on the Forest is tied very closely to the amount of regeneration harvests the Forest conducts in a given year. 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 only 4% 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 7 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 of 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 will thus improve watershed integrity. The new Forest 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 LRMP directs the Forest Service to protect and improve renewable resource quality while maximizing net public benefits. Specific direction contained in the LRMP

guides the Forest Service to "Provide a non-declining yield of forest products consistent with land capability, sustainability, protection needs and other resource values." (LRMP, pp 2-27)

## The Proposed Action:

The action proposed by the Forest Service to meet the purpose and need includes several vegetation/habitat management actions. This alternative proposes: even-aged management (EAM) on 348 acres of pine and hardwood forest (shelterwood,); thinning on 733 acres of pine and hardwood forest; release/PCT and timber stand improvement (TSI) of hardwood and pine via hand tools and herbicide to relieve them from suppressive competition on 334 acres; hardwood and shortleaf pine planting; wildlife stand improvement (WSI) thinning on 20 acres; wildlife pond and early-seral opening creation; fish habitat improvement; prescribed fire on 4,140 acres of Federal lands (approximately 2,108 acres of private lands) consisting of site preparation, wildlife, and fuel reduction, road maintenance of 21.50 miles, road re-construction of 1.75 miles, and road decommissioning of approximately 5.3 miles. Up to 0.75 mile of road construction may be necessary in order to access timber stands.

These proposed actions have been slightly modified from the original proposed actions that were sent to Interested Citizens and Forest Neighbors in September 2010; that is, road management and vegetation management activities have been adjusted slightly. This was due to several factors, such as: access was difficult because of terrain and private property was to be avoided as much as possible; current road locations and conditions were revisited and were deemed inadequate for proposed activities; better, more stable road locations have been sited. The table below illustrates the differences in the initially proposed actions and those being proposed now.

| Activity | Proposed Initially | Proposed Presently |
|---|---|---|
| Road Construction | 0 mile | Up to 0.75 mile |
| Temporary Roading | 6 miles | 6.5 miles |
| Road Decommissioning | 5 miles | 5.3 miles |
| Road Recontruction | .25 mile | 1.75 miles |
| Road Maintenance | 22 miles | 21.5 miles |
| Wildlife Opening Reconstruction | 8 openings | 9 openings |

**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 set forth in the Revised Land and Resources Management Plan (RLRMP).
- Which alternative best meets the purpose of the initiative while producing the least adverse cumulative environmental impacts.
- Which alternative best meets the six strategic goals of the Forest Service's 2004 National Strategic Plan.

**Public Involvement**

The proposal was listed in the Schedule of Proposed Actions in September 2009 until present. It was provided to the public and other agencies for comment during the initial 30-day scoping (comment) period beginning September 22, 2010, 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 interdisciplinary team developed a list of issues to address.

**Issues**

The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…"

**Issues Eliminated From Detailed Study**

An issue to use no prescribe burning for hazardous fuel reduction, and wildlife browse production was considered but not developed. 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.

Additionally, a single tree selection alternative was considered but not analyzed in detail for this EA. Single tree selection is not a common or preferred silvicultural system when managing oak stands due to their shade intolerance, erratic seed production, and seedling establishment. The use of single tree selection in oak stands can cause understocked stands, which results in epicormic branching and degradation of tree quality. The book, The Ecology and Silviculture of Oaks states "The practical limitations outweigh possibilities for effectively applying the single tree selection method to forests that have strong successional patterns to non-oak species (Johnson et. al 2005). The Land and Resource Management Plan for the Ozark-St. Francis NF's states "Typically single tree selection is only viable in shortleaf pine."

Shortleaf Pine is considered shade intolerant and is most commonly managed using even-aged silvicultural systems. Past studies have shown that single tree selection can be successfully used in shortleaf pine stands, however, it requires more intensive and frequent stand exams, monitoring, entries into the stand, and expenses than compared to even-aged management. Greater silvicultural control is required to apply and sustain effectively the single tree selection method in shortleaf pine stands. After initial site prep burns to create favorable seedling establishment conditions, fire is required to be pulled out of stands managed using single tree selection so damage is not done to new seedlings. Managing from a landscape level, this can cause many issues and is not the preferred silvicultural system to use in most cases. Stands that could be considered candidates for use of single tree selection are ones that are managed for shade tolerant species or stands that occur on small tracts of land where more intensive management can be applied.

**Issues Studied in Detail**

As for significant issues, the Forest Service identified **three** topics raised during scoping and/or ID Team meetings. These issues include:

***Issue #1***

The cumulative effects of past activities on private lands, together with past and proposed activities on public land, and their impacts on soil erosion, water quality and wildlife habitat.

The measurement indicator for this issue is: tons/acre of current and projected erosion/ sedimentation in the analysis area.

***Issue #2***

Forest health and sustainable ecosystems.

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

***Issue #3***

The effects of vegetation management on wildlife/plants/aquatics.

The measurement indicator for this issue is: acres of wildlife/aquatic habitat affected.

The issues addressed in this Environmental Assessment involve contrasts among optional uses of available forest resources. Once analyzed, they were then used by the team to develop project alternatives. All proposals within this EA meet all conditions of the Revised LRMP 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 Cougar 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 upon the extent of the alternative (for example, the amount of prescribed burning) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (for example, the amount of erosion or the degree of risk to public safety).

## *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:

- Wildlife species needing 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 is healthier and can more vigorously repel these attacks.
- 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.
- Available water on a dispersed basis for wildlife needs would not be met according to LRMP standards.
- 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 upon disturbance (e.g., fire) may decrease.
- Fish habitat improvements would be delayed or postponed.

**ALTERNATIVE 2**

**<u>The Proposed Action</u>**

**Hardwood Thinning followed by Timber Stand Improvement (TSI)** would be accomplished. The objective of hardwood thinning would be to reduce density, increase growth of residual trees, reduce the susceptibility of the stand to insect and diseases, improve habitat for wildlife by increasing vigor of residual hard-mast-producing trees, and create light conditions that promote advanced oak regeneration. Trees that are suppressed or that have poor form would be targeted for removal as well as mature trees that may be lost due to mortality. Trees of good form, more desirable species, and/or trees close to the correct spacing would be favored over trees that are simply of larger size. Removing approximately 40% of stand density would allow adequate light levels to promote advanced oak regeneration and put these stands in a condition that would ensure sustainability of these forest types. The target basal area would range from 60-80 $ft^2$ and spacing would depend on the average DBH (diameter of tree at breast height) of the stand.

Approximately 21 acres (1 stand) would be thinned. The stand that would receive this treatment currently has a dense midstory and understory of undesirable species. Thinning this stand would release these undesirable species to become more dominant in the stand. To combat this proliferation of undesirables, a Timber Stand Improvement (TSI) treatment (consisting of herbicide/handtool and Rx burning) would be done after harvest to encourage oaks and other desirable species to become abundant in the mid and understories and help perpetuate oaks on this site. Also, this would allow desirable species to grow free of competition and to enable the stand to be considered for a regeneration harvest next entry.

**Hardwood Shelterwood with Reserves followed by Site Prep Herbicide & Burning** would occur on 49 acres. Currently, two stands have adequate advanced regeneration of desirable species that will dominate the site after harvest. Unfortunately, most of the desirable regeneration is not oak. After harvest, these stands will have herbicide applied to undesirable stems by the hack and squirt and foliar methods, and controlled burned.

The combination of stump/root sprouts from oak species and the other existing desirable seedlings will establish the new stands. This treatment would sustain long term forest health, provide for the succession of early seral habitat, and contribute to providing a sustainable forest. The objective of a shelterwood with reserves is to open up the stand allowing sunlight to reach the forest floor while leaving an adequate amount of trees to provide seed. An average basal area of 20-40 $ft^2$ would be retained.

**Hardwood Shelterwood with Reserves with a pre-harvest TSI** would occur on approximately 6 stands (107 acres). These stands have oaks in the understory that are currently short in height and not in a position to compete with undesirable regeneration. A TSI treatment (herbicide/handtools) would remove the undesirable mid and understories and allow desired species to grow in height which would allow them to compete once the shelterwood harvest is done. Objectives and basal areas are the same as listed above for Hardwood Shelterwood with Reserves-SP Herb/Burn. A post-harvest treatment (herbicide/handtools) may be necessary along with a controlled burn to further reduce undesirable species and to augment wildlife benefits.

**Connected Treatments for all Hardwood Shelterwood stands**: If desired species fail to adequately establish a new stand, **planting & release** of oak species (possibly 156 acres) will be required, using handtools/herbicide and burning, if necessary, to reduce competing vegetation and release desirable hardwood species within 3-5 years after harvest.

The mature hardwood left over from the shelterwood harvests will remain until the new stands receive their first thinning.

**Oak Woodland Restoration** would occur on 37 acres (2 stands). This treatment is generally done on lower productivity sites with the objective of reducing density of the stand to a level that was common in oak woodlands in pre-European times. Oak woodland restoration would allow more sunlight to reach the forest floor (thereby increasing herbaceous species diversity) and promote more mast (nut and fruit) production from the remaining trees. This is not a regeneration treatment aimed at creating a new stand. These stands would have a grassy understory and the overstory would be managed to keep a 40 $ft^2$ basal area (until these trees reached over 140 years old). Oak woodland restoration would benefit a variety of game and non-game wildlife species. This treatment would generally leave a lower basal area than a thinning but more than a shelterwood.

**Hardwood Pre-commercial Thinning (PCT) with Handtools** would occur on 1 stand (23 acres). This is a non-commercial treatment used in one younger stand not feasible to commercially harvest. The purpose of PCT would be to cut small, unmerchantable trees competing with desired hardwood species. This treatment would allow for the selection of the trees with the best form to remain and to free them of competition.

**Hardwood TSI – Midstory Treatment with Handtools** is recommended in another stand, about 2 acres. This stand is about 70 years old, but is on a low-quality site adjacent to a good road. It can be thinned for firewood, with benefits similar to the treatment above.

**Hardwood TSI- Midstory Treatment with Herbicide** would occur on 227 acres (11 stands). These stands are mostly immature sawtimber but do have a component of mature trees; they have a dense midstory and understory of undesirable species. Removal of these undesirable species will allow oak and other desirable species currently in and underneath the midstory to be released and become competitive. The success of this treatment would allow a regeneration harvest to be considered next entry. Prescribed fire may be necessary to ensure adequate regeneration within these stands.

**Pine Thinning** would occur on 712 acres (23 stands). Thinning would increase growth of residual trees, reduce the susceptibility of the stand to insect and disease, and improve habitat for wildlife. The pine stands would be thinned to a target basal area of 60-70 $ft^2$/acre. Trees that are suppressed or that 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 pine spacing would depend on the average DBH of the stand. Prescribed burning following thinning would provide beneficial effects for wildlife.

**Pine Seedtree** harvests are proposed on 12 units that total approximately 360 acres. This type of regeneration harvest would remove 90% of the overstory (BA=20). Site preparation will be done with herbicide treatments and with a prescribed burn in order to prepare a proper seed bed. Adequate natural regeneration should be present to re-stock the stands with an average

300 trees/acre; however, planting may be necessary if stocking levels are not met through natural means. Following the establishment of the regenerated stand, release treatments with herbicide may be needed to promote "free-to-grow" conditions. The remaining mature overstory trees would be harvested when the new stand is ready for its first thinning.

**Pine Shelterwood with Reserves** harvests are recommended. Ten stands totaling about 192 acres would be treated. Shelterwood cutting would reduce the current density from about 130 trees per acre to 25-35 trees per acre (BA=30-40), allowing more sunlight to reach the forest floor and provide for the growth of new trees underneath the overstory. As the name implies, several trees would be left in the overstory to give shelter to the developing seedlings on the ground. 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. Subsequent herbicide and prescribed burn treatments (site preparation) would follow to prepare a good bed for seed fall. Natural regeneration adequate to re-stock the stands with an average of 300 trees/acre should be present; however, planting may be necessary if stocking levels are not met. Following the establishment of the regenerated stand, release treatments with herbicide may be needed to promote "free-to-grow" conditions. The remaining mature overstory trees would be harvested when the new stand is ready for its first thinning.

**Connected Treatments for all Pine Shelterwood & Seedtree stands**: if natural seeding fails to adequately establish a new stand within 3-5 years after harvest, **planting & release** of Shortleaf pine (possibly 552 acres) will be required. Handtools/herbicide and burning, if necessary, will be used to control competing vegetation and release the pine seedlings.

The mature pine left over from the shelterwood/seedtree harvests will remain until the new stands receive their first thinning.

**Pine Pre-commercial Thinning (PCT) Followed by Planting** is proposed for one stand, about 98 net acres. This stand was harvested of all of its marketable pine timber about fifteen years ago, after which it was acquired by the Forest Service. Hardwood is becoming more dominant. It needs to be restored to pine using herbicide means, then inter-planted to Shortleaf pine. Rx burning may also be employed to further control the hardwood species.

**Pine Pre-commercial Thinning** is recommended in another stand on about 30 acres. It, also, was acquired about 15 years ago after it had been harvested of all its merchantable pine. However, adequate young pine poletimber and saplings exist; they are in need of release from hardwood brush and sapling competition. This can be accomplished by herbicide means and burning.

**Pine TSI- Midstory Treatment with Rx Burning/Herbicide** is proposed in two stands, around 52 acres. This stand was thinned 10-15 years ago but has not accumulated any pine regeneration to be adequately stocked. The stand is approaching maturity and needs more pine seedlings on the ground to be prepared for final harvest in the next entry. Hardwood competition needs to be controlled by herbicide treatments and the seed bed prepared by prescribed burning for natural seedfall.

## Wildlife & Fishery Habitat Improvement

Wildlife Opening Reconstruction

Nine existing wildlife openings totaling approximately 14 acres would be reconstructed. Only 7 wildlife openings will be increased in size due to reconstruction. This will lead to 7.5 acres of increase in existing wildlife openings. Methods used to accomplish this would be dozing, blasting stumps, herbicide use, disking, and seeding. One existing wildlife opening (compartment 334, stand 22) would be reconstructed by removing encroaching trees around edges, brush-hogging and seeding. The size of this opening will not be increased.

| Compartment/Stand |
|---|
| 334/1 |
| 334/2 |
| 334/3 |
| 334/4A, 334/4B |
| 334/6 |
| 334/39 |
| 334/22 |
| 340/10 |

New Wildlife Opening Construction

Three new wildlife openings would be constructed approximately 2 acres in size. These wildlife openings would be constructed by timber harvest, dozing and seeding.

| Compartment/Stand | Size (ac.) |
|---|---|
| 334/20 | 2 |
| 340/4 | 2 |
| 340/16 | 2 |
| **Total** | **6 acres** |

Wildlife Pond Reconstruction

A ¼ acre silted in wildlife pond in Compartment 337 stand 30 would be reconstructed. The pond would be dozed out and sealed with bentonite.

Wildlife Prescribed Burning

Stands to be burned would include all thinned pine stands, all woodland restoration stands, and stands adjacent to commercial thinning units which may fall within sale area boundaries. First entry with prescribed fire would occur following completion of timber harvest. A second entry with fire is planned for 3-10 years following the 1$^{st}$ entry.

Woodland Restoration Thinning –WSI (low quality hardwood)

Two ridges in Stand 5 (20 acres) in Compartment 334 would be thinned for woodland restoration. This stand would be thinned to an average basal area of 40. Force account/contract methods used would include hand-felling, use of a bobcat mounted tree shear, cut-surface herbicide application, and foliar herbicide application. This stand may be commercially harvested as well.

Gate Construction

Wildlife habitat improvement through access management is proposed through use of approximately 5 gates. These gates would be installed primarily on access roads leading to

newly constructed wildlife openings. This type of management would help reduce disturbance to wildlife, provide increased opportunity for quality hunting, reduce erosion/sedimentation and improve water quality in the watershed.

| Compartment/Stand | Road Number | Comments |
|---|---|---|
| 340/14 | 94340E | Construct 1 gate at Junction with 1435 |
| 340/10 | 94340B | Construct 1 gate at Junction with 4432A |
| 340/7, 340/41 | 4432A | Construct 2 gates- one on rd. in 340/7 and one on rd in 340/41 |
| 334/2 | 94334F | Construct 1 gate at junction of 4432B |

## Fish Habitat Improvements

Large Woody Debris Introduction

Introduction of Large Woody Debris (LWD) to streams is proposed to improve fish habitat along certain stretches of Washita Creek and Bull Creek totaling approximately 2.6 miles. In addition to improving fish habitat in these streams, the introduction of LWD would also provide fish cover and would assist in the formation of creek pools. Chainsaw falling would be utilized to place trees into creek channels.

Fish Pond Improvement

An existing 1 acre fish pond (Bear Branch Pond) in Compartment 334 stand 4 would be improved using KV funds. To accomplish this, the pond would be stocked, access to the pond on 94334D would be improved, the parking area would be improved, and fish habitat structures would be added to the pond.

## Prescribed Fire

This type of treatment would occur on up to approximately 4,140 acres of federal lands within the Cougar project area. Prescribed fire treatments may occur on private lands located within the Cougar project area (approx. 2,108 ac.), 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 under prescription in conjunction with prescribed burns on public lands. Prescribed fire would be utilized for several purposes in the project area. 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 upon best available science regarding beneficial fire-return intervals for the project area.

**Roadwork**

Decommissioning: The transportation system in this project has been assessed to determine the need for closing roads no longer needed for land management. Roads (approximately 5.3 miles) to be decommissioned and closed with gates are displayed on the GIS maps associated with this project proposal.

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.

Reconstruction, Maintenance, etc.: To access the project area and implement vegetation management, roadwork would be necessary and consist of (approximately) maintaining 21.5 miles of existing Forest Service roads and reconstructing 1.75 miles. Approximately 0.75 mile of road may need to be constructed depending upon obtained easements. This road would be built or maintained to a Level D standard (the lowest Forest Service standard). Level D standard roads can be intermittent-use roads that are closed upon completion of logging and other activities. In general, Level D roads are constructed only for use by high-clearance vehicles like logging trucks or pick-ups and may not be usable during wet weather. Roads designated as temporary roads would be blocked following completion of use, and rehabilitated with seeding and/or natural re-vegetation. Closed temporary roads would be managed as linear herbaceous strips for wildlife in appropriate locations. The number of temporary roads would total approximately 6.5 miles. Temporary roads are not intended to be included as part of the forest road atlas, as they are managed for projects or activities and decommissioned after use. Roads to be maintained are displayed on the GIS maps associated with this project proposal. The Roads Analysis Process (RAP) report prepared for this project describes all road decommissioning, closures and traffic levels. Closures are evaluated as to what type will be used; whether they will be closed with gates, earthen mounds, or other means. Illegal, “renegade” OHV trails would be closed with earthen mounds or gates.

When administrative activities are complete and a forest system road is no longer needed for one or more years, they are closed for resource protection and to improve watershed integrity. Gating has proven to be a more effective method of eliminating illegal motorized vehicle use. Closure denotes storage for future use; the road remains on the forest development transportation system and periodic maintenance may be required.

The newly constructed roads or sections of roads would be open to administrative use only and closed with gates/berms after they are no longer needed.

**Table 2. Alternative 2 - Summary of Roadwork – Cougar**

**Table 2.0 Cougar Project Roads Management**

| Road No. | Total Rd. Miles | Roads Open on MVUM | MVUM Rds. To be closed | Closure for > 1yr. Miles | Existing Rd. No trtmnt | Closure Type | Closure Reason | Decom Miles | Recon. Miles | New Const. | Maint. Level | Maint. Req / Miles | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 94337A | 2.1 | | | 2.1 | | | Res. Pro. | | | | 1 | 2.1 | existing gates at both ends; partial ROW needed/1.1mi |
| 94337B | 0.63 | | | 0.63 | 0.15 | | Res. Pro. | | | | 1 | 0.48 | maintenance-closed to admin use only |
| 94334A | 0.96 | X | X | 0.96 | | | Res. Pro. | | | | 1 | 0.63 | maintenance already gated@jnct.(temp to stand 31) |
| 94334B | 0.8 | | | 0.8 | | | Res. Pro. | 0.69 | | | 1 | 0.12 | decommission |
| 94334C | 0.67 | | | 0.67 | | | Res. Pro. | | | | 1 | 0.63 | maintenance |
| 94334D | 0.12 | | | 0.12 | | | Res. Pro. | | | | 1 | | as-is |
| 94334E | 0.2 | | | 0.2 | | | Res. Pro. | | | | 1 | 0.2 | maintenance |
| 94334F | 0.91 | | | 0.2 | | | Res. Pro. | | | | 1 | 0.79 | wildlife gate (maintenance) |
| 94334G | 0.13 | | | 0.13 | | | Res. Pro. | 0.13 | | | 1 | | decommission, Temp road |
| 94334H | 0.65 | | | 0.65 | | | Res. Pro. | | | | 1 | 0.38 | maintenance-existing gate-berm near the 4432 rd. |
| 4432 | 3.22 | X | | | | | | | | | 3 | 1.67 | maintenance |
| 4432A | 2.95 | X | X | 2.4 | 0.55 | 2 Gates | Res. Pro. | | 0.25 | | 3,1 | 2.1 | Proposed Gates- maint. to C340 stand 42 |
| 4432B | 0.84 | X | | | | | | | | | 2 | 0.84 | maintenance |
| 4432C | 0.48 | X | | | 0.48 | | | | | | 3 | | Existing within the project area |
| 4432E | 1.33 | X | X | 1.33 | | | Res. Pro. | | | | 1 | 1.33 | maintenance |
| 94340A | 0.31 | | | 0.31 | | | Res. Pro. | | | | 1 | 0.31 | maintenance; existing gate |
| 94340B | 0.79 | X | X | 0.79 | 0.74 | Gate | Res. Pro. | | | | 1 | 0.05 | "B" is the old D- maintenance; Proposed Gate |
| 94340C | 2.94 | X | X | 2.94 | | | Res. Pro. | 2.94 | | | 1 | 2.94 | decommission whole rd. |
| 94340D | 0.53 | X | X | 0.53 | | Gate | Res. Pro. | | | | 1 | 0.53 | maintenance;gate change to "B" rd. ;D is unnamed |
| 94340E | 0.4 | | | 0.4 | | | Res. Pro. | | | | 1 | 0.4 | existing gate-wildlife gate below E & 1435 intersection |
| 94674A | 1.04 | X | X | 1.04 | | Gate | Res. Pro. | | 1.5 | | 2 | 0.50 | maintenance; proposed gate |
| 94674B | 0.8 | | | | | | | 0.8 | | | 1 | | take off infra-decommission; change to temp. |
| 94674C | 0.36 | X | | | | | | | | | 2 | 0.36 | maintenance |

| Road No. | Total Rd. Miles | Roads Open on MVUM | MVUM Rds. To be closed | Closure for > 1yr. Miles | Existing Rd. No trtmnt | Closure Type | Closure Reason | Decom Miles | Recon. Miles | New Const. | Maint. Level | Maint. Req / Miles | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 94674D | 0.32 | | | 0.32 | | | Res. Pro. | 0.32 | | | 1 | | decommission; change to temp. Keep unclassified |
| 94674E | 0.19 | | | 0.19 | | | Res. Pro. | 0.19 | | | 1 | | decommission; change to temp. Keep unclassified |
| 94674F | 0.26 | | | 0.26 | | | Res. Pro. | 0.26 | | | 1 | | decommission; change to temp. Keep unclassified |
| 94674G | 0.48 | | | 0.48 | | | Res. Pro. | | | | 1 | 0.48 | maintenance; open up w/dozer |
| 1435A | 0.87 | | | 0.87 | | | Res. Pro. | | | | 1 | 0.87 | maintenance; 2 existing gates |
| JO 4290 | 5 | | | | 1.16 | | | | | | 3 | 3.82 | Coop rd.-main. needed from Hwy 103 to middle stand 45. Need main. from 340 A to jct. 4432 |
| Unnamed road | | | | | | | | | | 0.75 | | | Depending upon easement obtainment |
| **Totals** | | | | | | | | 5.3 | 1.75 | 0.75 | | 21.5 | |

*All Open Roads are those shown only on the MVUM maps. Non-Forest maintained roads may still be open to the public.

**Existing Special Uses and Rights-of-Way Needs**

Three road Rights-of-Way needs have been identified in order to access stands within the analysis area. These ROW's will be utilized to access several stands in Compartment 337, and one stand in Compartment 334.

The road system and overall forest system lands within the analysis area are compatible with the management of special uses. A review of private in-holdings and recreational opportunities within the analysis 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 and proximity to the Mulberry Wild and Scenic River. There have also been several temporary special use permits issued here in previous years. These temporary special use permits were issued authorizing commercial hauling of timber across National Forest land from private property.

There are currently six special use authorizations issued within the analysis area. Three authorizations are issued allowing access across National Forest land to private in-holdings. One is issued for an easement to the Arkansas State Highway and Transportation Department for a section of State Highway 215 Right-of-Way across National Forest Land. A special use permit is issued for the operation and maintenance of a gas pipeline on National Forest land. The remaining authorization is an outfitting and guide special use permit associated with the Mulberry River Wild and Scenic River that is located within National Forest land.

No other types of permits are on file at this time. Proposed projects within the analysis area will not affect any permitted uses currently or in the future. If road closures occur resulting from various actions taken within the analysis area and a private landowner determines they are in need of legal access, proper procedures for permitting the access shall be followed.

## ALTERNATIVE 3

**No Herbicide/Reduced Prescribed Burning**

This alternative differs from Alternative 2 (the proposed action) by including less provision for the use of prescribed fire and no herbicide use. Only areas proposed for treatment would be burned. This alternative was developed in response to past public comments which relate to the use of prescribed fire and herbicides, and its perceived effects upon the environment. Prescribed fire would be utilized for the purposes of fuel reduction, silvicultural treatment, and wildlife habitat improvement in stands previously identified for mechanical vegetation manipulation. Herbicides would not be used, but would be replaced by mechanical and/or hand-tool methods. Generally, hand-tools are not as effective for vegetation manipulation as herbicides; therefore, more applications would be required in this alternative.

Areas which would be prescribed burned include pine and hardwood thinning areas, hardwood shelterwood and oak and pine restoration areas, Pine Seedtree, and TSI/WSI areas only. With implementation of Alternative 3, prescribed fire on Federal lands would be reduced by approximately 2,255 acres. Because this alternative would not utilize natural barriers such as ephemeral/perennial streams and man-made barriers such as roads and pastures as fire-breaks, a significant amount of fire-line would have to be constructed around each treatment area. Approximately 40 miles of fire-line would have to be constructed in order to only burn within the proposed treatment areas. However, if consent is given from private land-owners to burn off Forest land, some man-made barriers such as roads and pastures could be used as fire-breaks and could possibly reduce the amount of fire-line

needed to be constructed. With implementation of Alternative 3, all other potential management actions would be the same as those described for Alternative 2.

**Forest-Wide Standards**

In order to protect the environment and lessen possible negative impacts, the following Standards will be applied to the proposed alternatives. Management Requirements of the Revised Ozark-St. Francis National Forests Land and Resources Management Plan will apply as standard mitigating measures to all proposed activities. Best Management Practices (BMP) Guidelines for Silviculture Activities in Arkansas will also apply as standard mitigation measures for all proposed actions.

The following is a summary of the specific mitigating measures:

1. GENERAL

a. A biological evaluation has been conducted on all areas proposed for management activities. The list of the species surveyed for is in the project file. Any PETS that are found will be protected (FSM 2670.31).

b. Soil productivity will be protected by discing, seeding, and fertilizing haul roads, firelines, and temporary roads.

c. Water quality will be protected by retaining filter strips of vegetation along all perennial streams/springs and defined stream channels. This zone will be 100-150 feet on either side of the perennial streams and 50-100 feet on either side of defined channels; at least 50 square feet of basal area will be retained within each zone. No vegetation will be removed within 20 feet of the bank of a perennial stream and 5 feet of a defined channel (LRMP pp. 3-12).

   The Arkansas Forestry Commission Best Management Practices (BMP's) guidelines will be followed.

d. Wildlife den trees will be retained as well as six standing dead snags per acre when available.

2. HERBICIDES

For the herbicides commonly used by the Forest Service in its management activities, Human Health and Ecological Risk Assessments (RA) are prepared. In these documents, the process of risk analysis is used to quantitatively evaluate the probability that a given pesticide use might impose harm on humans or other species in the environment. The Forest Service then incorporates the relevant information from the RA into the appropriate environmental assessment document prepared for herbicide projects that are used to disclose potential environmental effects to the public.

The following general mitigating measures for herbicide use apply to Alternative 2. They are taken from current risk assessments as prepared for the U.S. Forest Service by Syracuse Environmental Research Associates, Inc. (SERA) for all proposed herbicides to be used in implementation of this project (USDA, 1999 and 2003). See section 10 of this EA (Human Health Factors) for more information.

a. Each Contracting Officer's Representative (COR), who must ensure compliance on contracted herbicide projects, is a certified pesticide applicator. Contract inspectors are trained in herbicide use, handling, and application. Herbicides are used in compliance with all Federal, State and local laws and regulations.

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

c. Herbicides will not be applied within 100 feet of private land or a domestic water source, or within 300 feet of a private residence.

d. Herbicides will not be applied within 30 feet of any spring or stream, or within 50 feet of any perennial stream.

e. 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.

f. Application equipment, empty herbicide containers, clothes worn during treatment, and skin will not be cleaned in open water or wells.

g. Herbicide mixing, loading, or cleaning areas in the field will not be located within 300 feet of a private residence, open water or wells, or other sensitive areas.

h. 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 US Forest Service are listed in the LRMP pages 3-4, and 3-5.

3. HERITAGE RESOURCES

Heritage resources consideration has been given to all acres where site-disturbing activities are proposed. Findings are discussed in the Heritage Resources Section of this EA. Any other sites found during implementation of this project will be examined and necessary mitigation measures prescribed by the Forest Archaeologist (FLMP, pp. 3-16).

4. PRESCRIBED BURNING

The following is a summary of mitigation measures found in the FEIS, pages 3-397 to 3-408:

a. All prescribed burns require the completion and approval of a prescribed burning plan for each specific project. This plan includes smoke management to comply with air quality regulations and protect visibility in smoke sensitive areas.

b. First entry landscape scale fuel reduction will be implemented by using low- to moderate-intensity burns during the dormant season, generally with flame lengths of two feet or less (Alt. 2&3).

c. Water diversions will be installed and firelines revegetated promptly to prevent erosion.

d. Coordination with neighboring Districts and Fire Dispatch regarding planned ignitions, and analysis of transport winds and mixing heights will be utilized to avoid smoke impacts to major metropolitan areas and other "communities at risk" downwind.

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.

**Table 3. Comparison of Alternatives' Effects.**

| | **Alternative 1** | **Alternative 2** | **Alternative 3** |
|---|---|---|---|
| **Soil Resources** | Natural erosion continues; unmaintained roads erode | Total expected temporary reduction of soil productivity would be 155acres (10% of the harvested area) | Total expected temporary reduction of soil productivity would be 155 acres (10% of the harvested area) |
| **Water Resources** | disrepaired roads contribute to stream sediment; currently 280% will increase to 292% | 288% increase in sediment by 6th level watershed; concern level = low | 293% increase in sediment by 6th level watershed; concern level = low |
| **Air Resources** | No change from current conditions | Short term direct effects include: 30,073 tons of $CO_2$; 1,204 tons of particulate matter | Short term direct effects include: 26,121 tons of $CO_2$; 1046 tons of particulate matter |
| **Road Access** | Approx. 33 miles of roads; 15.5 miles of open roads. | 21.5 miles of maintenance, 5.3 miles of road decommission; about 10.5 mi. road closure. | 21.5 miles of maintenance, 5.3 miles of road decommission; about 10.5 mi. road closure. |
| **Heritage Resources** | 6 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 | New sites may be discovered, and existing sites would be preserved intact | New sites may be discovered, and existing sites would be preserved intact |
| **Vegetation Resources** | As forest ages, they will become more vulnerable to outside elements; decrease in early-seral veg. = decrease in biodiversity | Thinning=733 acres; even- aged management=1026 acres, indirect/cumulative effects = increase in biodiversity, more benefits to oak regen. from RX fire | Replacing herbicides with handtools would slow regeneration of desirable species. Undesirable species could out compete desirable species without the use of herbicides. |
| **Wildlife Resources** | Short term early successionalhabitat in regenerated stands would not occur. Negative indirect impacts to wildlife species. No benefits from Rx Buring | Thinning and wildlife opening creation would yield positive indirect impacts to wildlife, Increased abundance of soft mast species; increased wildlife benefits from increased RX fire and regeneration harvests; re-establishment of native grasses using herbicides | Less herbaceous vegetation abundance and diversity for wildlife due to stump sprouts as a result of no herbicide applications. Reduction of oak/pine regeneration with lack of herbicide use. |

| | | | |
|---|---|---|---|
| **PETS** | No negative adverse effects would occur to Region 8 sensitive species | Benefit to species which require open and/or fire dependent habitats Implementation of this proposed project may benefit Ozark big-eared bat, gray bat and Indiana 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 no herbicide use. |
| **Wetlands & Riparian Areas** | No change from current conditions | No change from current conditions; No timber harvests proposed in riparian areas; BMP's will be followed. | No change from current conditions; No timber harvests proposed in riparian areas; BMP's will be followed. |
| **Human Health** | Potential effects of injury and damage to personal property in oak decline areas remain; mainly on travelways and camping/hunting sites | Risks of injury and damage to personal property in oak decline areas reduced; higher potential for worker injury due to timber harvest, TSI, WSI, and burning | Reduce hazard from over mature and dying trees, higher potential for worker injury due to timber harvest, TSI, WSI and Rx Burn, No herbicides would be applied. |
| **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. | 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. |
| **Recreation** | This alternative will not change the recreation use (OHV driving, camping, hiking, mountain bicycling, or fishing) in the project vicinity. | This alternative will not change recreation use (camping, hiking, mountain bicycling, or fishing) in the project vicinity. Some browning of vegetation from herbicide use and burning could occur | Drivers and forest users along county and forest roads may have more occasions to notice browning of vegetation from repeated mechanical or hand work to replace herbicide activities |

**Part 3 – Environmental Consequences**

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

## 1. Water Resources

Significant Issues Related to the Resource

**Issue #1**

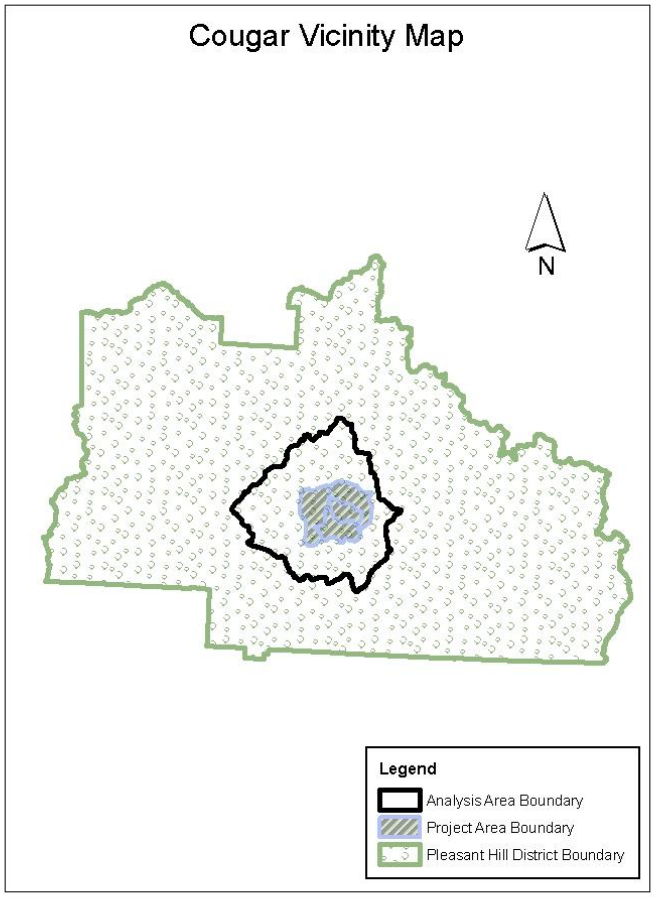
The cumulative effects of past activities on private lands, together with past and proposed activities on public land, and their impacts on soil erosion, water quality and wildlife habitat.

***Existing Condition***

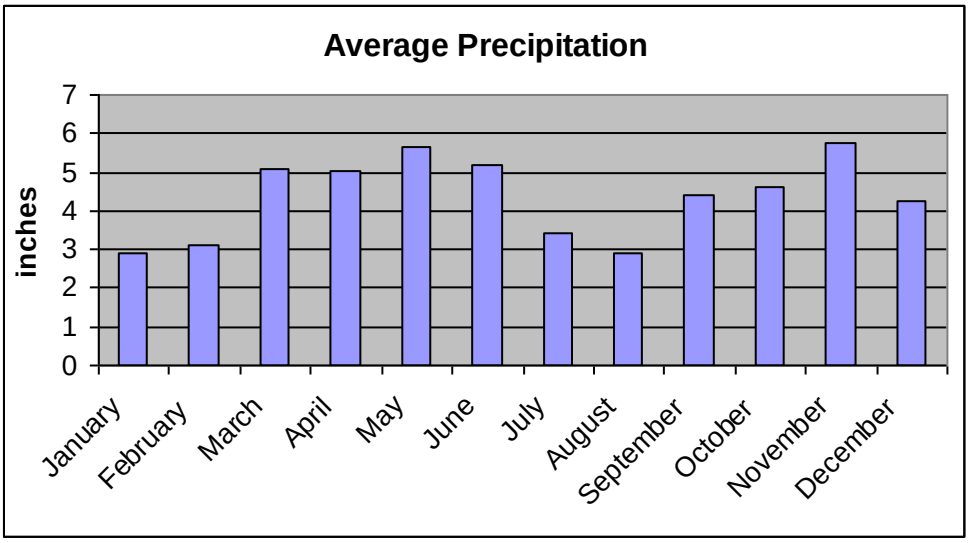
Watersheds in the United States are divided into progressively smaller units known as hydrologic units, recognized by the United States Geological Survey (USGS) - as regions, sub-regions, basin, and sub-basin units. This hierarchical division of watershed boundaries is useful for assigning address-like codes to drainage basins. This project area 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) (USGS-NHD and EPA, 2000; FGDC, 2002). The Ozark-St. Francis National Forest further classifies land areas into progressively smaller units: watersheds and sub-watersheds. The proposed project falls into one watershed unit, the Headwaters Mulberry River (1111020106) watershed. At the smallest scale, the proposed project is located in sub-watershed Washita Creek-Mulberry River (111102010605) with and area of 29,388 acres. This sub-watershed, or 6$^{th}$ level Hydrologic Unit Code (referred to as 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.

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. The primary streams that are found in the project area are: the Mulberry River, Bull Creek, Washita Creek, Bear Creek, Dry Creek, and Estep Creek and unnamed tributaries to the Mulberry River and Bull Creek. The creeks and tributaries flow north into the Mulberry River which then flows west and subsequently feeds the Arkansas River. No significant dams or significant-sized bodies of surface water are found within the analysis area watershed (USGS, 1999; NHD, 2000). A segment of the Mulberry River in sub-watershed 111102010605 has been designated as not meeting water quality standards for pH by the Arkansas Department of Environmental Quality. The cause of the occasional low pH readings has been determined to be a natural condition. The Arkansas Department of Environmental Quality (ADEQ) maintains a monitoring station (ARK 0138) on the Mulberry River in the vicinity of Washita Creek. There are approximately twenty-three acres of total surface area of small ponds across the analysis area watershed. Common to this area of the Ozarks, chicken houses are often found concentrated on private lands; in this watershed there

are relatively few of these features. A total of seventeen chicken houses are on the border or within the watershed analysis watersheds. An absence of chicken houses does not preclude inappropriate application of animal waste within the watershed by private landowners.




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.




Climate information obtained for the project area was derived from information for the town of Ozone, AR (NRCS-Climate Product). The bars on the above graph indicate average precipitation over a thirty year data period or climatic norm. Mid-winter and late summer are 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 .1$m^3$/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, et al. (1985) reported that for storm-flow values, the average turbidity from these ephemeral streams over a five year period averaged from 19 – 40 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 few 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 80% (or 23,731 acres) of the analysis area is administered by the Forest Service. This leaves a sizable area of the land within the watershed as privately owned, roughly 20% or 5,686 acres. Land use within the watershed is

approximately 94% 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 NF, 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; USDA SCS, 1989). Using soil information compiled for use across the Forest, ~87% of the project area soils have been given a slight to moderate rating for woodland erosion and woodland management equipment use; the remainder is classified as a severe risk (Various County Soil Surveys). Woodland erosion risk ratings indicate the probability of damage and erosion of soils as a result of timber harvest and site preparation where soils become exposed. Woodland equipment ratings indicate that year round equipment use on these soils is appropriate.

Within the analysis area, roads are found both within the forest boundaries and outside the forest boundaries. There are approximately 220 miles of roads within the analysis area. This translates into a road density of 4.8 miles per square mile and includes all roads as determined from forest wide information and 2004 census tiger data. Within the project area, there are approximately 33 miles of roads which translates to approximately 3.4 miles of road per square mile of project area. There is a total of approximately 220 miles of roads within the analysis area or 4.8 miles per square mile. Within the project area there are approximately two perennial stream crossings where the current road system crosses or intersects a stream.

As discussed in the Soil Resources section of this analysis, there is a 5 acre area of hydric soil in the center of the N1/2, SW1/4, NE1/4 Section 21 T12N, R24W in a native grass field north of the Mulberry River. The hydric soil area was altered when it was converted from forest to pasture when it was in private ownership. There are approximately 533 acres of floodplain within the project area. These occur mostly along the Mulberry River where they are primarily privately owned and along Washita Creek and relatively narrow portions of Bull Creek.

The proposed project is located in 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 (2004). 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 Boston Mountain stream fishery. 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 Boston Mountain fishery. Section 009 of the Mulberry River within this watershed analysis area boundary is on the 303d list of impaired water bodies due to occasional low pH readings. The Mulberry River is also listed as an Extraordinary Resource Water.

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. Within the project area there are no other potential sources of degradation, other than land uses that would impact the current condition of water quality.

## Direct and Indirect Effects

### Alternative 1

Selection of the No Action Alternative will result in no direct effects because no activities will 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 alternative 1, roads in need of maintenance and reconstruction will not receive the necessary upgrades to minimize resource conditions. Unpaved roads paralleling and crossing streams will continue to pose specific risks to water quality as they often maintain linkages with the stream channel. Roads have three primary effects on the hydrologic cycle; they intercept rainfall, concentrate flow, and divert 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.

Activities associated with other projects being conducted within the analysis area will continue as planned and have been assessed in the cumulative effects analysis for the watershed. These include portions of the Catalpa and Lock Hollow Projects which utilize management strategies similar to those of this project.

### 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 and reconstruction, and prescribed burning.

In a summary of silviculture activity effects in the Ozark-Ouachita Highlands, Lawson (1986) 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% 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. This is roughly equivalent to one half of a 5 gallon bucket of soil. 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 US. Therefore, the vegetation management practices proposed for this project will result in temporary increases of sediment but at relatively low levels for a short duration.

A water monitoring study conducted on a timber sale on the Pleasant Hill Ranger District between the years of 1971 and 1974 investigated flow data and water quality before, during, and after a timber sale (unpublished, SO report). The area of investigation included 198 acres feeding an intermittent stream channel. Within the study area 59 acres were clearcut and 25 acres were thinned. Water samples were collected after storm events and crest stage gauges were read at the time of water collection. The samples were analyzed for turbidity and suspended sediment among other variables. There were a limited number of samples (16-total) which revealed no apparent changes to water quality throughout the study period. One observation from the study was that an obvious sediment source within the watershed occurred where a temporary haul road crossed the stream above the sample location. This highlights the need for adequately constructed stream crossings and disconnection of the road drainage from the stream channels for addressing water quality concerns.

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% 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 are insignificant. This study also noted that the time to peak and total flow duration was unchanged.

The Washita Creek-Mulberry River watershed is 94% forested and 15% of it is proposed for harvest (including the acres that will be harvested as part of the Lock Hollow Project and remaining acres to be harvested as part of the Catalpa Project) which will reduce the basal area less than 50%, so the proposed harvest is not expected to significantly affect water yield.

Long term implications of nutrient loading after timber harvest for streams in the south were described in a study by Lynch and Edwards (1991). In this study, best management practices 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% 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.

Construction of 0.75 mile of new road, 6.5 miles of temporary road construction, and 1.5 miles of road reconstruction are proposed for this project, along with 2 mile of temporary road and 3 miles of road reconstruction for the Catalpa Project in the analysis area. 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 Forest Land Management Plan and the Arkansas Forestry Silviculture BMP manual outline the mitigation measures necessary to conduct these activities while controlling contributions to non-point source pollution. The remainder of the road work is maintenance, which when properly conducted, should result in a net decrease in sediment production, thus a benefit. Also approximately 5.3 miles of road are proposed for decommissioning as part of this project, resulting in an estimated net decrease of potential sediment.

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, 1988). 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, Van Lear and Waldrop 1988). Even where sedimentation and dissolved nutrients increase in streamwater in response to burns, the amounts are often negligible. For example, Neary and Currier (1982) reported that wildfires in the Blue Ridge Mountains resulted in a threefold increase in $NO_3$, but 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 streamflow and the soil solution after intense slash fires, but the effects are of short duration and of a magnitude not considered damaging to 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 significant effects to the water resources. Road stabilization through maintenance and construction, erosion control through revegetation 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.

To further differentiate between Alternative 2 and 3 requires a look at the potential impacts that may result from their differences. Alternative 2 has the potential to result in negative effects as a result of the use of herbicides. Alternative 3 has no potential for herbicide to result in any impacts.

## Cumulative Effects

For this analysis, the cumulative effects to water resources will be bound by the 6$^{th}$ 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 the following table. This analysis indicates that all watershed analysis areas are currently found to have a low concern level. As a result of the No Action alternative the concern level will remain Low, and under any of the Proposed Alternatives the concern level remains Low.

Results of the Water Resources Cumulative effects analysis:

| **Percent increase of sediment above undisturbed conditions** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Current** | | **Future** | | | | | |
| | | | Proposed | | No Action | | No Herbicide | |
| 6th level Watershed Analysis Area | % increase | Concern Level | % increase | Concern Level | % increase | Concern Level | % increase | Concern Level |
| **111102010605** | 280 | Low | 288 | Low | 292 | Low | 293 | Low |

The cumulative effects analysis indicates minimal risks to the water resource's current condition. A number of factors contribute to this outcome. No Forest Service activities, other than existing roads, contribute to the current conditions; these are mainly the result of off-forest activities and land uses. One of the initial contributing conditions is the land use patterns of public lands. Pastures, agriculture and cultivated field type land uses pose greater risks to water resources through non-point source pollution as they traditionally require a more intensive management regime than forested landscapes.

The similarity between the percent increase between the proposed action compared to the no herbicide/reduced burn alternative can be attributed to the higher volume of prescribe

burning vs. additional fireline, respectively. In this case, these two actions offset to yield similar sediment results with fewer acres treated in the no herbicide/reduced burn alternative.

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. The Proposed Alternatives result in a slight increase in the percentage of possible sediment contributions 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 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**

The cumulative effects of past activities on private lands, together with past and proposed activities on public land, and their impacts on soil erosion, water quality and wildlife habitat.

Much of the information in this section relies on the Soil Survey of Johnson County, Arkansas, and an article entitled, "The Effects of Forest Management Practices on Soil Nutrient Status," by Drs. Wheeler and Eichmann, University of Arkansas, Fayetteville.

### *Existing Condition*

The analysis area for soils will be Compartments 334, 337, 340, and 674. 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 920 feet on the nortern and eastern edges of the project area along Washita Creek and Mulberry River to 2000 feet in the southeastern corner of the project area. Several types of topography exist in this Boston Mountain section. Most of the timber harvest will 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 alluvial areas along Washita Creek, Bull Creek, and Mulberry River. 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% slope on mountain tops, benches, and creek bottoms, to fairly steep 40-60% on the 200 to 300 foot slopes between the benches and just above the stream bottoms in Washita Creek, Bull Creek, and Mulberry River.

The soils in the project area are mostly stable. Soils are mostly well-drained and range from shallow to deep. Portions of the ditch and cut bank along Forest Development Road (FDR) 1435 are unstable and are eroding. There are some small areas of poorly-drained hydric soils

in depressions included in the Ceda cobbly fine sandy loam, Guthrie silt loam, Leadvale silt loam, Taft silt loam and Spadra fine sandy loam soil map units on the floodplains along Washita Creek, Bull Creek, and Mulberry River. There is a 5 acre area of hydric soil in the center of the N1/2, SW1/4, NE1/4 Section 21 T12N, R24W that is in a native grass field north of the Mulberry River. The hydric soil area was altered when it was converted from forest to pasture when it was in private ownership.

There are some stumps in previously harvested stands, but there is no evidence of detrimental soil disturbance. Stands are well stocked and are productive. Most of the soils have 100% cover consisting of leaf litter, twigs, limbs, logs, gravel, stones, and have an intact root mat. Portions of the ditch and cut bank along FDR 1435 are unstable and are eroding in the steep section that runs through private land in the NE1/4 of section 6 T11N R24W. The topsoil has been stripped off of portions of the wildlife opening in stand 4 of compartment 334 and there are some rutted areas.

## Direct and Indirect Effects

### Alternative 1

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

### Alternative 2

Approximately ten percent (155 acres) of the harvested area would sustain a temporary reduction in soil productivity due to harvesting operations. An additional 10 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 3 acres due to road reconstruction. Approximately 8 acres of the analysis area would sustain a temporary reduction in soil productivity due to fireline construction. Five miles of road are proposed for decommissioning which will return approximately eight acres of soil to a productive state.

Total expected temporary reduction of soil productivity would be 176 acres (11% of the harvested area), including skidding, temporary road construction, road reconstruction, and fireline construction. Road decommissioning would reduce the net acreage of soil disturbance to 168 acres, but would not reduce the overall percentage. 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 will also prevent the loss of productivity on soils adjacent to the roads by helping to control runoff. Less than 15% of an activity area can sustain a reduction in soil productivity, according to the LRMP standard. If more than 15% 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.

**Cumulative Effects**

There is a potential for additional temporary loss in soil productivity in the stands that are proposed for shelterwood and seed tree harvest and follow-up shelterwood and seed tree removal harvests that are planned approximately 20 years in the future when the stands receive their first thinning harvest.

According to the soil model, the 156 acres of hardwood shelterwood proposed would yield a total of fourteen acres which are estimated to sustain a temporary loss in soil productivity due to the initial harvest. The estimated initial and additional temporary loss in soil productivity equals 20 acres, which is 13 percent of the shelterwood harvested area. The cumulative soil disturbance is expected to be much less because the removal harvest will take place approximately 20 years in the future. During the time between the initial harvest and the removal harvest, the addition of organic matter, cycles of freezing and thawing, and vegetation growth will reduce the soil impacts of the initial harvest. 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.

A yield of thirty two acres of the pine seed tree units are estimated to sustain a temporary loss in soil productivity due to the initial harvest. The estimated initial and additional temporary loss in soil productivity equals 61 acres, which is 17 percent of the seed tree harvested area. The cumulative soil disturbance is expected to be much less because the removal harvest will take place approximately 20 years in the future. During the time between the initial harvest and the removal harvest the addition of organic matter, cycles of freezing and thawing, and vegetation growth will reduce the soil impacts of the initial harvest. The estimated percentage of cumulative soil disturbance is greater than the LRMP standard if no recovery takes place during the 20 years between harvests. If detrimental soil disturbance exceeds the LRMP standard after the removal harvest the detrimentally disturbed areas will be ripped, seeded, fertilized, and mulched to improve productivity.

A yield of seventeen acres of the pine shelterwood units are estimated to sustain a temporary loss in soil productivity due to the initial harvest. The estimated initial and additional temporary loss in soil productivity equals 33 acres, which is 17 percent of the pine shelterwood harvested area. The cumulative soil disturbance is expected to be much less because the removal harvest will take place approximately 20 years in the future. During the time between the initial harvest and the removal harvest the addition of organic matter, cycles of freezing and thawing, and vegetation growth will reduce the soil impacts of the initial harvest. The estimated percentage of cumulative soil disturbance is greater than the LRMP standard if no recovery takes place during the 20 years between harvests. If detrimental soil disturbance exceeds the LRMP standard after the removal harvest the detrimentally disturbed areas will be ripped, seeded, fertilized, and mulched to improve productivity.

There was no evidence of detrimental soil disturbance in the previously harvested units that are proposed for treatment in the project area, so no cumulative effects are expected to result from the proposed treatments.

Soil disturbance is calculated as a percentage of the activity area. The activity area for harvest operations and road work would be the harvested area. The activity area for the soil disturbance associated with fireline construction is the burned area. Soil disturbance for the harvest operations and road work is expected to be the same for alternatives 2 and 3. Soil disturbance due to fireline construction is expected to be different for alternatives 2 and 3. In alternative 2 approximately 11 miles (8 acres) of fireline would be needed to exclude the private land in the area to be burned (4,140 acres). The acres of fireline would be divided by the burned area and multiplied by 100 to yield the percent soil disturbance (0.2%). In alternative 3 approximately 40 miles (29 acres) of fireline would be needed to enclose individual stands to be burned (1885 acres). The acres of fireline would be divided by the acres burned and multiplied by 100 to yield the percent soil disturbance (1.5%).

**Alternative 3**

Approximately ten percent (155 acres) of the harvested area would sustain a temporary reduction in soil productivity due to harvesting operations. An additional 10 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 approximately 3 acres due to road reconstruction. Approximately 29 acres of the analysis area would sustain a temporary reduction in soil productivity due to fireline construction. Five miles of road are proposed for decommissioning which will return approximately eight acres of soil to a productive state.

Total expected temporary reduction of soil productivity would be 197 acres (12% of the harvested area), including skidding, temporary road construction, road reconstruction, and fireline construction. Road decommissioning would reduce the net acreage of soil disturbance to 189 acres, but would not reduce the overall percentage. 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 will also prevent the loss of productivity on soils adjacent to the roads by helping to control runoff. Less than 15% of an activity area can sustain a reduction in soil productivity, according to the LRMP standard. If more than 15% of the activity area sustains a reduction in soil productivity, mitigation measures must be installed. Hand tools would be used instead of herbicides. The use of hand tools would not result in any additional detrimental soil disturbance because stumps and rootstock of the treated plants would be left intact

**Cumulative Effects**

The cumulative effects due to the activities proposed in alternative 3 are expected to be the same as those in alternative 2.

## 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 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, Indirect, and Cumulative 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 will 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 this alternative, there will be a lower risk of uncharacteristically severe wildfire for the treated acres than the current condition poses. The reduced risk has a two-fold effect on greenhouse gas emissions or the carbon cycle:

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

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 #1***

The cumulative effects of past activities on private lands, together with past and proposed activities on public land, and their impacts on soil erosion, water quality and wildlife habitat.

***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 defines a Class II area as "a geographic area designated for a moderate degree of protection from future degradation of the air quality."

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 significantly 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 National Ambient Air Quality Standards (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 a criteria air pollutant meet NAAQS for the pollutant. Under the CAA, any area that violates national ambient air quality standards 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 Johnson and Newton Counties in Arkansas.

Currently, the levels of all six criteria pollutants are at or below the NAAQS (attainment) in Johnson and Newton Counties.

**Direct and Indirect Effects**

**Alternative 1**

There would be no significant 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 this Alternative will have the potential to impact local and regional air quality. The area immediately downwind will have the greatest chances for impacts. Risks include respiratory damage and temporary impairment of visibility. The (FEISp. 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 be small in size and would typically not exceed 3,000 acres daily. Ignition of the project area would be spread over multiple years – therefore reducing potential for smoke impacts. Use of aerial ignition would serve to reduce burn-out time and associated duration of smoke impacts. Aerial ignition would also help develop smoke column lifting and reduction of smoke impacts.

The direct effects of prescribed burning on air quality will include temporary increases in particulate matter and carbon monoxide concentrations, eye, nose and throat irritations, decreased visibility along travel ways, and odor/nuisance of smoke. Smoke consists of small particles (particulate) of ash, partly consumed fuel, and liquid droplets. Other combustion products include invisible gases such as small quantities of nitrogen oxides. Oxides of nitrogen are usually produced at temperatures only reached in piled or windrowed slash or in very intense wildfires. In general, prescribed fires produce inconsequential amounts of these gases. Except for organic soils (which are not typically consumed in prescribed burns), forests 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. Some signing may 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 LMRP 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 burning 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.

Table 4 lists the estimated amounts of $CO_2$ resulting from the prescribed burning proposed by this Alternative. The organic matter consumed will be replaced by new vegetation so that there should be little net increase in the carbon dioxide in the atmosphere (Dipert 1992:2 draft/unpublished).

**Table 4.** Cumulative total emissions released during Alt. 2 site prep, WL, TSI, and hazardous fuel reduction prescribed burning.

| Compound Emitted | Estimated Release (U.S. Tons)* | Estimated Release (U.S. Tons)* |
|---|---|---|
| | Alternative 2 | Alternative 3 |
| Carbon Dioxide ($CO_2$) | **30,073** | **26,121** |
| Carbon Monoxide (CO) | **3,128** | **2,717** |
| Water Vapor | **12,030** | **10,449** |
| Particulate Matter | **1,204** | **1,046** |
| Hydrocarbons | **301** | **261** |
| Nitrogen Oxides | **56** | **49** |
| **TOTAL** | **46,792** | **40,643** |

*Estimates of coefficients used for calculations: a) 2.25 tons/ac actually consumed in hazardous fuel reduction burns; 4.5t/ac burned in thinning areas; 5.0t/ac burned in shelterwood areas; (Representative of fuel models in the Prescribed Fire Guide for the Southern Region). b) 2,000-3,000 lbs of $CO_2$/ton of fuel burned (Dipert, 1992).

## Cumulative Effects

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.

The global effects of prescribed burning are discussed in the VMEIS. The effect of prescribed burning on global warming 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.

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

## 5. Herbicides

### *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 this action alternative indicate that there is only a very low risk to wildlife, both from realistic and extreme exposures. Monitoring for herbicide concentrations following use has been a continuous policy of the Ozark-St. Francis National Forests. 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 (HAL). In some studies the author reviewed maximum herbicide concentrations observed in ephemeral to first-order streams exceeded the lifetime HAL, but found that they last only a few hours and the highest concentrations did not exceed EPA's 1-day HAL. Even with the widespread use of pesticides in North America, those typically used in forestry vegetation management programs have not been identified in surface or ground water at sufficiently high concentrations to impair drinking water quality. Their rapid break-down by physical, chemical, and biological routes coupled with current use patterns precludes the development of significant water contamination problems unless they are applied directly to water. Additionally, mitigation measures normally employed through State Best Management Practices (BMP's) further restrict herbicide's effects outside the boundaries of its application. On February 23 and 24, 2009 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 (USDA 2006). In a variety of human health and environmental health scenarios (including a variety of wildlife scenarios) most Hazard Quotients were projected to be below the Forest's maximum acceptable standard of 1.0. Application of mitigation measures shown previously in this document and adherence to Forest Standards for herbicide use and chemical labels for application will negate hazard quotients > 1.0 related to drift, accidental spills and run-off. Parameters and output from these analyses are available as part of the process record at the Pleasant Hill Ranger District Office, 2591 Highway 21, Clarksville, Arkansas 72830.

Glyphosate is not soil active and has low toxicity to animals. Lab studies conducted specifically on bobwhite quail also demonstrate extremely low toxicity. Typical hazard quotients for foliar and cut surface application for glyphosate to wildlife are less than 1.0.

Hexazinone causes no irritation with repeated contact with skin and no systemic activity. Repeated dosing by ingestion of excessive dietary levels of this chemical result in animal weight loss, alteration in liver weights, alteration in blood chemical measurements, and alteration in enzyme activities (MSDS for Velpar L dated 2/22/2006). Typical hazard quotients associated with soil application of hexazinone for wildlife are less than 1.0, with the exception of the longer-term (90 days) exposure of a large mammal to contaminated vegetation on site (see process record for specific numbers). These upper bound HQ's are not a concern because:

- The scenario assumes a diet composed of 100% contaminated vegetation or insects from the site which is highly unlikely. The long-term HQ assumes that vegetation is consumed on the same site for 90 days which is also unlikely.
- The HQ's deal with individuals, not populations.

Imazapic is weakly absorbed in basic soils, but absorption increases in acidic soils. This herbicide has low toxicity to animals. Hazard quotients calculated for risk to terrestrial wildlife are all less than 1.0 (see process record for specific numbers).

Imazapyr has very low toxicity to mammals or other animals, however it can be soil active particularly during spring leaf expansion. Application after mid-September may yield soil activity the following spring. All HQ's are well under 1.0, (see process record for specific numbers) with the exception of effects to aquatic plants. Any non-target plants if occurring in proximity to treated plants, could be killed and this could indirectly affect habitat for MIS on a very small scale.

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 hazard quotients associated with both foliar and cut surface application of triclopyr for wildlife are less than 1.0, with the exception of the longer-term (90 days) exposure of a large mammal to contaminated vegetation on site (see process record for specific numbers). These upper bound HQ's are not a concern because:

- The scenario assumes a diet composed of 100% contaminated vegetation or insects from the site which is highly unlikely. The long-term HQ assumes that vegetation is consumed on the same site for 90 days which is also unlikely.
- The HQ's deal with individuals, not populations.
- The amount of non-target vegetation subject to spray deposition is very small and animals are unlikely to be eating vegetation treated with cut surface application of chemical in woodland restoration and TSI areas.

On occasion it is more effective for the herbicides to be mixed together. For example, when trying to eradicate fescue, Wildlife sometimes mixes Glyphosate and Imazapyr. Timber occasionally may mix Triclopyr and Imazapyr or Glyphosate and Imazapyr. Additionally,

in order to improve the success of herbicide 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. Active ingredients for surfactants used by the District are as follow:

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

**Direct, Indirect, and Cumulative Effects**

Direct effects, occurring at time of application, to birds or large mammals are unlikely, since Although direct effects to amphibians are more likely since contact with herbicide could be absorbed through the skin and effect metabolic activity, amphibians are likely to be under logs, rocks or leaves, making direct contact 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, would minimize the possibility for spills and/or direct contamination to non-target species.

Indirect effects to MIS birds or mammals could occur if these species were to ingest foliage or seeds contaminated with any of the chemicals proposed in alternative 2, however, none of the chemicals would bioaccumulate in organisms. Indirect effects to MIS and habitats treated with all chemicals are likely to be negligible given that applicators treat target organisms only and that mitigation measures and forest-wide standards will be used.

There are likely to be few negative cumulative effects to MIS species over time as a result of implementing Alternative 2. None of the herbicides proposed for use will bioaccumulate or have lengthy half lives in the environment. Related to cumulative impacts, the Pleasant Hill 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 five years. In addition, no other herbicide projects are known from the Ozark National Forest or the vicinity at present, though some herbicide use is likely to occur on private lands particularly in association with agricultural production. Efforts to maintain early seral habitat and restore herbaceous species biodiversity in woodlands, and 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 negative direct, indirect or cumulative effects on water quality or wildlife with adherence to Forest Wide Standards FW19 - FW 32 (USDA, 2005). 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 WSI areas, and promoting oak and pine regeneration through TSI cultural practices.

Implementation of Alternative 3 (no herbicide use) would not provide the level of indirect benefits to wildlife as would be expected with implementation of Alternative 2. Lack 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):

***Existing Condition***

This analysis area is located in Johnson County. There are a total of roughly 220 miles of roads within and around the analysis area; county roads comprise about 4.7 miles within the Cougar area. These roads are regularly maintained by the County and Forest Service. Existing road locations shown in Appendix D (Current Conditions map) have been identified using GPS (Global Positioning System) equipment.

**Direct, Indirect, and Cumulative 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 of the roads which are currently open would remain so, and would continue to be maintained on a regular basis with implementation of the "no action" alternative. These roads are currently classed as maintenance level 2 or 3 and are maintained for the public to reach private residences or allow for administrative access. However, forest interior roads in need of maintenance or rehabilitation would continue to erode and contribute to sedimentation of creeks and streams.

**Alternatives 2&3**

A Roads 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 roadwork to be conducted are given on page 19 of this EA. Specific roadwork for Alternative 2 is given in Table 2 and locations shown on the map. Specific locations for 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. Additional information regarding roads is contained in the project specific RAP which is filed at the Pleasant Hill Ranger District Office in Clarksville, Arkansas.

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

Maintenance on approximately 21.5 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. County roads that will be used are regularly maintained by their respective counties. Special coop 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 level 1 roads are to be closed to motorized traffic when management activities are complete.

Approximately 5.3 miles of existing roads no longer needed for management or access are proposed for decommissioning. Decommissioning roads involves restoring roads to a more natural state. Activities used to decommission a road include, but are not limited to, the following: reestablishing former drainage patterns, stabilizing slopes, restoring vegetation, blocking the entrance to the road, installing water bars (earthen mounds), and removing culverts. These activities are designed to completely eliminate the roadbed by restoring natural conditions. Unnamed and illegally accessed OHV trails that are present in the project area may be closed using debris, rocks, earthen mounds, or gates.

Through the Roads Analysis Process, an inventory of all existing roads was completed and locations were obtained using Global Positioning System (GPS) equipment. Several "outlaw" 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 renegade OHV trails.

Several special use permits exist on Forest roads in the project area. 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 to access private forest stands for commercial timber removal. Proper procedures for gaining access will be followed.

Gates will be installed that close the following numbered roads: 4432A (2 gates), 94340B, 94340D, and 94674A. Foot travel will still be invited on all roads in the project area.

The density of open roads will decrease under both Alternatives as all presently closed roads will be re-closed upon completion of the project. In addition to the decommissioned miles, approximately 10.5 miles of roads would be closed on Forest Service land within the project area under alternative 2. 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 analysis area.

## 7. Heritage Resources

### *Existing Condition*

Information concerning possible heritage resources within the project area was obtained from the Master Site and Project Tracking Atlas, field-going personnel, historical maps, aerial photographs, land acquisition files, local historical and genealogical societies, descendant family members, and project and site records at the Pleasant Hill Ranger District office and Supervisor's Office.

The Master Site and Project Tracking Atlas indicates that there have been archeological projects conducted within or near the proposed project area. These include:

| Project No. | Name |
|---|---|
| 90-10-04-02 | 1990 Prescribed Burns |
| 91-10-04-15 | Garland's Knob Timber Sale |
| 92-10-04-02 | Methane Timber Sale |
| 92-10-04-04 | Baxter Timber Sale |
| 92-10-04-06 | Caesar Timber Sale |
| 92-10-04-05 | Cougar Timber Sale |
| 96-10-04-01 | Lock Hollow Environmental Analysis |
| 97-10-04-03 | James Environmental Analysis |
| 06-10-04-03 | Native Vegetation and Wildlife Management |

The Cougar EA project area includes 4,140 acres of federal lands that were included in a cultural resource survey conducted in 2008-2009 for the Upper Mulberry Watershed. The results of this fieldwork were reported to the Arkansas State Historic Preservation Office and relevant federally recognized Tribes in April 2010 (Upper Mulberry Watershed Assessment, Project Report No. 10-04-04-01).

Six archeological sites are located within or near the Cougar EA project area. These include five sites located on private inholdings and one site (3JO335) located on federal lands. Sites located on private inholdings will not be impacted by any activities associated with this project. The site located on federal lands is a historic houseplace with undetermined eligibility for inclusion on the National Register of Historic Places. In accordance with the 2005 Programmatic Agreement between the Forest, the Arkansas State Historic Preservation Office, and the relevant federally recognized Tribes, this site will be protected from ground-disturbing activities associated with this project by painting and flagging site boundaries and by designing and implementing project activities so that known sites are avoided. Should any new sites or cultural materials be encountered during project implementation, they will be examined by a professional archeologist who will prescribe the necessary mitigation measures.

## Direct, Indirect and Cumulative Effects

### Alternative 1

This alternative would have no effect on heritage resources. No additional surveys will be conducted. No sites will be addressed for their National Register of Historic Places eligibility.

### Alternatives 2 and 3

The project has been designed so that all sites that may be eligible for the National Register of Historic Places, or that are of undetermined eligibility, lie outside any of the project's areas of planned ground disturbing activity. Rock alignments associated with historical farmstead sites and the extensive cleared and plowed fields surrounding them will be avoided

by ground disturbing activities. Historic site areas which contain no organic cultural material will undergo prescribed burning. Past research has shown that sites such as these will not be affected by a low-intensity prescribed burn.

Alternative 3 proposes prescribed burning be limited only to the treatment areas. This will require an approximate 40 miles of new dozer and/or hand lines. Should this alternative be selected, additional field survey would be needed to inspect proposed new fire line for cultural materials.

Should any additional sites be found during project implementation, they will be examined by a professional archeologist (mitigation measure 3), who will prescribe necessary mitigation measures.

Based on these findings, all sites will be preserved intact and no significant effects will be produced upon significant historical or prehistoric sites that may be eligible for nomination to the National Register of Historic Places.

## 8. Vegetation Resources and Vegetation Diversity

Significant Issues Related to the Resource

***Issue #2***

Forest health and sustainable ecosystems.

***Existing Condition***

The Cougar 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).

Natural and Native-American fires more than likely occurred periodically, long before European settlement and, along with other factors, greatly influenced the development and structure of the pine and hardwood forests that existed when the first settlers arrived in the Ozarks. Historian Steven Pyne (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 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 and 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 pulpwood during the early 1900's. Much of the hardwood forestlands were heavily logged for railroad ties and barrels in the early part of the twentieth 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 and the occasional lightning and Native-American fires described above, and cattle and 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 National Forest 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 was being reduced by as much as 85% within the affected areas. Incidents of infestation leveled off in 2004-05 and have continued to decline. 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 Cougar project vicinity. Farming continues on some private lands with the maintenance of pasture and some crop acreage on the mountaintops and along the Mulberry River. 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 4,140 acres of National Forest land, of which 3,574 acres are suitable timber-producing lands. The project area consists of pine timber types and hardwood timber types. Currently, the project area does not have a balanced age-class with 72% of stands being over 80 years old (Table 5). National Forest lands in the project area exhibit the following age-class distributions:

**Table 5. Current Age-Class distribution in Cougar project area on Public Land.**

| | 0-10 | 11-40 | 41-80 | 81-99 | 100+ |
|---|---|---|---|---|---|
| Pine Acres | 0 | 341 | 468 | 718 | 275 |
| Hardwood Acres | 73 | 46 | 240 | 1349 | 616 |
| Total Acres | 73 | 387 | 708 | 2067 | 891 |
| % of total acres | 1% | 9% | 17% | 50% | 22% |

*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 A.

The Cougar project has approximately 566 acres (14%) that are currently designated as unsuitable for timber production that have developed, or will develop, old-growth characteristics.

## Direct, Indirect, and Cumulative Effects

### Alternative 1

This alternative would allow another 387 acres (9%) to move up into the >80 year old age-class, comprising a total of 81% 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 any of the stated purpose 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 LRMP would not be gained in the Cougar project area.

**Alternative 2**

The estimated hardwood volume produced by this alternative would be 1,000 CCF of sawtimber and 605 CCF of pulpwood. The estimated pine volume produced would be 15,752 CCF of sawtimber and 2,000 CCF of pulpwood (CCF= one hundred cubic feet).

The effects of hardwood thinning would improve the vigor and growth of future crop trees in the stand and favor more vegetative diversity on the forest floor by permitting more sunlight. The objective of hardwood thinning would be to reduce density, increase growth of residual trees, reduce the susceptibility of the stand to insects and diseases, improve habitat for wildlife by increasing vigor of residual hard-mast-producing trees, and create light conditions that promote advanced oak regeneration. Trees that are suppressed or that have poor form would be targeted for removal as well as mature trees that may be lost due to age-related mortality. Trees of good form, more desirable species, and/or trees close to the correct spacing would be favored over trees that are simply of larger size. Removing approximately 30% of stand density would allow adequate light levels to promote advanced oak regeneration and put this stand in a condition that would ensure sustainability of these forest types. Timber Stand Improvement (TSI) measures would follow thinning. This treatment would be done to encourage oaks and other desirable species to become abundant in the mid and understories, would help perpetuate oaks on this site, and would allow a regeneration harvest to be considered next entry. Herbicide and handtool treatments would be done after thinning to remove undesirables and allow desirable species to grow free of competition.

The effects of Hardwood & Pine Shelterwood harvests would be the replacement of mature even-aged stands with immature even-aged stands containing naturally-seeded sprouts 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. 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 & pine seed 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 ten years, the understory will be very dense and emerging into midstory status.

The effects of Timber Stand Improvement (TSI) treatments pine and hardwood and Pre-commercial Thinning (PCT) on pine and hardwood using handtools and/or herbicide would allow favored trees to gain dominance or get a good growth jump to stay ahead of its competitors. Forest-wide Standards mentioned on pp. 26-27 will be followed during implementation of timber treatments using herbicides near Wild and Scenic Rivers (e.g., Mulberry River) in order to avoid negative impacts. Additional discussion regarding timber

treatments 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. Interplanting of pine seedlings by hand would occur after PCT practices take place on one pine stand.

Oak Woodland Restoration Thinning is proposed within the analysis area. This treatment is generally done on lower productivity sites with the objective of reducing density of the stand to a level that was common in oak woodlands in pre-European times. The effects of Oak Woodland Restoration would allow more sunlight to reach the forest floor (thereby increasing herbaceous species diversity) and promote more mast (nut and fruit) production from the remaining trees. These stands would have a grassy understory (due to more frequent burning) and the overstory trees will be larger and more widely spaced.

Pine Thinning would occur on 712 acres. Its effects would increase vigor & growth of residual trees, reduce the susceptibility of the stand to insect and disease, and improve habitat for wildlife.
The pine stands would be thinned to a target basal area of 60-70 $ft^2$/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 DBH of the stand. More light would reach the forest floor, thereby increasing herbaceous vegetation.

The effects of the Pine Seedtree harvests will be the eventual replacement of mature even-aged stands with immature even-aged stands containing naturally-seeded pine (and some hardwood) sprouts. These harvest methods meet the guidelines and objectives set out in the LRMP. They are appropriate methods because the native shortleaf pine have reached mature age, exhibit good cone-bearing characteristics, and are located on soils suitable for natural pine regeneration. The seedtree harvests will be similar to the shelterwood harvests in that a partial component of the original stand will remain intact to provide seed to the forest floor.

Treating some of the remaining non-merchantable hardwoods with herbicides in the pine shelterwood areas that are not needed for wildlife and other purposes, will let light reach the forest floor and allow pine seeds to germinate in these areas. Prescribed burning for site preparation in these and other areas before a good pine seedfall will reduce the duff and litter, topkill small brush, and expose some bare soil, which will promote a successful seed catch from the overstory pine trees (good seedbed for natural seeding). These actions should ensure that areas of the present species composition can develop in the future. In the short term, the stands will be more open and early seral vegetation will develop across these areas.

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. Oak & 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 replacing Non-Native Invasive Species with natural, historically endemic vegetation would reintroduce faunal and avian species that once thrived in pre-settlement times.

The effects of creating scattered wildlife openings by dozer/herbicide, and expansion of existing wildlife openings 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.

The effects of wildlife thinning will be similar to the oak woodland restoration thinning. Trees will be more widely spaced and a more herbaceous understory will develop as controlled burning will occur more frequently. This thinning practice is primarily done to enhance wildlife benefits by encouraging more nut and fruit production on larger trees.

The cumulative effects from all actions proposed in Alternative 2 on vegetative diversity of the project area, relative to the no-action alternative, are shown below:

**Table 6. Effect of vegetative diversity changes under Alt. 2 & 3 timber harvesting actions (acres).**

| Forest Type | Within-Stand Diversity (Thinnings) | Between-Stand Diversity (Even Aged Management) |
|---|---|---|
| Hardwood | 21 | 193 |
| Pine | 712 | 552 |

Implementation of this alternative 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.

### Alternative 3

The effects of implementing Alternative 3 would be similar to the effects mentioned above for Alternative 2. Eliminating the use of herbicides and replacing it with handtools (i.e., chainsaws, machetes, etc.) would slow the process of regenerating the desirable species. When using handtools to eliminate the undesirable species within a treatment area, only those undesirables that are 24-inches or taller would be cut. Everything less than 24 inches would remain, thereby leaving the treatment area occupied with undesirable species that could out-compete the desirable species. If herbicides were used, the less than 24-inch undesirables would be treated and would more than likely die. Additionally, herbicides prevent stump-sprouting from occurring. When only using hand-tools to cut undesirables, stump-sprouting will almost always occur, thus causing the desirable species to struggle against formidable competition for sunlight.

This alternative proposes less Rx burning (i.e., fewer than 2,000 acres). Effects of this reduction will be more woody vegetation accumulating in the understory. Expansion of the borders of non-native invasive species may occur. Benefits to deer, quail, and migratory birds will decline. More miles of fireline will have to be constructed around individual stands or groups of stands; this will contribute more sediment into water sources, endangering aquatic biota.

Based on this analysis, the implementation of this alternative could have a negative cumulative impact on water resources. Even though acres of burning are reduced, this action is more than off-set by having to construct many more miles of soil-disturbing firelines to control burn isolated areas that could more easily be burned if natural features could be used as fire barriers.

## 9. Wildlife Resources

Significant Issues Related to the Resource

***Issue #1***

The cumulative effects of past activities on private lands, together with past and proposed activities on public land, and their impacts on soil erosion, water quality and wildlife habitat.

***Issue #2 -*** Forest health problems in the area and sustainable ecosystems.

***Issue #3***

The effects of vegetation management on wildlife/plants/aquatics.

The measurement indicator for this issue is: acres of wildlife/aquatic habitat affected.

***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 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 is being altered by the oak decline phenomenon, particularly the red oak borer infestation. If this phenomenon progresses on the District, habitat changes 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 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 7. 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 | decreasing |
| Whitetail deer | demand | mosaic of forest age classes | stable to increasing* |
| Black bear | demand | remote habitat with mature forest component with intermixed 0-5 year old regeneration | stable to increasing* |
| Wild turkey | demand | mature forest with open areas containing grasses/forbs/soft mast | stable to decreasing* |
| Prairie warbler | ecological indicator | regenerating forest communities | decreasing |
| Brown-headed nuthatch | ecological indicator | open pine forest and woodlands | stable to decreasing |
| Cerulean warbler | ecological indicator | communities associated with mature hardwood forest with complex canopy structures, and dry-mesic oak Forest communities | stable to decreasing |
| Northern parula | ecological indicator | communities associated with forests in riparian areas | stable |
| Ovenbird | ecological indicator | dry-mesic oak forests | stable to increasing |
| Red-headed woodpecker | ecological indicator | oak woodland overstories | stable to decreasing |
| Pileated woodpecker | ecological indicator | large snags | stable to increasing |
| Scarlet tanager | ecological indicator | mature dry-mesic oak forest communities | stable |
| Acadian flycatcher | ecological indicator | mature mesic hardwood forest communities | stable to increasing |
| Smallmouth bass | demand | cool water stream communities | increasing |
| Largemouth bass | demand | quality pond and lake habitat | stable |

*information from AGFC harvest data

Table 7 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, USDA 2001, USDA 2007 and NatureServe 2010). From the Forest MIS list, 15 species have potential habitat based on occurrence records and/or habitat requirements within the analysis area and will be addressed.

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 (USDA, 2007), and summarized for MIS avian species on the Ozark National Forest in supporting documentation (Taylor, 2010). 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. Currently on federal lands, approximately 53% of the project area forest is composed of hardwood/hardwood-pine forest types of an age capable of producing abundant hard mast for wildlife. Pine/pine-hardwood and cedar/hardwood forest types comprise approximately 44% of the analysis area. Grassland/open areas on Federal lands in the analysis area comprise approximately 0.7% of the total area, primarily consisting of permanently maintained wildlife openings, small fields, powerline right of ways, gas well pads, and roadsides.

Hard mast capability is well distributed across the landscape. The majority of the project area's hardwood forest types is currently of mast-producing age. These age classes are those which are 41+ years of age. These stands are found within stream corridors and on all aspects with the best representation found on the north and east slopes. Mast-producing trees are also represented within the shortleaf pine sub-matrix, but to a lesser degree.

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

The majority of pine forest types in the project area are currently in age classes >61 years of age (approximately 88%). These stands are represented on all aspects, ridgetops and bottomland areas.

At present, approximately 1% of the public lands in the project area (forest and woodlands) is in an early seral condition (0-10 years of age). Most of this representation of the 0-10 year age classes is the result of silvicultural treatments.

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 8. Forest Age Class Distribution by Alternative (public lands)**

| Age Classes (years) | Alternative 1 (acres/% total) | Alternatives 2 &3 (acres/% total) |
|---|---|---|
| grass/forb* | approx. 30/0.7% | approx. 44/1% |
| | | |

| | | |
|---|---|---|
| 0-10 | 73/1% | 781/19% |
| | | |
| 11-20 | 128/3% | 128/3% |
| | | |
| 21-40 | 259/6% | 259/6% |
| | | |
| 41-60 | 51/1% | 51/1% |
| | | |
| 61-80 | 657/16% | 657/16% |
| | | |
| 81-100+ | 2958/72% | 2250/54% |

* grass/forb acres are represented by existing road and utility right of ways, and existing and proposed wildlife openings

With implementation of Alternatives 2 or 3, approximately 708 acres would be converted, through harvest and subsequent regeneration, from the 81-100+ year age classes to the 0-10 year age class. Browse and early-successional forest habitat would be provided in these regeneration areas for a variety of wildlife species. Viability of disturbance-dependent avian species would be enhanced. Avian species requiring both large and small areas of early successional vegetation and forest edge would benefit. Implementation of shelterwood and seedtree regeneration systems would result in 19% of the public land-base within the project area compartments in early successional forest habitat, as opposed to 1% under current conditions. In addition, approximately 13.5 acres in the 61-100+ year age classes would be converted to grass/forb habitat (wildlife openings). This would result in 1% of the public land-base within the project area being in grass/forb habitat, as opposed to 0.7% under current conditions.

Implementation of Alternatives 2 or 3 would result in an approximate 18% reduction of forest habitat that is greater than 81 years old (federal lands). Following implementation of this alternative, approximately 54% of the forested (both pine and hardwood) public land base within the project area compartments would remain in the 81-100+ year age classes. When considering recruitment of stands from the 61+ year age classes (approximately 657 acres or 16% of project area land base) in the next 1-20 years, and examination of distribution of stand age classes, fragmentation of interior forest habitat is not anticipated.

## Direct, Indirect and Cumulative Effects

### Alternative 1

Currently approved management actions would be maintained under this alternative.

Effects to wildlife and MIS from implementation of the no action alternative are analyzed in detail in a reference paper compiled by the Pleasant Hill Ranger District (Taylor, 2010). This paper is part of the project analysis file.

Timber Harvest and Wildlife Habitat Improvement.
Effects of implementation of the no action alternative are described in Taylor (2010), in relation to the subsections Early Successional Habitat, Soft Mast Production, and Hard Mast Production. Indirect beneficial effects to wildlife species dependent upon older seral stages, and habitat requirements associated with closed-canopy conditions would occur. Thinning to help restore woodland conditions and creation of wildlife openings 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 use 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.

Timber Stand Improvement Practices

Timber stand improvement practices, silvicultural release and precommercial thinning practices, and planting of hardwoods in oak-poor 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; maintaining other fire-dependent or adapted species and habitats; and abatement of non-native invasive plant species would not occur. Lack of use of prescribed fire would not allow for improved production of soft mast. Increases in abundance of soft mast utilized by a variety of wildlife species as a reliable seasonal food source would not occur. This would cause negative indirect impacts to wildlife species. Forest Plan (USDA, 2005) recommendations of diverse, high quality habitats supporting well-distributed and viable populations of all native and desired non-native plants and animals would not be met. Natural disturbance regimes within terrestrial habitats providing a stable and sustained flow of both early- and late-successional habitats over time would not meet desired conditions for fish and wildlife habitat.

Herbicide Use

Herbicide use is also an important tool for benefiting oak/pine regeneration, by reducing interspecies competition and 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.

Aquatic Species/Habitat

Aquatic habitat for fish would not be improved because placement of large woody debris (LWD) in creeks, removal and remediation of fish passage barriers, and streambank stabilization would not occur. In most cases, Forest Plan desired conditions would not be met for fish and wildlife regarding LWD in streams. This would cause indirect adverse effects to aquatic species which may be currently limited through lack of habitat, barriers to fish passage, and water quality. Improved distribution of water sources for wildlife through construction of ponds would not occur. This would cause indirect adverse impacts to amphibians, bats, migratory and resident birds and game species.

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.

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 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 non-native invasive species treatment (OBJ. 9) would not be met in the project analysis area. 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, 2010). This paper is part of the project analysis file.

Timber Harvest and Wildlife Habitat Improvement.

Effects of implementation of the action alternative are described in Taylor (2010), in 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 creation of wildlife openings 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. Oak species would be expected to be maintained as a component of the forest ecosystem in the long term. This alternative would cause positive indirect impacts to wildlife species. Diverse and high quality habitats

supporting well-distributed and viable populations of all native and desired non-native plants and animals would meet desired conditions for fish and wildlife as specified in the Forest Plan (USDA, 2005). Disturbance regimes within terrestrial habitats providing a stable and sustained flow of both early and late-successional habitats over time would meet desired conditions for fish and wildlife habitat as specified in the Forest Plan (USDA, 2005). Implementation of Alternative 3 (no herbicide use) would not be as beneficial to wildlife species as implementation of Alternative 2. Herbicide use (as proposed with Alternative 2) is an important tool often used in woodland restoration thinning and wildlife opening construction and maintenance to prevent sprouting of woody species and therefore allowing for greater understory herbaceous vegetation abundance and diversity. Woodland restoration thinning and wildlife opening construction would be more effective and produce greater vegetation diversity with implementation of Alternative 2.

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.

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 8 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/Oak-Restoration 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).

Aquatic Species/Habitat

Implementation of the action alternative would benefit native fish populations by providing additional quality habitat through introduction of large woody debris (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. Improved distribution of water sources for wildlife through construction of ponds would occur with this proposal. This would cause indirect positive impacts to amphibians, bats, migratory and resident birds and game species.

Road Work

No negative long term impacts to wildlife would occur through proposed road construction, 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 BMP's 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). Un-maintained 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.

In summary, the action alternative is 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, 2010).

The use of proposed management actions as described in this Environmental Assessment would be of long term benefit to MIS that rely upon forest ecosystems, particularly oak/pine ecosystems, for habitat. In summary, alternative 2 is predicted to have positive long term effects on 15 of 15 management indicator species analyzed. Although some individual negative long term effects are predicted, populations of all MIS would be expected to remain viable in the Ozark Highlands and on the National Forest (Taylor, 2010).

## 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:

1. Reviewing the list of TES plant and animal species known or likely to occur on the Ozark – St. Francis National Forest, and their habitat preferences. This review included the U.S. Fish and Wildlife Service current list of endangered, threatened, and proposed species for Arkansas as of Feb. 23, 2009 (USDI 2009), the forest-wide list as of Oct. 8, 2007 and the current Southern Region Sensitive Species list for the Forest, dated August 8, 2007 (list attached as Appendix A).

2. Consulting element occurrence records (EOR's) for TES species as maintained by the Arkansas Natural Heritage Program (ARNHP).

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

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

5. Reviewing the results of field surveys that have been conducted in the area.

Most TES species known to occur on the Forest have unique habitat requirements, such as glades, barrens, rock outcrops, bogs, caves, and natural ponds. Appendix A of the BE/BA lists all 63 TES species currently known or expected to occur on or near the Ozark – St. Francis National Forest. 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 Forest 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 biological evaluation for this project (Taylor, 2010).

**Species Identified as Being in the Action Area or Potentially Affected by the Action**

From past field surveys and knowledge of the area, and given the proposed action, those species which are analyzed and discussed further in this document are those that: a) are found to be located in the activity area (OAR code "5"), and b) were not seen during the survey(s), but possibly occur in the activity area based on habitat observed during the survey(s) or field survey was not conducted when species is recognizable (OAR code "6"), and c) 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, the following species occur as documented by field surveys or may potentially occur in the activity area based on habitat observations:

| OAR Code | Scientific Name | Common Name | Taxa | Status |
|---|---|---|---|---|
| 7 | *Percina Nasuta* | Longnose darter | Fish | Sensitive |
| 6 | *Haliaeetus leucocephalus* | Bald eagle | Bird | Sensitive |
| 6 | *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 sodalis* | Indiana bat | Mammal | Endangered |
| 5 | *Lirceus bicuspicatus* | An isopod | Isopod | Sensitive |
| 5 | *Orconectes williamsi* | Williams' crayfish | Crustacean | Sensitive |
| 7 | *Paduniella nearctica* | Nearctic paduneillan caddisfly | Insect | Sensitive |
| 6 | *Amorpha Ouachitensis* | Ouachita leadplant | Plant | Sensitive |
| 6 | *Callirhoe bushii* | Bush's poppymallow | Plant | Sensitive |
| 5 | *Castanea pumila var. ozarkensis* | Ozark chinquapin | Plant | Sensitive |
| 6 | *Cypripedium kentuckiense* | Southern lady's slipper | Plant | Sensitive |
| 6 | *Delphinium newtonianum* | Moore's larkspur | Plant | Sensitive |
| 5 | *Dodecatheon frenchii* | French's shooting star | Plant | Sensitive |
| 6 | *Silene ovata* | Ovate-leaf catchfly | Plant | Sensitive |
| 6 | *Tradescantia ozarkana* | Ozark Spiderwort | Plant | Sensitive |
| 6 | *Valerianella nuttallii* | Nutall's cornsalad | Plant | Sensitive |
| 6 | *Valerianella ozarkana* | Ozark cornsalad | Plant | Sensitive |

The occurrence analysis results table shows one isopod species (*Lirceus bicuspicatus*), one crustacean species (Williams' crayfish) and two plant species (Ozark chinquapin, and French's shooting star) were identified within the analysis area (OAR code "5").

Thirteen 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 code"6"); 1 bird species (bald eagle), 4 mammal species (Ozark big-eared bat, gray bat, Indiana bat and Eastern small-footed bat), and 8 plant species (Ouachita leadplant, Bush's poppymallow, Southern lady's slipper, Moore's larkspur, Ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad, and Ozark cornsalad).

Two aquatic species are known to occur downstream of the project area, but outside identified geographic bounds of water resource cumulative effects analysis area (defined as a point below which sediment amounts are immeasurable and insignificant). Species with OAR code "7" include one fish species (longnose darter) and one insect species (Nearctic paduniellan caddisfly).

**Direct, Indirect & Cumulative Effects of Proposed Management Action on Each Identified Species**

The analysis of possible effects to species identified as known or expected to occur in the vicinity of the proposed project, or likely to be affected by the action, includes the following existing information:

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

Effects to species include anticipated effects from implementation of the proposed action. Predicted effects to species shown in the table above are described in the Biological Evaluation for the Cougar Projects (Taylor, 2010).

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

No negative adverse effects would occur to federally listed (T & E) species populations (Ozark big-eared bat, gray bat and Indiana bat). Potential positive effects to these species through habitat improvement would not occur.

No negative adverse effects would occur to Region 8 sensitive species (longnose darter, bald eagle, Eastern small-footed bat, lirceus isopod, Williams' crayfish, Nearctic paduniellan caddisfly, Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, Moore's larkspur, French's shooting star, 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, Moore's larkspur, ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad and Ozark cornsalad.

**Determination of Effects – "Proposed Action" Alternatives 2 and 3(TES species)**

### Ozark big-eared bat

The proposed action was 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 activities in the area (not associated with this project) that would directly or indirectly affect the Ozark big-eared bat population as a whole, or cause additive or synergistic adverse cumulative impacts in conjunction with the proposed action.

With implementation of Forest-wide standards from the Revised LRMP 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 activities in the area (not associated with this project) that would directly or indirectly affect the gray bat population as a whole, or cause additive or synergistic adverse cumulative impacts in conjunction with the proposed action.

With implementation of Forest-wide standards from the Revised LRMP 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 population as a whole, or cause additive or synergistic adverse cumulative impacts in conjunction with the proposed action.

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

Implementation of this proposed project may benefit Ozark big-eared bat, gray bat and Indiana bat by providing habitat improvement. Implementation of Alternative 2 would be of more benefit to TES bat species than would be implementation of Alternative 3, due to increased vegetation effects/responses as well as prey increases with the use herbicides. 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, 2010).

**Sensitive Species**

For sensitive species, bald eagle, Eastern small-footed bat, lirceus isopod, Williams' crayfish, Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, Moore's larkspur, French's shooting star, 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. No negative indirect or cumulative impacts are expected for these species from implementation of the project. For sensitive aquatic species confined to the Mulberry River (longnose darter and Nearctic paduniellan caddisfly), there will be no negative direct, indirect or cumulative impacts from implementation of the proposal. For all Region 8 sensitive species, implementation of the proposal will not lead 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 this proposed project would indirectly benefit sensitive species which require open (unshaded) and/or fire-dependent habitats. These sensitive species include Ouachita leadplant, Bush's poppymallow, Moore's larkspur, 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, 2010).

## 11. Human Health Factors

Significant Issues Related to the Resource

**Issue #1 –** The cumulative effects of past activities on private lands, together with past and proposed activities on public land, and their impacts on soil erosion, water quality and wildlife habitat.

***Existing Condition***

At the present time, on National Forest Land, there are no risks to human health from the use of herbicides or cutting tools in the project area. There are other human health risks for forest workers and visitors: dead and dying trees that are aging. Falling trees and limbs in recreation areas can cause injury to forest visitors and can cause damage to personal property. Furthermore, the Cougar area in Johnson County has a small concentration of ice storm damage. There are areas along travel-ways and in dispersed camping/hunting sites where trees are dead or dying from old age. Forest fuel accumulations and the interspersion of private lands/property within the analysis area, in combination, lead to potential for negative effects to human health and property.

**Direct, Indirect and Cumulative Effects**

**Alternative 1**

There would be no change from the existing condition regarding risks to human health from the use of herbicides, controlled burning, or cutting tools. Risks to human health and safety from falling limbs and trees associated with oak decline would increase due to rot, decay, and wind-throw.

**Alternative 2**

There is a perception by the public that any use of herbicides in the forest is unsafe. The more recent Syracuse Environmental Research Associates, Inc. (SERA) Risk Assessments for herbicides evaluate imazapyr, triclopyr, imazapic, hexazinone, and glyphosate from a human safety viewpoint, evaluating risks, short term effects and cumulative effects. All information contained in these Herbicide Risk Assessments (RA's) is incorporated by reference into this analysis (Refer to Herbicide Section). Risk assessments for these chemicals are documented in the project analysis file.

Removal of dead and dying trees through harvest and thinning operations will make the forest safer for forest visitors.

Since 1986, eight injuries including 3 deaths have occurred on the Ozark-St. Francis National Forest while doing manual vegetation control. None have occurred in the last 15 years. Vegetation management activities with the greatest risks to the average worker in a 25-year career are those connected with manual site preparation. This is evidenced by high workers' compensation insurance rates for this type of work. There is a risk of worker injury doing manual tree and brush cut-down work. There should be no risk to the public from manual work.

Through prescribed burning, potential wildland fire occurrence will be greatly lessened. Effects to water quality and risk to flooding are addressed in the water section of this EA (pp. 29-40).

Strict adherence to FEIS and LMRP 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 burning plan will ensure that smoke or other combustion products do not reach, or significantly affect, smoke sensitive areas. Monitoring during and after the burn 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.

Downwind effects of reduced air quality would be short-term in nature. Impacting large population centers would be avoided. The acres burned under the action alternative would occur over several days. Individual ignitions would generally be limited to 500 to 2,000 acres daily. Ignition of the project area would be spread over several days, and probably over multiple years – thereby 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 reduce smoke impacts.

Smoke concentrations from prescribed burning can be a very serious matter, particularly near homes of people with respiratory illnesses, or near health-care facilities, or on roadways. Human health effects related to particulate matter in smoke include aggravation of respiratory or cardiovascular illnesses and changes in lung function, structure, and natural defense. Prescribed burn plans are required for each burn. Such plans provide burn unit locations, smoke sensitive targets, 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, private landowners are notified before the burn. 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 will be given the option to stay in a hotel room provided by the USFS)

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 the 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.

Based upon the analysis, there should be no significant long-term cumulative effects on Human Health from implementation of vegetation management associated with Alternative 2. In addition, there should be no significant long-term cumulative effects on Human Health from implementation of prescribed fire associated with Alternative 2 (see “Air Resources” section of EA).

**Alternative 3**

The effects to human health from implementing timber and wildlife habitat improvement projects would be the same as the effects mentioned above for Alternative 2. Because no herbicides are proposed for this alternative, there would not be a potential risk to human health associated with herbicide use.

## 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 106-393). The Act addressed the decline in revenue from timber harvests in recent years on Federal land, which has historically been shared with counties. These funds have been used by counties for schools, roads, and emergency activities.

On October 3, 2008, the Secure Rural Schools and community Self Determination Act of 2000 was reauthorized as part of Public Law 110-343. This allows counties to choose either 25% 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. Johnson County has elected to receive payments using the "formula" method. In 2011, Johnson County is projected to receive $478,449.

### 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, release, and wildlife habitat improvement work.

The revenues derived from the selling price of timber would contribute to school and road funds in Johnson County, in accordance with PL 106-393. At the time of the Cougar project economic analysis, hardwood sawtimber sold for $40/CCF, hardwood pulpwood sold for $5.00/CCF, pine sawtimber sold for $70/CCF, and pine pulpwood sold for $10.00/CCF. These figures reflect an average from several timber sales recently sold on the Ozark National Forest. Table 9 lists the Present Net Value and the Benefit/Cost Ratio of implementing each alternative.

**Table 9. Economic Report on the forest product revenues generated by alternatives**

| | No Action | Alternative 2 | Alternative 3 |
|---|---|---|---|
| Timber Volume (CCF) | 0 | 19,357 | 19,357 |
| PV Timber Revenue | $0.00 | $1,165,665.00 | $1,165,665.00 |
| PV Road Costs | $0.00 | $5,697.60 | $5,697.60 |
| PV Cultural Trtmts Costs | $0.00 | $259,622.36 | $462,112.41 |
| PV Sale Prep & Admin Costs | $0.00 | $318,901.00 | $318,901.00 |
| PV of All Costs | $0.00 | $584,220.96 | $786,711.01 |
| Present Net Value | $0.00 | $581,444.04 | $378,953.99 |
| Revenue (Benefit)/Cost Ratio | 0/0 | 2.0 | 1.48 |

Both alternatives have a positive outcome from a cost-efficiency perspective. Alternative 3, which would not include herbicide applications, would cost more to implement than Alternative 2 since two or more applications of manual cutting of vegetation would be needed for TSI, release and oak woodland restoration thinning. Wildlife opening maintenance would be costlier in the long term without herbicide use bcause it would necessitate brush-hogging on a more frequent basis. While supply costs are much lower, the costs associated with manual felling as opposed to herbicide application for site preparation can be higher because multiple treatments are necessary. Of course, if these two alternatives are compared in a strict efficiency analysis, the revenue of the timber for both alternatives would more than offset the costs of sale preparation, administration, and road expenditures. For instance, cultural treatments (manual or herbicide site preparation, release, TSI, PCT, etc.) are done after the timber operation to help rehabilitate the forest sites to the desired future condition.

Furthermore, this analysis does not include non-market values or non-monetary benefits. Improved wildlife habitat, decreased sedimentation from road closures, and improved hunting and recreational opportunities are hard to assign a dollar amount to and are not considered in this economic analysis. Also, costs for sale administration, silvicultural contract administration, and sales preparation would occur regardless if this project is implemented or not. All employees will be funded with appropriated dollars each year regardless of the implementation of this particular project. Due to budget constraints and changes, and 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. Therefore, before this project is implemented, all costs for the proposed project would be re-evaluated and the project would be implemented only if the cost ratio is beneficial to the government.

**Cumulative Effects**

The action alternatives have a positive effect on the local economy in that it would provide revenue to the counties/schools and provide for local jobs. Economic benefits would also be realized through creation/improvement of wildlife habitat and associated improvement to the Wild & Scenic Mulberry River. 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

***Existing Condition***

**Recreation**
The project area is classified as “Roaded Natural” or “Semi Primitive 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 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 settings are characterized by naturally-appearing environment. Concentration of users is low. 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.

Recreation use in and around the analysis area is low to moderate, with highest use periods during the spring, early summer and fall seasons. Use consists of hiking fishing, camping, picnicking, sightseeing, hunting, mountain bicycling, and OHV driving. The analysis area has several scattered dispersed recreation use sites.

Recreation visitors for hunting mostly utilize the dispersed campsites within the analysis area. OHV's and pick-up trucks are driven or brought from either private lands or other forestlands outside this project area to these areas primarily to ride roads for sightseeing and/or hunting. Dispersed camping and hunting of deer, turkey, and squirrel are common in the analysis area.

**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.

There are currently not any designated OHV roads in the Cougar project area. Therefore, this project will have no affect on OHV use. However there will be changes to highway legal vehicles with in the project area. This will affect the Motor Vehicle Use Map (MVUM). See changes on the Project Roads Management Chart Table 2 (pp. 23-24)

**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. Fifty-percent of projects undertaken on the Ozark-St. Francis National Forests within High Scenic Integrity Objective (SIO) areas will attain a high SIO, 65% of projects undertaken in Moderate SIO areas will attain Moderate SIO rating, and 100% of projects located in Low SIO areas will attain that rating.

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 or Moderate. The areas of SIO of High are concentrated around the Mulberry River in Compartment 334; stands 7, 39 and 31. The stands with an SIO of High along Highway 103 are 8, 16, 20, 31, and 46 in Compartment

337. The stands in the project area with the Visual Quality Objectives of Retention are all along Highway 103 and they are in Compartment 337; stands 8, 16, 20, and 32.

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 rolling hills with mixed hardwoods, some pine, and some areas of open pasture land.

**Wild and Scenic River**

The Forest Plan states that the desired condition for Wild and Scenic Rivers for the recreational river corridors is to provide outstanding opportunities for people to enjoy a wide variety of river-oriented recreation opportunities in an attractive setting. The rivers are readily accessible by roads. Transportation facilities may parallel the river for long stretches.

There is a low need for visitors to rely on their personal physical abilities and primitive recreation skills within these areas. The sights and sounds of other visitors are evident, and opportunities to encounter other visitors are moderate to high. Visitors seeking solitude may find that difficult to achieve, particularly in peak-use seasons. Trails may be highly developed including hardened trails for a high level of accessibility for persons of all abilities. Off-highway vehicle (OHV) use is only allowed on trails designated for OHV use.

The landscape character may range from naturally appearing to transitional-mixed use. There is substantial evidence of human activity along the shores of some of these rivers, possibly including modern residential development, commercial structures, and a full range of various agricultural and forestry uses. On National Forest System lands, visitors enjoy a natural appearing setting with a range of human-made recreational developments. Utility transmission corridors, electronic or communication facilities, or signs of mineral development activity may be seen within these river corridors. The goal, however, is to blend these facilities into the background so that they remain visually subordinate to the natural landscape. Existing scenic integrity may range from high to very low, but the objectives on National Forest System lands will be moderate or higher.

With continued population growth and the popularity of these recreational river sections, there is the potential for large numbers of visitors at peak-use seasons. In the future, regulations may be necessary for protection of the resources and visitors. Information is provided at bulletin boards or kiosks at the river, off-site Forest Service visitor centers, and in brochures. Visitors are encouraged to practice minimum impact techniques while recreating. Trash receptacles may be provided at parking areas and high-use areas. Facilities of a modern nature may be present to provide for visitor safety and comfort and to protect the river resources. Facilities are designed to fit the character of the specific sites where they are located. This could range from semi-primitive to rural. Facilities might include parking areas, trailheads, bulletin boards, interpretive kiosks, signs, rest rooms, canoe/raft launches, fishing platforms, and picnic sites. Outfitter and guide permits provide river tours and equipment at access points within the corridors.

These linear corridors provide 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 mixed 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.

Vegetation is influenced both by natural processes and humans. Lands are classified as unsuitable for timber production, although management of vegetation is permitted within the river corridor to maintain outstandingly remarkable values. Prescribed fire, commercial, and non-commercial felling of trees may be used for scenic enhancement or rehabilitation to provide wildlife viewing opportunities; maintain developed recreation facilities; improve threatened, endangered, sensitive, and locally rare species habitat; restore native vegetative communities; restore riparian ecosystems; reduce unnatural fuel buildups; or control non-native invasive vegetation. Naturally-ignited wildland fires are permitted to play a natural role when external risks such as private land, weather, or terrain allow.

**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. Highway 103 is designated Scenic Byway in the analysis area. 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 throughout 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.

The management area is easily accessed. A good road surface and providing informational signs for protection of the natural and cultural resources as well as the safety and comfort of visitors minimizes impacts of visitors within the MA.

The potential for encounters with other forest visitors is moderate to high, especially at byway facilities, (pullouts, overlooks, interpretive kiosks, trails, restrooms, and picnic sites). Scenic, historic, and natural resources are interpreted for the benefit of visitors. These recreation and interpretive facilities are designed and constructed to blend well and complement the natural or cultural environment surrounding the byway. There are limited opportunities for remoteness, although visiting the byway in the winter (if not seasonally closed) or mid-week improves opportunities for achieving solitude. There is low risk and little need for visitors to rely on personal physical abilities or primitive outdoor recreation skills. Most, if not all, facilities are designed to accommodate persons with disabilities.

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. Timber harvesting operations focus on what is retained in the stand, not on wood fiber production. Timber harvest practices are visually subordinate to the surrounding landscape. The MA is suitable for timber production. Prescribed fire and other management treatments are appropriate vegetative management tools available to be used to enhance the byway corridors in conjunction with other resource values.

These 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.

## Direct, Indirect and Cumulative Effects

### Alternative 1

### Aesthetics and Management Areas

There would be few short-term changes; however, as ecosystems in the analysis area progress, hardwoods would be expected to be an increasing component in the areas now dominated by pine, and hardwood stands would be expected to progress toward containing a greater component of shade-tolerant, fire-intolerant species. Visual color and pattern diversity, especially during leaf-off, would decrease with less of the contrasting green gray patchwork patterns. Neither the ROS nor the SIO designations will be changed under this alternative.

The No Action alternative would not allow management activities which would move management areas towards their desired future conditions.

### Recreation and OHV Use

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

Dispersed camping and hunting will 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. Squirrel hunting will improve as the hardwood stands age.

### Alternative 2

**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 for the first season.

Thinning in stands 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 under story species. Marking should 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 should be completed.

Visitors to all areas of the proposed project area may also smell and see smoke during burning and blackened trees and ground for the first season until the next spring green-up, some browning of vegetation from harvest activities during the initial work and, for the first season, in stands along county and forest roads. They may also notice an increase in log truck traffic during the logging operations, but will continue to see a diverse landscape in the area. In the background, National Forest land will continue to offer viewers a variety of forest types from pines to hardwoods.

The Wild and Scenic River Corridor and the Highway 103 Corridor (high SIO) planned thinning and shelterwood harvests may have differing levels of basal area throughout the stand. The basal area right next to the corridor may not be reduced as much as the parts of the stand that are located further from the corridor.

All of the proposed actions are consistent with the Forest Plan's Scenery management and desired conditions for Wild and Scenic Recreation Sections of River and Scenic Byway Corridors, for the project area and no long-term adverse effects should occur.

**Recreation and OHV Use**
Recreation users in the area may smell and see smoke during prescribed burning and browning of vegetation from harvest, herbicide and burning activities during the initial work and for the first season. During prescribed burning, area closures will be implemented to improve visitor safety. At the conclusion of the harvest activities and prescribed burning, certain roads will be closed, blocked and seeded. These activities will have no long-term negative effects on the dispersed recreation activities except with the use of closures on user-created trails.

There are currently not any designated OHV roads in the project area. Therefore, this project will have no affect on OHV use. However there will be changes to highway legal vehicles with in the project area. This will affect the Motor Vehicle Use Map (MVUM) see changes on the Project Roads Management chart Table 2.

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 will be placed on all currently closed roads, which will be reopened for this project and then reclosed after project completion by seeding the roadbed, gates and/or other closure structures. Roads closed with gates or earthen mounds will allow foot travel for hunters to access more secluded hunting spots. Roads that are closed can be used by hikers to access the interior of

the project area. Reclosing roads will 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 will be managed to maintain a high-quality experience.

The proposed timber harvests and wildlife activities will improve hunting opportunities around the dispersed hunter camps and adjacent private lands. Planned vegetation treatments would improve wildlife viewing and hunting opportunities.

Hunters are frequently drawn to logged areas because 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 placement of the proposed ponds, wildlife openings and areas restored to woodland condition will tend to attract animals to under-utilized areas on National Forest lands and, thereby increase hunting opportunities.

Campers at dispersed sites will notice logging traffic, hear chainsaws, and will see stands as they are being logged and other timber-related and wildlife improvement activities. Campers may see some short-term effects from other activities such as brown leaves in the prescribed burned and herbicide-treated areas, and areas where release work has been conducted. 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 will allow outdoor enthusiasts to continue to enjoy the forest on foot and allow hikers access to areas for dispersed camping and hunting. Timber harvests, silvicultural treatments, 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 forms of wildlife viewing and hunting should improve.

This alternative will not change non-consumptive recreation use (camping, hiking, and mountain bicycling,) in the project vicinity. Implementation of alternatives 2 or 3 would affect/reduce unauthorized OHV use in the area. User created OHV trails would be reduced through planned road decommissioning and closure of roads with gates.

Based on the analysis, there is nothing in Alternative 2 that 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 revised Forest Land and Resources Management Plan.

**Alternative 3**

The effects for Alternative 3 would be the same as the effects for Alternative 2 with the exception of herbicide application. Drivers and forest users along county and forest roads may have more occasions to notice browning of vegetation from repeated mechanical or hand work to replace herbicide activities. Repeat hand treatments may be necessary to obtain the same effect that 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 herbicide. There would be no change in log truck traffic during the logging operations without the use of herbicide. With implementation of alternative 3, opportunities for recreational hunting would be reduced. Lack of 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**

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 |
|---|---|---|
| Trevor Ozier | Forester | Pleasant Hill Ranger District |
| Mary Brennan | Zone Archaeologist | Pleasant Hill/Boston Mountain Ranger Districts |
| Mindi Lawson | NEPA Coordinator | Pleasant Hill Ranger District |
| Tom Cravens | Forester | Pleasant Hill Ranger District |
| James Bicknell | Special Uses/Lands | Pleasant Hill Ranger District |
| Dan Martin | Fire Management Officer | Pleasant Hill Ranger District |
| Pat Kowalewycz | District Ranger | Pleasant Hill Ranger District |
| Megan Impson | Recreation Manager | Pleasant Hill Ranger District |
| Greg Taylor | Wildlife Biologist | Pleasant Hill Ranger District |
| Len Weeks | Forest Soil Scientist | Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR |
| Keith Whalen | Forest Fisheries Biologist | 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 |

## FEDERAL, STATE, AND LOCAL AGENCIES:

| Name | Position | Office |
|---|---|---|
| Margaret Harney | 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 of Oklahoma | Pawhuska, Oklahoma |
| Quapaw Tribe of Oklahoma | Quapaw, Oklahoma |
| Tunica-Biloxi Tribe of Louisiana | Marksville, Louisiana |
| United Keetowah Band of Cherokee Indians | Tahlequah, Oklahoma |

**Part 5 – Appendices**

### APPENDIX A
### Interested Citizens and Forest Neighbors List (Adjacent Landowners)

Chris Allen
1690 CR 4200
Clarksville, AR 72830

Jim Bensman
Heartwood
1802 Main St.
Alton, IL 62002

Frank Eichenberger
391 Parette Lake Rd.
Morrilton, AR 72110

Glen Hooks
Sierra Club
1308 W. 2nd St.
Little Rock, AR 72201

Zen and Pam Boulden
8008 Cass-Oark Rd.
Ozark, AR 72949

David and Claire Gainey
592 CR 3537
Clarksville, AR 72830

Sarah Goodman
2469 CR 3341
Clarksville, AR 72830

Leo Knoernschild
Supervisor's Office

605 W. Main St.
Russellville, AR 72801

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P.O. Box 711
Morrilton, AR 72110

Tom Post
Deltic Timber Corp.
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Ola, AR 72853

Tom McKinney
Sierra Club, Ark. Chapter
105 Southwood
West Fork, AR 72774

Richard Meers
6228 Fallstone Rd.
Fort Smith, AR 72916-8964

Mike Michelson
17504 Hwy. 21
Ozone, AR 72854

Natl Assoc. of RV Parks & Campgrounds
113 Park Ave.
Falls Church, VA 22046

Newton Co. Wildlife Association
HC 33, Box 40
Pettigrew, AR 72752

Travis Lumber Company, Inc.
Hwy. 71 South
P.O. Box 39
Mansfield, AR 72944

David Renko
14 Elk St.
Eureka Springs, AR 72632

Bob Townsell
1837 Caldwell
Conway, AR 72834

John Berry
NAGPRA Coord.
Quapaw Tribe
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Caddo Indian Tribe of Oklahoma
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United Keetowah Band of
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Rodger Boen
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Bo Mack
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Billy and Mary Keith
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Harrison, AR 72601

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Robert Cook
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Ozone, AR 72854

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Ozone, AR 72854

Sam Fields
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Ozone, AR 72854

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Kathy Germann
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Judy Criss
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Ozone, AR 72854

Ernest or Wanda Criss
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Kenneth Melson
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Ozone, AR 72854

Dwain Langdon
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Ozone, AR 72854

Patricia Silvey
6886 Casual Court
San Jose, CA 95120

Donald Ray Vaught
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James Mitchell
3928 CR 5440
Ozone, AR 72854

James or Charlotte Wilder
3570 CR 5440
Ozone, AR 72854

Amy Lois Hignite
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Hartman, AR 72840

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Larry or Theresa Johnson
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Robert or Clara Ritchie
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Ozone, AR 72854

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Tim Vanderford
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Anna Hammons
7272 CR 5440
Ozone, AR 72854

Bert Hammons
7272 CR 5440
Ozone, AR 72854

Donnie or Charlotte Kimbriel
1821 CR 4490
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Donald Langdon
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James Vaughan
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These comments were considered in the development of the issues and concerns section, and in other sections of this EA.

## APPENDIX B – 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)

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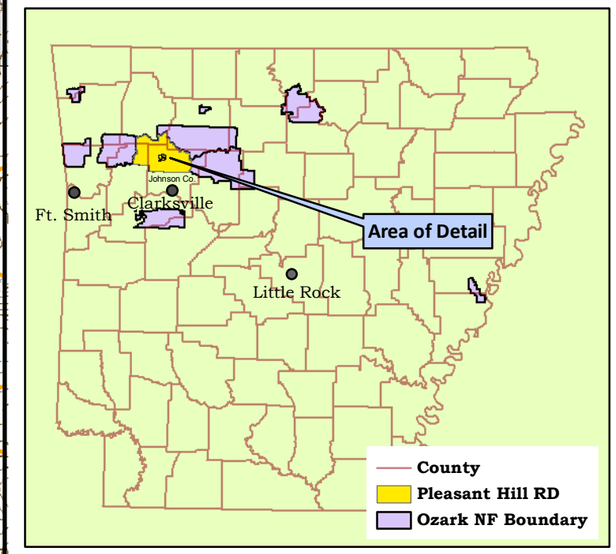
**APPENDIX D- MAPS**

# Cougar

## Proposed Actions




- Compartment Boundary 334
- Forest Stands
- Mulberry W & S River Corridor
- Private Ownership

**Roadwork**
- Existing-within project area
- Existing-outside project area
- Reconstruction
- Maintenance
- Decommission
- Needs R.O.W.
- Temporary
- Temporary, then Decomm

**Wildlife Habitat Improvements**
- Existing Opening
- Existing Opening-reconstruction
- Proposed New Opening
- Existing Pond
- Proposed New Pond
- Large Woody Debris Placement

**Gates**
- Existing
- Proposed

**Hardwood Harvest**
- Thinning
- Shelterwood
- Oak Woodland

**Hardwood Treatments**
- PCT-handtools
- TSI-handtools
- TSI-herbicide

**Pine Harvest**
- Thinning
- Seedtree
- Shelterwood

**Pine Treatments**
- PCT: herb & burn
- PCT: herb-burn-plant
- TSI: herb & burn

0 0.5 1 Miles

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