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Environmental Assessment

Calico Rock Project

Mt. Magazine Ranger District
Ozark-St. Francis National Forests
Logan County, AR

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COMPARTMENTS 42, 47, 53, 54, 71 AND 72
OZARK-ST. FRANCIS NATIONAL FORESTS
MT. MAGAZINE RANGER DISTRICT
LOGAN COUNTY, ARKANSAS

I. INTRODUCTION

A. DOCUMENT STRUCTURE

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

- *Introduction:* This section includes 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.
- *Comparison of Alternatives:* This section provides a more detailed description of the agency's Proposed Action as well as the No Action Alternative. The Proposed Action Alternative was developed based on 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 both alternatives.
- *Environmental Consequences:* This section describes the environmental effects of implementing the Proposed Action and other alternatives. This analysis is organized by resource area.
- *Agencies and Persons Consulted:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- *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 Mt. Magazine Ranger District Office in Paris, Arkansas.

B. PURPOSE AND NEED FOR ACTION

The purpose of this project is to bring the current conditions of compartments 42, 47, 53, 54, 71, and 72, known as Calico Rock, closer to desired future conditions in accordance with the Revised Land and Resource Management Plan (RLRMP) for Ozark-St Francis National Forests. Forest health and ecosystem management, endangered species management, silvicultural treatments, road and trail management, and wildlife habitat management are being proposed. These management activities, designed to align current conditions with desired future conditions, are needed to:

1. Manage for Endangered Species

The American burying beetle (ABB) (*Nicrophorus americanus*) is a federally endangered species known to occur within the project area. Habitat loss and disturbance are considered the greatest threats to this species. In 2010, the Ouachita and Ozark-St. Francis National Forests finalized a conservation plan for the ABB. According to the conservation plan, approximately 52% of the forested land within the ABB area will be managed as a woodland forest community. The goals of the conservation plan include, but are not limited to: thinning woodlands with timber management and prescribed burning; burning on a 3-5 year interval to maintain woodlands and desirable herbaceous cover; reducing cedar encroachment through timber sales, wildlife stand improvement, and prescribed burning; and restoring wildlife openings to increase carrion.

2. Promote Healthy Forests

There are many factors, both climatic and physical, that may influence tree health. Some of these are drought, being root sprung, physical damage from an ice storm, or overstocking. When a tree becomes stressed, its

defenses are weakened and it may be overwhelmed by an insect infestation, disease or a combination of both.

Pine boring beetles (e.g., black turpentine beetle, ambrosia beetle) and pine bark beetles (e.g., Ips engraver beetle, southern pine beetle, southern pine sawyer) can attack and overwhelm unhealthy stressed pine forests. Once insect infestations start, it is too late to effectively treat large areas and many acres of trees rapidly die. Prevention is the best control method. Thinning stands reduces competition and moisture stress. By keeping the trees healthy, beetles are often exuded from the trees by pitch and are less likely to reach epidemic proportions.

Upland hardwood trees are also susceptible to many insects and diseases. The annual combined loss due to insects and diseases is often more than the losses to forest fires. Some losses to insects and diseases are unavoidable. However, most losses can be avoided through proper forest management. Maintaining healthy stands by promoting tree vigor helps to avoid these losses.

3. Improve Wildlife Habitat Through Establishment Of Early Seral Habitat

The Forests provide a wide variety of habitats that support a diversity of wildlife species. One of the most important is the early seral successional habitat (0-5 years old). The overall amount of early successional forest on the Ozark-St. Francis National Forests decreased slightly from 2008 to 2009 (USDA FS, 2010). The amount of early successional habitat created on the Forests is tied very closely to the amount of regeneration harvests the Forests conduct in a given year. This type of harvesting has declined over the years and this has driven the decline in early successional habitat. At the current time in the project area, there are no forested acres in the 0-5 year old age class to provide this early successional habitat.

Four of the Management Indicator Species (MIS) from the RLRMP are dependent upon early successional habitat. As shown in the paper Management Indicator Species Population and Habitat Trends, although deer populations appear to be increasing based on harvest data, it is possible that the decline in early seral habitat could alter this trend. There is a need to maintain a portion of the habitat in early stages to maintain quality deer habitat over time. The yellow-breasted chat population appears to be stable or increasing possibly due to prescribed fire or natural events. The uncertainty and unpredictability of these events would not guarantee existence of quality habitat for chat (USDA FS, 2001).

Due to site conditions, visuals coordination, and forest plan regulations, only approximately 2% of the Calico Rock project area is proposed for regeneration. This level of regeneration is well below the desired level of approximately 10% early seral habitat development; however, stand exam data indicated it was nearly the maximum amount allowed considering restraints.

4. Balance Age Class

The pine type age classes in this analysis area are not in balance. The age class distribution is weighted heavily in the 41-70 and 71+ year-old age classes. Approximately 38% of the pine type acres are in the 41-70 age class. Approximately 37% of the pine type acres are in the 71+ year old age class. If no new acres are regenerated, the majority of the project area will get old at once. Although the Proposed Action only contributes 2% toward age class diversity, failure to implement this small amount could have negative impacts on future vegetation and early seral dependent species. Breaking up the age classes now would help prevent substantial mortality from insects and/or disease later. The effects of poor management could cross the project area boundary impacting other possibly healthy forested acres on both government and private lands.

5. Maintain and Expand Fire in the Ecosystem

Approximately 16% of the project area was prescribed burned in 1999 and 2001. Forest fuels accumulate rapidly in pine stands. In 5 to 6 years, heavy fuel layers can build up from normal growth, posing a serious threat from wildfire to all forest resources. Prescribed fire is the most practical way to reduce dangerous accumulations of combustible fuels. Wildfires that burn into areas where fuels have been reduced by prescribed burning cause less damage and are much easier to control (Waldrop and Goodrick, 2012). The entire project area is planned for prescribed burning in order to achieve the benefits described above.

In this analysis area, approximately 2,896 acres (39% of project acres) are located within the Wildland Urban Interface (WUI). WUI areas are National Forest lands within one-quarter of a mile from private land. These areas are at risk of a wildland fire that may occur within the National Forest lands that border these private lands.

This analysis area was once a fire-dominated ecosystem. Frequent fires top killed shade tolerant species resulting in favorable conditions for the development of pine and oak woodland, and thus providing ample forage for many species of wildlife. Past management practices have maintained fire in Compartments 53 and 54. Where fire has been maintained, the understory is open allowing good site distances into the forest. Areas where fire has typically not been a management practice have created a situation where shading and buildup of duff or needle layers has reduced or possibly eliminated grasses and forbs. The loss of these grasses and forbs is reducing the number of small mammals, seed-eating birds, and other species such as deer and turkey. A heavier duff layer increases the potential for a wildfire and its uncontrolled effects on the flora or fauna (Waldrop and Goodrick, 2012). In addition, cedar has expanded in range due to the removal of fire from the landscape; consequently decreasing wildlife habitat and increasing wildfire potential (Smith, 2011).

6. Provide Quality Wildlife Habitat

Well-managed wildlife openings provide quality wildlife forage for species such as deer and bugging areas for turkeys (McPeake, 2014). Wildlife openings also provide carrion, the only food source, for the federally endangerd American burying beetle. The RLRMP objective is to have at least four well-distributed wildlife openings per 640 acres of land. Currently, there are 16 existing wildlife openings in the project area. These 16 existing wildlife openings need to be restored to provide more edge, forage, and turkey brood habitat than is currently being produced. In addition, three new wildlife openings need to be constructed to help move towards meeting the RLRMP objectives as well as implementing the American Burying Beetle Conservation Plan.

7. Manage the Transportation System While Reducing Wildlife Impacts and Erosion Potential

Certain roads within the project area are no longer needed for management in the near future. Their continued use by the public creates an unfavorable situation for wildlife through unnecessary disturbance and adds to soil loss through erosion.

8. Provide Commodities

One output of achieving the needs of the project area would be harvesting of timber. The project area is in Management Area (MA) 1.G (Special Interest Areas), MA 1.H (Scenic Byway Corridors), MA 2.B (State Parks), MA 3.A (Pine Woodland), MA 3.C (Mixed Forest), and MA 3.I (Riparian Corridors) (See Map 12: Management Area Map on page 98). These MAs are all classified as suitable for timber management except MA 1.G (Special Interest Areas) and MA 2.B (State Parks) (RLRMP, pgs. 2-43, 2-45, 2-48, 2-56, 2-61, and 2-71).

9. Control Invasive Species in the Project Area

Within the Calico Rock Project area, there are occurrences of non-native invasive species (NNIS). Species such as Sericea lespedeza (*Lespedeza cuneate*) have become the dominant species along roadsides. Privet (*Ligustrum* spp.) has also been identified within the project area. Suppression of these and other NNIS is needed to prevent these species from becoming over abundant and causing negative effects on native plant species (Miller et al., 2013) as well as negatively affecting carrion availability for the federally endangered American burying beetle (source: ABB Conservation Plan).

10. Perform Stream Habitat Improvement Management

It was determined during stream surveys conducted in the summer of 2005 that some project streams were in need of large woody debris (LWD) according to Objectives 22 and 23 from the RLRMP. Wood in the streambed helps to slow the water flow, extend the water supply further into the dry season, and provide additional habitat for amphibians and fish (Harmon *et al.*, 1986).

Also during the inventory, 8 road/stream crossings within the project area were found to be barriers to movement/migration of aquatic organisms within the stream channel. These road/stream crossings are in need of structures that will allow for movement through the stream system of aquatic organisms at all times as well as large wood and rock during higher flows.

11. Have the Ability to Salvage Timber Across Project Area

The ability to salvage timber expeditiously is good stewardship. Without the option of salvaging timber after a damaging event, utilizing the timber in a condition most similar to its condition prior to the damaging event is

prevented (Gorte, 1996). Timber is not merchantable or sells at a loss within 90-120 days after a damaging event. Thus, rapid treatment of the damaged areas is critical in order to utilize commercial sales as a method for treatment. If not sold commercially, the cost of treating the dead timber is beyond current and expected agency budgets. In addition, dead timber becomes hazardous fuel leading to higher intensity burns, more smoke, and a greater risk of wildfire (Wade *et al.* 2000).

12. Manage the Mt. Magazine OHV Trail System

With the current and proposed changes to the road system, the OHV trail system can support approximately 2.65 miles of proposed designated OHV trails. In addition, an old road template, approximately 0.95 miles long, can be constructed and designated as OHV trails. The approximate 3.6 miles of proposed OHV trail designation aids in meeting the integrated system of roads and trails outlined in the Ozark-St. Francis Revised Land and Resource Management Plan (RLRMP).

C. PROPOSED ACTION

The Calico Rock Project area encompasses approximately 7,484 acres of National Forest land and approximately 1,686 acres of privately owned land. The Proposed Actions of the Mt. Magazine Ranger District are in Table 1 on page 6 and correspond to Compartments 42, 47, 53, 54, 71 and 72. This area is located approximately 4 air miles southeast of Paris, Arkansas, in Logan County (See Vicinity Map, page 5). This area is in the northwest corner of the Mt. Magazine Ranger District located in T6N, R25W and R26W and T7N, R25W and R26W.

Map 1. Vicinity Map

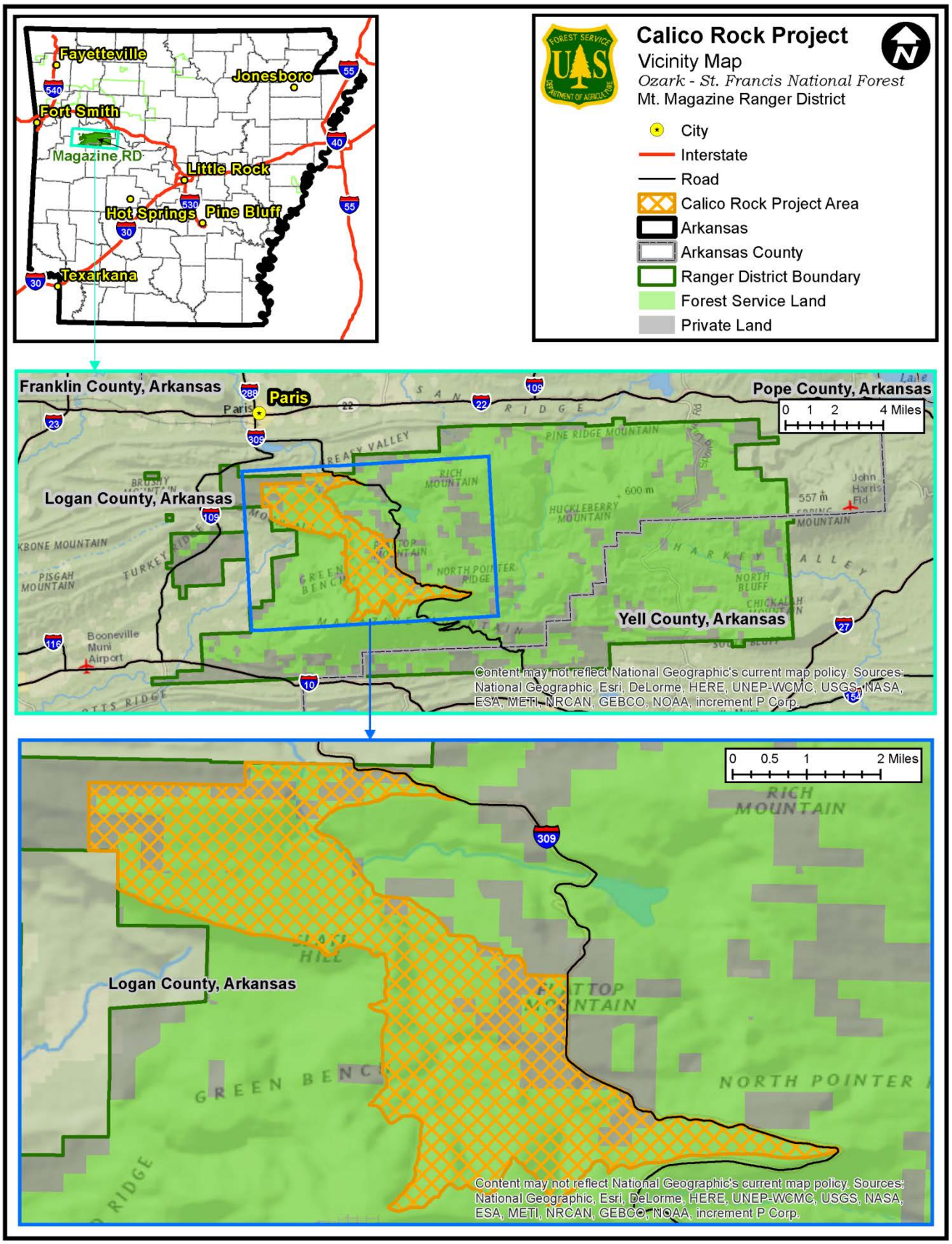


Table 1. Proposed Action

Treatment Description	Total[1]
Shortleaf Pine Shelterwood Harvesting	172 Acres
Shortleaf Pine Site Preparation	172 Acres
Shortleaf Pine Planting	172 Acres
Shortleaf Pine Release (Shelterwood and existing pine seedling/sapling stands)	284 Acres[2]
Shortleaf Pine Seed Tree Removal	172 Acres
Shortleaf Pine Commercial Thinning	2,114 Acres
Shortleaf Pine and Hardwood Commercial Thinning	1,349 Acres
Pre-Commercial Thinning (PCT) (existing shortleaf pine seedling/sapling and poletimber stands)	192 Acres
Cedar Thinning	7,484 Acres[3]
Salvage/Sanitation Thinning	7,484 Acres
Non-native Invasive Species Treatment	Up to 700 Acres/Year
Wildlife Habitat Improvement/Fuels Reduction Prescribed Burning[4]	7,484 Acres
Wildlife Stand Improvement/Riparian Stand Improvement	148 Acres
Wildlife Linear Food Plot Construction	10 Acres
Wildlife Opening Construction	3 Openings
Wildlife Opening Maintenance/Restoration[5]	16 Openings
Wildlife Pond Construction	1 Pond (Up to 1 Acre)
Stream Habitat Improvement/Management	16 Miles
Aquatic Organism Passage Construction	8 Passages
Temporary Road Construction	10.1 Miles
Road Reconstruction	8 Miles
Road Decommissioning	2 Miles
Road Maintenance	As needed
Off Highway Vehicles (OHV) Trail Extension	3.6 Miles
Borrow Pit Development	Up to 5 acres

[1] Acres and miles are approximations.
[2] The 284 acres encompasses 172 acres of Shelterwood stands and 112 acres of existing shortleaf pine seedling/sapling stands.
[3] Estimate up to 450 acres per year for implementation.
[4] Proposed burning treatments on a 3 to 7-year rotation in both dormant and growing seasons.
[5] Proposed for 2 additional follow-up maintenance/restoration treatments on a 2-year interval.

D. DECISION FRAMEWORK

The decision to be made is whether to implement the Proposed Action (Alternative 1) or the No Action Alternative (Alternative 2). Rob Kopack, Deputy District Ranger of the Mt. Magazine Ranger District, or his acting line officer has the authority to make this decision.

E. RELATED EIS/EA(S) THAT INFLUENCE THE SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

This EA is tiered to the Ozark-St. Francis National Forests Final Environmental Impact Statement (Ozark-St. Francis FEIS) and the Revised Land and Resources Management Plan (RLRMP). The Ozark-St. Francis FEIS and the RLRMP can be viewed at local U.S. Forest Service offices or at http://www.fs.usda.gov/main/osfnf/landmanagement/planning. Other documents incorporated by reference in this EA can be viewed at the Mt. Magazine District office in Paris, Arkansas.

F. PUBLIC INVOLVEMENT

Scoping for this project began with the mailing of the Proposed Action to adjacent landowners and interested citizens on May 2, 2014. This list included letters to the Arkansas Game and Fish Commission, landowners, organizations, individuals and eight Native American Tribes that have asked to be on the District or Forest mailing list. The scoping package contained a description of the Proposed Action, a map depicting the Proposed Action, and a comment form.

A copy of the Proposed Action letter was posted that same week on the Ozark-St. Francis National Forests website at http://www.fs.usda.gov/detail/osfnf/landmanagement/planning. This project was also listed in the Schedule of Proposed Actions and posted on the Ozark-St. Francis National Forests website at http://www.fs.usda.gov/detail/osfnf/landmanagement/planning/?cid=stelprdb5212192

G. ISSUES

Issues serve to highlight effects or unintended consequences that may occur from the Proposed Action, providing opportunities during the analysis to explore alternative ways to meet the purpose and need for the proposal while reducing adverse effects. Issues identified early in the process during scoping help set the scope of the actions, alternatives, and effects to consider.

Concerns related to forest management such as sustainability, road management, water quality, soils, air quality, climate change, visuals, recreation, heritage resources, minerals, wildlife, fisheries, and proposed endangered, threatened and sensitive species were thoroughly integrated into the project proposal and were not identified as issues that would require a separate alternative to resolve the concerns.

Four responses to scoping have been received as of December 10, 2014; all were reviewed by the interdisciplinary team assigned to this project (refer to page 89). Only one response highlighted an issue. The response requested construction of firelines for the controlled burns. This issue was incorporated into the proposed actions on pages 12 and 15 and is shown visually on the Wildlife Treatment Maps on pages 21 and 23. The project planning record includes a copy of the scoping letter, a list of persons to whom the letter was mailed, and copies of all responses received to date.

II. ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes and compares the alternatives considered for the Calico Rock Project. There was one alternative developed in detail, the Proposed Action. The No Action Alternative is compared to the Proposed Action. No other alternatives were developed in detail.

The mission of the Forest Service is to "sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations." The resource management function is responsible for the long-term health and sustainability of the forest, providing goods and services from the land, the quality of the water running on and under the land, air quality above the land, habitat for wildlife, and protecting species of plants and animals from extinction (USDA FS, 2005c).

The Proposed Action was developed from the RLRMP including the mission of the Forest Service and customized direction for the MAs within the project boundary. The MAs within the project boundary are 1.G (Special Interest Areas), 1.H (Scenic Byway Corridors), 2.B (State Parks), 3.A (Pine Woodland), 3.C (Mixed Forest), and 3.I (Riparian Corridors) (Map 11 Management Areas, page 98). A brief description of each MA follows.

1.G Special Interest Areas
Emphasis
This MA occurs on approximately 1,574 acres in the project area. Special Interest Areas (SIAs) are managed for their unique geological, botanical, biological, zoological, scenic or cultural features. The features are unique enough that they are not found on large areas anywhere else on the Forests, or they provide the best representation of similar areas on the Forests. These areas are unsuitable for timber production.

Desired Condition
The unique qualities of the SIAs of the Ozark-St. Francis National Forests are predominately geologic, scenic, or botanical. They provide outstanding opportunities to learn about the natural history of the Forests and to enjoy a variety of recreation opportunities in an attractive setting. Public access is designed to protect sensitive resources; access to some SIAs may be limited in order to protect resources.

1.H Scenic Byway Corridors
Emphasis
This MA occurs on approximately 192 acres in the project area. Scenic byway corridors are managed to offer visitors the opportunity to enjoy viewing outstanding natural and cultural landscapes along a well-maintained road. These areas may contain recreational and interpretive trails. Management is focused on increasing tourism while protecting and showcasing the unique and scenic natural and cultural resources. These areas are suitable for timber production.

Desired Condition
The areas provide exceptional opportunities for motorized recreation, especially scenic driving. The views along the different byways vary, including 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.

2.B State Parks
Emphasis
This MA occurs on approximately 17 acres in the project area. State Parks are destination area recreation sites. They are managed to provide the public with a high level of recreational opportunities in visually appealing and environmentally healthy settings. The terms and conditions of the land use authorizations serve as the underlying management direction for managing these parks. This area is unsuitable for timber production.

Desired Condition
The landscape character is a natural appearing, visually appealing landscape emphasized by providing open park-like settings featuring special attractions like rock outcroppings and waterfalls. Management activities maintain a healthy mid-successional forest of mixed hardwoods and pines. Understory vegetation includes a variety of native deciduous and evergreen flowering trees, shrubs, and wildflowers. These areas may also include natural appearing open areas or pastoral landscapes.

3.A Pine Woodland
Emphasis
This MA occurs on approximately 2,050 acres in the project area. This MA is suitable for timber production. The primary emphasis in this MA is to restore and maintain a landscape mosaic of open pine woodland that approximates historical conditions. The purpose is to provide habitat for associated plants and animals, some of which are rare and declining, and to create a setting for recreation that is different, uncommon, visually appealing, and rich in wildlife.

Restoration and maintenance of pine woodland is accomplished through application of a variety of forest management practices. Thinning of trees is often needed to create initial open-canopy conditions. This may be achieved through manual, mechanical, or chemical methods including use of commercial timber sales. Frequent prescribed fire (often applied at landscape scales) may be used to thin trees, and is the predominate method used to maintain open conditions and well-developed understory communities. Regeneration of woodland occurs on a scheduled basis to diversify age class distribution to ensure a sustained supply of this habitat over time.

Desired Condition
A mosaic of woodland and forest characterizes this area. Pine woodland occupies approximately 60% of the total community acreage and typically occurs on ridges and south- to-west facing aspects. Generally, patches of pine woodlands are well connected in networks of ridges and other suitable sites incorporating other fire-dependent communities such as glades and barrens. Forests (> 60% canopy closure) are present on lower slopes and drains, with most being in an open condition (60 to 80% canopy closure).

Pine woodlands have open canopies (10-60% canopy closure), sparse midstories, and well-developed understories that are typically dominated by grasses and forbs, but also may have a significant woody component. The density of the overstory, midstory, and the woody component of the understory generally increase as one moves down slope and onto north and east aspects, gradually merging with more typical forest conditions.

3.C Mixed Forest
Emphasis
This MA occurs on approximately 3,565 acres in the project area. These lands are managed to ensure the health and sustainability of the pine, pine/hardwood, hardwood/pine, and hardwood forest types across the landscape. Timber would be a by-product of vegetation management aimed at maintaining sustainable ecosystems. This area is suitable for timber production.

Light levels to the forest floor are managed to develop an assemblage of desirable regeneration and to maintain a moderate herbaceous component. This is accomplished through silvicultural activities including prescribed fire as well as mechanical and chemical vegetation control. The difference between this MA and the pine woodland MA is that stocking levels of trees in this MA are denser than the stocking levels in the pine woodland MA.

Desired Condition
The character of the land is predominately natural appearing with a diversity of forest successional classes and ecological community types. Thinning, prescribed fire at regular intervals, and regeneration harvests are common silvicultural treatments. Stands are regularly thinned to reduce stress as trees age. Fire is common, typically as prescribed burning.

On low productivity sites, other communities (e.g., glades) occur, but typically comprise a small proportion of the area. Where they occur, however, they exhibit high levels of ecological integrity and diversity of characteristic species. Rare communities within the MA are maintained at desired composition, structure, and function. They support characteristic associations of species. Occurrences of threatened and endangered species are stable or expanding as are those for sensitive and locally rare species, which are needed to provide for their viability.

3.I Riparian Corridors
Emphasis
This MA occurs on approximately 86 acres in the project area. Riparian corridors are managed to retain, restore, and enhance the inherent ecological processes and functions of the associated aquatic, riparian, and upland components within the corridors. Silvicultural treatments including timber and vegetation removal may occur to restore and/or enhance riparian resources such as water, wildlife, and natural communities.

Desired Condition
Riparian corridors reflect the physical structure, biological components, and ecological processes that sustain aquatic, riparian, and associated upland functions and values. The preferred management for riparian corridors is one that maintains, or moves toward, the restoration of processes that regulate the environmental and ecological components of riparian areas.

These areas are suitable for timber management. Vegetation management activities take place to maintain, restore, and/or enhance the diversity and complexity of native vegetation; rehabilitate both natural and human-caused disturbances; and provide habitat improvements for aquatic and riparian associated wildlife species (including migratory birds). Silvicultural treatments including timber and vegetation removal may occur within the riparian corridor. Prescribed fire could be used within the corridor to create or maintain the composition and vitality of fire-dependent vegetative communities.

A. DETAILED DESCRIPTION OF ALTERNATIVE 1 (PROPOSED ACTION ALTERNATIVE)

A summary table (Table 2) of the following Proposed Actions begins on page 14. The Vegetation Treatments Maps start on page 17, the Wildlife Habitat Improvement Maps start on page 21, and the Road and Recreation Treatments Maps start on page 25.

Harvest of mature shortleaf pine sawtimber stands by shelterwood cutting is proposed on approximately 172 acres within the following stands of the respective compartment: Compartment 53/Stand 21; Compartment 54/Stand 15; and Compartment 72/Stands 2 and 6. Using the pine shelterwood method of cutting, approximately 20-30 pine seed trees would be left per acre for regeneration. Additionally, den trees and mast-producing hardwood would be left at a rate of approximately 10-20 trees per acre where available.

To facilitate site preparation after harvesting, firewood removal would be evaluated for demand and availability. If areas are set up for firewood removal, firewood would be removed through firewood permits. Mast producing trees above 8.0" diameter at 4.5' height would not be cut for firewood unless approved by a wildlife biologist or technician in order to improve mast production on an adjacent tree.

Site preparation of the shelterwood harvested stands (approximately 172 acres, Table 2) would be accomplished with handtools of the herbicides: triclopyr, glyphosate and/or imazapyr. Herbicide treatment would be done through foliar spraying, injection, or cut stump treatment directly on the target plant. These treatments help control competing vegetation until shortleaf pine becomes established. Herbicides are applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human and wildlife health.

The directed foliar application would be used on vegetation up to 6 feet in height. Hand tool injection would be used on selected hardwood trees above 1" in diameter at 4.5' height. Mast producing trees 8.0" diameter or larger at 4.5' height above ground level would not be treated during site preparation unless otherwise approved by a wildlife biologist or technician. See Mitigation Measure #19 on page 31 for a list of species that would not be treated regardless of size.

Herbicide treatment would occur between May and October. May, June, September, and October are the optimum months for foliar spray. July/August is the optimum period for injection treatments. See Mitigation Measures #20-33 starting on page 31 for specific mitigation for site preparation.

Site preparation burning would be done if needed to provide an adequate seedbed in the shelterwood harvested stands. The stands would be evaluated after the chemical treatment has had time to be effective to see if this prescribed burning is necessary. If needed, burning would be thirty or more days following chemical treatment and timed to occur prior to seedfall in the fall season when residual trees would be least susceptible to fire damage.

Planting of shortleaf pine in these shelterwood harvested stands (approximately 172 acres, Table 2) would be done if natural seedfall does not regenerate these sites. Stocking evaluations would be done 1-3 years after site preparation to determine stocking. If a stand is not adequately stocked, planting would be done the following winter.

Once pine seedlings are established and a release treatment is deemed necessary, the shelterwood harvested stands (approximately 172, Table 2) and existing shortleaf pine seedling/sapling regeneration failure stands (approximately 112 acres comprised of Compartment 53/Stand 18 and Compartment 54/Stands 3 and 10) would be released from competition. Release might be accomplished by handtools or directed foliar

application, injection or cut surface treatment. Triclopyr, glyphosate, imazapyr or a combination of these herbicides would be used to implement these treatments. These treatments would be applied within a 4' radius of the selected pine leave tree to be released on an 8' x 8' spacing. After treatment, the selected shortleaf pine leave trees would gain sufficient height growth to exceed the competing vegetation. If there isn't a shortleaf pine available for release, a desirable hardwood would be selected for release.

Herbicide treatment would occur between May and October. May, June, September, and October are the optimum months for foliar spray. July/August is the optimum period for injection treatments. See Mitigation Measures #20-33 starting on page 31 for specific mitigation for release.

The shelterwood harvested stands (approximately 172 acres, Table 2) would be evaluated for seed tree removal after the stands are certified as being adequately stocked with the desired regeneration. Total potential for seed tree removal would be approximately 172 acres. Hardwoods protected during the shelterwood cut would be protected during the seed tree removal cut as well.

An approximate total of 3,463 acres is proposed for commercial thinning; of which, approximately 2,114 acres would thin only shortleaf pine thinned and approximately 1,349 acres would thin both pine and hardwood. Of the 2,114 acres of pine only thinning, approximately 1,427 acres would be thinned to an approximate basal area of *50 ft^2/acre* and approximately 687 acres would be thinned to an approximate basal area of 6*0 ft^2/acre.* Of the 1,349 acres of pine and hardwood thinning, approximately 273 acres would be thinned to an approximate basal area of *50 ft^2/acre*, approximately 842 acres would be thinned to an approximate basal area of 6*0 ft^2/acre,* and approximately 234 acres would be thinned to an approximate basal area of 7*0 ft^2/acre.* See Table 2 starting on page 14 for compartment and stand specifics.

Perform pine pre-commercial thinning (PCT) using handtools in existing shortleaf pine seedling/sapling stands and shortleaf pine poletimber stands on approximately 192 acres within Compartment 47/Stands 5, 8, and 24; Compartment 54/Stand 7; and Compartment 72/Stand 23. Stand vigor in these stands is being lost through competition between pine trees for nutrients, sunlight, and water. Currently, pine stocking in these stands range from approximately 650 to 4200 shortleaf pine trees/acre. The PCT treatment would only be applied on individually selected stems within a 4-foot radius of the selected pine leave tree. Pine leave trees would be chosen on an 8' by 8' spacing. After treatment, the selected shortleaf pine leave trees would gain sufficient height growth to exceed the competing vegetation.

Cedar would be harvested or cut and left when management activities are conducted in Compartments 42, 47, 53, 54, 71 and 72 totaling approximately 7,484 acres. Estimate a maximum 450 acres treated per year. Thinning cedar from these stands would reduce the trees per acre and increase growth and vigor of the remaining trees. Opening up these stands would increase the amount of sunlight reaching the forest floor and improve conditions for ground level plants such as bluestem grasses and various forbs (Smith, 2011). American burying beetle, small rodents, song birds, deer, northern bobwhite quail, and turkey would benefit from this treatment.

Due to the frequency of recent wind and ice storms that have occurred, salvage/sanitation thinning is being proposed on all 7,484 acres of Compartments 42, 47, 53, 54, 71 and 72. Both pines and hardwoods would be subject to removal under these circumstances. Remove trees that blow over or die when feasible for safety, forest health, or public utilization reasons.

Non-native invasive plant species would be treated on up to approximately 700 acres per year within the boundaries of Compartments 42, 47, 53, 54, 71 and 72. Species treated could include but are not limited to Tree-of-Heaven (*Ailanthus altissma*), paulownia (*Paulownia tomentosa*), mimosa (*Albizia julibrissin*), privet, Sericea lespedeza, kudzu (*Pueraria montana*), fescue (*Lolium arundinaceum*), etc. This would include any species from the Regional Forester's List of Invasive Exotic Plant Species of Management Concern. Some sites of privet have already been noted within the project area. This would be for future treatment of infestation as sites are identified. Herbicide treatment would be done according to label directions for the target species using triclopyr amine, glyphosate, imazapyr, and/or picloram or a combination of these chemicals. Treatment would be done through foliar spraying or stump treatment directly on the target plant. Up to 0.3 lb. of active ingredient per acre of imazapyr, up to 0.125 lb. of imazapic per acre, up to 1.0 lbs. per acre of triclopyr amine, up to 1.0 lb. of active ingredient per acre of picloram, and up to 2.0 lbs. of active ingredient per acre of glyphosate (1.5 lbs. active acid equivalent) would be applied. Picloram would only be used to treat kudzu. Specifically, kudzu would be treated using a backpack sprayer containing a mix of herbicides, one of which is Tordon K (picloram) with a nozzle on the sprayer that produces large droplets. See Mitigation Measures #21-22 and 24-33 starting on page 31 for specific mitigation for herbicide use.

Prescribed burning for wildlife habitat improvement and fuels reduction is proposed for all 7,484 acres in Compartments 42, 47, 53, 54, 71, and 72. First planned burning rotation would include all stands. Subsequent rotations would include all compartment acres (7,484 acres). Wildlife habitat improvement and fuels reduction burning are proposed on a 3 to 7 year rotation in both the dormant and growing seasons. To conduct these burns, approximately 5.1 miles of existing and up to approximately 21.6 miles of newly constructed fireline, approximately 8-feet wide, would be utilized. For approximate location, see Table 2 on page 14 and the Wildlife Treatment Maps starting on page 21. A fireline, or portion of, may not be constructed if a natural barrier, such as a road or stream, exists or if a Wyden Act Agreement is in place with a neighboring landowner. See Mitigation Measures #35-40 starting on page 32 for specific mitigation relating to prescribed burning.

Perform wildlife stand improvement (WSI) and riparian stand improvement (RSI) on approximately 148 acres in Compartment 53/Stands 6, 24 and 25. Stands would be thinned to a basal area of 50 and would receive a prescription of 114 (Pine Bluestem). The purpose of this prescription is to create a woodland condition in shortleaf pine. Prescribed burning would be utilized to control the understory vegetation and create an herbaceous component. All Eastern red cedar, merchantable and non-merchantable, would be cut but would not be treated with chemical. RSI might be accomplished within 100 feet on either side of Calico Creek. The Forest Plan calls for using a silvicultural prescription of 106 for Riparian Corridors. Riparian areas would be cut to a basal area of between 60 to 80 with most areas closer to 60. Trees would be cut and left on the flood plain to improve riparian conditions.

A large linear opening, up to 10 acres in size, would be created as a food plot on the proposed closed sections of forest development road (FDR) 96053B in Compartment 53/Stands 7, 11, 12 and 14; and Compartment 54/Stands 26 and 27. The linear opening would be disked, fertilized, limed and planted with seeds and forbs suitable for wildlife, specifically northern bobwhite quail.

Three wildlife openings (one per Compartment/Stand) are proposed for construction in Compartment 47/Stand 2; Compartment 53/Stand 25, and Compartment 71/Stand 4. Construction of these openings, up to 5 acres in size, would consist of removing/harvesting the timber during the timber sale or by permit at time of opening construction. During construction, stumps would be mechanically removed and then the openings would be disked, fertilized, limed, and planted with seed suitable for wildlife. These openings would receive subsequent routine restoration on a 2-year interval as described below. Access roads into these openings would be blocked after the openings are constructed.

The 3 new wildlife openings, 12 existing wildlife openings, and the linear food plot are proposed for maintenance/restoration. The openings are located in Compartment 42/Stands 2 and 5; Compartment 47/Stands 2, 4, 18, and 22; Compartment 53/Stands 4, 8 and 25; Compartment 54/Stands 5 and 12; Compartment 71/Stand 4; and Compartment 72/Stands 6, 13 and 14. The linear food plot would be located along the proposed closed sections of FDR 96053B. Routine maintenance and restoration would be performed by brushhogging the openings followed by a chemical treatment with imazapyr, imazapic, triclopyr amine, and/or glyphosate, if needed, to eradicate non-native species and woody species. Each opening would be evaluated before treatment to determine which chemical(s) would be used if needed. Chemical application would occur between March and October using a tractor-mounted sprayer. This would be followed by liming, disking, and planting seed suitable for wildlife on each opening. These openings are proposed for 3 restoration treatments on a 2-year interval. Up to 0.3 lb. of active ingredient per acre of imazapyr, up to 0.125 lb. of imazapic per acre, up to 1.0 lbs. per acre of triclopyr amine, and up to 2.0 lbs. of active ingredient per acre of glyphosate (1.5 lbs. active acid equivalent) would be applied during mechanical liquid applications. Access roads into these openings would be blocked after the openings are constructed.

A wildlife pond up to 1 acre in size would be constructed in Compartment 53/Stand 7. The pond would benefit both game and non-game wildlife species, such as bats and amphibians, as a permanent water source for all wildlife to utilize in drought years.

In the project area, stream habitat management is proposed on all blue-line streams found on topographic maps (approximately 16 miles of stream). The Wildlife Habitat Improvement Maps starting on page 21 show the locations of this treatment and Table 2 starting on page 14 lists the individual stands. Large woody debris (LWD) would be felled or placed in the streambed. Wood would consist of trees over 16.4 feet long and greater than 19.7 inches in diameter. Anywhere from 8-20 trees per mile would be placed in the streams.

Eight aquatic organism passages might be installed with one at each of the following road/stream locations: 1676C and Short Mountain Creek (Compartment 54/Stand 9), 1676 and Short Mountain Creek (Compartment

54/Stand 19), 1609 and an unnamed tributary to Short Mountain Creek (Compartment 54/Stand 3), 1605 at Gutter Rock Creek (Compartment 71/Stand 7), 1605 and two unnamed tributaries to Gutter Rock Creek (Compartment 42/Stands 5 and 7), 1605 and Lick Creek (Compartment 42/Stand 3), and 1605 and an unnamed tributary to Lick Creek (Compartment 47/Stand 1). These crossings might be replaced with structures that are equal in width to the stream channel with as big of an opening as possible and would be either bottomless or if the structure has a bottom then the structure would be counter sunk into the stream bottom. Structures might also be replaced with natural crossings or repaired to eliminate fish barriers. The crossings would be replaced as funding becomes available. See Wildlife Habitat Improvement Map starting on page 21 for approximate locations.

Road activities proposed include approximately 10.1 miles of temporary road construction, road maintenance, 8 miles of road reconstruction, 2 miles of road decommissioning, development of a borrow pit (approximately 5 acres) and designation of approximately 4.4 miles of new off-highway vehicle routes. Individual road numbers are listed in Table 2 starting on page 14. Locations of these road activities are shown on the Roads and Recreation Treatments Maps starting on page 25 for the Proposed Action Alternative with the exception of temporary road locations. Maps of these temporary road locations are located in the project file.

Designate approximately 3.6 miles of new off-highway vehicle (OHV) routes. Approximately 1.75 miles of FDR 1675 would be designated as OHV trails. FDR 1675 is currently closed and would be width restricted to allow OHV traffic only. Approximately 0.65 miles of FDR 96053B and 0.25 miles of FDR 1609B would be designated to allow both OHV and highway vehicles. Both routes are currently open to highway vehicle traffic and are proposed to be reconstructed with the timber sales from this project. During field reviews conducted after the initial Proposed Actions were developed, an old existing road template (approximately 0.95 miles) was discovered. This old existing road bed is proposed to be developed as an OHV route to give OHV riders an alternative route through the woods and to create a loop; thus, increasing OHV riding opportunities in the project area. None of the existing routes open to OHV in the project area are proposed to be closed or decommissioned.

Table 2. Summary of Alternative 1 Actions[1]

SHORTLEAF PINE SHELTERWOOD HARVESTING	**172 Acres** *C-53/Stand 21* *C-54/Stand 15* *C-72/Stands 2 and 6*
SHORTLEAF PINE SITE PREPARATION Handtools/Chemical/Prescribed Burning	**172 Acres** *C-53/Stands 21* *C-54/Stands 15* *C-72/Stands 2 and 6*
SHORTLEAF PINE PLANTING Handtools	**172 Acres** *C-53/Stand 21* *C-54/Stand 15* *C-72/Stands 2 and 6*
SHORTLEAF PINE RELEASE Handtools/Chemical	**284 Acres**[2] *C-53/Stands 18 and 21* *C-54/Stands 3, 10 and 15* *C-72/Stands 2 and 6*
SHORTLEAF PINE SEED TREE REMOVAL	**172 Acres** *C-53/Stand 21* *C-54/Stand 15* *C-72/Stands 2 and 6*
SHORTLEAF PINE COMMERCIAL THINNING	**2,114 Acres** *Thin 1,427 acres to 50 BA* *C-53/Stands 1,2,3,4,5,7,8,9,10,15,19,22,26,27* *C-54/Stands 6,11,12,13,14* *Thin 687 acres to 60 BA* *C-42/Stands 5,7,9* *C-53/Stands 8,11,12,13,20* *C-54/Stands 12,14,16,24,32* *C-71/Stands 1,2,3,4*
SHORTLEAF PINE AND HARDWOOD COMMERCIAL THINNING	**1,349 Acres** *Thin 273 acres to 50 BA* *C-47/Stands 14, 15, 16* *C-72/Stands 16 & 17* *Thin 842 acres to 60 BA* *C-47/Stands 1,3,9,10,12,13,22,23,27* *C-72/Stands 1,3,4,5,7,10,12,13,14,15,17,23* *Thin 234 acres to 70 BA* *C-47/Stands 2,4,7,8,21,24* *C-72/Stand 9*

[1] All acres and miles are approximations.
[2] The 284 acres encompasses 172 acres of Shelterwood stands and 112 acres of existing shortleaf pine seedling/sapling stands.
[3] Proposed for prescribed burning on a 3 to 7-year rotation in both dormant and growing seasons.
[4] These stands might receive a site preparation burn after a Shelterwood harvest and would thus be included in subsequent burn rotations.
[5] Proposed for two maintenance/restoration treatments on a 2-year interval.
[6] Would remain open with erosion control measures in place.

Table 2. Summary of Alternative 1 Actions, continued[1]

PRE-COMMERCIAL THINNING (PCT) Existing shortleaf pine seedling/sapling and poletimber stands	**192 Acres** *C-47/Stand 5, 8 and 24* *C-54/Stand 7* *C-72/Stand 23*
CEDAR THINNING	**7,484 Acres (Up to 450 acres per year)** *Compartments 42, 47, 53, 54, 71, and 72*
SALVAGE/SANITATION THINNING	**7,484 Acres** *Compartments 42, 47, 53, 54, 71, and 72*
NON-NATIVE INVASIVE SPECIES TREATMENT Handtools/Chemical	**Up to 700 Acres Per Year** *Compartments 42, 47, 53, 54, 71, and 72*
WILDLIFE HABITAT IMPROVEMENT/ FUELS REDUCTION PRESCRIBED BURNING[3]	**7,484 Acres** *C-42/Stands 1, 2, 3, 5, 7, 8, 10, 11, 12, 14, 16 and 17* *C-47/Stands 2, 10, 11 and 20* *C-53/Stands 2, 7, 9, 12, 13, 16, 19, 21[4], 24, 25 and 26* *C-54/Stands 3, 9, 11, 13, 14, 15[4], 19 and 27* *C-71/Stands 3, 4, 5, 6 and 7* *C-72/Stands 2[4], 6[4], 8, 18 and 24*
NEW FIRELINE CONSTRUCTION AND MAINTENANCE	**Up To 21.6 Miles** *C-42/Stands 1, 6, 7, 8, 10, 11, 12, 14, 16* *C-47/Stands 14, 15, 18, 19, 20* *C-53/Stands 7, 12, 13, 14, 15, 25, 26* *C-54/Stands 1, 2, 4, 5, 7, 9, 10, 19, 21, 22, 24, 26, 27* *C-71/Stands 1, 2, 5, 7* *C-72/Stands 6, 8, 9, 10, 11, 14, 15, 16, 17, 20, 22*
EXISTING FIRELINE RECONSTRUCTION AND MAINTENANCE	**5.1 Miles** *C-53/Stands 1, 3, 4, 5, 6, 7, 8, 15, 18, 19, 21, 27* *C-54/Stands 6, 13*
WILDLIFE STAND IMPROVEMENT/ RIPARIAN STAND IMPROVEMENT	**148 Acres** C-53/Stand 6, 24 & 25
LINEAR FOOD PLOTS	**10 Acres** *Closed section of FDR 96053B*
WILDLIFE OPENING CONSTRUCTION	**3 Openings** *C-47/Stand 2* *C-53/Stand 25* *C-71/Stand 4*

[1] Acres and miles are approximations.
[2] The 284 acres encompasses 172 acres of Shelterwood stands and 112 acres of existing shortleaf pine seedling/sapling stands.
[3] Proposed for prescribed burning on a 3 to 7-year rotation in both dormant and growing seasons.
[4] These stands might receive a site preparation burn after a Shelterwood harvest and would thus be included in subsequent burn rotations.
[5] Proposed for two maintenance/restoration treatments on a 2-year interval.
[6] Would remain open with erosion control measures in place.

Table 2. Summary of Alternative 1 Actions, continued[1]

WILDLIFE OPENING MAINTENANCE/ RESTORATION	**16 Openings** *C-42/Stands 2 & 5* *C-47/Stands 2, 4, 18 and 22* *C-53/Stands 4, 8 and 25* *C-54/Stands 5 and 12* *C-71/Stand 4* *C-72/Stands 6, 13 and 14*
CONTRUCT WILDLIFE POND	**1 Pond – Up to 1 acre** C-53/Stand 7
STREAM HABITAT IMPROVEMENT	**16 Miles** *C-42/Stands 1, 2, 3, 5, 7, 8, 10, 11, 12, 14, 16 and 17* *C-47/Stands 2, 10, 11, 19 and 20* *C-53/Stands 2, 7, 9, 12, 13, 16, 19, 24, 25 and 26* *C-54/Stands 3, 9, 11, 13, 14, 15, 19 and 27* *C-71/Stands 3, 4, 5, 6 and 7* *C-72/Stands 2, 8, 18 and 24*
AQUATIC ORGANISM PASSAGE CONSTRUCTION	**8 Passages** *C-42/Stands 3, 5, and 7* *C-47/Stand 1* *C-54/Stands 3, 9, and 19* *C-71/Stand 7*
TEMPORARY ROAD CONSTRUCTION	**10.1 Miles**
ROAD RECONSTRUCTION	**8 Miles** *Portions of FDR 1605, 1609, 1609B, 1676, & 96053B*
ROAD DECOMMISSIONING	**2 Miles** *Portions of FDR 1609E, 1609F, 96053D, 96054C, 96072D, 96072E*
ROAD MAINTENANCE	**As needed**
OHV TRAIL ADDITION	**3.6 Miles** *FDR 1675 – 1.75 miles* *FDR 96053B - 0.65 miles* *FDR 1609B - 0.25 miles* *Old Road Template – 0.95 miles*
DEVELOP BORROW PIT	**Up to 5 acres**[6]

[1] Acres and miles are approximations.
[2] The 284 acres encompasses 172 acres of Shelterwood stands and 112 acres of existing shortleaf pine seedling/sapling stands.
[3] Proposed for prescribed burning on a 3 to 7-year rotation in both dormant and growing seasons.
[4] These stands might receive a site preparation burn after a Shelterwood harvest and would thus be included in subsequent burn rotations.
[5] Proposed for two maintenance/restoration treatments on a 2-year interval.
[6] Would remain open with erosion control measures in place.

Map A

Calico Rock Project
Vegetation Treatments

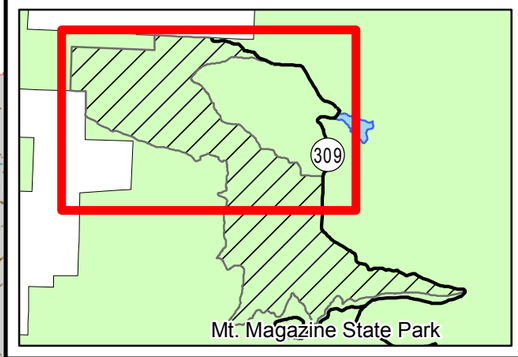
Ozark-St. Francis National Forest

Mt. Magazine Ranger District

- Hiking Trail
- Roads
- Compartments
- Stands
- Project Boundary
- PVT
- District Boundary
- Commercial Thin
- Shelterwood
- PCT
- Removal
- Release
- Site Prep
- Cedar/Salvage Thin

0 0.25 0.5 0.75 1 Kilometers

0 0.25 0.5 0.75 1 Miles



Map B

Calico Rock Project
Vegetation Treatments

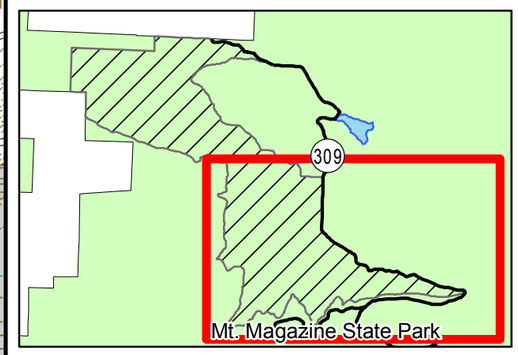
Ozark-St. Francis National Forest

Mt. Magazine Ranger District

- Hiking Trail
- Roads
- Compartments
- Stands
- Project Boundary
- PVT
- District Boundary
- Commercial Thin
- Shelterwood
- PCT
- Removal
- Release
- Site Prep
- Cedar/Salvage Thin

0 0.25 0.5 0.75 1 Kilometers

0 0.25 0.5 0.75 1 Miles



Mt. Magazine State Park

Map A

Calico Rock Project
Wildlife Treatments

Ozark-St. Francis National Forest

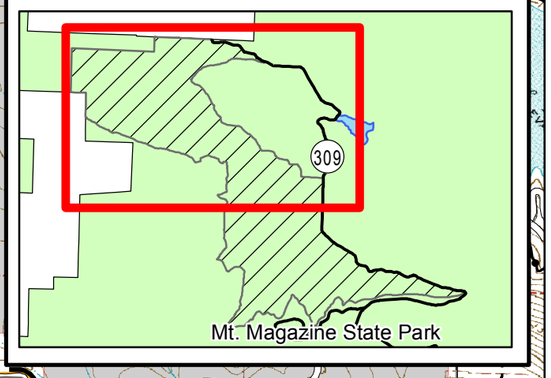
Mt. Magazine Ranger District

- Construct Pond
- Pond
- Maintain WLO*
- Construct WLO*
- Proposed Gate
- Existing Closure
- AOP**
- LWD***
- Rx Burn
- Hiking Trail
- Roads
- Linear Plots
- Compartments
- Stands
- Project Boundary
- WSI/RSI****
- District Boundary
- PVT
- Existing Fire Line
- Proposed Fire Line

*Wildlife Opening
**Aquatic Organism Passage
***Large Woody Debris
****Wildlife Stand Improvement/ Riparian Stand Improvement

0 0.25 0.5 0.75 1 Kilometers

0 0.25 0.5 0.75 1 Miles



Map B

Calico Rock Project
Wildlife Treatments

Ozark-St. Francis National Forest

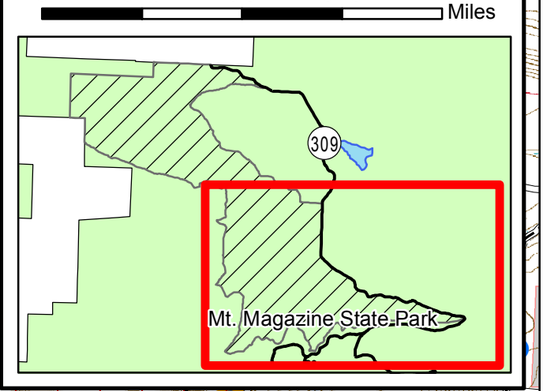
Mt. Magazine Ranger District

- Construct Pond
- Pond
- Maintain WLO*
- Construct WLO*
- Proposed Gate
- Existing Closure
- AOP**
- LWD***
- Rx Burn
- Hiking Trail
- Roads
- Linear Plots
- Compartments
- Stands
- Project Boundary
- WSI/RSI****
- District Boundary
- PVT
- Existing Fire Line
- Proposed Fire Line

*Wildlife Opening
**Aquatic Organism Passage
***Large Woody Debris
****Wildlife Stand Improvement/ Riparian Stand Improvement

0 0.25 0.5 0.75 1 Kilometers

0 0.25 0.5 0.75 1 Miles



Map A

Calico Rock Project
Road/Rec. Treatments

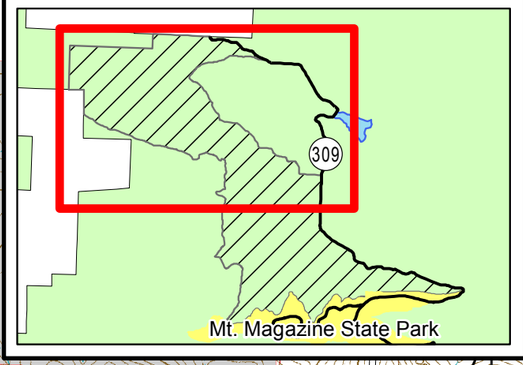
Ozark-St. Francis National Forest
Mt. Magazine Ranger District

- AOP*
- ShalePit
- Width Restrictors
- Realignment
- Reconstruction
- Close
- Decomission
- Hiking Trail
- Existing Closed
- Roads
- Proposed OHV
- OHV Route
- Project Boundary
- District Boundary
- PVT

*Aquatic Organism Passage

0 0.25 0.5 0.75 1 Kilometers

0 0.25 0.5 0.75 1 Miles



Map B

Calico Rock Project
Road/Rec. Treatments

Ozark-St. Francis National Forest

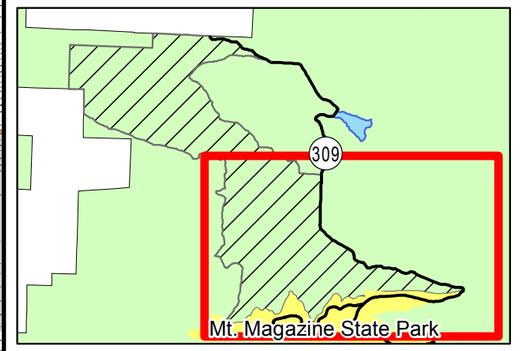
Mt. Magazine Ranger District

- AOP*
- ShalePit
- Width Restrictors
- Reconstruction
- Close
- Decomission
- Hiking Trail
- Existing Closed
- Roads
- Proposed OHV
- OHV Route
- Project Boundary
- District Boundary
- PVT

*Aquatic Organism Passage

0 0.25 0.5 0.75 1 Kilometers

0 0.25 0.5 0.75 1 Miles



B. DESCRIPTION OF ALTERNATIVE 2 (NO ACTION ALTERNATIVE)

This alternative would not implement any part of the Proposed Action. Only ongoing Forest Service permitted and approved activities would continue.

C. MITIGATION MEASURES

For each alternative, all applicable standards in the Ozark-St. Francis National Forests RLRMP would be applied. The following standards and guidelines are incorporated by reference in this EA:

RLRMP -- pages 3-1 to 3-21 (Forest-Wide Standards), page 3-27 (MA 1.G – Special Interest Areas), page 3-27 (MA 1.H – Scenic Byway Corridors), page 3-31 (MA 2.B – State Parks), page 3-35 (MA Pine Woodland) page 3-35 (Mixed Forest) and page 3-37 (MA 3.I – Riparian Corridors) (USDA FS, 2005c).

Best Management Practices (BMP) Guidelines for Water Quality Protection (Arkansas Forestry Commission, 2002) and selected Region 8 Timber Sale AT, BT, and CT Clauses would also apply as standard mitigation measures for all Proposed Actions.

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

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

1) Logging slash would be placed above the ordinary high water mark of any stream (Arkansas Forestry Commission BMP).

2) Concurrent with temporary road construction, install silt barriers at the base of the cut and fill slopes within 50 feet of a stream course (RLRMP, p. 3-11).

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

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

5) Stream crossings that will be utilized on a regular basis would be improved with oversized rock to help prevent rutting in the channels.

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

7) Soil disturbances within streamside management zones (SMZs) would be treated with erosion control measures within 5 days (RLRMP, p. 3-11).

8) Streamside management zones (SMZs) would be identified and designated during the appropriate stages of project planning for all defined channels, perennial streams, and springs. Minimum SMZs would be as described below based on the percent of the adjacent slope (RLRMP, p. 3-12):

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

- Vegetation within 20 feet of the bank of a perennial stream and 5 feet of a defined channel would not be removed.
- Retain at least 50 square feet per acre of basal area within the SMZs when available.
- No mechanical site preparation is allowed within the SMZs.

- Within SMZs, only non-motorized trails are allowed. Motorized trails are prohibited except at designated crossings or where the trail location requires some encroachment for safety.
- No more than 5% of the mineral soil within the SMZs would be exposed during ground disturbing activities.
- Exceptions to SMZ standards are only allowed after site-specific determinations and with consultation/approval by the appropriate Staff Officer (RLRMP, p. 3-12).

9) On all soils dedicated to growing vegetation, the organic layers, topsoil, and root mat would be left intact over at least 85% of an activity area (RLRMP, p. 3-12).

10) Removal of natural debris from streams would only be allowed where it poses a significant risk to public safety or threatens private property or Forest Service infrastructure (RLRMP, p. 3-12).

11) Within the SMZs, cross only at designated crossings identified during planned activities. Cross at a 90-degree angle and utilize temporary structures to maintain bank stability (RLRMP, p. 3-13).

12) When temporary culverts or other approved structures are used, they must be removed upon completion of the activity. Streamside management zones disturbances would be restored to a stable, natural condition (RLRMP, p. 3-13).

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

14) Logging and roadwork would be restricted during wet soil conditions to minimize resource damage (Arkansas Forestry Commission BMP).

15) Protect the visual resource by stand shaping and irregular boundaries in the proposed shelterwood stands as needed to achieve the visual quality objective. Take advantage of any opportunities to leave groups of hardwoods in pine regeneration areas (USDA FS, 2008).

16) Heritage sites that are determined eligible for the National Register and sites that have undetermined eligibility would be protected from any ground-disturbing activities associated with this project. Buffers would be painted around these sites, and heavy machinery would not be allowed within these boundaries. If additional sites are found during implementation of this project, they would be examined and necessary mitigation measures prescribed by the Forest or District Archaeologist, in consultation with the Arkansas SHPO and relevant federally recognized Tribes, would be implemented.

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

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

    Timber harvest activities would leave, on average, a minimum of 6 roost trees, snags, or potential roost trees per acre as per the 1998 U.S. Fish and Wildlife Service Biological Opinion for the Indiana Bat (USDI FWS, 1998).

    Maintain the following average standing dead, existing, and potential hollow den and loose bark trees per acre forest wide:

    2 snags per acre greater than 12” dbh; plus
    4 snags per acre
    Total 6 snags per acre

    Snags would be left from the largest size classes and may be clumped (RLRMP, p. 3-6).

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

18) Mast producing trees 8.0" diameter or larger at 4.5' height above ground level would not be treated during site preparation unless otherwise approved by a wildlife biologist or technician.

19) Exclude herbicide application from designated hardwood key areas.

    The following trees, shrubs, and plants - regardless of size and of treatment method - would not be treated during site preparation or release: black cherry, dogwood, French mulberry, persimmon, serviceberry, plum, and Ozark chinquapin.

20) During site preparation and release, treatments with hand tools and/or herbicide would not be done within 100 feet of private land (RLRMP, p. 3-5).

21) Herbicides and application methods are chosen to minimize risk to human and wildlife health and the environment. Diesel oil would not be used as a carrier for herbicides, except as it may be a component of a formulated product when purchased from the manufacturer. Vegetable oils would be used as a carrier for herbicides when available and compatible with the application proposed (RLRMP, p. 3-4).

22) Herbicides are applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human and wildlife health. Application rate and work time must not exceed levels that pose an unacceptable level of risk to human or wildlife health. If the rate or exposure time being evaluated causes the Margin of Safety or the Hazard Quotient (HQ) computed for a proposed treatment to fail to achieve the current Forest Service Region 8 standard for acceptability (acceptability requires a MOS > 100 or, using the Syracuse Environmental Research Associates (SERA) Risk Assessments found on the Forest Service website, a HQ of < 1.0), additional risk management must be undertaken to reduce unacceptable risks to acceptable levels or an alternative method of treatment must be used (RLRMP, p. 3-4).

23) Fuelwood sales would not be made for a minimum of 30 days after treatment in areas where pesticide treatments have been made. Should injection of trees be done, effected trees would not be sold as fuelwood (RLRMP, p. 3-4).

24) Weather is monitored and the project is suspended if temperature, humidity, and/or wind are in excess of the criteria shown below (RLRMP, p. 3-4).

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

25) Each COR, who must ensure compliance on contracted herbicide projects, is a certified pesticide applicator (RLRMP, p. 3-5).

26) A certified pesticide applicator supervises each Forest Service application crew and trains crew members in personal safety, proper handling and application of herbicides, and proper disposal of empty containers (RLRMP, p. 3-5).

27) With the exception of treatment by permittees of right-of-way corridors that are continuous into or out of private lands and through Forest Service managed areas, no herbicide is broadcast within 100 feet of private land or 300 feet of a private residence unless the landowner agrees to closer treatment. Buffers are clearly marked before treatment so applicators can easily see and avoid them (RLRMP, p. 3-5).

28) Application equipment, empty herbicide containers, clothes worn during treatment, and skin are not cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate labeled containers. (RLRMP, p. 3-5).

29) Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas (RLRMP, p. 3-5).

30) Herbicide would not be used within the appropriate SMZs or within 300 feet of any public or domestic

water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas (RLRMP, p. 3-5).

31) The risk of herbicide spills would be reduced by securing containers during transport, carrying only enough for a day's work, mixing and cleaning on the work site, proper disposal of containers and preparation of an emergency spill plan (USDA FS, 1981). This spill plan is part of the process file.

32) Edible berries would not be treated with herbicide.

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

34) Best available smoke management practices (FSM 5140, Arkansas Smoke Management Guidelines, and State Implementation Plans) would be used to minimize the adverse effects of prescribed burning on public health and safety and to protect visibility in Class I Area (Upper Buffalo Wilderness) (RLRMP, p. 3-13).

35) Prescribed burning would be conducted in, or adjacent to, counties with forecasted high Air Quality Index (AQI) values (AQI equals orange or higher) only if meteorological conditions indicate that smoke would be carried away from the high AQI area (RLRMP, p. 3-13).

36) Conduct all National Forest management activities in a manner that does not result in (1) a significant contribution to a violation of National Ambient Air Quality Standards or (2) a violation of applicable provisions in the State Implementation Plan (RLRMP, p. 3-13).

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

38) In any prescribed burning, the duff layer would remain present on 80% of the burn area (RLRMP, p. 3-20).

39) Appropriate erosion control strategies would be applied to firelines in order to minimize soil erosion (RLRMP, p. 3-20).

40) If necessary to cross a stream with a fireline, the crossings would be as close to right angles as possible and be stabilized as soon after the fire is controlled as possible (RLRMP, p. 3-20).

41) Historic Properties (HP)1: Site Avoidance During Project Implementation

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

42) HP2: Site Protection During Prescribed Burns

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

(2) Burn Unit Interior: Combustible elements at historic properties in burn unit interiors will be protected

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

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

43) HP3: Other Protection Measures

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

(1) In consultation with the Arkansas SHPO, the site(s) will be evaluated against National Register of Historic Places (NRHP) significance criteria (36 CFR 60.4) to determine eligibility for the NRHP. The evaluation may require subsurface site testing;

(2) In consultation with the Arkansas SHPO, relevant federally-recognized Tribes, and if required with the Advisory Council on Historic Preservation (ACHP), mitigation measures will be developed to minimize the adverse effects on the site, so that a finding of No Adverse Effect results;

(3) The agreed-upon mitigation measures will be implemented prior to initiation of activities having the potential to affect the site.

44) HP4: Discovery of Cultural Resources during Project Implementation

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

Monitoring

Implementation monitoring would be accomplished through harvest and contract inspections conducted by certified timber sale administrators and contract inspectors. This would ensure the appropriate standards and guidelines would be implemented to protect soil productivity, water quality and other resources.

For Alternative 1, surveillance monitoring to ensure that herbicide label instructions are being followed would be conducted as part of contract administration. To monitor the offsite movement of herbicides, water samples would be collected and analyzed on 10% of the district's project per year in accordance with the Ozark-St. Francis National Forests' Herbicide Monitoring Plan for Water Quality.

Survival monitoring would be done to determine success of reforestation efforts in regeneration areas.

Monitoring of prescribed burns would be done in accordance to prescribed burning plans. Results of the burns would be monitored and documented.

Those areas that are proposed to have timber harvest and/or prescribed burning would have an additional post-treatment walkover for heritage resource examination. Post treatment walkover would be conducted according to the direct gradient method that has been found highly successful in site discovery (Collins and Bousman 1993, Lockhart *et al.*, 1995). Landforms that appear to have intact soils and high potential for human use or occupation (e.g. benches, river flats and slopes and floodplain terraces) would be given special attention in an effort to maximize the potential of finding as many sites as possible.

D. COMPARISON OF ALTERNATIVES

This section provides a summary of the effects of implementing each alternative. Information in Table 3 on page 34 is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively among alternatives.

Table 3. Comparison of Effects Summary Matrix

ACTION	ALTERNATIVE 1[1]	ALTERNATIVE 2[1]
SOIL AND WATER EFFECTS		
Disturbance Acres (skid trails, temporary road construction, road reconstruction, fireline construction)	696 acres	----
% of Total Activity Area	9%	----
Upper Short Mountain Creek Watershed[2] Concern Level	Moderate	Moderate
ECONOMICS		
Present Value Revenues	$1,303,266	$ 0
Present Value Costs	$ 955,289	----
Net Present Value	$ 347,976	$ 0
Benefit/Cost Ratio	1.36	----

[1] All measures are approximations.

[2] Based on worst-case scenario: all management activities would occur within the same year. This is highly unlikely to occur.

III. 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.

A. SOILS

Existing Condition

The analysis area (Compartments 42, 47, 53, 54, 71 and 72) for soils consists mostly of broad gently sloping ridgetops separated by sloping to moderately steep side slopes and narrow stream valleys. Soils are stable throughout the project area. About 42% of the project area is on slopes less than 8%; 25% is on slopes between 8% and 20%; and 33% is steeper than 20%. Stands 3 and 5 in Compartment 72 were harvested in 1977 and 1978. These stands sustained severe compaction in the surface soil (1 to 9 inches) due to harvest and site preparation. Drought and compaction contributed to the death of the pine seedlings and the stands were chisel plowed to break up compaction and replanted in 1983. Transects were done through the previously harvested stands to determine the current condition of the soil. Soil has recovered from the disturbance by the harvests and site preparation conducted in 1977 and 1978. Soils are covered by litter and duff, surface stones, understory forbs, vines, understory shrubs, midstory pines and hardwoods, and over story shortleaf pines. Soils have good structure and surface soils are friable. Soils are mostly well drained and range from shallow to deep. There are some deep well drained soils on the floodplains and terraces along Short Mountain Creek and Gutter Rock Creek, which have small inclusions of poorly drained hydric soils in depressions. There are some moderately well drained soils on the floodplains along Calico Creek and the tributaries of Cove Creek, which have small inclusions of poorly drained hydric soils in depressions. Appendix A, page 99, contains a map showing the soil types for these compartments.

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

Effects

Alternative 1 (Proposed Action)

Approximately 9% (662 acres) of the harvested area would sustain a temporary reduction in soil productivity due to harvesting operations. An additional 17 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 4 acres due to road construction, reconstruction and realignment because soil would be taken out of production permanently and dedicated to use as a road. A borrow pit would be developed in the project area to provide material for road construction and reconstruction (up to 5 acres of soil is expected to be permanently taken out of production). Soil productivity would be lost on approximately 0.5 acre due to OHV trail construction because soil would be taken out of production permanently and dedicated to use as an OHV trail. Roads, streams, and areas cleared of leaves and other fuels using leaf blowers would be used as firelines in most cases. If bladed or plowed firelines are necessary, approximately 21 acres of the project area would sustain a temporary reduction in soil productivity due to fireline construction. Approximately 3 acres of soil would be returned to productivity when 2 miles of roads are decommissioned.

Total expected temporary reduction of soil productivity would be 709 acres (9% of the activity area), including skidding, temporary road construction, and fireline construction. Decommissioning roads and trails would reduce the temporary reduction of soil productivity to 706 acres. 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. Approximately 9 acres of soil would be permanently taken out of production due to realignment and widening during road reconstruction and borrow pit development. However, road reconstruction would stabilize these roads and prevent loss of productivity on soils adjacent to these roads and would reduce erosion and sedimentation. Road maintenance would also prevent the loss of productivity on soils adjacent to the roads by helping to control runoff. Less than 15% of an activity area could

sustain a reduction in soil productivity, according to the RLRMP standard (FW85 RLRMP p. 3-12). If more than 15% of the activity area sustains a reduction in soil productivity, mitigation measures must be installed to reduce the temporary loss in soil productivity below 15%. The documentation for temporary reduction in soil productivity can be found in the analysis file.

Wildlife opening and linear food plot construction/restoration would cause some soil disturbance and a temporary increase in erosion. Disking, seeding, and fertilizing would lead to the establishment of vegetation and thus quickly reduce the effects on soil productivity and erosion.

Placement of large woody material in streams could cause a slight increase in erosion at points along the streams where trees are felled into the stream, but these areas would revegetate quickly and erosion would decline to natural levels.

Wildlife stand improvement and riparian stand improvement thinning would have little effect on the soils because trees would be cut and left on site.

Site prep, release, and precommercial thinning would have little effect on soils because hand tools would be used. Treatment of invasive species with hand tools and chemicals is also expected to have little or no effect on soils. Burning was included in the effects.

The following is a summary of the effects of the use of proposed herbicides on soils.

Triclopyr is absorbed by plant roots, but it is not considered effective as a soil-applied herbicide. Triclopyr is adsorbed primarily by organic matter particles in soil. The organic matter content is the primary factor in the degree of soil adsorption. Long-term forest and pasture field studies found very little indication that triclopyr would leach substantially either horizontally or vertically in loamy soils (USDA FS 1996). Microorganisms degrade triclopyr readily. It degrades more rapidly under warm, moist conditions which favor microbial activity. Average soil half-lifes for triclopyr formulations are 0.2 days for triclopyr butoxyethyl ester (BEE), 14 days for triclopyr acid, and 69 days for 3,5,6-tricloro-2-pyridinol (TCP) one of the major metabolites of triclopyr. Several diverse studies are available on the toxicity of triclopyr to terrestrial microorganisms. None of these studies suggests that triclopyr is likely to have an effect on soil organisms. There is little indication that concentrations of triclopyr in soil are likely to adversely affect soil invertebrates. There are numerous field studies suggesting that effects on terrestrial invertebrates are most likely to be associated with changes in habitat and food availability rather than direct toxic effects from triclopyr (SERA 2011d). The warm temperatures at the time of application and the high density of plant roots are expected to rapidly degrade triclopyr.

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

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

Glyphosate is readily absorbed by foliage. It had practically no leaching characteristics because it binds tightly to the soil. Soil binding of glyphosate is directly proportional to the organic carbon in the soil. In soil, it is highly susceptible to degradation by microorganisms, being converted to natural products such as carbon dioxide and water. Many species of soil microorganisms can use glyphosate as their sole carbon source. Microorganisms like higher plants, use the shikimate pathway to produce aromatic amino acids. Since glyphosate inhibits this pathway, it is potentially toxic to microorganisms. Nonetheless, there is very little information suggesting that glyphosate would be harmful to soil microorganisms under field conditions and a substantial body of information indicates that glyphosate is likely to enhance or have no effect on soil microorganisms (SERA 2011a). Persistence in soils is about 2 months or less.

Picloram is extremely soluble in water. Hexachlorobenzene, a contaminant in technical grade picloram, is much less soluble in water. Hexachlorobenzene is highly persistent in soil with metabolic half-lives of about 3

to 6 years. Conversely, hexachlorobenzene is relatively volatile and is expected to dissipate rapidly from soil surfaces (SERA 2011c). However, piclorma wil only be applied as Tordon K which does not contain hexachlorobenzene. Studies on soil microorganisms suggest that both picloram and picloram metabolites may impact soil microorganisms. Although picloram could have an effect on soil microorganisms, the consequences of such effects are not clear. No field studies linking adverse effects on soil microorganisms with detectable adverse impacts on soil productivity have been encountered (SERA 2011c). Picloram chemically attaches to clay particles and organic matter. Breakdown caused by sunlight and microorganisms in the soil are the main ways in which picloram degrades in the environment. Picloram will dissipate more quickly in warm, wet weather. Alkaline conditions, fine textured clay soils, and a low density of plant roots can increase the persitence of picloram. Carbon dioxide is the major end product of the breakdown of picloram in the soil. The half life of picloram in soil is reported to vary from 1 month under favorable conditions to more than 4 years in arid regions (USDA FS 2000). At high application rates, picloram may inhibit microbial activity (Krzyszowska et. al. 1994 cited in USDA FS 2000). At a level of 10 ppm in sandy loam soil, picloram caused a transient decrease in nitrification after 2 but not 3 weeks of incubation and no effect on ammonia formation or sulfur oxidation (Tu 1994 cited in USDA FS 2000). The decrease in nitrification was relatively mild and does not portend a substantial or prolonged impact on microbial activity. Bacteria and fungi can utilize picloram as a single source of carbon and nitrogen. It increases the number of ammonifying bacteria (Spiridonov, Smokhalov, and Rudakov 1981 cited in Brown *et al.* 1990). The warm weather at the time of application, the high density of plant roots, and the acidic soil conditions are expected to rapidly breakdown the picloram.

Nutrient Cycling

Pine needles have the highest concentration of all nutrients compared to other parts of the tree (Rolfe *et al.* 1976; Jorgensen and Wells 1986). Overall, an average of about 31% of the total nutrients was found in the needle component, 28% in the branches and 42% in the bole of loblolly and shortleaf pines (Rolfe *et al.* 1976). Stump soil, the soil that is directly under tree stumps, makes up approximately 1.2% of the total soil volume, but contains 10% and 4% of the total soil carbon and nitrogen (Sucre and Fox 2009). Stem-only removal for wildfire risk reduction and bio-energy production would have little effect on total soil C and N pools (Jurgensen *et al.* 2011). Only the bole of the trees would be removed in the proposed harvests, so about 42% of the nutrients in the harvested trees would be removed from the harvest areas. The nutrients in the needles, branches, stumps, and roots would be left on the harvested areas.

In a review of the effects of shortleaf pine-hardwood forest management on soils in the Ouachita Highlands, Liechty and others (2002) concluded that forest management can alter soil nutrient status and organic matter contents. However, these changes probably would not reduce soil productivity; at least over short time periods (3-8 yr.). They recommended emphasizing research that will elucidate how, if, and to what degree forest management practices alter important soil/ecosystem processes such as decomposition, nutrient cycling, and nutrient uptake. Soil organic matter plays a key role in nutrient cycling, cation exchange, and water retention in soils. When organic matter is combusted, the stored nutrients are either volatilized or changed into highly available forms that can be readily taken up by microbial organisms and vegetation (Knoepp *et al.*, 2005). The magnitude of nutrient losses during burning is positively and linearly correlated with fuel consumption ((Hough, 1981; Raison *et al.*, 1985; Schoch and Binkley, 1986) cited in Carter and Foster, 2004)). Liechty and others (2004) concluded that shortleaf pine-bluestem restoration, which includes harvesting, midstory reductions, and prescribed fire, can alter nutrient availability within surface soils. They found that pH, Ca, total N, C, and C:N ratios were increased by approximately 20 years of restoration activities.

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

The RLRMP objectives and standards serve to protect soil productivity and nutrient pools and cycling processes. Specific standards include FW85 which requires that organic layers, topsoil, and the root may be left intact on 85% or more of activity areas, FW81 which requires that 50 square feet per acre of basal area be left in stream side management zones, FW33 which requires that 6 snags per acre be left for wildlife habitat (indirectly benefits soil productivity and nutrient pools), and FW18 which requires that mature forest cover be maintained 100 foot distance from the top and 200 foot distance from the bottom of bluffs.

Cumulative Effects

Cumulative effects include the combination of direct and indirect effects from past, present, and reasonably foreseeable activities. Direct, indirect, and cumulative effects on soils are measured within each activity area.

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

Seed tree removal harvest is proposed for the 651 acres of shelterwood harvest. Approximately 59 acres of soil in these units is expected to sustain a temporary loss in soil productivity due to the initial shelterwood preparation harvest. An additional 26 acres of soil is estimated to sustain a temporary loss in soil productivity due to the removal of the seedtrees in the future. The potential existing and estimated additional temporary loss in soil productivity equals 85 acres which is 13% of the shelterwood harvest and seed tree removal area. The actual amount of the temporary loss of soil productivity is expected to be less because the same skid trails that were used in the initial harvest would be used and erosion control measures would speed the recovery of the soil during the interval between the first and second harvest.

Commercial thinning of 2,352 acres is proposed in pine-hardwood stands which might have cedar thinning and salvage/sanitation harvests in the future. Approximately 282 acres of soil in these units would be expected to sustain a temporary loss in soil productivity due to the initial thinning harvest. An additional 141 acres of soil is estimated to sustain a temporary loss in soil productivity due to cedar and salvage/sanitation thinning in the future. The potential existing and estimated additional temporary loss in soil productivity equals 423 acres which is 18% of the commercial thinning and cedar salvage/sanitation thinning harvest area. Soil disturbance would have to be reduced below 15% of the commercially thinned and cedar salvage/sanitation thinned harvested area to comply with the RLRMP standard of maintaining the soil organic layers, topsoil, and root mat on at least 85% of an activity area. The cumulative soil disturbance effects are expected to be less than 18% of the activity area because the skid trails used to commercially thin the stands would also be used to conduct cedar salvage/sanitation thinning and erosion control measures would speed the recovery of the soil during the interval between the first and second harvest and after the second harvest.

Alternative 2 (No Action)

Road reconstruction, realignment and maintenance would not occur and roads would continue to erode. Road decommissioning would not occur and the soils in and adjacent to these roads would not be returned to productivity. Existing soil processes would continue.

B. WATER QUALITY

Existing Condition

Watersheds in the United States are divided into progressively smaller units known as hydrologic units and recognized by the U.S. 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 Arkansas sub-region (1111), the Lower Arkansas- Fourche La Fave basin (111102), and the Dardanelle Reservoir sub-basin unit (11110202) (Seaber *et al.*, 1987). The Ozark-St. Francis National Forests further classify land areas into two progressively smaller units: watersheds and sub-watersheds. The proposed project falls into the Six Mile Creek (1111020201) watershed. At the smallest scale, the proposed project is located within the Upper Short Mountain Creek (111102020106) sub-watershed. This sub-basin or 6th level hydrologic unit code (HUC) area will serve as the analysis area for the proposed project with respect to water resources. This sub-watershed contains a total of 29,358 acres, of which 17,184 acres are National Forest. The project area encompasses 7,484 acres, almost all of which occurs within this analysis area.

Before the USGS completed designation of the 6th level HUCs, the Ozark-St. Francis National Forests utilized boundary and name information compiled by the Forest; these occasionally differ from the current dataset. The analysis area used for the water resource effects section of this document is defined by these earlier, forest-derived boundaries.

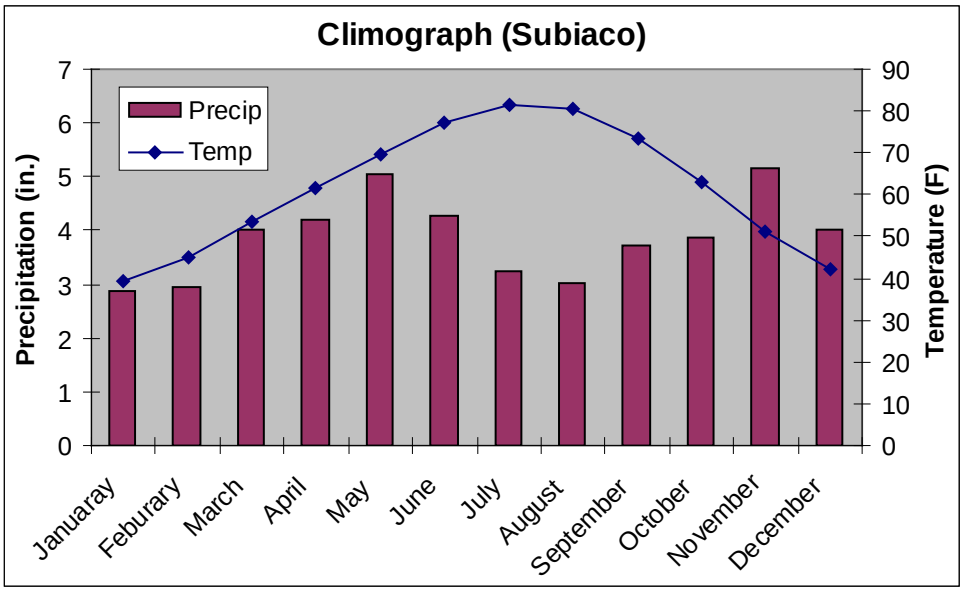
The project area and the sub-basin analysis area support streams and rivers that have a dendritic drainage pattern. Dendritic drainage patterns are typically small tributaries feeding into progressively larger streams, which can result in rapid storm responses. There are over 70 miles of streams in the analysis area sub-watershed. The proposed project area is immediately associated with 17.9 miles of streams. The primary

streams within the project area are Calico Creek, Cove Creek and Gutter Rock Creek. These streams flow into Short Mountain Creek, which is a tributary to Paris Reservoir approximately 3 miles downstream of the National Forest boundary.

The project area geology consists of Pennsylvanian age clastic sedimentary rocks of the Atoka, Hartshorne and McAlester formations (McFarland, 2004). These are primarily sandstones and shales that are not particularly good aquifers. Therefore, the base flow contributions necessary to maintain perennial streams are highly variable and associated with seasonal climatic variation. This is further documented by Hines' (1975) low-flow determination of nearby Spring and Chickalah Creeks indicating base flows (exceeded 90% of time) of 0.1 and 0.0 cubic feet per second, respectively.

Climate information obtained for the project area was derived from information for the town of Subiaco, AR (USDA NRCS, 2005). Mid-winter and late summer are found to be the driest portions of the year. This, combined with the high temperatures indicated for July and August, suggests that stream flow would most likely be the lowest during the late summer (Figure 1).

Figure 1. Climate Information for Water Resource Analysis



Within the 6th level watershed analysis area, only approximately 58% of the land is administered by the Forest Service. This leaves a sizable proportion of the land within the watersheds as privately owned. Approximately 87% of the analysis area is forested. The balance of the watershed land uses are mainly pastures.

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 National Forests, 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).

Within the analysis area, roads are found both within and outside the forest boundaries. There are approximately 102 miles of roads on the forest within the analysis area. Within the project area, there are approximately 10 stream crossings where the current road system crosses or intersects a stream.

There are approximately 15 gas well pads within the project area and 56 within the analysis area. Each well pad is approximately 2-4 acres in size. Activity on these well pads may vary from active drilling to production to abandoned and rehabilitated.

There are some small inclusions of wetlands in the Spadra Fine Sandy Loam soil map unit that are found in small depressions. This identification was made by comparing the project area to numerous data sources of

wetland location information; including, National Wetland Inventory database; FEMA flood maps; STATSGO soil use database; the USGS wetlands, swamps, and marsh digital line graphs (DLG) coverage; and detailed forest level soil survey information.

Floodplains were identified on the forest in the vicinity of the project area by comparing the project area with information from the STATSGO soil database and the detailed forest level soil survey. These areas were mainly found to occur where Spadra Fine Sandy Loam soils were present along the banks of Calico Creek and its tributaries, Cove Creek and Short Mountain Creek.

The proposed project is located in the Arkansas River Valley ecoregion as identified by the Environmental Protection Agency (EPA) 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 areas for this project, are determined by the Arkansas Pollution Control and Ecology Commission Regulation 2 – Water Quality Standards for Surface Water (2011). The designated uses assigned to all the surface waters in the project area are as follows: secondary contact recreation; domestic, industrial and agricultural water supply; and seasonal Arkansas River Valley fishery. For surface water where the watershed is greater than 10 square miles, and all lakes and reservoirs, the designated uses are the same as above but also include primary contact recreation and perennial Arkansas River Valley fishery. There are no 303d listed streams (impaired water bodies) within the watershed analysis area boundaries.

The U.S. Geological Survey's Ozark Plateaus National Water Quality Assessment Program has studied existing land uses in the region and their impacts on water quality. Trends that show increased nitrogen, phosphorous, and coliform bacteria concentrations occur with increases in agricultural and urban land uses (Davis and Bell, 1998). Forested land use has 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 effects of alternative land uses in the Ozarks and surrounding Arkansas Landscapes.

Effects

Alternative 1 (Proposed Action)

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

In a summary of silviculture activity effects in the Ozark-Ouachita Highlands, Lawson (1986) documented the undisturbed erosion from small watersheds and the amount of sediment 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 was described to produce 3 times this amount of sediment during the first year after harvest with 31.3 lbs/acre. Three years after the treatment, the erosion rates were similar to the undisturbed state. This is roughly equivalent to a 5-gallon bucket of soil. Another study by Lawson and Hileman (1982) investigated the effects of 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 would result in the production of sediment, but at levels below those found on typically managed forest lands of the eastern United States. Therefore, the vegetation management practices proposed for this project would result in temporary increases of sediment but at relatively low levels and for a short duration.

Using paired watershed studies for regions of the United States, effects of silviculture practices on annual average stream discharge were depicted by Stednick (1996). In this study, the actions necessary for producing measurable increases in water yield from forests in Arkansas were 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 would return to the pretreatment level quite rapidly; however; changes to peak flow and storm flow timing might continue if drainage patterns are altered by activities such as road construction. Any changes to runoff timing would not result in effects to current water uses or quality.

In a study, Lynch and Edwards (1991) described long-term implications of nutrient loading after timber harvest for streams in the South. In this study, the following best management practices were used: 100 foot wide perennial buffers; removal of logging slash from streams; monitoring of sale units by a responsible party; ceasing of operations during wet weather; laying out of roads by professional; roads not exceeding 10% grade; using culverts to cross perennial streams; removing culverts when road is no longer needed; utilizing water bars; gating roads; and maintaining filtration strips. The results indicated that nutrients would not exceed water quality standards and that only during the treatment year would nutrients show a substantial increase. An important conclusion was the demonstration of the effectiveness of Best Management Practices (BMPs) for controlling nutrient export.

Herbicide use in this alternative is not broadcasted but applied by direct injection, cut surface, or foliar spray. For these purposes, herbicide use is infrequent and direct application methods would minimize off-site movement. Forest-Wide Standards for herbicide application would be followed as well as appropriate BMPs designed to limit risk to water quality and protect municipal water supplies. Monitoring for herbicides used on the Forests has been a continuous policy on Ozark-St. Francis National Forests for the last 10 years. Results from this monitoring have not documented any considerable concentrations of herbicides off-site from their application (unpublished reports). Other monitoring suggests that subsequent to runoff producing precipitation events, concentrations of herbicide (triclopyr) in ephemeral streams with BMP protections were very small and well below any significant risk concentration (unpublished report). When herbicide fate is measured in runoff water, two common outcomes are apparent. First, measured peak concentrations are of short duration. Second, the highest concentrations occur when buffer strips are not used on streams (Neary and Michael, 1996). Picloram would be used only on kudzu. Currently, kudzu is not known to occur in the project area. In other areas on the district, kudzu occurs in upland areas away from water sources.

Exposure is determined by such things as application rate, chemical behavior in the environment and biological factors. Many chemicals used in forestry applications break down fairly rapidly under normal conditions, usually within several weeks. Chemicals can enter streams through a variety of mechanisms - by direct application, drift, mobilization of residues in water, overland flow, and leaching. The most significant transport pathway would be direct application, drift, and mobilization during periods of heavy precipitation and overland flow. The most effective means for reducing this likelihood is to maintain a buffer between the area for use and waterbodies, and to plan appropriately for application time frames (Michael and Neary, 1991).

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

Forestry use of herbicides poses a low pollution risk to groundwater because of its use pattern. Herbicide use in forestry is only a fraction of agricultural usage and likely to occur only once or twice over rotations of 25 and 75 years. The greatest potential hazard to groundwater comes from stored concentrates, not operational application of diluted mixtures (Neary and Michael, 1996). Regional, confined, groundwater aquifers are not likely to be affected by silviculture herbicides (Neary, 1985). Surface unconfined aquifers in the immediate vicinity of herbicide application zones have the most potential for contamination. It is these aquifers which are directly exposed to leaching of residues from the root zone. The only known groundwater contamination incidents of importance (contamination of bedrock aquifers, persisting more than 6 months, concentrations in excess of the water quality standard, etc.) in the southeastern United States, where significant amounts of forestry herbicides are used, involved extremely high rates of application, or spills of concentrates. In these situations, herbicide residue was detected in ground water 4 to 5 years after the contamination. These situations are definitely not typical of operational use of forestry herbicides. Proper handling precautions during herbicide transport, storage, mixing-loading, and clean-up are extremely important for preventing groundwater contamination (Neary and Michael, 1996).

Pesticides are common chemicals used in a variety of applications and have been found in surface water, ground water, and in wells. Often these residue concentrations are far below levels harmful to human health and the occurrence is infrequent (Larson *et al.* 1997). Reports of pesticide contamination of water are usually from agricultural uses or urban applications, but the potential for contamination from forest vegetation

management program exists (Kolpin *et al.* 1997; Koterba *et al.* 1993; Michael *et al.*, 2000).

Although short term, low-level stream contamination has been observed for ephemeral to first order streams draining studied sites, levels of herbicides in these streams have been neither of sufficient concentration nor of sufficient residence time to cause observable effects on aquatic ecosystems. These studies have confirmed, with a few exceptions, the absence of significant contamination of surface water. Thus, herbicides used properly could help protect water quality in the reduction of sediment in streams while accomplishing forest management goals. It is imperative that pesticides, unless clearly labeled for aquatic uses, must not be applied directly to water, and that pesticides should be used around water resources that are particularly sensitive only after careful considerations of the ramifications (Michael *et al.*, 2000).

It is noted that Picloram is designated only for use on kudzu for this project. Although there are no known occurrences of kudzu within the project area, Picloram is included as an option in case a patch is located. This herbicide has been shown to be mobile in the soil profile and capable of movement to offsite locations. If kudzu is located and treated, care should be taken to assure it is used judiciously on slopes. Known kudzu patches on the Magazine Ranger District occur in upland areas, away from water sources.

From a review of literature surrounding herbicide application and use on forest lands, and monitoring conducted on the Ozark-St. Francis National Forests, it has been determined that the selection of this alternative could potentially result in low levels of herbicide residues entering waterbodies within the project area (Ozark-St. Francis National Forests' Supervisors Office, unpublished reports). However, the levels found in the past and those anticipated for the future, are expected to be very small, and not in excess of the levels of concern established by the EPA. The Ozark-St. Francis National Forests utilize standards for herbicide application that require buffers between treated vegetation and waterbodies, as well as standards to ensure that drift and direct application to waterbodies does not occur. This alternative includes the use of BMP practices and monitoring to ensure environmental quality is maintained.

Roads are the most common source of accelerated erosion on National Forest lands. Road generated sediment might result from the erosion of cut and fill slopes, ditches, road surfaces, and road maintenance operations. Unpaved roads paralleling and crossing streams pose specific risks to water quality as they often maintain direct linkages with the stream channel (Fulton and West 2002). Roads result in three primary effects on forested lands. They can intercept rainfall directly, concentrate flow, and divert or reroute water from traditional hydrologic pathways. Through these actions, road systems mimic the stream channel network, effectively increasing the drainage density of streams in the landscape (Wemple *et al.*, 1996). This might result in modifications to the timing of water delivery to stream systems; however, this is not expected to be a major nor measurable difference from current conditions. The activities of the Proposed Action would work toward 'disconnecting' the road system from the stream network.

Temporary road construction would create 10.1 miles of roads in the project area. Upon completion of harvesting, these roads would be seeded, waterbarred and blocked. Guidance provided in the RLRMP and the Arkansas Forestry Commission's Best Management Practices for Water Quality Protection outline the mitigation measures necessary to conduct these activities while controlling contributions to non-point source pollution. The remainder of the road work is road reconstruction, road maintenance, road decommissioning and road closure; all of which when properly conducted, would result in a decrease in sediment production, thus a benefit.

The effects of prescribed fire on water yield and timing, erosion, and nutrient cycling depend on fire severity, fuel characteristics, soil moisture, and recurrence interval, and primarily the amount of ground cover removal. Less intense fires result in effects of less magnitude than moderate to severe fire intensity (Marion, personal communication, 2004). Controlled burns designed to meet fuel reduction, wildlife, recreation, watershed, or ecological objectives are typically planned to be less intense than a wildfire. There is little evidence that water yield increases substantially following prescribed burning (Neary *et al.*, 2003).

Erosion following a prescribed burn depends on soil erodibility, slope, precipitation timing, volume, intensity, fire severity, and soil cover remaining. For low intensity fires that avoid complete consumption of the organic layers, erosion has been found to not leave the treated site or be transported to stream channels (Fulton and West, 2002). The organic layer and root mat remains intact after low severity fires. Erosion from prescribed burning is typically less than road and skid trail construction or intensive site preparation (Golden *et al.*, 1984). Erosion following prescribed fire is mainly created from plowed firelines as opposed to the general treatment area (Van Lear *et al.*, 1985). In the construction of firelines, care should be taken to install water diversion structures at appropriate intervals where needed and to avoid crossing drainages. Minor increases in

stormflow and nutrients return to pre-treatment levels within 3 years. Prescribed fire could affect water quality by altering the nutrient cycle within soils and increasing bioavailability of certain nutrients. Prescribed fire alone is not expected to increase nutrient content of runoff (Golden *et al.*, 1984).

The direct and indirect effects from this project are not expected to contribute to degradation of the current water quality. Implementation of the activities associated with this alternative would 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 this alternative, 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 Water Quality Protection, current Forest Plan standards, and any other mitigation measures noted in this EA, the activities of this alternative would not result in major effects to the water resources. Road stabilization through maintenance and reconstruction, erosion control through revegetation of disturbed ground, and observance of streamside management zones around surface water features are typical measures used to ensure the mitigation of adverse effects which might occur.

The activities described in this alternative are not expected to affect wetland areas or the proper functioning of floodplains.

For this analysis, the cumulative effects to water resources would be bound by the Upper Short Mountain Creek Watershed, the 6th level watershed in which the project is located. Cumulative effects result from practices that 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 could potentially result in increased sedimentation of aquatic habitats or threaten water quality as turbidity.

Computer modeling is one tool that can be used for screening watersheds for possible problems. 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, would occur during a 1-year period, 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 estimate of effects to the water resources and designated use fisheries.

Within the computer model tool, there are two risk values for every 6th 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. Proper application of all forest plan standards and Arkansas Forestry Commission 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 might 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 might 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 result from 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 Upper

Short Mountain Creek watershed shows a Moderate Concern Level even before any project activities are applied. This is likely due to the high percentage of private land and having approximately 11% pasture land within the watershed. The Proposed Action maintains the Moderate Concern Level for the future condition of the watershed.

The cumulative effects analysis indicates elevated 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 conditions contributing to the elevated concerns is the land use patterns off 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. From a water quality perspective, intensive animal farming operations increase the risks of adverse effects to water resources within the watershed. A number of chicken houses is present off the forest but within the watershed.

The activities proposed by the Forest Service for the Proposed Action would 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. It is most likely that these activities would take place over a 3 to 5 year period instead of instantaneously as predicted by the analysis, thus reducing acute effects. The use of RLRMP standards and Arkansas Forestry Commission BMPs is expected to reduce the effects of the proposed activities. Monitoring in the form of subsequent fisheries evaluation and BMP compliance checks would be adequate to discern any adverse effects that might result from the implementation of the Proposed Action.

It is recommended that bare stream crossings that would be utilized on a regular basis be improved with oversized rock to help prevent rutting in the channels. It is also recommended that log landings and skid trails be seeded soon after their final use instead of waiting to seed several at once as is sometimes the case.

Alternative 2 (No Action)

There would be no direct effects from this alternative because no activities would result from the selection of this alternative. The current trends and conditions are expected to continue. Indirect effects would continue to result from the existing conditions of the project area. The effects of vegetation on water yield within the watershed would continue through evapotranspiration processes. Roads that do not receive necessary maintenance would continue to pose a chronic threat to water quality as problem erosion areas would 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 2, roads in need of maintenance and reconstruction would not receive the necessary upgrades to minimize resource conditions. Unpaved roads paralleling and crossing streams would continue to pose specific risks to water quality as they often maintain linkages with the stream channel.

C. AIR QUALITY

Existing Condition

The framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act, as amended in 1977 and 1990 (42 U.S.C. §7401 et seq.). Lands designated as Class I Areas under the Clean Air Act Amendments of 1977 are afforded the highest level of protection from air pollutants in the nation (USEPA, 2011c). These lands consist of national wildernesses (Forest Service), parks (National Park Service) and wildlife refuges (U.S. Fish & Wildlife Service) in existence at the time the amendment was passed. The Clean Air Act identifies areas designated as Class I as "A geographic area designated for the most stringent degree of protection from future degradation of air quality." The closest Class I areas to the proposed burns are Caney Creek Wilderness area, located about 60 miles southwest of the proposed burn areas and Upper Buffalo Wilderness, located approximately 75 miles north of the proposed burn areas (USDI NPS, 2011). All other lands in the nation, including the proposed project area, lie within lands designated as Class II with respect to the air resource (USEPA, 2011c). 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."

National Ambient Air Quality Standards (NAAQS) were set by the Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards (OAQPS) for 6 principle pollutants called criteria pollutants (Table 4, page 45) (USEPA, 2011b). The State of Arkansas uses the NAAQS for the criteria pollutants set by the EPA. If an area consistently violates one of the NAAQS, then the area becomes federally designated as a "non-attainment" area. EPA defines non-attainment areas, as "A geographic area in which the level of a criteria air pollutant is higher than the level allowed by the federal standards". Attainment areas are defined by the EPA as "A geographic area in which levels of a criteria air pollutant meets the health-based primary standard (NAAQS) for the pollutant" (USEPA, 2011a).

Table 4. National Ambient Air Quality Standards for the Six Criteria Pollutants*

Pollutant	Averaging Time	Primary Standards** Level	Secondary Standards*** Level
Carbon Monoxide (CO)	8-hour	9.0 ppm (10 mg/m^3)	N/A
	1-hour	35.0 ppm (40 mg/m^3)	N/A
Nitrogen Dioxide (NO_2)	Annual (Arithmetic Mean)	0.53 ppb (100 $\mu g/m^3$)	Same as Primary
	1-hour	100 ppb (100 $\mu g/m^3$)	N/A
Ozone (O_3)	8-hour	0.075 ppm	Same as Primary
Particulate Matter with diameters of 10 micrometers or less (PM-10)	24-hour	150.0 $\mu g/m^3$	Same as Primary
Particulate Matter with diameters of 2.5 micrometers or less (PM-2.5)	Annual (Arithmetic Mean)	12.0 $\mu g/m^3$	15.0 $\mu g/m^3$
	24-hour	35.0 $\mu g/m^3$	Same as Primary
Sulfur Dioxide (SO_2)	3-hour	N/A	0.5 ppm
	1-hour	75 ppb	N/A
Lead (Pb)	Rolling 3-Month Average	0.15 $\mu g/m^3$	Same as Primary

*The units of measure are: $\mu g/m^3$ – micrograms per cubic meter of air
ppm – parts per million by volume
ppb _ parts per billion by volume

** Primary Standard – This is a standard set by the Environmental Protection Agency (EPA) to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly.

**Secondary Standard – This is a standard set by EPA to protect public welfare. This includes, but is not limited to decreased visibility, damage to animals, crops, vegetation, and buildings.

Based on RLRMP direction, priorities for the air resource in the analysis area are to meet NAAQS and to protect Air Quality Related Values (AQRVs) in the Class I Area, Upper Buffalo Wilderness (USDA FS, 2005 (pages 2-14)). The AQRV used for Caney Creek and Upper Buffalo Wilderness Class I areas is visibility. Ambient air quality and visibility monitoring for Class I areas are typically done collaboratively with the states. The EPA urges states to develop, implement and certify smoke management programs that meet the recommended requirements of the Interim Policy. If a certified program is in place and smoke exceeds the particulate standard, the EPA will work with the State and then determine if it is indeed a violation or not (Source: http://www.epa.gov/ttn/caaa/t1/memoranda/wilson.pdf).

Arkansas has an approved smoke management program. The Arkansas Forestry Commission's Smoke Management Program contains guidelines for prescribed fire which are designed to limit public safety hazards posed by smoke intrusion into populated areas; prevent deterioration of air quality; prevent NAAQS violations; and limit visibility impairment at Class I areas or other smoke sensitive areas. These guidelines address when

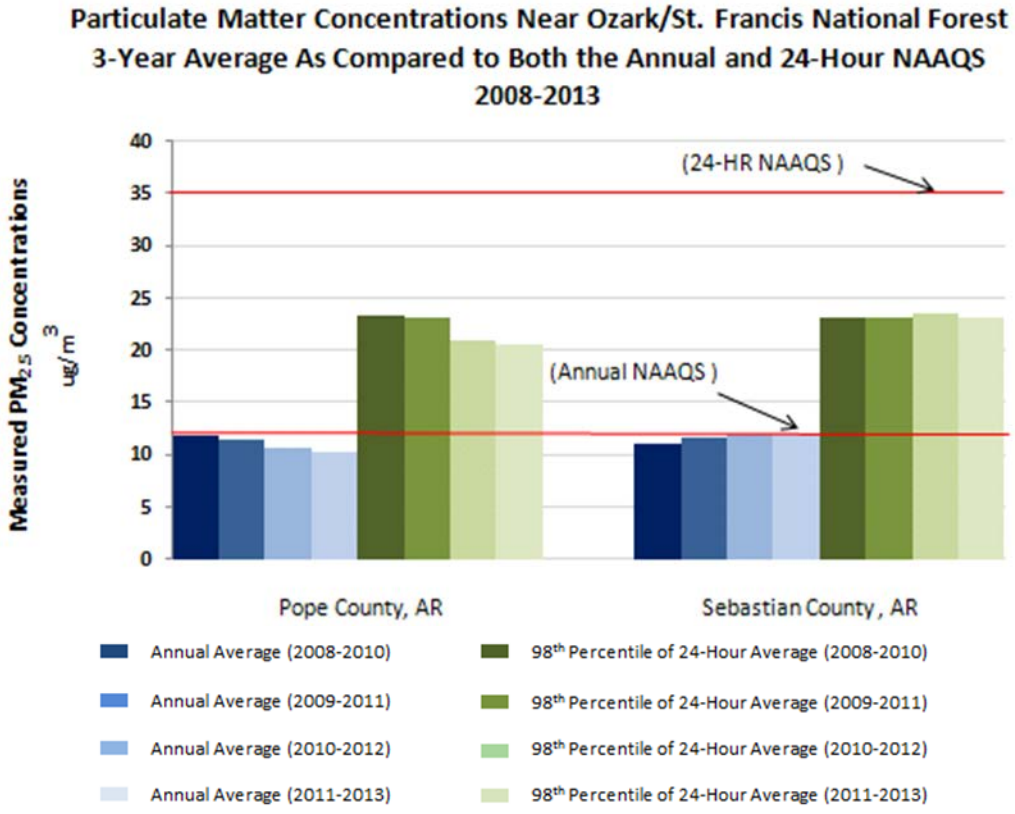
to burn, not how to burn. Actions to minimize smoke effects are also provided in the Smoke Management Program (Source: http://forestry.arkansas.gov/Services/KidsTeachersEveryone/Documents/ArkansasVSMG.pdf).

Local visibility is affected by several variables; including the amount, size, and type of air borne particulates. Visibility data from air quality monitoring stations at the Class I Areas at Caney Creek Wilderness, near Mena, Arkansas, and Upper Buffalo Wilderness near Deer, Arkansas have remained relatively constant for the past 7 years. The average annual visual range is approximately 56 km for Caney Creek and 55km for Upper Buffalo. Between 2004 and 2010, the visual range was between 20km and 169 km for Caney Creek and 17 km and 149 km for Upper Buffalo. On the worst days, the primary pollutants affecting visibility were sulfates, organic carbon, and nitrates. These visibility ranges reflect the emissions that are coming from industrial sources, such as coal fired power plants, pulp mills, etc.

Of the six criteria pollutants, the ones of concern for this project are PM_{10} and $PM_{2.5}$. Nitrogen dioxide and sulfur dioxide are important but are linked to urbanization and industrialization and not a result of natural resource activities or wildfires. Although lead and ozone are caused by fire, it is rare and infrequent. Carbon monoxide is also attributed to fire, but it is rapidly diluted and dispersed and thus poses little to no risk (Sandberg and Dost 1990).

There are two $PM_{2.5}$ monitors near the Ozark-St. Francis National Forests; one is located in Pope County, AR and the other is located in Sebastian County, AR. The National Ambient Air Quality Standards are based on 3-year averages of the measured concentrations. Using 2008 through 2013 data, the measured concentrations were compared to the 24-hour and the annual $PM_{2.5}$ NAAQS. The measured concentrations of fine particulate matter at each of these locations, both on a daily and an annual basis do not exceed the $PM_{2.5}$ NAAQS which are 35 and 12 µg/m^3, respectively (Figure 2). Thus, it can be concluded that forest management activities are not resulting in any exceedances of the NAAQS. This includes prescribed fire which may be contributing to nearby concentrations of $PM_{2.5}$, but is still meeting the NAAQS for this pollutant (USDA FS, 2013).

Figure 2. Three-year Averages of Particulate Matter Concentration from 2008-2013



All proposed activities are within Logan County. As of April 21, 2011 Logan County was in attainment for all the six EPA criteria air pollutants (Source: http://www.epa.gov/airquality/greenbook/ancl.html#ARKANSAS). The closest non-attainment area to the proposed burn sites for PM_{10} is Phoenix, AZ. This is approximately

1,060 miles to the west of the proposed burn area. The closest non-attainment area to the proposed burn sites for $PM_{2.5}$ is Knoxville, TN approximately 548 miles to the east of the burn areas. These determinations are based on the EPA's data and maps as of April 21, 2011 (USEPA, 2011a). In general, the air quality in the analysis area is good (USDA FS, 1999). The main existing sources of PM_{10} and $PM_{2.5}$ within the analysis area are from local wood burning home units, burning on private and federal lands, fugitive dust from unsurfaced roads, and combustion engines (such as those found in motor vehicles). Episodes of regional haze occur, mainly in the spring and summer.

Effects

Alternative 1 (Proposed Action)

All analysis for the proposed project will be based on potential effects to the identified smoke sensitive receptors (Table 5, page 47) with respect to the NAAQS levels for PM_{10} and $PM_{2.5}$.

Table 5. Smoke Sensitive Receptors

Smoke Sensitive Receptor	Distance (miles) from Receptor to Fire	Direction from Receptor To Fire
Mt. Magazine State Park	4.34	North
Corley & Scenic Byway 309	2.95	West
State Highway 10	6.13	North
State Highway 109	4.16	East
State Highway 22	5.15	South
Paris	5.54	South
I-40	19.13	South
Clarksville	21.55	South
Russellville	31.14	West

The Proposed Action is to use prescribed fire on all 7,484 acres of the project area. The burn unit sizes would vary. Each unit would be burned on a 3 to 7 year cycle in both growing and dormant seasons. A burn plan is developed for each burn unit prior to implementation that considers wind direction and other smoke dispersal factors. The burn plan is prepared to ensure that the combustion products (smoke) are minimized in smoke-sensitive areas. Burning would only occur when conditions are right for adequate smoke dispersal. In addition, all prescribed burning activities would follow guidelines in the Arkansas Smoke Management Guidelines (Arkansas Forestry Commission, 2007).

There might be times when smoke from the proposed prescribed fires causes short-term respiratory discomfort, is a nuisance, or reduces visibility of those near the burn units. Although burns are planned to minimize these effects to smoke sensitive areas and nearby residents, there is the potential after ignition for changed conditions to cause the smoke plume to shift direction and temporarily affect those in its path. These effects are usually short-lived, lasting less than 24 hours. Effects could occur some distance downwind depending on the weather conditions. This is particularly the case for burn units that might contain higher than normal fuel loads due to insect or storm damage where previous fuels reduction activities have not been implemented.

The direct effects of smoke include human health and safety issues (Hardy *et al*., 2001). Fine particulates could affect human health through the respiratory system and cause eye irritation. Individuals with cardiopulmonary diseases are especially susceptible. Residents near the burn unit and personnel conducting the burn might have some respiratory discomfort from ground level smoke, however it is expected that most effects would be in the form of nuisance smoke and/or smell. These effects could be minimized by implementing the burn under weather conditions that are good for dilution and dispersion of the smoke away

from smoke sensitive targets.

Herbicide application prior to burning would not affect air quality or human health. Forest Plan standard FW 153 states that no prescribed fires will be conducted in areas treated with herbicide until at least 30 days after the herbicide is applied. This waiting period is supported by results of a study of airborne herbicide residues in smoke from prescribed fires conducted in the southeast (McMahon, 1992).

Fine particulates could also reduce visibility at scenic views by scattering and adsorbing light. A sufficient concentration could result in a reduction in how far a person can see a distant object, and how well a person can see the color and texture of a distant object. The visibility impairment caused by prescribed fire is likely to decrease as a person moves away from the prescribed fire and be less than 24 hours in duration.

Visibility on roads could be reduced by ground level smoke, causing a safety issue. This could be particularly bad if smoke continues into the night when emissions are likely to be trapped near the ground and slowly transported from the burned area. Smoke follows drainages and collect in low lying areas. In a humid atmosphere, the fine particles along with the water vapor released from the fuels could be a primary contributor to the formation of fog, which could become very dense. A person operating a vehicle in the vicinity of the prescribed fire might first experience good visibility conditions and then suddenly have visibility reduced significantly (perhaps to a few feet) when they drive into the fog formed by the smoldering emissions. Conditions like this could significantly increase the potential for highway accidents; however, the likelihood of accidents could be reduced by assisting vehicles driving through the fog or directing the traffic along a different route away from the fog.

The indirect effects of smoke are similar to the direct effects, but are experienced at greater distances from the burn. These effects are usually the result of the “lifted” portion of the smoke. Prescribed fires are managed to disperse and dilute smoke to avoid the negative effects of emissions, especially downwind of the burn. Mass ignition techniques, such as aerial ignition from helicopters, are used to treat large units over a shorter time period. These ignition techniques shorten the length of time that smoke remains in the vicinity of the burn; however, more particulate matter could enter the atmosphere over a relatively short time. In some situations this increase in particulate concentration might be enough to cause already dirty air to violate air quality standards, affect human health or reduce visibility.

The smoke dispersion modeling analysis, VSMOKE (Lavdas, 1996) was conducted for an average burn unit expected for this project in order to examine potential effects to smoke sensitive targets. Meteorological parameters used for the modeling were estimates of expected conditions and not actual forecasts. Dispersion modeling conducted at this stage of planning is done to identify potential air quality problems and to make recommendations for burn planning where air quality issues might arise. It is important to remember that modeling results are predictions based on assumptions. As the assumptions get closer to actual conditions, modeling results become more reliable.

The Dispersion Index (DI) is an estimate of the ability of the atmosphere to disperse smoke to acceptably low average concentrations downwind of one or more fires. This value could represent an area of approximately 1000 square miles under uniform weather conditions. Typically, the Dispersion Index value should be greater than 30 when igniting a large number of acres within an area. The calculated Dispersion Index value was 42, which predicts the atmosphere has a good capacity to disperse smoke.

To determine the likelihood of the smoke contributing to fog formation, Dispersion Index was combined with the relative humidity value. The Low Visibility Occurrence Risk Index (LVORI) ranges from 1 (lowest risk) to 10 (greatest risk) with less than 4 being good for not contributing to fog. The baseline risk of having low visibility as a result of smoke contributing to fog formation is about 1 in 1000 accidents. The Low Visibility Occurrence Risk Index value for this VSMOKE analysis was 1 and equals the baseline.

High concentrations of particulate matter, especially fine particles (PM2.5), and carbon monoxide could have a negative effect on people's health. The EPA developed the Air Quality Index (AQI) to help people understand what concentrations of air pollution might affect their health (Table 6, page 49). When the AQI value is unhealthy for sensitive groups, then people who are sensitive to air pollutants, or have other health problems, might experience health effects. Sensitive groups of people include the elderly, children, and people with either lung disease or heart disease. Everyone might begin to experience health effects when AQI values are unhealthy. People who are sensitive to air pollutants might experience more serious health effects when concentrations reach the unhealthy levels.

The Vsmoke analysis for 1-hour particulate matter resulted in being unhealthy when within 15.61 miles of the burn and unhealthy for sensitive groups within 24.74 miles of the burn. The analysis results for visibility conditions gave a visibility distance of 0.39 miles from the edge of the fire. The analysis also showed that the smoke plume would carry and disperse $PM_{2.5}$ up to 30 miles from the edge of the fire.

The proposed project would be implemented in an attainment area and, thus, would comply with the general conformity regulation. Based on the proposed burning times, the nuisance of smoke would be short-term, less than 10 hours.

Table 6. Air Quality Index (AQI) and Particulate Matter (PM) Breakpoints

AQI Value	Health Concern	24-Hour Average µg/m^{3*}	
		PM_{10} Breakpoints	$PM_{2.5}$ Breakpoints
0 – 50	Good	0 – 54	0 – 15.4
51 – 100	Moderate	55 – 154	15.5 – 40.4
101 – 150	Unhealthy for Sensitive Groups	155 – 254	40.5 – 65.4
151 – 200	Unhealthy	255 – 354	65.5 – 150.4
201 – 400	Very Unhealthy	355 – 424	150.5 – 250.4
> 400	Hazardous	> 424	> 250.5

* µg/m^3 – micrograms per cubic meter of air

The smoke sensitive receptor with the greatest potential for effect is Scenic Byway 309. At this time, there are no established rule(s) for sight distance along travel ways for Arkansas. Based on the designated speed for Scenic Byway 309, and using the Forest Service Handbook 7709.56, a safe stopping distance would require a minimum sight distance of 357 feet for Scenic Byway 309. If the mitigation identified in the mitigation section of this EA for air quality is implemented, the proposed project would meet visibility concerns for all alternatives. If they were not, the proposed project would not meet visibility concerns for safe stopping distances.

If climatic conditions change quickly, some travel ways, such as Scenic Byway 309 and State Highway 10, might experience decreases in visibility. These effects could be mitigated with the use of flaggers, notification of state highway and local police departments, signing and other mitigation measures.

Carbon monoxide as a product of combustion is rapidly diluted at short distances from a fire and therefore poses little or no health risk to the general public. Firefighters are at the greatest health risk because they have longer exposures at higher concentrations. It is recommended that the fireline crew bosses rotate personnel away from the fireline to decrease their exposure. By doing this, they would be able to mitigate the health effects to firefighters. This would be implemented under all alternatives, thus allowing the proposed activity to comply with NAAQS for carbon monoxide.

Based on the distance and the direction from the proposed project, visibility would not be affected at Caney Creek and Upper Buffalo Wilderness areas. Based on modeled analysis, literature review, and implementation of the identified mitigation measures, all three of the above mentioned criteria pollutants would be below NAAQS for the proposed project.

Air quality cumulative effects includes, but is not limited to activities such as operation of combustion engines (i.e. vehicles, lawn mowers, turbines etc.), use of fireplaces, dust from surfaced and unsurfaced roads, wildfires, industrial emissions, etc. These activities, combined with the proposed burning and the implementation of the mitigation measures, are not expected to exceed the NAAQS. The implementation of the proposed projects would not move Logan County towards non-attainment with the implementation of the identified mitigation measures. If an exceedance occurred, the Forest Service would work with the Arkansas Department of Environmental Quality to develop a State Implementation Plan that would allow the state to make reasonable progress towards meeting NAAQS and allowing the Forest Service to continuing using prescribed fire as a tool.

The prescribed treatments would not detrimentally effect the quality of air in the analysis area based on these factors: (1) the most recent EPA-air quality data for Logan County, (2) $PM_{2.5}$ and PM_{10} emissions from the proposed burning being below the acceptable limit set by EPA, (3) Forest Service compliance with NAAQS,

and (4) meeting general conformity and meeting the intent of the Regional Haze regulation. The prescribed burning in Alternative 1 is expected to have negligible short-term effects (less than 12 hours), on air quality.

Based on existing air quality information from within the analysis area, regional air quality modeling projections, smoke dispersion modeling, and best available science; no long-term adverse effects to air quality standards are expected as long as prescribed burning operations are conducted as designed. Air emissions from the proposed project would not threaten to lead to a violation of the federal Clean Air Act, nor any state or local air quality law or regulation.

Alternative 2 (No Action)

No prescribed burning would be associated with this alternative. Therefore, air quality would remain at its current level. However, if a wildfire occurred within the project boundary the current level of air quality could be expected to diminish. Furthermore, since a wildfire would not burn under the same parameters as a controlled burn would, the effects associated with smoke direction and duration cannot be predicted. Wildfires typically have greater emissions than prescribed burns.

D. CLIMATE CHANGE

Existing Condition

Although it is possible to quantify a project's direct effects on carbon sequestration and Greenhouse Gas (GHG) emissions, there is no certainty about the actual intensity of individual project indirect effects on global climate change. Uncertainty in climate change effects is expected because it is not possible to meaningfully link individual project actions to quantitative effects on climatic patterns. Complete quantifiable information about project effects on global climate change is not currently possible and is not essential to a reasoned choice among alternatives. However, based on climate change science, we can recognize the relative potential of some types of proposals and alternatives to affect or influence climate change and therefore provide qualitative analysis to help inform project decisions. Climate change in this assessment focused on using qualitative rather than quantitative analysis. Appendix C, page 102, contains a report from the Template for Assessing Climate Change Impacts and Management Options (TACCIMO).

Forests play a major role in the global carbon cycle by storing carbon in live plant biomass (approximately 50% of dry plant biomass is carbon), in dead plant material, and in soils. Forests contain three-fourths of all plant biomass on earth, and nearly half of all soil carbon. The amount stored represents the balance between absorbing CO_2 from the atmosphere in the process of photosynthesis and releasing carbon into the atmosphere through live plant respiration, decomposition of dead organic matter, and burning of biomass (Krankina and Harmon, 2006).

Through the process of photosynthesis, carbon is removed from the atmospheric pool. About half the carbon absorbed through photosynthesis is later released by plants through respiration as they use their own energy to grow. The rest is either stored in the plant, transferred to the soil where it might persist for a very long time in the form of organic matter, or transported through the food chain to support other forms of terrestrial life. When plants die and decompose, or when biomass or its ancient remains in the form of fossil fuels are burned, the original captured and stored carbon is released back to the atmosphere as CO_2 and other carbon-based gases. In addition, when forests or other terrestrial ecosystems are disturbed through harvesting, conversion, or natural events such as fires, some of the carbon stored in the soils and organic matter, such as stumps, snags, and slash, is oxidized and released back to the atmospheric pool as CO_2. The amount released varies, depending on subsequent land use and probably rarely is more than 50% of the original soil store (Salwasser, 2006). As forests become older, the amount of carbon released through respiration and decay can exceed that taken up in photosynthesis, and the total accumulated carbon levels off. This situation becomes more likely as timber stands grow overly dense and lose vigor. Wildfires are the greatest cause of carbon release from forests. At the global scale, if more carbon is released than is captured and stored through photosynthesis or oceanic processes, the concentration of carbon dioxide (CO_2) builds in the atmospheric pool. However, the greatest changes in forest sequestration and storage over time have been due to changes in land use and land use cover, particularly from forest to agriculture. More recently changes are due to conversions from forest to urban development, dams, highways, and other infrastructure (Malmsheimer *et al.*, 2008).

Effects

Alternative 1 (Proposed Action)

Direct Effects:
The proposed harvest operations associated with the Proposed Action would result in a release of carbon and reduce carbon storage in the forest; both by removing organic matter (trees) and by increasing heterotrophic soil respiration. However, much of the carbon that is removed is offset by storage in forest products. Forest management that includes harvesting provides increased climate change mitigation benefits over time because CO_2 emissions from decay of wood products are delayed (Malmsheimer *et al.*, 2008). Prescribed burning activities, although a carbon neutral process, would release CO_2, other greenhouse gasses, and particulates into the atmosphere. However, implementing the proposed prescribed burns would reduce fuel loading and could be expected to reduce fire intensity and severity as well.

Indirect Effects:
Indirectly, implementation of the Proposed Actions would increase the overall health, vitality, and growth of vegetation within the project area, reduce the susceptibility to insects and disease, as well as reduce fuel accumulations and lower the risk for a catastrophic wildfire from occurring in the project area. This would serve as a way to increase carbon storage within the project area and mitigate carbon accumulation in the atmosphere.

Cumulative Effects:
As GHG emissions and carbon cycling are integrated across the global atmosphere, it is not possible to determine the cumulative effect on global climate from emissions associated with this project or any number of projects. It is not expected that the effects of this project or multiple projects could be specifically attributed to the cumulative effects on global climate change.

Alternative 2 (No Action)

Direct Effects:
No management activities would occur under this Alternative, therefore no direct effects on greenhouse gas (GHG) emissions and carbon cycling would occur.

Indirect Effects:
Because no management activities would take place under this alternative, carbon would continue to be sequestered and stored in forest plants, trees, (biomass) and soil. Unmanaged, older forests could become net carbon sources, especially if probable loss due to wildfires are included (Malmsheimer *et al.*, 2008). In the absence of prescribed fire, fuel loadings would continue to increase and accumulate on the forest floor. In the event of a wildfire, fuel loading would be higher, increasing the risks of catastrophic damage to natural resources. This would result in a large release (pulse) of GHG into the atmosphere. By deferring timber harvest activities, the forests would continue to increase in density. Over time this could pose a risk to density dependent mortality, insects, and disease. This could result both in a release of carbon from tree mortality and decomposition as well as hinder the forest's ability to sequester carbon from the environment because live, vigorous stands of trees have a higher capacity to retain carbon.

Cumulative Effects:
As GHG emissions and carbon cycling are integrated across the global atmosphere, it is not possible to determine the cumulative effect on global climate from emissions associated with this project or any number of projects. It is not expected that the effects of this project or multiple projects could be specifically attributed to the cumulative effects on global climate change.

E. RECREATION AND SCENERY RESOURCES

Visitors come to the Ozark-St. Francis National Forests to participate in a wide variety of recreation opportunities in an outdoor setting. Since visitor perception of an outdoor setting is often greatly affected by changes in scenery, these two resource areas are discussed together. The entire project area serves as the analysis area for recreation and scenery resources. Major recreation activities or critical issues adjacent to the project area may also be considered during analyses.

Existing Condition

The project area contains visual diversity. The viewshed from state highways, county roads and other primary forest roads are mostly mountains and rolling hills with pine and mixed hardwoods, and some areas of open pasture land. Private land ownership in the project area consists of private forested areas, home and cabin sites, pasture for livestock, and rural communities.

Distinctive features in the project area include Short, Calico, and Flattop Mountains; Turkey Knob; Slate Hill; and Ross Hollow. Major drainages include Calico, Short Mountain, Lick, and Gutter Rock Creeks. Named Springs include Jug, Brown, Burnett, and Bray. Forest Service Roads 1609, 1675, and 1610 are primary travel routes through the area. State Highway 309 traverses the south and east border of the project area and facilitates views into the area.

Mount Magazine State Park is located along the south border of the project area on Mount Magazine and provides viewing opportunities into the project area from several scenic overlooks. Cove Lake Recreation Area is located approximately 1.5 miles to the northwest. Mount Magazine Hiking Trail connects these popular recreations sites and travels through the middle of the project area.

There are several historic cemeteries, as well as numerous other heritage resources throughout the project area. There are no National Recreation Areas, Wilderness Areas, or Special Interest Areas within or in the vicinity of the project area.

Scenic Management System

The 2005 RLRMP adopted a Scenic Management System (SMS) to assist in inventory and management of the aesthetic values of Forest lands. Forest landscapes were inventoried based on viewing distance, concern level, and scenic attractiveness, and assigned individual scenic classes. Each management area includes a range of Scenic Integrity Objectives (SIOs) based on the inventoried scenic class. An SIO is a desired level of scenic excellence, ranging from Low to Very High, based on sociological and physical characteristics of an area and defines the degree of acceptable alteration of landscape characteristics. Priorities for scenery management on the Ozark-St. Francis National Forests include maintenance or enhancement of the visual character of the Forest to achieve or maintain designated SIOs (USDA FS, 2005b (pages 3-372 to 3-379); USDA FS, 2005c; USDA FS, 2008). The SIOs used in this analysis are defined below:

High = 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 (USDA FS, 2005b (pages 3-372 to 3-379); USDA FS, 2005c; USDA FS, 2008).

Moderate = Valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed (USDA FS, 2005b (pages 3-372 to 3-379); USDA FS, 2005c; USDA FS, 2008).

Low = 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 (USDA FS, 2005b (pages 3-372 to 3-379); USDA FS, 2005c; USDA FS, 2008).

“Seldom Seen” = These areas are not traversed by recreation trails or roads with high sensitivity levels and are not seen from significant viewpoints or travel routes. Consequently, these areas are not assigned an SIO. The SMS manual directs managers to use discretion and individual judgment when prescribing treatments for these seldom seen areas to protect valued public resources (USDA FS, 2005b (pages 3-372 to 3-379); USDA FS, 2005c; USDA FS, 2008).

For all FS owned lands in the project area, approximately 5,574 acres (75%) are zoned High and approximately 1,780 acres (24%) are zoned Moderate. Only 110 acres (1%) were classified as “Seldom Seen” and are assigned a value of Low for this analysis. Private land accounted for approximately 1,634 acres of the analysis area and was not assigned an SIO (Map 5 Scenic Integrity Objectives, page 92).

Recreation Opportunity Spectrum (ROS)

The Recreation Opportunity Spectrum (ROS) is a mapping and classification system that distinguishes between different types of recreation settings available in the Forest. The ROS provides a method for recreation managers and users to understand and visualize the variety of natural outdoor settings, the types of activities that can be pursued, what recreation experiences to expect, where these experiences are available, and how many other people may be found in a specific area of the Forest. This planning tool assists recreation managers in matching the diversity of recreation interests with appropriate opportunities in suitable locations. Lands in private ownership within the Forest boundary are included and assigned an ROS class. The ROS is divided into 6 major classes for Forest Service use: Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Rural, and Urban (USDA FS, 2005b (pages 3-326 to 3-328); USDA FS, 1986). The ROS classes used in this analysis (Roaded Natural and Rural) are defined below.

Roaded Natural is defined as an area characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of man. 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. Opportunities for both motorized and non-motorized forms of recreation may be provided. Roaded Natural settings on the Forest are located within a half mile of a road and usually provide higher levels of development such as campgrounds, picnic areas, and river access points (USDA FS, 2005b (pages 3-326 to 3-328); USDA FS, 1986).

Rural is defined as an area characterized by substantially modified environment. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. These factors are generally more important than the setting of the physical environment. Management emphasis is for rural and roaded natural recreation opportiunities. These settings represent the most developed sites and modified natural settings on the Forest. Examples of this classification are motorized and non-motorized recreation, such as driving for pleasure, viewing scenery, picnicking, and fishing (USDA FS, 2005b (pages 3-326 to 3-328); USDA FS, 1986).

Almost the entire project area (98%), approximately 7,318 acres, is classified as Roaded Natural (Map 6 Recreation Opportunity Spectrum, page 93). Roaded Natural areas encompass the major roadways and associated moderate levels of development that dissect the project area. Approximately 165 acres (2%) are classified as Rural and is located in an isolated tract of Forest Service land on the eastern border of the project area along Highway 309, and a very small tract in the northwest corner of the project area.

Effects

Alternative 1 (Proposed Action)

Opportunities exist in the project area to enhance recreation experiences. This entails changing designation on approximately 3.6 miles of existing road routes to allow Off Highway Vehicle (OHV) traffic. Approximately 1.75 miles of FDR 1675 is proposed to be designated as part of the OHV trail system. FDR 1675 is currently closed and would be width restricted to allow only OHV traffic. Approximately 0.65 miles of FDR 96053B and 0.25 miles of FDR 1609B would be designated to allow both OHV and highway vehicles. Both routes are currently open to highway vehicle traffic and are proposed to be reconstructed with the timber sales from this project.

During field reviews conducted after the initial Proposed Actions were developed, an old existing road template (approximately 0.95 miles) was discovered. Developing this as an OHV route would not only increase OHV riding opportunities in the area, but it would provide OHV riders a section of scenic views away from the road while creating a loop. None of the existing routes open to OHV would be removed in this project.

Recreation users in the Project Aarea might notice effects from vegetation, wildlife, roads, and recreation management activities.

Direct and indirect effects: Vegetation and Wildlife Management
Proposed vegetation management activities include forest stand thinnings (i.e., commercial, pre-commercial,

salvage, and cedar thinnings), stand regenerations through shelterwood harvests and silvicultural treatments (i.e., midstory removal, herbicide treatments, planting, and prescribed burning). Wildlife and riparian stand improvements are also propsed utilizing mechanical treatments to thin stands. Landscape scale prescribed burning is also proposed to improve wildlfie habitat and for fuel reduction.

Proposed wildlife management activities include prescribed burning; development, restoration, and maintenance of wildlife openings and a wildlife pond; stream habitat improvement (i.e. adding LWD to the streambed and constructing 8 aquatic organism passages); and wildlife and riparian stand improvements through forest stand thinnings.

Eradication of non-native invasive species, establishment of native vegetation, additional and improved wildlife openings, prescribed burning, and subwatershed improvements would improve the scenic quality and integrity of this area by returning it to a more natural setting. Many of these activites would result in long-term improvements to wildlife habitat and consequently improve recreation opportunities and scenery resources.

Potential effects of vegetation management include decreased canopy cover, increased sunlight, increased visibility into the forest, visible vegetative debris (e.g, forest slash and stumps), damaged living vegetation, and browned or dying vegetation from the use of herbicides and prescribed fire. There would also be noticeable changes in forest texture and color due to the open character of the stand and exposed soil, particularly when viewed in conjunction with areas that have not been treated. Additional effects would include a more open understory allowing views further into the forest, potentially improved scenic and wildlife viewing, and some improved recreation opportunities such as hunting and wildlife viewing.

At destination locations, Forest visitors might notice the immediate effects of activities associated with these proposed activities, as some of these treatment areas are visible from roads and trails. Some users might also be affected by sounds of mechanical equipment and possible road or trail closures. Blending the proposed treatments with surrounding areas by feathering the edges, screening treatment areas and access roads/log landings, and treating slash would mitigate many short-term effects to scenery resources. However, most visible effects that disturb vegetation, soil, or viewsheds would be short-term and not noticeable in the long-term. Vegetative growth over a period of several years would substantially reduce negative noticeable effects of management activities. With implementation of key design criteria found in the RLRMP, the proposed vegetation treatment activities are not expected to have any long-term direct or indirect negative effects on recreation resources and would meet the required ROSs and SIOs in the project area.

Direct and indirect effects: Roads and Recreation Management
Proposed roads management activities include temporary road construction, road maintenance, pre-haul road reconstruction, road decommission, borrow pit development, and designation change and development of exisiting roads to allow OHV use.

Roads management activities would enhance recreation opportunities by improving Forest transporation routes and public safety. These activities would also reduce negative effects to scenery and recreation activities by eliminating unnecessary roads and reducing road density. This would reduce the level of disturbance caused by motorized vehicles and allow for increased probability of experiencing isolation from sights and sounds of human activities. Methods used to accomplish proposed roads management activities would result in visible effects that disturb the vegetation, soil, or viewshed. However, these effects would be short-term and not noticeable in the long-term. With implementation of key design criteria found in the RLRMP, the proposed transportation and recreation management activities are not expected to have any direct or indirect negative effects on recreation resources and would meet the required ROSs and SIOs in the project area.

Managing OHV use has become integral to recreation management to provide for safety, user satisfaction, reduction of resource damage, and manage conflicts among user groups. Approximately 3.6 miles of new OHV routes would be designated. None of the existing routes open to OHV use would be removed in this project. These proposed changes would increase safety by improving existing OHV routes and improve user satisfaction by creating more loops and reducing user group conflicts. These activities are appropriate and would support efforts to meet RLRMP future desired conditions in recreation resources. The proposed recreation activities are not expected to have any direct or indirect negative effects on recreation resources and would meet the required ROSs and SIOs in the project area. Future implementation of the OHV trails would be dependent on funding.

Cumulative effects: All Proposed Treatments

Activities that have occurred in the project area in the recent past include wildlife and vegetation management activities, wildfires, prescribed burning, recreational uses and improvements, utility right-of-way (ROW) maintenance, and road maintenance. Activities that are currently occurring in the analysis area include wildfires, prescribed burning, recreational uses and improvements, and maintenance of ROWs and roads. Reasonably foreseeable activities that might occur in the project area include vegetation and wildlife management activities, wildfires, prescribed burning, recreational uses and improvements, ROW maintenance, road maintenance, effects from pest and disease outbreaks, changes in private land use patterns, construction of new ROWs, and treatments of non-native invasive species.

The past, present, and foreseeable projects might have a cumulative effect on recreation and scenery resources. Implementation of key design criteria found in the RLRMP, which are required during implementation, would limit the negative effects of proposed activities on recreation and scenery resources.

Alternative 2 (No Action)

Under the No Action Alternative, none of the proposed project activities would be implemented. The beneficial effects of the proposed project activities previously discussed would not be realized.

Direct and indirect effects: Under the No Action Alternative, there would be no perceivable short-term direct or indirect effects. However, long-term visual quality could decline as natural processes result in increased tree density and successional vegetation invades open areas. The result is a reduction in visual penetration into the forest, populations of early successional and open habitat species, compromised public safety on roads and trails, decreased quality recreational opportunities. Long-term direct and indirect effects from the No Action Alternative might decrease the scenic integrity of the area and negatively affect efforts to achieve future desired conditions.

Cumulative effects: The No Action Alternative would not result in increased cumulative effects in the analysis area. However, no beneficial effects to recreation, such as improved hunting, fishing, hiking, and scenery and wildlife viewing opportunities would result.

F. HERITAGE RESOURCES

Existing Condition

Known Cultural Resources. The National Historic Preservation Act of 1966, as amended (NHPA), requires federal agencies to take into account the effects of federal undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. Additionally, federal agencies are required to follow the implementing regulations of the ACHP set forth in 36 CFR Part 800. Specifically, 36 CFR Part 800 requires that State Historic Preservation Offices and federally-recognized Tribes be consulted about any undertaking that has the potential to affect historic properties and/or properties of religious or cultural significance at the earliest possible stage in the planning process. Protocols for cultural resource reviews, surveys, and reporting are specified by a Programmatic Agreement (PA) between the U.S. Forest Service, relevant federally-recognized Tribes, and State Historic Preservation Offices (SHPO) of Arkansas and Oklahoma, signed in 2006 and extended in 2011, 2012, 2013, 2014, and 2015.

The Mt. Magazine Ranger District in its entirety has been inventoried for cultural resources (Mt. Magazine Assessment 08-10-06-01 and Addendum 09-10-06-01). The completion of inventory for the District enables projects to be planned so as to avoid impacts to known archeological sites. Under the provisions of the 2006 Programmatic Agreement (PA) between the Ozark-St. Francis National Forests, the Arkansas State Historic Preservation Office, and the relevant federally recognized Tribes, proposed projects located in areas that have been previously surveyed and where no cultural resources will be disturbed or impacted may be documented internally as a Heritage Categorical Exclusion. A resurvey of the area is not required by the PA or by the National Historic Preservation Act. However, in areas with higher probabilities of containing sites, additional testing may be conducted during the planning phase to ensure that no additional sites will be impacted. This fieldwork is conducted under the supervision of the District or Forest Archeologist and pursuant to the work standards established in the PA.

Accordingly, the heritage review for this project is documented as project no. 14-10-06-01. Additional fieldwork was conducted in 2013 and 2014. All sites determined Eligible for nomination to the National Register and sites with undetermined eligibilities in the Mt. Magazine Assessment and Addendum reports were revisited.

Fifty-one archeological sites have been identified in or near the project area as a result of cultural resources inventory surveys (Table 7, page 56). Eligibility recommendations for the undetermined require additional field and/or archival research before a recommendation can be made.

Sites recommended eligible for nomination to the National Register of Historic Places include two cattle dipping vats that represent the Texas Tick Fever Eradication program in Arkansas (1907-1943) and a prehistoric lithic scatter with culturally diagnostic material. Historic sites include houseplaces, farmsteads, the Wilborn School, sorghum cooker, sawmills, and a mill. These sites, in aggregate, represent the remains of the late 19th-early 20th century community of Calico.

Table 7. Summary – National Register Eligibility Recommendations by Site Types

National Register Eligibility Recommendation	Historic Site	Prehistoric Site	Multi Comp1nt Site	Total
Eligible	2	1	---	3
Not Eligible	23	3	1	27
Undetermined	20	---	1	21
Total	45	4	2	51

Sites listed on the National Register of Historic Places, recommended eligible for nomination, and with undetermined eligibility would be protected from effects of activities proposed by this project. Mitigation measures are discussed in detail in Chapter 2 (See Mitigation Measure 16 on page 30; and Mitigation Measures 41-44 starting on page 32).

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

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

These areas would be surveyed and, as needed, consultation would be completed prior to implementation in accordance with the provisions of the Programmatic Agreement.

The Ozark-St. Francis National Forests are carved out of ancestral American Indian lands. American Indians' historical and spiritual connections to the land have not been extinguished despite changes in title. Respecting, honoring, accommodating, and protecting American Indian Sacred Sites is part of our commitment to restore forests and reserves. There may be American Indian sacred sites or landscapes currently unknown to the Forest. The Forest will continue to consult with our Tribal partners to ensure that American Indian sacred sites and landscapes are identified, assessed, and considered in project planning and implementation.

Effects

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

An effect to a cultural resource is the "…alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." (36 CFR 800.16(i)) Any project implementation activity that has potential to disturb the ground has potential to directly affect archeological sites, as does the use of fire as a management tool. Specific activities outlined in the project that have potential to directly affect cultural resources include timber harvesting and associated log landings, skid trails, and temporary roads, prescribed burning and associated fireline construction, road and trail maintenance or reconstruction where ground disturbance takes place outside existing right-of-way area, and pond construction for wildlife water source.

Proposed activities that do not have potential to affect cultural resources, and therefore, are not considered undertakings for purposes of this project include: Non-commercial thinning, timber stand improvements, on-

going maintenance of existing Forest roads or reconstruction of previously surveyed roads where ground disturbance does not take place outside existing road prisms and existing drainage features, rehabilitation/closure of temporary roads, log landings, and skid trails using non-ground disturbing methods, road decommissioning using non-ground disturbing methods, and non-native invasive plant species control using non-ground disturbing methods.

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

Alternative 1 (Proposed Action)

Direct and Indirect Effects
Proposed access changes, soil restoration work, and opening of forested areas resulting from timber harvest could affect cultural resources. Improved access and visibility to the forest landscape increases the potential for damage from natural and human action (i.e. erosion, impacts of illegal or inappropriate OHV usage, and looting).

Project components with potential to directly affect archeological sites primarily include timber, prescribed fire, road management, OHV trail addition, and some wildlife management activities. However, if the prescribed mitigation measures discussed in Chapter 2 (Mitigation Measure 16 on page 30; and Mitigation Measures 41-44 starting on page 32) are properly implemented, project activities would not be expected to adversely affect cultural resources.

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

Alternative 2 (No Action)

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

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

G. MINERALS

Existing Condition

This project will not approve any wells and does not evaluate any gas well proposals. This information is intended to provide background for possible gas well development. Any proposal would be fully evaluated using applicable Federal laws and regulations. The entire project area is in Logan County. The majority of the project area is under lease for gas exploration at this time. This area is in the B-44 Field, established by the Arkansas Oil and Gas Commission (AOGC) and recognized by the Bureau of Land Management (BLM).

There are mineral proposals for this project area. As many as four Applications for Permit to Drill (APD) have been approved. There are four producing wells on federal land and other producing wells on private land within the project area. In close proximity to the project area there are numerous producing wells on private land and one on federal land just to the west.

The Mt. Magazine Ranger District has about 40 producing gas wells. There are many producing wells on private land within the forest boundary. To see the latest well information available go to the Arkansas Oil and Gas Administration web site. Gas production is driven by economic forces. At this time, natural gas prices are in a medium range, encouraging lease request and interest in drilling currently approved wells. It would be expected, that as economic conditions improve for the industry, that general development will increase. This project area has a high probability of future development because of the proven production and existing infrastructure.

The Calico project area is next to the Mt. Magazine State Park and covers part of the Mt. Magazine Special Interest Area. Both of these are no surface occupancy areas based upon the RLRMP. Due to the no surface occupancy stipulation, there could be increased activity in the southern portions of the Calico project area to access those mineral rights to the south with directional or horizontal drilling.

Effects

Alternative 1 (Proposed Action) and Alternative 2 (No Action)

Requests for surface occupancy through an APD to withdraw minerals that are legally entitled to the leaseholder within the project area would be approved according to the President's Energy Initiative through all pertinent laws. Prior to approval, an on-site meeting with the operator, BLM, and Forest Service specialists would take place. All relevant aspects addressing environmental concerns as well as the operator's right to enter for mineral withdrawal under the lease would be evaluated; these might include: visuals, air quality, noise levels, water quality, pad, road and utility placement, construction standards, and Best Management Practices. The rehabilitation of areas would be done in a timely manner with direction given individually for each site.

If a well is deemed a producer, per BLM and AOGC, a gathering pipeline would be needed to connect the gas well to an existing transmission pipeline. These gathering pipelines would generally be buried within or parallel to an existing road or utility corridor.

APDs received would be evaluated on their own merit to minimize effects to the area, including cumulative effects. Whenever possible, the existing access roads and gas pipelines would be utilized by multiple drilling areas. This is the practice that has been followed in the past and reduces the number of linear miles of roads and pipelines on the ground.

As wells become depleted, thus unprofitable, they are generally plugged by the producer, at which time the area is rehabilitated to meet Forest Service standards.

Cumulative effects to vegetative resources from potential future gas well development in the area would be from conversions of small areas of forest to semi-permanent openings. Each new gas well would require native vegetation to be removed creating an opening of 3 to 7 acres, depending on topography, number of wells and well requirements. Following the drilling process the opening would be reclaimed down to a smaller size required for production or plugged and reclaimed if not producible. The life span of each individual location may vary from a dry hole to approximately 40 years.

The APDs that have previously been approved went through the same processes noted above. Pre-work meetings would be held at the operators request and the approved APDs could be implemented.

In following the President's Energy Initiative, the Forest Service must continue to honor access to the minerals under existing leases and look at potential areas that can environmentally accommodate additional leases.

H. TRANSPORTATION

Existing Condition

There are approximately 41.6 miles of existing roads in the analysis area (Compartments 42, 47, 53, 54, 71, and 72) for transportation. Approximately 12.8 miles of these roads are currently closed. Appendix B on page 100, displays the road numbers, mileage, and status (current and proposed) for existing roads of the transportation system in the project area.

A Roads Analysis Report (RAPS) was done for this project (USDA FS, 2005c). The Upper Short Mountain Creek Watershed Roads Analysis area is approximately 29,358 acres in size and is located in the Six Mile Creek watershed (map located in project file). Within this sub-level watershed, Level 1-5 roads and unclassified roads were assessed to determine the future road network. Findings from this analysis were used in developing transportation needs for the Calico Rock Project.

FDR 1605, 1609, 1609B, 1610, 1620, 1631, 1652, 1675A, 1676, 1676A, 1676B, 96046F, 96047B, 96053B, 96072B and 96072C are open to the public for travel. They suffer from a lack of surface aggregate, areas of weak sub-grade, poor drainage, and encroachment of woody vegetation into the roadway.

FDR 1609A, 1609C, 1609D, 1609E, 1609F, 1629, 1629A, 1631A, 1631B, 1676C, 96046F, 96047A, 96047C, 96047D, 96047E, 96047F, 96047G, 96053C, 96053D, 96053E, 96053F, 96054B, 96054C, 96072A, 96072D and 96072E are closed to motorized travel and receive no annual maintenance. Over past years, these roads have become overgrown with vegetation and are in need of some aggregate placement and drainage improvements to support timber management activities.

FDR 1631C, 1675, 1675A and 96054A have portions of the road that are both open and closed to the public for travel. These roads have a lack of surface aggregate, areas of weak sub-grade, poor drainage, and encroachment of woody vegetation into the roadway.

Effects

Alternative 1 (Proposed Action)

Temporary road construction would provide access to harvest areas during the timber sale. These roads would be blocked and seeded once the sale is completed.

Road maintenance would be performed as needed to maintain or improve the roads in no less than the same condition that existed prior to timber harvesting activity. Maintenance might consist of mechanical brushing and the use of herbicides to control vegetation along roadsides, removal or repair of minor slides or slumps, cleaning of roadside ditches and drainage devices, spot aggregate placement, and blading of the travel way. All disturbed areas would be mulched and seeded along with the use of hay bales for erosion control where needed.

Approximately 8 miles of FDR 1605, 1609, 1609B, 1676 and 96053B would be reconstructed to support traffic associated with timber harvesting and public safety. This activity would involve but would not be limited to clearing the existing vegetation back to daylight the road, replacement of failing drainage structures such as culverts and adding additional structures to facilitate drainage. Geotextile and oversize aggregate might be added to improve the bearing strength of the sub-base. Borrow material would be used when needed to raise the road grade and to cover exposed rock. The travel way would be resurfaced with gravel. Realignment of some sections of road might be required. All disturbed areas would be mulched and seeded along with the use of hay bales for erosion control where needed.

During road maintenance and road reconstruction, some road/stream crossings might be replaced to improve aquatic organism passage. These replacement crossings would allow for passage of all aquatic species.

A borrow pit would be developed up to 5 acres in size. Borrow material from this site would be removed for use during the proposed road work in this project. The borrow pit would remain open for future needs. Erosion control measures would be implemented to limit the effects outside the borrow pit location. Erosion control measures could include hay bales, sedimentation ponds, and construction of diversion ditches.

In an effort to reduce system road miles within this project area, all or part of the roads that are currently closed

and are no longer needed as systems roads would be decommissioned. These roads are FDR 1609E, 1609F, 96053D, 96054C, 96072D and 96072E, totaling approximately 1.9 miles.

Forest Road 1676A is a dead end road and is currently open. This road would be closed and become part of the Off Highway Vehicle trail system. Approximately 1.4 miles of FDR 1675 which is currently closed is proposed to be designated as an addition to the OHV trails by placing width restrictors at the beginning and end of the road section. Approximately 0.65 miles of FDR 96053B and 0.25 miles of FDR 1609B, both currently open to highway vehicle traffic, would be designated to allow both OHV and highway vehicles and are proposed to be reconstructed with the timber sales from this project.

During field reviews conducted after the initial proposed actions were developed, an old existing road template, approximately 0.95 miles in length, was discovered. This old existing road bed is proposed to be developed as an OHV route in order to provide OHV riders with a scenic wooded trail away from the road while creating a loop; thus, increasing OHV riding opportunities in the project area. None of the existing routes open to OHV in the project area are proposed to be closed or decommissioned.

All or part of Alternative 1 would be implemented based on revenues received from the timber sold from the project area or from other forest funding.

Alternative 2 (No Action)

No road work would be done. Roads that currently need road work would continue to deteriorate. Some deterioration can also be expected on portions of roads from natural processes such as erosion and plant encroachment into the road right-of-way.

I. VEGETATION

Existing Condition

The analysis area for vegetation is comprised of the stands in Compartments 42, 47, 53, 54, 71 and 72.

The MAs within the project boundary are 1.G (Special Interest Areas), 1.H (Scenic Byway Corridors), 2.B (State Parks), 3.A (Pine Woodland), 3.C (Mixed Forest), and 3.I (Riparian Corridors). The portion of the project area that is in MA 3.A (Pine Woodland), MA 3.C (Mixed Forest), and MA 3.I (Riparian Corridors) is classified as suitable for timber management (RLRMP, pgs. 2-56, 2-61, and 2-74).

The Forest Type Map on page 94 displays the distribution of forest cover types by pine and hardwood types. The project area has a dominant cover made up of even-aged stands, ranging from 13 -127 years of age in 2014 (see Age Class Distribution Map, page 95). The pine type age classes in this analysis area are not in balance. Approximately 88% of the pine and pine/hardwood type acres are in the 41-70, 71-100 and 100+ year old age classes. Table 8 on page 60 illustrates the acreages of different age classes by forest type. The surrounding compartments are similar in age class distribution to these compartments. Stands in which at least 70% of the dominant and codominant crowns are either pine species or hardwood species are classified as such. Stands in which 51-69% of the dominant or codominant crowns are either pine species or hardwood species are classified as mixed pine/hardwood or mixed hardwood/pine stands.

Table 8. Acreage in Each Age Class (as of 2014) by Forest Type

Age Class	% Total Acres	Pine-Pine/Hardwood Acres	Hardwood-Hardwood/Pine Acres
0 - 10	0%	0	0
11 - 20	1%	114	0
21 - 40	11%	778	21
41 - 70	31%	2,138	150
71 -100	46%	820	2,608
100+	11%	204	622
	TOTAL	**4,054**	**3,401**

Appendix A contains a Stand Map (page 96). Table 9, page 61, contains the codes used to describe the forest type and condition of the stands within the project area. Table 10, page 61, shows the current stand conditions in the project area. Some type of activity, ranging from site preparation to wildlife habitat improvement/fuel reduction prescribed burning, is proposed for each stand (see Table 2, page 14, for the proposed actions).

Table 9. Forest Type and Condition Class

Forest Type		Condition Class	
12	Shortleaf Pine/Oak	07	Low Quality Poletimber
31	Loblolly Pine	08	Low Quality Sawtimber
32	Shortleaf Pine	10	Mature Sawtimber
43	Oak-Eastern Red Cedar	11	Immature Poletimber
47	White Oak/Black Oak/Yellow Pine	12	Immature Sawtimber
48	Northern Red Oak-Hickory-Yellow Pine	13	Seedling/Saplings
53	White Oak/Red Oak/Hickory	14	Adequately Stocked Seedling/Saplings

Table 10. Current Stand Condition

Compartment	Stand	Acres	Forest Type	Condition Class	Age	Basal Area (ft^2/acre)			Site Index
						Pine	Cedar	Hardwood	
42	1	152	53	10	93	0	0	137	60
42	2	50	53	12	85	0	0	130	60
42	3	16	53	12	75	25	0	100	60
42	4	18	53	12	75	10	0	95	70
42	5	119	32	11	44	69	0	60	50
42	6	11	48	12	86	50	0	75	60
42	7	49	53	12	84	64	0	62	60
42	8	113	53	10	114	0	0	113	50
42	9	7	32	11	30	133	0	0	60
42	10	160	53	10	82	0	0	106	50
42	11	321	53	10	114	0	0	104	80
42	12	98	53	10	103	0	0	90	60
42	14	22	12	11	44	57	0	50	50
42	16	21	53	12	84	50	0	35	50
42	17	82	53	10	84	0	0	110	50
47	1	60	32	10	94	92	0	36	60
47	2	57	32	11	26	152	0	6	60
47	3	38	32	10	93	83	0	3	70
47	4	24	32	12	53	123	0	7	60
47	5	21	47	12	53	23	0	66	50
47	6	38	32	11	37	61	0	38	60
47	7	29	32	12	50	160	0	30	70

Table 10. Current Stand Condition

Compartment	Stand	Acres	Forest Type	Condition Class	Age	Basal Area (ft^2/acre)			Site Index
						Pine	Cedar	Hardwood	
47	8	20	32	11	30	134	0	3	60
47	9	40	32	10	105	78	3	23	60
47	10	142	53	8	91	17	0	114	50
47	11	96	53	8	85	11	6	126	60
47	12	23	32	10	67	106	0	6	60
47	13	17	32	10	99	100	5	18	60
47	14	66	32	12	51	82	14	22	60
47	15	112	32	12	56	145	2	21	60
47	16	35	32	12	59	88	6	15	60
47	17	21	32	11	33	94	10	17	60
47	18	12	32	8	52	60	40	33	50
47	19	22	32	10	84	110	3	23	50
47	20	87	53	8	97	0	0	120	60
47	21	22	32	12	56	113	10	3	50
47	22	36	32	10	99	103	3	20	60
47	23	20	53	10	95	0	0	147	60
47	24	65	32	13	23	85	2	3	60
47	27	11	32	10	99	80	0	27	60
53	1	44	32	12	50	140	3	10	60
53	2	59	32	10	90	61	8	24	70
53	3	159	32	12	59	96	7	18	60
53	4	55	32	11	23	108	2	0	60
53	5	83	32	12	58	40	32	30	50
53	6	81	32	11	38	64	8	14	50
53	7	298	32	12	61	113	8	12	70
53	8	196	32	12	57	98	21	15	60
53	9	28	32	12	62	95	0	5	70
53	10	21	32	12	73	87	13	26	70
53	11	40	31	11	32	106	2	6	60
53	12	33	32	12	56	120	0	3	60
53	13	60	32	12	64	100	8	27	70
53	14	84	53	8	70	32	19	47	40
53	15	87	32	12	54	104	9	23	60
53	16	48	53	12	92	15	0	78	70
53	19	70	32	10	78	92	12	15	60
53	20	97	32	10	96	127	5	32	60
53	21	49	32	10	104	75	2	13	60

Table 10. Current Stand Condition

Compartment	Stand	Acres	Forest Type	Condition Class	Age	Basal Area (ft^2/acre)			Site Index
						Pine	Cedar	Hardwood	
53	22	28	32	12	69	113	0	10	60
53	23	23	32	12	57	67	14	10	40
53	24	21	43	8	73	0	44	74	70
53	25	45	43	12	63	26	53	30	60
53	26	10	32	12	67	100	15	20	70
53	27	41	32	12	42	128	2	18	60
54	1	23	32	10	101	52	7	26	60
54	2	27	32	10	58	63	13	17	50
54	4	190	53	12	89	18	0	96	60
54	5	146	43	7	74	8	8	53	50
54	6	88	32	12	56	94	9	4	70
54	7	53	32	11	40	90	14	8	60
54	9	38	53	8	74	8	35	60	70
54	11	40	32	12	56	128	0	6	70
54	12	74	32	12	62	145	2	14	60
54	13	94	32	12	57	58	31	17	60
54	14	76	32	12	74	87	6	13	70
54	15	33	32	10	106	108	14	28	60
54	16	26	32	12	56	88	0	0	70
54	17	17	32	10	97	50	0	40	60
54	18	42	32	10	90	62	0	40	70
54	19	29	53	12	92	17	10	84	70
54	20	73	53	12	74	10	0	104	60
54	21	21	48	11	38	30	10	60	60
54	22	7	32	10	100	93	7	63	70
54	24	72	32	11	39	82	3	5	50
54	26	16	43	8	74	35	25	55	60
54	27	31	32	12	48	90	7	5	70
54	32	24	32	13	25	108	0	2	60
71	1	31	32	11	26	122	0	10	60
71	2	13	32	12	69	87	0	37	70
71	3	14	32	10	108	127	4	30	60
71	4	23	32	13	26	140	0	17	60
71	5	110	53	12	86	8	0	96	70
71	6	785	53	10	98	0	0	123	70
71	7	30	53	8	82	2	0	90	70
72	1	20	32	11	30	163	0	13	60

Table 10. Current Stand Condition

Compartment	Stand	Acres	Forest Type	Condition Class	Age	Basal Area (ft^2/acre)			Site Index
						Pine	Cedar	Hardwood	
72	2	39	32	10	86	116	2	50	60
72	3	21	32	11	30	133	5	5	60
72	4	29	31	10	77	140	0	8	60
72	5	79	31	11	29	149	0	0	60
72	6	51	32	10	89	116	0	2	60
72	7	22	32	11	30	130	6	0	60
72	8	199	53	8	91	20	5	25	60
72	9	17	32	12	49	190	0	3	50
72	10	46	32	10	66	116	0	12	60
72	11	90	53	8	107	20	20	40	60
72	12	15	32	10	105	126	0	47	60
72	13	10	32	11	36	80	3	30	60
72	14	69	32	10	71	89	1	1	60
72	15	29	32	12	51	113	0	13	60
72	16	43	32	10	76	93	0	0	70
72	17	99	32	10	67	99	2	19	70
72	18	19	53	8	85	10	15	60	60
72	20	6	32	12	36	126	0	3	60
72	22	30	32	10	127	86	0	50	50
72	23	33	32	13	23	63	0	25	70
72	24	16	32	10	95	100	0	45	70

Compartment	Stand	Acres	Forest Type	Condition Class	Age	Stems Per Acre			Site Index
						Pine	Cedar	Hardwood	
53	18	46	32	13	16	6920	1640	1360	60
54	3	39	32	13	16	550	800	1717	70
54	10	29	32	14	13	300	400	2620	70

The midstory and ground vegetation components and densities in these stands are typical of those found in the cover types of the area. The species composition in the midstory consists of oak, hickory, dogwood, persimmon, sassafras, sweetgum, locust, blackgum, elm, pine, redcedar, and red maple. Common shrubs and vines found include French mulberry, hawthorns, blueberries, viburnums, greenbriers, blackberry, honeysuckle, and grape. Grasses and other herbaceous vegetation in the understory include bluestem, foxtail, nutsedge, poison ivy, greenbrier, Desmodium, and panicums.

Shading due to canopy closure and buildup of duff or needle layers is reducing or possibly eliminating grasses and forbs in the majority of the analysis area.

In the analysis area, the fire ecosystem currently falls into the Condition Class II category. Condition Class II fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return

intervals (either increased or decreased). This historical fire regime results in moderate changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Where appropriate, these areas need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire condition class (Hann and Bunnell, 2001).

In this analysis area, approximately 2,896 acres (39% of project acres) are located within the Wildland Urban Interface (WUI). WUI areas are National Forest land that is within one-quarter of a mile from private land. These areas are at risk of a wildland fire that may occur within the National Forest lands that border these private lands. They are a priority for wildfire fuel reduction treatments due to the lives and property that need to be protected.

Introduction of non-native invasive species has altered native vegetation. Sericea lespedeza and privet are two of many non-native invasive plants that have become well established throughout the district. Sericea has become the dominant roadside species along many forest roads, including roads within the project area.

Effects

Alternative 1 (Proposed Action)

Shelterwood cutting is generally accepted within the scientific community as being an appropriate regeneration harvest cutting method for shortleaf pine when establishment of an even-aged stand is the desired future condition (Baker, 1991). Shelterwood cutting would utilize the seed source already in place. These stands have seed trees that are of good quality and form and have a uniform distribution of sawtimber trees. Past experience on the Mt. Magazine District has shown that stands with an adequately distributed number of well-formed sawtimber trees with good seed carrying capacity provide a sufficient number of seedlings to meet stocking requirements. However, on occasion, natural regeneration fails due to poor seed catch, drought, or other ecological reason. On these occasions when natural regeneration fails to achieve minimum stocking requirements (150-300 trees per acre depending on site index) as described in the RLRMP, shortleaf pine seedlings would be planted at a density of 680 trees per acre to reach the target level of 500-700 trees per acre following third-year stocking checks as indicated in the RLRMP.

The desired future condition of these stands is vigorous, well-stocked shortleaf pine seedling/sapling stands similar in composition to the existing stands. Current composition of these stands range from 69% to 98% shortleaf pine. The objective is to maintain this pine type composition with at least a 70% pine and up to 30% hardwood stocking. After harvest and site preparation, the proposed stands would change from a mature pine condition class to an early successional stage consisting of a mix of natural shortleaf pine seedlings; hardwood sprouts, seedlings, poletimber, and sawtimber; and grasses and forbs.

Hardwood key areas and hard mast trees with diameters of 8.0 inches or larger at 4.5 feet height and black cherry, dogwood, French mulberry, persimmon, serviceberry, plum, and Ozark chinquapin would not be treated during site preparation. This would contribute to the hardwood composition objective defined above.

Unfortunately, due to site conditions, visuals coordination, and forest plan regulations, only approximately 2% of the Calico Rock project area is proposed for regeneration. Although this level of regeneration is well below the desired level of approximately 10% early seral habitat development, stand exam data indicated it was nearly the maximum amount allowed considering restraints. Nevertheless, regenerating 172 acres by shelterwood harvest would provide diversity and improve habitat quality in the project area by increasing the number of acres in the 0-10 year age class. The percentage of early seral habitat acres after implementation in 2018-2020 would increase the forested acres in this age class from 0% to approximately 2%. Early seral habitat would be provided for the next 10 years on these 172 acres as they reach 10 years of age.

Approximately 78% of the pine/pine-hardwood acres are in the 41-year old and older age classes. Regenerating 172 acres of shortleaf pine would help break up these age classes. In 2024, the percentage would increase to approximately 82% following implementation of the shelterwood treatment. Breaking up the age classes now would help decrease the amount of mortality occurring at one time.

The forest type of the shelterwood stands would not change. The percentage of hardwoods would increase in the harvested stands initially. As the shortleaf pine mature, a percentage of the smaller hardwood component would be lost due to competition and control. Approximately 10-20 leave den trees and mast producing hardwoods per acre would be left when the stand is regenerated. This hardwood component would remain in

the stands.

Prescribed burning for site preparation and wildlife habitat improvement/fuels reduction is proposed. Prescribed burning would reduce the risk of serious wildfire potential to the Wildland Urban Interface areas on approximately 39% of the project acres. Light to moderate intensity burns would temporarily reduce woody species coverage in the stands. Almost all of the hardwood species, most of the shrubs, and most of the vines are fire-adapted. While these might be top-killed by the burn, rootstocks would not be affected and resprouting would occur. Hardwood vegetation is expected to return to pre-burn levels in 5-7 years.

The temporary control of hardwood sprouts after site preparation burning would allow pine seedlings to become established in the regeneration areas. Seedbed site preparation by prescribed burning for shortleaf has been observed to increase seedling establishment 1 to 5 times that of unburned controls (Shelton and Wittwer, 1992).

The shelterwood stands would be planted with shortleaf pine if natural seedfall does not regenerate the sites. These non-stocked areas would change to a stocked condition following planting and certification after the third year check.

Stands that are proposed for thinning are overstocked resulting in a competition for water, sunlight, and nutrients. These trees are reaching or have reached maturity level and are becoming more susceptible to insect infestations, oak hypoxylon canker, and stress.

Pine boring beetles (e.g., black turpentine beetle, ambrosia beetle) and pine bark beetles (e.g., Ips engraver beetle, southern pine beetle, southern pine sawyer) can attack and overwhelm unhealthy stressed pine forests. Once insect infestations start, it is too late to effectively treat large areas and many acres of trees rapidly die. Prevention is the control method of choice by thinning stands to reduce competition and relieve moisture stress. By keeping the trees healthy, beetles are often exuded from the trees by pitch and are less likely to reach epidemic proportions (Clarke and Nowak, 2009; Connor and Wilkinson, 1983).

Upland hardwood trees are susceptible to many insects and diseases. The annual combined loss due to insects and diseases is often more than the losses to forest fires. Some losses to insects and diseases are unavoidable. However, most losses can be avoided through proper forest management. Maintaining healthy stands by promoting tree vigor helps to avoid these losses (Romagosa and Robinson, 2003).

Thinning would reduce the basal area in these stands and increase growth, vigor, and sustainability of the remaining trees. Thinning would relieve moisture stress while allowing space for new pine and hardwood seedlings to become established. Vigorous growth would produce timber that is of good quality for future supply.

In woodland and forest treatment areas, herbaceous plant and animal diversity is expected to increase dramatically. Plants such as bluestem grasses and various forbs would flourish. This would occur on approximately 55% of the project acres.

Stands proposed for cedar thinning contain patches of thick cedar causing the crowns of these trees to grow together. This has prevented sunlight from reaching the forest floor creating bare ground under these cedar trees. Thinning these stands would reduce the trees per acre and increase growth and vigor of the remaining trees. Opening up these stands would increase the amount of sunlight reaching the forest floor and improve conditions for ground level plants such as bluestem grasses and various forbs. Where cedars occur on overgrown glades, glade plants could return to these special communities (Smith, 2011).

Release treatment would be selective, treating a 4-foot radius around each desired leave tree. Approximately 21% of each stand would remain untreated because vegetation would only be treated on an 8' x 8' spacing. The vegetation within the 4-foot treated circle would be treated and the desired shortleaf pine or hardwood leave tree would be free from competing vegetation. This release would allow forbs and grasses established last entry to continue to thrive in these stands contributing to plant and animal diversity and insuring them viability until the next entry.

Removing the seed trees in stands proposed for seed tree removal might create linear openings in the stands as the seed trees are skidded out. Grasses and forbs and eventually tree species would reclaim these open areas. Shortleaf pine seedlings might be damaged or killed in this removal but this would not decrease the stocking level below stocking standards.

Timber is damaged and dies due to unexpected events, such as wind and ice storms. Dead timber becomes hazardous fuel leading to higher intensity burns, more smoke, and a greater risk of wildfire (Wade *et al.*, 2000). Removal of windblown and dead trees, when feasible, would create a safer environment and a healthier forest. Salvaging the timber after a damaging event allows the utilization of the timber (Gorte, 1996). Timber becomes unmerchantable or sells at a loss within 90-120 days after a damaging event. Thus, rapid treatment of the damaged areas is critical in order to utilize commercial sales as a method for treatment. If not sold commercially, the cost of treating the dead timber is beyond current and expected agency budgets. Both pines and hardwoods would be subject to removal under these circumstances. Pine needles have the highest concentration of all nutrients compared to other parts of the tree. Only the bole of the trees would be removed in the proposed harvests, so about 42% of the nutrients in the harvested trees would be removed from the harvest areas. The nutrients in the needles, branches, stumps, and roots would be left in the harvested areas (Rolfe *et al.*, 1976; Jorgensen and Wells, 1986).

During wildlife stand improvement, vegetation within a 6-foot radius of the selected hardwood leave tree would be treated on a 12' x 12' spacing. The treated vegetation would be inhibited from competing with the desired hardwood leave tree for nutrients and sunlight giving the desired leave tree an advantage to outgrow competing vegetation.

Construction of wildlife openings would change the area from the existing forested condition to an open area consisting of grasses and forbs. Restoration of the existing wildlife openings would change the area from the existing brushy condition to one of improved forage preferred by wildlife. Brush species could sprout back, but maintenance on a 2-year rotation would return thee openings to a grass/forb state.

Road maintenance would include cutting back encroaching brush from the road right-of-ways. Vegetated areas would be disturbed when roads are bladed and ditches are reworked. Brush and vegetation would eventually reclaim these disturbed areas.

Temporary road construction would change these corridors from a forested condition to a grassy condition. Following the sale, these roads would be blocked and vegetation would be allowed to reclaim these corridors with time.

Road construction and OHV trail construction from an old road template would change these miles of corridor from a forested condition to an open corridor that might include grasses along the edges.

Road reconstruction that includes widening roads would remove existing trees. These corridors would become part of the roadway and might include grasses on the edges of the road.

Road decommissioning would restore roadways back to a more natural state. Decommissioning would include reestablishing former drainage patterns, stabilizing slopes, blocking the entrances, installing water bars, removing culverts, removing unstable fills, pulling back road shoulders, scattering slash on the roadbed, and restoring natural corridors. Vegetation would reclaim these corridors over time.

Road closure of system roads would include seeding with wildlife-preferred seed mixtures and over time would provide a more grassy condition along these roadways.

Placing trail restrictors on the proposed trails would reduce the effect from larger vehicles on the trails. Vegetation would naturally become re-established over time along the trail edge.

The development of a borrow pit would change this site to an open area with little to no vegetation. Erosion control measures would be implemented to limit the effects outside the borrow pit location.

Stream habitat management is proposed on approximately 16.0 miles of streams in the project area. Large wood would be felled or placed in the streambed. Anywhere from 8-20 trees per mile are planned for placement in the streams. Small openings created by this tree removal would be vegetated by grasses and shrubs and eventually by seedlings and saplings.

Treatment of non-native invasive species (NNIS) would reduce intra-species competition encouraging native grasses and forbs to fill in the available habitat. Any species on the Regional Forester's List of Invasive Exotic Plant Species of Management Concern could be treated. The list includes, but is not limited to, Tree-of-heaven, paulownia, mimosa, privet, Sericea lespedeza, kudzu, and fescue. Terrestrial applications of any effective herbicide are likely to alter vegetation within the treatment area, which may lead to secondary effects on non-target plants. Using the proposed methods according to label direction, Forest Plan guidelines, and the

mitigation measures (See Mitigation Measures #20-33 starting on page 31 for specific mitigation for herbicides), the herbicides, with the exception of picloram, do not pose damage to non-target terrestrial plants adjacent to areas of application via runoff or drift. Picloram's mobility and integrity in soil indicate the potential for direct and cumulative adverse effects to nearby non-target vegetation from its use (SERA 2011c). However, picloram's use would be limited to kudzu treatment; which currently does not occur in the project area. In addition, the warm weather, plant roots, and acidic soil will help breakdown picloram. Based on the prescribed application method of picloram as Tordon K in a backpack sprayer using large droplets on foliar vegetation, the effects of picloram would be minimized. In summary, the proposed actions do not pose direct, indirect, or cumulative effects to non-target vegetation communities in the project area.

Alternative 2 (No Action)

Implementing the no action alternative would allow continued growth of the vegetation. There would be little or no substantial short-term effect on vegetation in this alternative. However, if the no action alternative were followed indefinitely, then there would be a long-term effect. Stands which are presently 70 years of age and older would suffer a loss in growth rates and a higher rate of mortality. Hardwood species, principally oak and hickory, present in the midstory would replace the pine trees that die. Average site indices for the area are 60-70 for shortleaf pine. This is equivalent to 50-60 for upland oak (primarily black oak, blackjack oak, post oak, and a small component of white oak), usually of poor merchantable quality on these sites. The primary value of these species would be for wildlife habitat, but typically, mast production is not consistent on the sites in this area.

Additional acreage would not be added to the 0-10 year old age class. Therefore, plant diversity would not increase. The basal areas in the younger stands would continue to increase. This would result in crown closure that would gradually reduce and eventually eliminate populations of early stage understory plants and the animal species associated with these vegetative communities. Plant species composition would be restricted to plants that can tolerate heavy shade resulting in a decrease of diversity. Heavy stem density in the canopy would also result in increased stress/competition leading to a higher incidence of mortality due to drought, insects and disease, loss of vigor and eventually stagnation.

Brush species along roadways would continue to encroach into the right-of-ways. Erosion would continue on system roads and trails.

Wildlife openings would grow up in unfavorable grass and brush species and eventually be taken over by pine and hardwood stems.

The exclusion of prescribed burning would cause the buildup of duff and needle layers to continue in the project area. This would reduce the number of small mammals, seed-eating birds, as well as some species such as deer and turkey. The lack of controlled prescribed burning would increase the chances of a catastrophic wildfire in this area. The possibility of wildfires within the WUI would increase.

Non-native invasive plant species would continue to become established in the project area. As non-native invasive plants out-compete the native vegetation, plant diversity would decrease.

The habitat requirements of the endangered American burying beetle would not be met.

J. WILDLIFE

Existing Condition

The project area is part of the Mt. Magazine Wildlife Management Area. 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 AG&F's main responsibilities are to set policy for hunting and fishing regulations and law enforcement programs. The ARNHC is responsible for 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.

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. National Forest Management Act (NFMA) regulations, adopted in 1982, requires selection of management indicator species (MIS) during

development of forest plans (36 CFR 219.19 [a]). 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. From the Ozark-St. Francis National Forests MIS list, 15 species have potential habitat based on occurrence records and/or habitat requirements within the analysis area and will be addressed (Table 11 on page 69) (Arkansas Game and Fish Commission, 2001, 2006, 2007a, 2007b; USDA FS, 2001, 2007; NatureServe *(*Accessed March 2010*,* from http:www.natureserve.org/explorer)).

Table 11. Management Indicator Species (MIS), Habitat Requirements, & Population Trends

MIS Species	Habitat Requirements	Population Trend
Northern bobwhite	pine and oak woodland and native grasslands	decreasing
Whitetail deer	mosaic of forest age classes	stable to increasing*
Black bear	remote habitat with mature forest component with intermixed 0-5 year old regeneration	stable to increasing*
Wild turkey	mature forest with open areas containing grasses/forbs/soft mast	stable to decreasing*
Prairie warbler	regenerating forest communities	decreasing
Brown-headed nuthatch	open pine forest and woodlands	stable to decreasing
Cerulean warbler	communities associated with mature hardwood forest with complex canopy structures, and dry-mesic oak Forest	stable to decreasing
Northern parula	communities associated with forests in riparian areas	stable
Ovenbird	dry-mesic oak forests	stable to increasing
Red-headed woodpecker	oak woodland overstories	stable to decreasing
Pileated woodpecker	large snags	decreasing
Scarlet tanager	mature dry-mesic oak forest communities	stable
Acadian flycatcher	mature mesic hardwood forest communities	stable to increasing
Smallmouth bass**	cool water stream communities	increasing
Largemouth bass**	quality pond and lake habitat	stable

** Information from AGFC harvest data*
*** Also addressed under the Fisheries Section of this EA*

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 FS, 2007) and summarized for MIS avian species on the Ozark-St. Francis National Forests in supporting documentation (Taylor, 2011). Data collected from 1992 to 2004 is utilized.

The analysis area is a mature forest matrix generally composed of a shortleaf pine sub-matrix and an oak-hickory sub-matrix. Currently on federal lands, approximately 3,443 acres or 46% of the analysis area is composed of hardwood/hardwood-pine forest types of an age capable of producing abundant hard mast for wildlife. Pine/pine-hardwood forest types comprise approximately 3,967 acres or 53% of the analysis area. Grassland/open areas on federal lands in the analysis area comprise approximately 18 acres or 0.2% of the total area, primarily consisting of permanently maintained wildlife openings.

Hard mast capability is somewhat patchy across the landscape. The majority of the analysis area's hardwood forest types are currently of mast-producing age (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. Hard 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% of 640 acres (1 square mile) is occupied by well-distributed mast-producing hardwood trees (Holbrook, 1974).

The analysis area reflects conditions that are seen Forest-wide in relation to age classes of forest stands. At present, approximately 0% of the public lands in the project area (forest and woodlands) are in an early seral condition (0-10 years of age). The analysis area contains a high proportion of late-seral wildlife habitat, and lacks open woodland capable of supporting diverse understory grass and herbaceous vegetation as shown in Table 8 (page 60). The majority of pine forest types in the analysis area are currently in age classes >41 years of age (approximately 75%). These stands are represented on all aspects, ridgetops and bottomland areas.

There are 16 permanent wildlife openings within these compartments (see Wildlife Habitat Maps starting on page 21). The RLRMP objective is to have at least four well-distributed 1-5 acre openings per 640 acres of land (RLRMP- FW34, p. 3-6). Three new openings are proposed in an effort to attain four openings per 640 acres. Due to the terrain, soil types and rocky ground, only three areas provided a suitable area to build a wildlife opening.

Currently there are 20 permanent ponds in the project area. Several intermittent streams provide seasonal water for the project area along with Gutter Rock creek, a perennial stream. A goal of the RLRMP is to provide at least two permanent water sources per 640-acre habitat unit (RLRMP, p. 4-7). Construction of a 1-acre pond is proposed within the analysis area in an effort to meet this goal.

Effects

Alternative 1 (Proposed Action)

Effects to wildlife and MIS from implementation of the action alternative are analyzed in detail in a reference paper compiled for the Pleasant Hill and Mt. Magazine Ranger Districts (Taylor, 2011). This paper is part of the project analysis file.

With implementation of Alternative 1, approximately 172 acres would be converted, through harvest and subsequent regeneration, from the 71-100 year age class 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 regeneration systems would result in 2% of the public land-base within the analysis area compartments in early successional forest habitat, as opposed to 0% under current conditions. In addition, approximately 14.5 acres in the 41-70 and 71-100 year age classes would be converted to grass/forb habitat (wildlife openings). This would result in 0.3% of the public land-base within the analysis area being in grass/forb habitat, as opposed to 0.2% under current conditions.

Overall, in both pine and hardwood forest types, implementation of Alternative 1 would result in an approximate 8% increase of forest habitat that is greater than 71 years old by 2024 (Table 12, page 71). Following implementation of this alternative, in the year 2024, approximately 33% of the forested (both pine and hardwood) public land base within the analysis area compartments would be in the 71-100+ year age classes. When considering recruitment of stands from the 41-70 year age class (approximately 2,288 acres or 31% of analysis area land base) in the next 1-30 years, and examination of distribution of stand age classes, fragmentation of interior forest habitat is not anticipated.

Timber Harvest and Wildlife Habitat Improvement.

Effects of implementation of the action alternative are described in Taylor (2011), in relation to the subsections Early Successional Habitat, Soft Mast Production, and Hard Mast Production. Indirect negative effects would occur to wildlife species dependent upon older seral stages and with habitat requirements associated with closed canopy conditions. Thinning to help restore woodland and riparian conditions and the creation of wildlife openings to improve herbaceous diversity would have positive indirect effects to many species of 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 effects 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 RLRMP. 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 RLRMP. Herbicide use is an important tool often used in woodland restoration thinning and wildlife opening construction and restoration to prevent sprouting of woody species and therefore allowing for greater understory herbaceous vegetation abundance and diversity.

Table 12. Forest Age Class Distribution by Alternative (Public Lands)

Age Classes (years)	Current (Year 2014)		Alternative 1 – Year 2024		Alternative 2 – Year 2024	
	Acres	% Total Acres	Acres	% Total Acres	Acres	% Total Acres
grass/forb*	18	0.2%	32.5	0.4%	18	0.2%
0-10	0	0.0%	172	2.3%	0	0.0%
11-20	114	1.5%	0	0.0%	0	0.0%
21-40	799	10.7%	571	7.6%	571	7.6%
41-70	2288	30.6%	1815	24.4%	1822	24.4%
71-100	3428	45.9%	2386	33.0%	2475	33.1%
100+	826	11.1%	2415	32.3%	2587	34.6%

** Grass/forb acres are represented by existing and proposed wildlife openings. Grass/forb habitat is interspersed amongst forest stands in the 0-10 year through 100+ age classes.*

Prescribed Fire

Implementation of prescribed fire might cause some direct mortality to small mammals and herpetofauna in the short-term. However, Kirkland and others (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 might 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 effect on the terrestrial vertebrate fauna. In addition, immediate effects 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 and others (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 and Parker, 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).

Herbicide Use

Herbicide use is an important tool for benefiting pine regeneration by providing for these species presence in the ecosystem in the long term. Herbicide use is also an important tool for maintaining and improving grass/forb habitat for wildlife. Effects of herbicide toxicity data and dosage estimates for triclopyr, imazapyr, imazapic, picloram (Tordon K), and glyphosate 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 considerable concentrations of herbicides or off-site movement. In a study regarding the use of herbicides in forestry applications, Michael (2001) 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 noteworthy water contamination problems unless they are applied directly to water. Additionally, mitigation measures normally employed through State Best Management Practices (BMPs) further restrict herbicide's effects outside the boundaries of its application. On February 23 and 24, 2009 an analysis of risk was performed for the chemicals glyphosate, imazapyr, imazapic, triclopyr amine, and triclopyr ester at the proposed rate of application in SERA risk assessments prepared for the USDA Forest Service. In a variety of human health and environmental health scenarios (including a variety of wildlife scenarios), most Hazard Quotients (HQs) were projected to be below the 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 would 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 Mt. Magazine Ranger District Office.

Glyphosate is not soil active and has low toxicity to animals. Lab studies conducted specifically on bobwhite quail also demonstrate extremely low toxicity. Typical HQs for foliar and cut surface application for glyphosate to wildlife are less than one. Glyphosate has been researched in conjunction with Colony Collapse Disorder (CCD) in honeybees. According to vanEnglesdorp (2009), no single factor was found with enough consistency to suggest one causal agent for CCD. Other factors being analyzed as potentially contributing to CCD include pathogens such as the Israeli acute paralysis virus (IAPV) and other viruses, bacteria, and funguses. While pesticides and their effects on CCD have been studied, IAPV of bees was found to be strongly correlated to CCD and is a significant marker for CCD (Cox-Foster *et al.*, 2007).

Imazapic is weakly absorbed in basic soils, but absorption increases in acidic soils. This herbicide has low toxicity to animals. HQs 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. Imazapyr can be soil active, particularly during spring leaf expansion and application after mid-September might 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 occurring in proximity to treated plants could be killed which could indirectly affect habitat for MIS on a very small scale.

Picloram appears to be relatively nontoxic to terrestrial mammals. Individuals exposed to picloram excrete most of the compound, unchanged, in their urine (USDA FS, 2000).

Picloram is moderately to slightly toxic to fish and slightly toxic to aquatic invertebrates (USDA Forest Service 2011c). Toxicity of picloram to aquatic animals was tested in various species of trout and Daphnia magna, a small aquatic invertebrate. Acute LC50 values for aquatic species tested ranged from about 5 to 75 ppm, with trout being the most sensitive (USDA FS 2000). Based on available data, picloram does not appear to be mutagenic and does not bioaccumulate in fish (EPA 1988).

Glyphosate, imazapyr, imazapic, picloram and triclopyr are all considered nontoxic to honeybees (WSSA 1994; Kamrin 1997; SERA 2004; SERA 2011a, b, c, d).

Triclopyr Amine and Triclopyr Ester have low bioconcentration potential and single dose toxicity to mammals is low; although, prolonged or repeated exposure might cause skin irritation in mammals (Source: MSDS dated 1/17/2001). Typical HQs 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 HQs 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 HQs 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 WSI, wildlife opening and site preparation areas.

Direct effects, occurring at time of application, to birds or large mammals are unlikely, since these species are likely to move from the area when project activities are implemented. Although direct effects to amphibians are

more likely since contact with herbicide could be absorbed through the skin and affect 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. However, the proposed application methods, including direct application to target foliage or cut surfaces, 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 1; however, none of the chemicals would bioaccumulate in organisms. Indirect effects to MIS and habitats treated with all proposed chemicals are likely to be negligible given that applicators treat target organisms only and that mitigation measures and forest-wide standards would be used.

There are likely to be few negative cumulative effects to MIS species over time as a result of implementing Alternative 1. None of the herbicides proposed for use would bioaccumulate or have lengthy half lives in the environment. Related to cumulative effects, the Mt. Magazine District is proposing to apply herbicide in the analysis area on up to 700 acres annually to treat non-native invasive species (NNIS). Realistically, for the reasonably foreseeable future, this might amount to 300-700 acres of herbicide treatment in the analysis area for NNIS over 5 years after project implementation. Picloram (Tordon K) would only be used to treat Kudzu in the Calico Rock project area if any is ever found. No other herbicide projects are known to be occurring within the project area except for those listed in the Proposed Action. Efforts to maintain early seral habitat and restore herbaceous species biodiversity in WSI areas and TSI treatments and site preparation treatments to benefit pine regeneration and 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 in the RLRMP. Proposed herbicide use would have beneficial effects on species using early-successional habitat. This would occur by allowing creation and restoration of wildlife openings, reduction of overstory and midstory canopy in WSI areas, and promoting pine regeneration through site preparation practices.

Road and OHV Trail Work

No negative long-term effects to wildlife would occur through proposed road construction, road reconstruction, road maintenance, temporary roads, or conversion of an old roadbed to an OHV designated trail. Closure of roads following use 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. The designated OHV trail would be constructed on an old road template and would be restricted to OHVs. Application of BMPs and RLRMP forest-wide standards (FW-72 – FW-76, FW-78, FW-79, FW-81, FW-82, and FW-87 – FW-90) would be utilized for all road and trail related work. Unmaintained and unauthorized non-system roads are one of the most common sources of accelerated erosion on National Forest lands. The Proposed Action would serve to assist in “disconnecting” the road system from the stream network. Road maintenance would help preclude entrainment of sedimentation in creeks from poor quality roads. This would cause positive indirect effects 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 effects 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.

Alternative 2 (No Action)

Only currently approved management actions would continue under this alternative. Effects to wildlife and MIS from implementation of the no action alternative are analyzed in detail in a reference paper compiled for the Pleasant Hill and Mt. Magazine Ranger Districts (Taylor, 2011). 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 (2011), 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 in pine and to a lesser extent 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 major forest stand disturbance or treatments that favor oak regeneration. This alternative would cause negative indirect effects to wildlife species. The RLRMP 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. Silvicultural practices, including pine release and planting of pine (as necessary) would not occur. Lack of improvement of stands containing beneficial tree species for wildlife would not occur, thereby causing indirect adverse effects. The habitat requirements of the endangered American burying beetle would not be met, thus causing adverse effects.

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 major 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 effects to wildlife species. The RLRMP 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 for site preparation in pine shelterwood harvest areas is an important tool for benefiting pine regeneration, by reducing interspecies competition and providing for this species presence in the ecosystem in the long term. Herbicide use for completion of WSI and wildlife opening construction/restoration is an important tool for improving grass/forb habitat for wildlife. Without use of this tool, benefits to pine regeneration and wildlife would not occur.

Road Work

Road maintenance, road decommissioning and closure of roads to administrative use only would not occur. The “No Action” alternative would not serve to disconnect the road system from the stream network. Road maintenance at levels expected to occur with the action alternatives would not occur, thereby allowing entrainment of sedimentation to continue in creeks from poor quality roads. This would cause adverse indirect effects 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 effects to water quality and aquatic species.

K. FISHERIES

Existing Condition

The analysis area for fisheries effects is comprised of all streams and waterbodies within and downstream of Compartments 42, 47, 53, 54, 71, and 72 within the Gutter Rock Creek and Short Mountain Creek Watersheds. The major streams in the project area include Gutter Rock Creek, Calico Creek, and Short Mountain Creek. The entire project area falls within the Arkansas River Valley ecoregion.

Field visits were made to the project area to collect habitat and species composition information to determine potential project activities that could be included in the alternatives and to evaluate the potential for effects from all the proposed management activities. The Short Mountain Creek Watershed was inventoried in the summer of 2007 (Krause and Roghair, 2007). Gutter Rock Creek and Short Mountain Creek were inventoried as part of the survey. Calico Creek was not surveyed because the stream was dry but observers did note a lack of large woody debris in the channel.

Table 13, page 75, displays the habitat surveyed in the summer of 2007 with the number of pieces of large woody debris per mile and the pool/riffle ratio for Gutter Rock Creek and Short Mountain Creek (Krause and Roghair, 2007). These stream showed a lack of overall large woody debris in both the larger size class (greater than 16.4 feet long and greater than 19.7 inches in diameter) and the smaller size class (greater than 3.3 feet long and greater than 3.9 inches in diameter) compared to the objectives set aside in the RLRMP. Both streams do meet the objectives for pool habitat set aside in the RLRMP.

Table 13. Stream Habitat Surveyed in the Project Area

Stream Name	Large Woody Debris (pieces/mile)		Pool/Riffle Ratio
	>3.3 feet long >3.9 inches diameter	>16.4 feet long >19.7 inches diameter	
Short Mountain Creek	24	0	64/36
Gutter Rock	16	0	57/43

Regulation 2 of the Arkansas Pollution Control and Ecology Commission states: “High quality streams of the Arkansas River Valley ecoregion would support diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by a substantial proportion of sensitive species; a sunfish and minnow dominated community exists but with substantial proportions of darters and catfish (particularly madtoms)” (Arkansas Pollution Control and Ecology Commission, 2011).

Table 14, page 75, shows the Key and Indicator species listed by the Arkansas Pollution Control and Ecology Commission under Regulation Number 2 for the Arkansas River Valley ecoregion.

Table 14. Key and Indicator Species

Key Species	Indicator Species
Bluntnose minnow	Orangespotted sunfish
Golden redhorse	Blackside darter
Yellow bullhead	Madtoms
Longear sunfish	
Redfin darter	
Spotted bass	

Fish surveys were completed for Short Mountain Creek and Gutter Rock Creek during the field visits to the watershed. Table 15, page 76, displays the fish species and number of fish that were captured. An Index of Biotic Integrity (IBI) was done for the fish sample from both streams. This IBI was developed by the Arkansas Department of Environmental Quality (ADEQ) for the Arkansas River Valley ecoregion. An IBI is a scientific tool used to identify and classify water quality within a waterbody based on biological species information. The IBI score for both streams was in the fair range. Short Mountain Creek has a very high diversity of species and was at the very upper end of the range of scores for the fair category. Gutter Rock Creek had lower species diversity than Short Mountain Creek. This was caused by the difference in sizes of the stream. Both streams had a very high score for the percentage of individuals in the population that are considered sensitive to disturbance. This would show that these species are not being affected by issues like sedimentation, pollutants, etc.

Smallmouth bass was selected as a MIS due to popularity as a sport fish and as an indicator of high quality stream habitat. It is an inhabitant of cool, clear mountain streams with permanent flow and rocky bottoms. It is more intolerant to habitat alteration than any of the other black basses, and is especially intolerant of high turbidity and siltation. The species was not found during surveys of streams in the project area.

Effects

Alternative 1 (Proposed Action)

Streams are dynamic systems and are in a continuous state of change. Natural sedimentation would continue to occur from bank erosion and heavy rain events. In addition, sedimentation from private lands within the

watershed would be expected to continue but is outside the control of the agency.

Table 15. Fish Species Captured in the Calico Project Area

Fish Species	Short Mountain Creek		Gutter Rock Creek	
	Total Individuals	Relative Abundance	Total Individuals	Relative Abundance
Central Stoneroller	26	48%	52	57%
Creek Chub	1	2%	22	24%
Slender Madtom	6	11%	4	4%
Green Sunfish	1	2%	4	4%
Bluegill	1	2%	-	-
Longear Sunfish	1	2%	-	-
Largemouth Bass	2	4%	-	-
Orangethroat Darter	2	4%	-	-
Redfin Darter	5	9%	8	9%

Data collected from the Short Mountain Creek watershed would suggest that water quality has remained fair in the project area. Past management activities have included timber harvesting, silvicultural treatments, road construction and reconstruction, wildlife habitat improvement, and prescribed burning. National Forest management on these drainages has been ongoing since the early 1940s and water quality problems have not been noted.

Based on the analysis in the Soils and Water Quality effects sections, along with the incorporation of the mitigation measures beginning on page 29; there would be no substantial effect on any stream (or aquatic species utilizing them) in the Short Mountain Creek watershed.

There might be minimal increases in water yields. Since the streams in the analysis area are intermittent, any minimal increase in water yield would provide at the most, very limited benefits to fish populations. Increased water yields, particularly during the summer and fall, could benefit the fish populations in these streams by providing more through-gravel flow, increased nutrients, and more available aquatic habitat. However, since any increases are expected to be minimal and short term, there would not be any observable benefit to the fish population in the effected streams. Similarly, since any increases in yield would be small, there would not be any adverse effect from increased flow, such as increases in stream bank erosion or scouring.

The addition of the large woody debris would lead to greater habitat complexity which could lead to greater retention of water through the summer months. The addition of the large woody debris from the activities proposed in Alternative 1 would create more in stream habitat for all species, which could increase the biomass and productivity within these systems (Harmon *et al.*, 1986).

With this alternative, forest standards from the RLRMP and Best Management Practices (BMPs) guidelines in Section VI of the Arkansas Forestry Commission's BMPs for Water Quality Protection would be implemented and followed.

BMPs used for streamside management areas are similar on the Ozark and Ouachita National Forests. Clinginpeel (1989) and Neihardt (1992) measured the effectiveness of Best Management Practices on the Ouachita National Forest in Arkansas and Oklahoma. Clinginpeel focused on BMPs for streamside management areas (SMAs) and for road crossings of intermittent and ephemeral streams. The measured parameters in both studies were sediment, turbidity in Jackson Turbidity Units (JTUs), conductivity, alkalinity, pH, nitrites, nitrates, sulfates, and chlorides. Additional parameters in Neihardt's study were total dissolved solids, hardness, turbidity in Nephelometric Turbidity Units (NTUs), acid, and several metals.

Clinginpeel found that sulfates differed considerably above and below stream crossings, but actual differences were small (1.84 mg/l and 1.94 mg/l, respectively). Above and below measurements at SMAs were statistically different for turbidity (16.1 JTUs and 19.5 JTUs, respectively) and pH (6.13 pH and 6.32 pH, respectively), but remained within State standards. All the other parameters were unchanged. Neihardt found that turbidity

measured in JTUs was statistically different, but turbidity measured in NTUs was not. Both investigators concluded that forestry BMPs, as implemented on the Ouachita National Forest, effectively maintained water quality within State standards.

In a separate study, Clinginpeel (1993) evaluated the effectiveness of BMPs for silvicultural herbicide application on the Ouachita National Forest from Fiscal Years 1989 through 1993. Again, stormwater samples were collected above and below treated areas from streams in potentially impacted areas, and analyzed for positive readings of Garlon, Velpar, and Roundup. In all, 348 water samples were collected from 168 sites. Sixty-nine samples, or 19.8%, tested positive for herbicides, but all positive samples were less than one-quarter of the EPA limit for the specific herbicide and toxic limit for fish. He concluded that the BMPs tested effectively protected water quality and fisheries (Clinginpeel, 1989, 1993; Neidhardt, 1992).

The replacement of road/stream crossings that are known barriers to aquatic organism migration would increase connectivity for the populations of aquatic organisms that live within the watershed. This would increase the genetic variability of the population as well as increase the ability for individuals to utilize different habitats during different times of the year.

Smallmouth and largemouth bass have a low tolerance for sedimentation. The timber harvesting, silvicultural treatments, temporary road construction, system road reconstruction and construction, wildlife habitat improvement, prescribed burning, and other proposed activities might cause a temporary increase in sediment, but would be minimal because BMPs and forest standards would be followed during the activities. The use of herbicide in the project area would have no effect on smallmouth or largemouth bass as long as label directions and agency protocols are followed. The addition of large woody debris to the streams would create greater stream complexity which could provide more habitat and greater amounts of food biomass for smallmouth bass within the project area as well as for largemouth bass in larger streams downstream of the project area as the large wood moves through the system. Given forest-wide standards and riparian standards, the activities associated with this project would keep smallmouth bass populations at current levels or increase the relative abundance of the species in the watershed as well as increase largemouth bass populations in the watershed.

The effects of the Proposed Action, both individually and cumulatively, are not expected to have any considerable effects on the water quality within the project area. There would be no negative effect on fish or other aquatic species from the Proposed Actions in Alternative 1.

Alternative 2 (No Action)

No activities are planned or implemented with this alternative; therefore, no change would occur in stream conditions that would be attributable to management actions proposed here. Streams are dynamic systems and are in a continuous state of change. Natural sedimentation would continue to occur from bank erosion, from existing roads and trails, as well as heavy rain events.

Because no activities are planned with this alternative, aquatic MIS species would not be affected. Smallmouth and largemouth bass populations would stay at current levels within the watershed or could drop due to the lack of road and trail maintenance that would not be completed as part of the project and the roads and trails that would not be closed. This would be caused by the increase in sediment from these sources as they get increasingly more traffic. It also could be caused by the lack of habitat improvements from the lack of large wood in the stream system and the lack of aquatic connectivity caused by the fish passage barriers.

L. PROPOSED, ENDANGERED, THREATENED AND SENSITIVE 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 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 threatened, endangered, or sensitive (TES) plant and animal species known or likely to occur on the Ozark-St. Francis National Forests, and their habitat preferences. This review included the U.S. Fish and Wildlife Service current list of endangered, threatened, and proposed species for Arkansas as of Feb. 23, 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.
2. Consulting element occurrence records (EORs) for TES species as maintained by the Arkansas Natural Heritage Program (ARNHP).
3. Consulting with individuals in the private and public sector who are knowledgeable about the area and its flora and/or fauna.
4. Reviewing sources listed in the reference portion of this report.
5. Reviewing the results of field surveys that have been conducted in the area.

Most TES species known to occur on the Forest have unique habitat requirements, such as glades, barrens, rock outcrops, bogs, caves, and natural ponds. Appendix A of the BE lists all 63 TES species currently known or expected to occur on or near the Ozark-St. Francis National Forests. All species on the list were considered during the analysis for this project.

A "step down" process was followed to eliminate species from further analysis and focus on those species that may be affected by proposed project activities. Species not eliminated are then analyzed in greater detail. Results of this "step down" analysis process are displayed in the Occurrence Analysis Results (OAR) column of the table in Appendix A of the BE. First, the range of a species was considered using county records contained in such documents as An Atlas and Annotated List of the Vascular Plants of Arkansas and NatureServe Explorer (Accessed March 2010, from http:www.natureserve.org/explorer). Range is refined further when additional information is available; such as, more recent occurrences documented in scientific literature or in Natural Heritage databases. Many times the historic range information clearly indicates a species will not occur in the analysis area due to the restricted geographic distribution. When the analysis area is outside a known species range then that species is eliminated from further consideration by being coded as OAR code "1" in the Appendix A table. For the remaining species, 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 (Lawson, 2014).

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

From past field surveys and knowledge of the area, 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"), 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 would be immeasurable or insignificant (OAR code "7"). Sixteen 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"). One species was found to occur in the project area (OAR code"5") (Table 16, page 79).

Effects

Alternative 1 (Proposed Action)

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 BE for the Calico Rock Project (in project file).

Table 16. Threatened, Endangered, or Sensitive Species Occurrences: Calico Rock Project Area

OAR*	Scientific Name	Common Name	Taxa	Status
6	*Aimophila aestivalis*	Bachman's sparrow	Bird	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	*Myotis septentrionalis*	Northern long-eared bat	Mammal	Threatened
6	*Lirceus bicuspicatus*	An isopod	Isopod	Sensitive
6	*Nicrophorus americanus*	American Burying Beetle	Beetle	Endangered
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
6	*Solidago ouachitensis*	Ouachita mountain goldenrod	Plant	Sensitive
6	*Tradescantia ozarkana*	Ozark Spiderwort	Plant	Sensitive
6	*Valerianella nuttallii*	Nutall's cornsalad	Plant	Sensitive
6	*Eriocaulon koernickianum*	Small-headed pipewort	Plant	Sensitive

* Occurrence Analysis Results (OAR) are coded as 5 when the species is found to be located in the activity area or as 6 when the species was not seen during the survey(s) but could possibly occur in the activity area based on habitat observed during the survey(s) or field survey was not conducted when species is recognizable.

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 effects in conjunction with the Proposed Action.

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

Gray bat

There are no foreseeable additional 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 effects in conjunction with the Proposed Action.

With implementation of Forest-wide standards from the RLRMP which were developed in coordination with the USFWS during the revision process, the determination of effect for the Gray bat related to this proposed

project is: “may affect – not likely to adversely affect.”

Northern long-eared bat

There are no foreseeable, additional management activities in the area (not associated with this project) that would directly or indirectly affect the NLEB as a species in a negative manner, or cause additive or synergistic adverse cumulative impacts in conjunction with the proposed action.

There is potential habitat for the NLEB within the analysis area, but with implementation of Forest-wide standards from the Revised LRMP and adherence to direction provided by the USFWS during the revision, and guidance from the 2015 NLEB Biological Opinion any negative direct, indirect or cumulative effects to this species as a whole should be minimized.

This project is likely to adversely affect the northern long-eared bat; however, there are no effects beyond those previously disclosed in the programmatic biological opinion dated August 5, 2015 (FWS Log #04E00000-2015-F-0003). Any taking that may occur incidental to this project is excepted from the prohibitions for taking threatened species under 50 CFR 17.31 and 17.32. This project is consistent with the forest plan, the description of the proposed action in the programmatic biological opinion, and activities excepted from taking prohibitions under the ESA section 4(d) rule applicable to the northern long-eared bat; therefore, the programmatic biological opinion satisfies the Forest Service’s responsibilities under ESA section 7(a)(2) relative to the northern long-eared bat for this project (NLEB BO, 2015).

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 effects in conjunction with the Proposed Action.

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

American Burying Beetle

This species of carrion beetle was formerly distributed throughout temperate eastern North America. It is now known from several locations in Oklahoma and Arkansas as well as Nebraska, Southwest Missouri and on Block Island, off the coast of Rhode Island. Based on the drastic decline and extirpation of the species over nearly its entire range, *Nicrophorus americanus* was listed as endangered by the U.S. Fish and Wildlife Service in 1989.

This species has been found in several different habitat types, including grassland, lightly grazed pasture, oak hickory forests with open understory and edge sites. Soil types that are conducive to excavation are important. Carrion size is important but not a critical factor. Preferred carrion size ranges from 100 to 200 grams. Habitat loss and disturbance are considered the greatest threats to this species (USDI FWS, 1991).

In 25 years of sampling for American burying beetle (ABB) on the Mt. Magazine Ranger District, a total of 7 have been captured along the western edge of the district. Although ABBs have been captured near the project area, open understory conditions do not currently exist on average in the proposed project area. Positive effects to the species could occur with the implementation of the project. After project work is completed there would be more open understory and edge. The addition of fire to the landscape coupled with thinning trees and removal of cedar trees would create a more desirable habitat for the ABB. Negative direct effects to individuals of this species could possibly result from implementation of this project; however, with implementation of Forest-wide standards from the RLRMP and the Final American Burying Beetle Conservation Plan, and adherence to direction provided by the USFWS during the revision of the RLRMP, the project would have no negative direct, indirect, or cumulative effects to the species as a whole.

This project area is within the Ozark-St Francis National Forests’ American Burying Beetle Conservation Area. The Proposed Action Alternative makes progress towards implementing the American Burying Beetle Conservation Plan and would have a positive effect on this endangered species. In addition, implementation of this alternative might benefit the Ozark big-eared bat, gray bat and Indiana bat by providing habitat improvement. Because there are no other threatened or endangered species or associated habitat present, the proposed project would have no effect on any other listed or proposed species.

Sensitive Species

For sensitive species (Bachman's sparrow, bald eagle, Eastern small-footed bat, lirceus isopod, Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, Moore's larkspur, Ouachita mountain goldenrod, Ozark spiderwort, Ozark Chinquapin, Small-headed pipewort, and Nuttall's cornsalad), direct negative effects to individuals of these species might occur through implementation of the project. No negative indirect or cumulative effects are expected for these species from implementation of the project. For all Region 8 sensitive species, implementation of the proposal would not lead to the federal listing of these species under the Endangered Species Act. Furthermore, there would 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 Bachman's sparrow, Ouachita leadplant, Small-headed pipewort,Bush's poppymallow, Moore's larkspur, Ozark spiderwort, and Nuttall's cornsalad. Because there were no other sensitive species or habitat for such species present, the project would have no effect on any other Southern Region sensitive species.

Alternative 2 (No Action)

No negative adverse effects would occur to federally listed threatened and endangered 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 (Bachman's sparrow, bald eagle, Eastern small-footed bat, lirceus isopod, Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, Ouachita mountain goldenrod, Ozark spiderwort, Small-headed pipewort, and Nuttall's cornsalad). Potential positive effects to species which require open (unshaded) and/or fire-dependent habitats would not occur. These sensitive species include Bachman's sparrow, Ouachita leadplant, Bush's poppymallow, Ozark spiderwort, Small-headed pipewort, and Nuttall's cornsalad.

M. HUMAN HEALTH FACTORS

Existing Condition

The analysis area for human health factors is comprised of Compartments 42, 47, 53, 54, 71 and 72. There are no risks to human health from the use of herbicides or cutting tools in the project area. Dead and dying trees along traveled roadways and in camping/hunting areas in the analysis area may give pause for concern for forest workers and visitors. Falling trees and limbs can cause personal injury and damage personal property. Accumulations of forest litter in the analysis area creates potential for wildfires.

Effects

Alternative 1 (Proposed Action)

Alternative 1 proposes the use of triclopyr, glyphosate, and/or imazapyr or a combination of these herbicides for site preparation and release. Imazapyr, imazapic, triclopyr amine, picloram, and/or glyphosate are proposed for use in non-native invasive species treatment and wildlife opening restoration.

The most current Human Health and Ecological Risk Assessments available for each of the chemicals being proposed for use in this alternative were reviewed during the preparation of this document (SERA 2011a, 2011b, 2011c, 2011d, 2004). These assessments describe in narrative form the relative level of risk for human and ecological factors for a given application rate of the herbicide. These assessments are supported by the accompanying risk assessment worksheets which document the calculations used in the assessments. If needed, worksheets can also be used to analyze the level of risk for specific application rates.

The proposed application rates for each herbicide in this alternative fall at or below the range of rates examined in these risk assessments. The proposed rate of **triclopyr** (1 lb. a.i./acre) is below or equal to the amount of active ingredient (a.i.) per acre analyzed in the risk assessment. The lowest rate analyzed in the **imazapyr** risk assessment was 0.45 lbs. a.i./acre; the highest rate proposed in this alternative is 0.3 lb. a.i./acre. **Glyphosate** treatment in this alternative is proposed for up to 2.0 lbs. acid equivalent (a.e.)/acre being applied, the risk assessment analyzed 2.0 lbs. a.e./acre. **Imazapic** treatment in this alternative is proposed for up to 0.125 lb. a.e./acre being applied. The risk assessment analyzed 0.1 lbs. a.i./acre with a

range of 0.0325 to 0.1875 lb. a.e./acre. The proposed rate of up to 1 lb. a.i./acre of **picloram** is equal to that analyzed in the risk assessment. Therefore, no additional worksheets were prepared for any of these herbicides.

The Hazard Quotient (HQ) is a measure of the relative hazard of a proposed action. Risk assessment worksheets calculate the HQ. The risk assessment uses the HQ to address acute exposure, which could result in direct or indirect effects, and chronic exposure, which could result in cumulative effects. The U.S. Department of Agriculture - Forest Service, Southern Region standard for acceptable level of risk requires a HQ less than 1.0. For human safety, the risk assessments examine the level of risk to workers applying herbicide and to the general public. Workers could be exposed during accidents or general exposure during herbicide application. The general public could be exposed by direct spray of individuals in treatment areas; skin contact with contaminated vegetation; or consumption of contaminated fish, fruit, vegetation, or water. HQs are calculated for exposed women and children as they are considered to have the most potential for adverse effects, and represent the worst-case scenario when analyzing potential for human health effects.

The risk characterization for the herbicides being proposed for use are:

Triclopyr

There is no indication that workers would be subject to hazardous levels of triclopyr at the typical application rate of 1.0 lb. a.i./acre and under typical exposure conditions. Nonetheless, at the upper range of exposures, all application methods exceed the level of concern based on the chronic reference dose (RfD) but not the acute RfD. Thus, for workers who might apply triclopyr repeatedly over a period of several weeks or longer, it is important to ensure that work practices involve reasonably protective procedures to avoid the upper extremes of potential exposure. At higher application rates, particularly rates that approach the maximum application rate of 10 lbs./acre, measures would be taken to limit exposure. These measures would need to be developed on a case-by-case basis depending on the specific application rates that are used and the type of the applications that are employed.

For members of the general public, the risk characterization for triclopyr is thus relatively unambiguous at the typical application of 1.0 lb/acre. Based on the available information and under the foreseeable conditions of exposure, there is no route of exposure or exposure scenario suggesting that the general public would be at risk from longer-term exposure to triclopyr (SERA 2011d). Even at the maximum projected application rate of 10 lbs./acre, the only longer-term scenario that exceeds the level of concern is the consumption of contaminated fruit. This is a standard scenario used in all Forest Service risk assessments and is extremely conservative – i.e., it assumes that fruit that has been directly sprayed is harvested and consumed for a prolonged period of time and that the contaminated fruit accounts for 100% of the individuals consumption of fruit. Under these extreme conditions, the level of concern is exceeded by a factor of five at the upper range but not the central estimate of exposure. Several acute exposures also lead to hazard quotients that are above the level of concern at the upper range of exposure. Two dermal exposures to triclopyr (ester formulation) – i.e., accidental spray of a woman over the lower legs as well as dermal contact with contaminated vegetation by a woman – exceed the level of concern at the central estimate of exposure. The use of the highest application under consideration – i.e., 10 lbs./acre – alters the risk characterization for acute exposures terms of dermal exposures and the spill into a pond. At an application rate of 10 lbs./acre, both triclopyr ester and triclopyr amine formulations would exceed the level of concern for all dermal exposure scenarios at the upper range of exposure as well as some central estimates of exposure. Again, all of these dermal exposure assessments are extremely conservative and designed to identify which possible types of exposure would be most hazardous. For triclopyr, such scenarios include dermal contact and accidental spills into water.

Imazapyr

Typical exposures to imazapyr do not lead to estimated doses that exceed a level of concern for either workers or members of the general public at either the typical (0.45 lb./acre) or highest application rate (1.25 lb./acre) (SERA, 2011b). Although there are several uncertainties in the exposure assessments for workers and the general public, the upper limits for hazard quotients associated with the longer-term exposures are sufficiently below a level of concern that the risk characterization is relatively unambiguous. Based on the available information and under the foreseeable conditions of application, there is no route of exposure or scenario suggesting that the workers or members of the general public would be at any substantial risk from longer-term exposure to imazapyr even at the upper range of the application rate considered in this risk assessment.

Mild irritation to the eyes could result from exposure to relatively high levels of imazapyr. From a practical

perspective, eye irritation is likely to be the only overt effect as a result of mishandling imazapyr. This effect could be minimized or avoided by prudent industrial hygiene practices – e.g., exercising care to reduce splashing and wearing goggles – during the handling of the compound.

Glyphosate

The risk characterization for both workers and members of the general public for glyphosate is reasonably consistent in unambiguous (SERA, 2011a). For both groups, there is very little indication of any potential risk at the typical application rate of 2 lbs. a.e./acre. Even at the upper range of plausible exposures in workers, most hazard quotients are below the level of concern.

For workers, the highest hazard quotient – i.e., 0.2, the upper range for workers involved in broadcast ground spray – is below the level of concern by a factor of about 5. The highest hazard quotient for any accidental exposure scenario for workers - i.e., 0.006 for the upper range of the hazard quotient for spill over the lower legs for 1-hour - is lower than the level of concern by a factor of over 150. Confidence in these assessments is reasonably high because of the availability of dermal absorption data in human as well as worker exposure studies. The Forest Service might apply glyphosate at a maximum rate of 7 lbs. a.e./acre, a factor of 3.5 higher than the typical application rate of 2 lbs. a.e./acre. This has essentially no effect of the risk characterization for workers. The highest hazard quotient for the typical application rate is 0.2. For an application rate of 7 lbs. a.e./acre, the corresponding hazard quotient would be higher by a factor of 3.5 or 0.7, which is still below the level of concern.

From a practical perspective, the most likely accidental exposure for workers that might require medical attention involves accidental contamination of the eyes. Glyphosate and glyphosate formulations are skin and eye irritants. Quantitative risk assessments for irritation are not normally derived, and, for glyphosate specifically, there is no indication that such a derivation is warranted. Glyphosate with the polyoxyethyleneamine (POEA) surfactant is about as irritating as standard dishwashing detergents, all-purpose cleaners, and baby shampoos. As with the handling of any chemical, including a variety of common household products, reasonable care should be taken to avoid contact of skin and eyes.

The only area of remarkable uncertainty involving worker exposures concerns the potential health effects during brown-and-burn operations. The combustion of wood and wood by-products might produce a number of toxic compounds. This is a concern with brown-and-burn operations but does not pertain to the use of glyphosate or any other herbicide. The potential effects of combustion products is common to all risk assessments of materials that might be subject to burning. With the exception of some plastics, the combustion products of which are known to pose a risk to fire fighters, the combustion products of most chemicals have not been examined in detail. The necessity of addressing this data gap must be weighed against the need to address other data gaps on glyphosate and other chemicals. The combustion products of burning wood and vegetation are respiratory irritants as well as carcinogens, and exposure to these combustion products should be avoided. There is no basis for believing that the presence of low or even high levels of glyphosate residues would have a considerable effect on this hazard.

For members of the general public, none of the longer-term exposure scenarios exceed or even approach a level of concern. Although there are several uncertainties in the longer-term exposure assessments for the general public, the upper limits for hazard indices are below a level of concern by factors of about 25 (longer term consumption of contaminated fruit) to over 2 million (2,500,000 for longer-term consumption of fish by the general population). The risk characterization is thus relatively unambiguous: based on the available information and under the foreseeable conditions of application and exposure, there is no route of exposure or exposure scenario suggesting that the general public would be at risk from longer-term exposure to glyphosate. As with the hazard characterization for workers, an application rate of 7.5 lbs. a.e./acre makes no difference in the assessment of potential risks. At this application rate, the highest hazard quotient would be about 0.14 [0.04 × 3.5], which is still below a level of concern by a factor of about 7.

One acute exposure scenario does exceed the level of concern at the upper range at the typical application rate of 2 lbs. a.e./acre. The exposure scenario for the consumption of contaminated water after an accidental spill into a small pond results in an excursion above the RfD at the upper limit of exposure – i.e, a hazard quotient of 2. This exposure scenario is extreme to the point of limited plausibility. This sort of scenario is routinely used in Forest Service risk assessments as an index of the measures that should be taken to limit exposure in the event of a relatively large spill into a relatively small body of water. For glyphosate, as well as for most other chemicals, this exposure assessment indicates that such an event would require measures to ensure that members of the general public do not consume contaminated water.

At the highest application rate that might be used in Forest Service programs, the accidental spill scenario is the only other scenario that results in a hazard quotient above unity. At this application rate, the associated dose is about 14 mg/kg, which is still below the dose of 184 mg/kg associated with no apparent overt effects in humans by a factor of over 10.

Imazapic

Typical exposures to imazapic do not lead to estimated doses that exceed a level of concern. For workers, no exposure scenarios, acute or chronic, exceed the RfD even at the upper ranges of estimated dose. For members of the general public, the upper limits for hazard quotients are below a level of concern except for the accidental spill of a large amount of imazapic into a very small pond. Based on the available information and under the foreseeable conditions of application, there is no route of exposure or scenario suggesting that workers or members of the general public would be at any substantial risk from longer-term exposure to imazapic (SERA 2004).

Picloram

Technical grade picloram, which contains hexachlorobenzene, **would not** be used in the project area so is not discussed.

Typical exposures to picloram do not lead to doses that exceed a level of concern. For workers, no exposure scenarios, acute or chronic, exceed the RfD even at the upper ranges of estimated dose. For members of the general public, the upper limits for hazard quotients are below a level of concern except for the accidental spill of a large amount of picloram into a very small pond. Even this extreme exposure scenario results in only a small excursion above the chronic RfD and is not likely to be toxicologically significant, because of the short duration of exposure relative to those considered in the derivation of the RfD. Thus, based on the available information and under the foreseeable conditions of application, where applicable directions and BMPs are employed, there is no route of exposure or scenario suggesting that workers or members of the general public would be at any substantial risk from longer-term exposure to picloram (SERA 2011c).

Irritation and damage to the eyes can result from exposure to relatively high levels of picloram (i.e., placement of picloram directly onto the eye) and repeated exposures to picloram can lead to skin sensitization (SERA 2011c). From a practical perspective, eye irritation and skin sensitization are likely to be the only overt effects as a consequence of mishandling picloram. These effects can be minimized or avoided by prudent industrial hygiene practices and adherence to BMPs during the handling and application of picloram.

Herbicide Interaction

There is very little information available on the interaction of these herbicides with other compounds. These herbicides are not persistent in the environment or in the human body, so a member of the public or a worker is not likely to be chronically exposed through the Forest Service's program nor receive simultaneous exposures from this herbicide in any other program.

A well-ventilated, fully, developed fire in a wood stove or fireplace where temperatures can reach 800-1000^{oC} can produce virtually complete decomposition of triclopyr (Bush *et al.*, 1987). Under conditions of rapid flaming combustion, triclopyr decomposed readily, with high temperatures causing almost complete decomposition. Fires producing incomplete combustion (temperatures<50^{oC}) can result in the evolution of trace pesticide residues in smoke and combustion gases. However, the levels of herbicide residue evolved and potentially absorbed systemically are well below levels that are judged by regulatory agencies to be safe to ingest on a daily basis.

Worker exposure assessments and field studies of triclopyr and imazapyr have shown that risk from herbicide exposure to forest workers under "brown and burn" conditions is small, even if the fire occurs immediately after herbicide application, as might occur in a wildfire (Bush et.al, 1998). Thus, use of herbicides in combination with fire in site preparation, understory vegetation management, or creating wildlife habitat/openings does not increase human exposure over risks associated with fire alone.

Injuries to the back, hand, and skin predominate in accidents involving vegetation management. Vegetation management activities with the greatest risks to the average worker in a 25-year career are those connected with site preparation. This is evidenced by high workers' compensation insurance rates for this type of work. There would be no effect to the forest visitor from mechanical methods since the visitor would not be present

when this work is done.

Smoke

Prescribed burning for fuels reduction would reduce the risk of wildfire within the Wildland Urban Interface in this area. Occasional brief exposure of the general public to low concentrations of drift smoke is more a temporary inconvenience than a health problem. High smoke concentrations could, however, be a very serious matter, particularly near homes of people with respiratory illnesses or near health-care facilities. Prescribed burning proposed for this project would meet the standards established for the National Ambient Air Quality Standards as discussed in the Air Quality section of this EA.

Smoke could have negative short-and long-term health effects (Wade and Lunsford, 1988). Fire management personnel who are exposed to high smoke concentrations often suffer eye and respiratory system irritation. Under some circumstances, continued exposure to high concentrations of carbon monoxide at the combustion zone could result in impaired alertness and judgment. The probability of this happening on a prescribed fire is, however, virtually nonexistent.

Over 90% of the particulate emissions from prescribed fire are small enough to enter the human respiratory system. These particulates can contain hundreds of chemical compounds, some of which are toxic. The repeated, lengthy exposure to relatively low smoke concentrations over many years could contribute to respiratory problems and cancer. But, the risk of developing cancer from exposure to prescribed fire has been estimated to be less than one in a million (Wade and Lunsford, 1988).

In general, the public, with the exception of the very ill, very young, and the elderly, have a low risk of long-term chronic health effects, such as asthma, pulmonary disease or other respiratory diseases from prescribed burns (Sandberg and Dost 1990). This is due in part to the short exposure times, typically 15 hours or less, at concentrations that are below the NAAQS.

Both theoretical calculations and field studies suggest that prescribed fires are hot enough to destroy any chemical residues. Minute quantities that might end up in smoke are well within currently-accepted air quality standards. Threshold limit values (TLVs) are often used to measure the safety of herbicide residues in smoke. Expected exposure rates of workers to various brown-and-burn combinations have been compared with TLVs. They showed virtually no potential for harm to workers or the general public.

There is at least one group of compounds carried in smoke that could have an immediate acute effect on individuals. When noxious plants such as poison ivy burn, the smoke could cause skin rashes. These rashes could be much more widespread on the body than those caused by direct contact with the plants. If this smoke is inhaled, respiratory systems could also be affected.

Alternative 2 (No Action)

There would be no change from the existing condition regarding risks to human health from the use of herbicides, prescribed burning, or cutting tools. Risks to human health and safety from falling limbs and trees would remain stable or increase. Accumulations of forest litter in the analysis area would continue to create a potential for wildfires.

N. ECONOMICS AND SOCIAL ENVIRONMENT

Existing Condition

The project area lies within Logan County. Logan County was used as the analysis area for economic and social effects. The economy of Logan County is summarized in the tables below using the 2008-2012 American Community Survey data of the United States Census Bureau (http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml).

The 2012 total population estimate of Logan County was 22,352 people (http://factfinder.census.gov/bkmk/table/1.0/en/ACS/12_5YR/B01003/0400000US05|0500000US05083). The population 16 years and over in the labor force for Logan County was 9,695. Of these numbers of people, 45 in Logan County were in the Armed Forces and the remainder was in the civilian labor force. Approximately 9,650 people were employed in the civilian labor force (Table 17, page 86) with 821 being unemployed (http://factfinder.census.gov/bkmk/table/1.0/en/ACS/12_5YR/DP03/0500000US05083).

Table 17: Logan County Civilian Labor Force Occupations

Description	Number of Employees	Percent (%) of Total Employees
Management, Professional, and Related Occupations	2,278	25.8
Service Occupations	1,528	17.3
Sales and Office Occupations	1,927	21.8
Forestry, Construction, and Maintenance Occupations	1,081	12.2
Production, Transportation, and Material Moving Occupations	2,015	22.8

Table 18, page 86, shows the income for Logan County (http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml).

The total land area of Logan County is estimated at 453,203 acres. Ozark and Ouachita National Forest lands comprise 94,744 acres of land in Logan County. This means that approximately 21% of the taxable land base of Logan County is in National Forest ownership and not subject to property taxes.

In addition to the percentage of jobs and income generated by forest industries, a portion of county roads and school budgets is funded from generated income on National Forest lands within the counties. These 2 sources are Payments in Lieu of Taxes (PILT) and Title I of the Secure Rural Schools and Self-Determination Act (SRS). Logan County received $267,159 from the PILT program in Fiscal Year 2014 (USDI, 2014) and $178,632 from the SRS in 2012 (USDA FS, 2012).

Table 18: Logan County Household Income

Income in Dollars	Number of Households	Percent (%) of Households
Less than $10,000	604	7.2
$10,000 to $14,999	766	9.1
$15,000 to $24,999	1,346	16.0
$25,000 to $34,999	1,280	15.2
$35,000 to $49,999	1,282	15.3
$50,000 to $74,999	1,553	18.5
$75,000 to $99,999	711	8.5
$100,000 to $149,999	572	6.8
$150,000 or more	286	3.4

The Ozark-St. Francis National Forests FEIS for the RLRMP estimated benefits, costs, net benefits, and cumulative present net value (USDA FS, 2005b (pages 3-454 – 3-456)). The benefits included market values and non-market estimated values. Market values included those values for which the Forest Service receives money such as minerals, timber, range, and special uses. Non-market values are estimated values for amenities such as wildlife and recreation. Over a 50-year analysis period, the Benefit/Cost ratio for all resource activities (in the selected RLRMP alterative) was 1.59. The Benefit/Cost ratio for the timber management program alone was 1.35 (USDA FS, 2005b (Table 3-228, p. 3-455)). A Benefit/Cost ratio of more than 1.0 represents a positive net benefit. Therefore, timber management on the Ozark-St. Francis National Forests was shown to be cost effective. When combined with the benefits of non-commodity resources that accompany timber harvesting, the overall benefits to the public are even greater.

Effects

Alternative 1 (Proposed Action)

An economic analysis of proposed activities for each alternative was prepared. Calculations are part of the process documentation. Quick-Silver, a project analysis tool developed by the U.S. Forest Service, was used to determine the economic performance of long-term investments for this project. Present Net Value (PNV) is calculated and used as an indicator of the efficiency of the project. The following assumptions were made for this analysis: (1) The period for this economic analysis begins with project decision and continues through the

project planning cycle (10 years); (2) Calculations, which considered the time value of costs and revenues for each alternative, were used to determine net present value; (3) A 4% discount rate was used for this analysis; (4) The Benefit/Cost ratio for each alternative reflects revenues generated from timber harvesting and hunting generated by wildlife management; and (5) The dollars generated by dispersed recreation and tourism would not be affected by activities in the alternative. Results of the analysis are shown in Table 19, page 87.

Table 19: Comparison of Economic Analysis for all Alternatives[1]

Action	Alternative 1	Alternative 2
Present Value Revenues	$ 1,303,266	$ 0
Present Value Costs	$ 955,289	----
Net Present Value	$ 347,976	$ 0
Benefit/Cost Ratio	1.36	----

[1]All measures are approximations.

The action alternative had a Benefit/Cost ratio greater than 1.0 resulting in a positive net benefit. The revenues derived from the selling price of timber would contribute to school and road funds in Logan County. Social effects on public health, recreation, and visual quality are discussed under these headings in the EA.

Alternative 2 (No Action)

No money would be spent by nor returned to the Federal Government. No additional employment in the timber industry would occur, nor would potentially available intermediate age and maturing trees contribute to maintaining jobs that already exist. Some employment might actually be lost. No firewood from these areas would be available to local people for home heating purposes. Some standing timber, and the corresponding expected potential economic returns, would be lost with the mortality of some trees. Wildlife habitat condition would remain essentially static, deteriorating for some game and non-game species, while improving slightly for others.

Logan County would still receive a payment under the PILT and the SRS programs. However, under the SRS program, the potential amount that would be returned to all counties in Arkansas containing Ozark-St. Francis National Forests lands would be reduced because no revenues from timber sales in these compartments would be contributed toward the Forest's total amount of timber sale revenue generated.

Social effects on public health, recreation, and visual quality are discussed under these headings in the EA.

O. ENVIRONMENTAL JUSTICE AND CIVIL RIGHTS

Existing Condition

Logan County was used as the analysis area for environmental justice and civil rights effects. All data for the analysis was taken from the 2008-2012 American Community Survey data of the United States Census Bureau (http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml).

The estimated population of Logan County in 2012 was 22,352. Table 20, page 88, shows the estimated breakdown in demographics for Logan County and Arkansas in 2012.

The percent of persons below the poverty level in 2008-2012 in Logan County was 12%. The state's level as a whole was 14.1% making Logan County's poverty average slightly lower than the state as a whole.

Using these figures as a basis for analysis, there would be no disproportionate effects to these minority groups resulting from the alternatives.

Civil rights implications were considered related to each alternative. This included the effects of the alternatives on minority groups, women, and consumers. Civil rights imply the fair and equal treatment under law, both within the agency and in relations with the public. No potentially major civil rights effects were found related to any alternative. Therefore, a civil rights impact analysis and statement of findings are not required for this project.

Table 20: Year 2012 Population Demographics for Logan County and Arkansas

Race	Logan County	Arkansas
White	93.8%	78.4%
Black or African American	1.4%	15.5%
American Indian and Alaska Native	1.0%	0.6%
Asian	1.8%	1.2%
Native Hawaiian and Other Pacific Islander	0.0%	0.2%
Persons of Hispanic or Latino Origin	2.4%	6.4%
Person reporting two or more races	1.4%	1.9%

IV. CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals, Federal, Tribal, State, and local agencies during the development of this environmental assessment:

ID Team Members:

Amanda Bataineh; NEPA Coordinator; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

Dava Bauer; NEPA Coordinator; Cold Springs/Poteau Ranger District; Ouachita National Forest; Booneville, Arkansas

Mary Brennan; Zone Archeologist; Boston Mountain/Pleasant Hill/Mt. Magazine Ranger Districts; Ozark-St. Francis National Forests; Ozark, Clarksville, and Paris, Arkansas

Mark Burge; Timber Management Assistant; Supervisor's Office; Ozark-St. Francis National Forests; Russellville, Arkansas

Richard Carpenter; Wildlife Technician; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

Jason Davis; Civil Engineering Technician; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

Coyle Ellingberg; Timber Sales Administrator; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

Brent Johnson; Law Enforcement Officer; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

Mindi Lawson; Wildlife Biologist; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

John Lane; Zone Recreation Program Manager; Boston Mountain/Mount Magazine Ranger Districts; Ozark-St. Francis National Forests; Ozark and Paris, Arkansas

Richard Monk; Forest Hydrologist; Supervisor's Office; Ozark-St. Francis National Forests; Russellville, Arkansas

David Moore; Lead Timber Marker; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

Charles Mosley; Minerals Technician; Supervisor's Office; Ozark-St. Francis National Forests; Russellville, Arkansas

Chip Stokes; GIS Technician; Boston Mountain/Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Ozark and Paris, Arkansas

Gina Tatum; Silvicultural Technician; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

John Thias; Forester; Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Paris, Arkansas

Len Weeks; Forest Soil Scientist; Supervisor's Office; Ozark-St. Francis National Forests; Russellville, Arkansas

Keith Whalen; Fisheries Biologist; Supervisor's Office; Ozark-St. Francis National Forests; Russellville, Arkansas

Rickey Williamson; Fire Management Officer; Boston Mountain/Mt. Magazine Ranger District; Ozark-St. Francis National Forests; Ozark and Paris, Arkansas

Federal, Tribal, State, and Local Agencies:

Anita Chouinard; Arkansas Dept. of Parks and Tourism

Randy Roberson; Arkansas State Parks

Arkansas State Historic Preservation Office

Colby Wells; Wildlife Technician; Mt. Magazine Wildlife MA; Arkansas Game and Fish Commission; Paris, Arkansas

Kevin Lynch; Biologist; Arkansas Game and Fish Commission; Fort Smith, Arkansas

Henrietta Ellis; Absentee Shawnee Tribe of Oklahoma; Shawnee, Oklahoma

Robert Cast; Caddo Nation of Oklahoma; Binger, Oklahoma

Richard Allen; Cherokee Nation of Oklahoma; Tahlequah, Oklahoma

Tamara Francis; Delaware Nation; Anadarko, Oklahoma

Robin Dushane; Eastern Shawnee Tribe; Seneca, Missouri

Jean Ann Lambert; Quapaw Tribe; Fayetteville, Arkansas

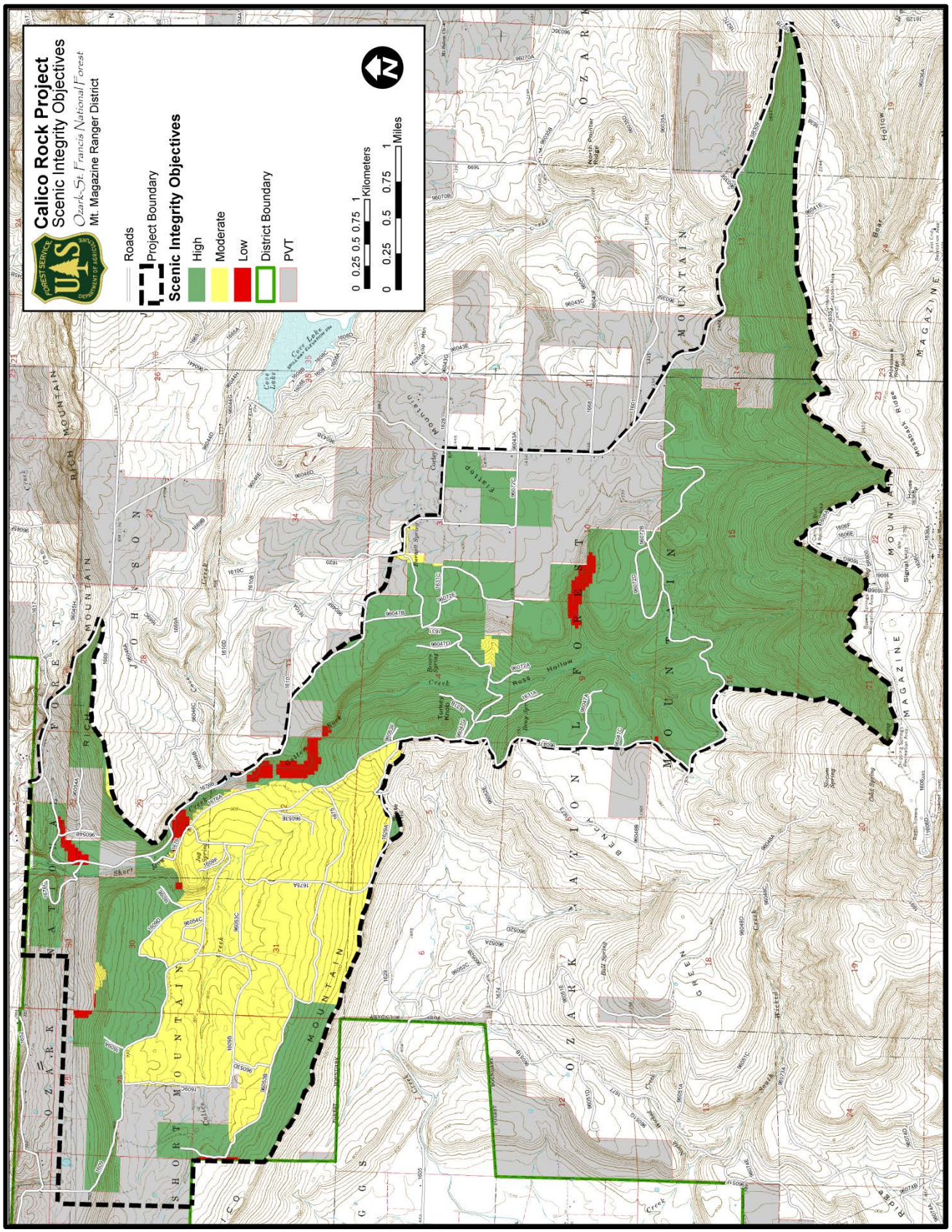
Dr. Andrea Hunter; Osage Nation; Pawhuska, Oklahoma

Lisa LaRue Stopp; United Keetoowah Band of Cherokee Indians; Tahlequah, Oklahoma

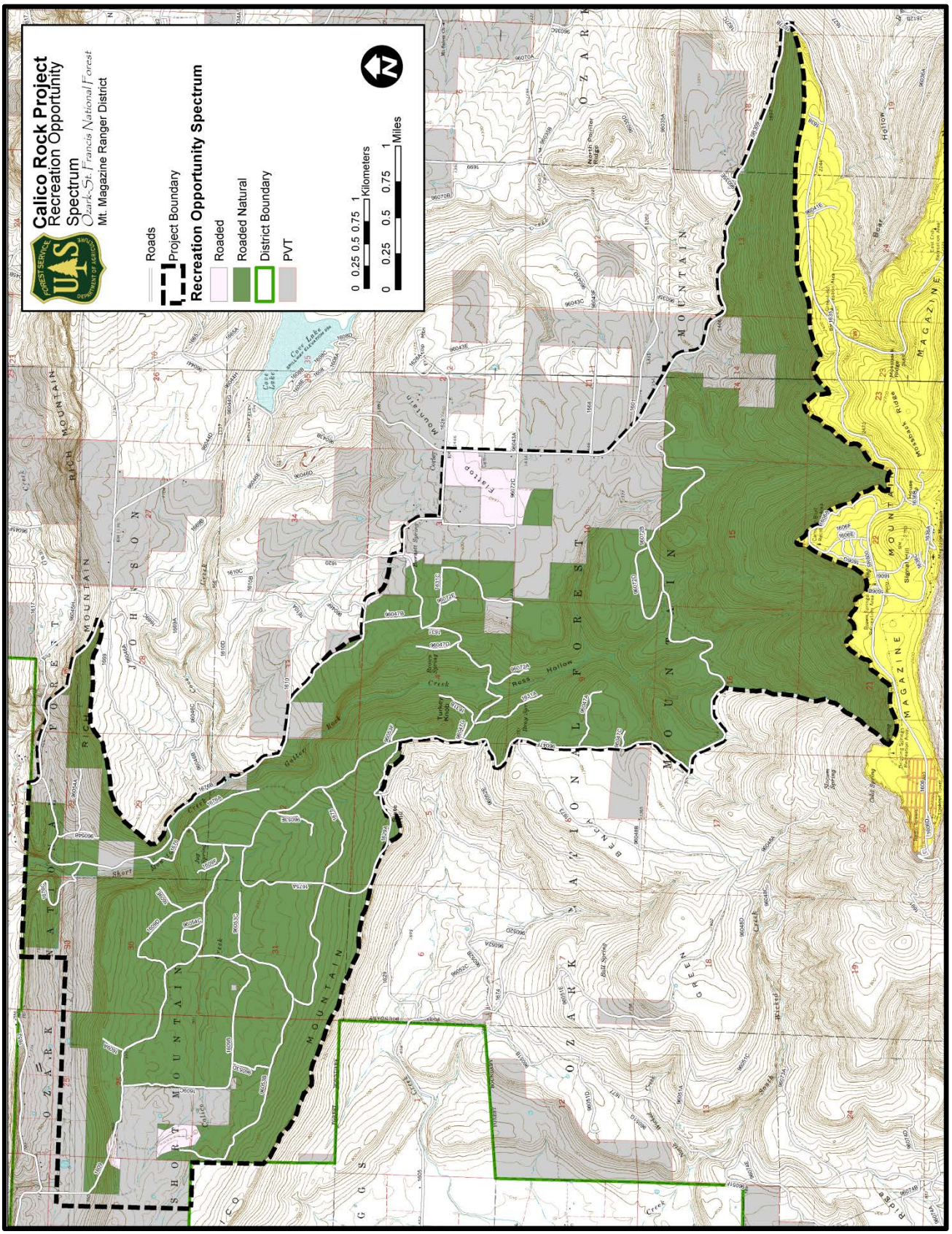
United States Fish and Wildlife Service

APPENDIX A. RESOURCE MAPS

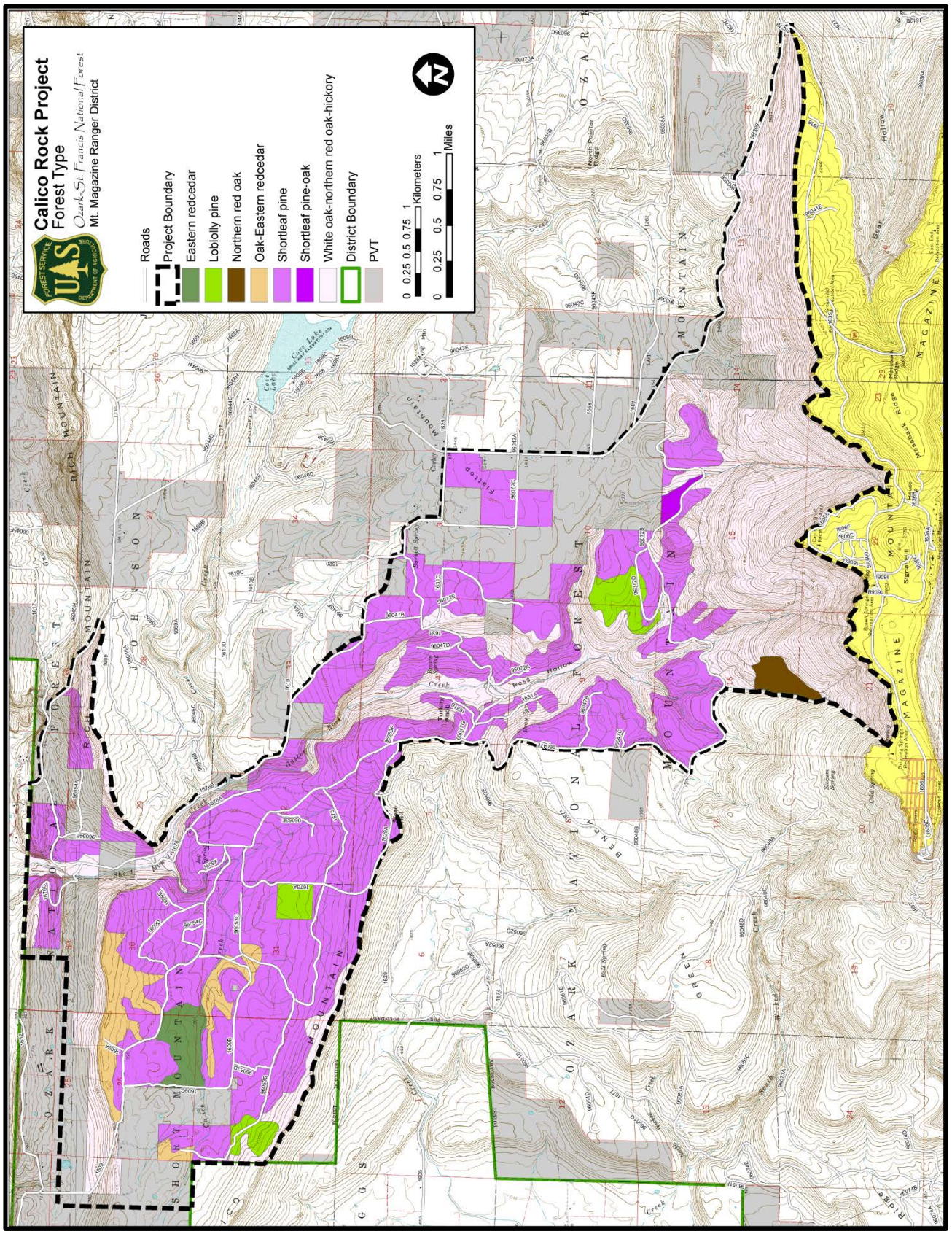
Map 5. Scenic Integrity Objective Map



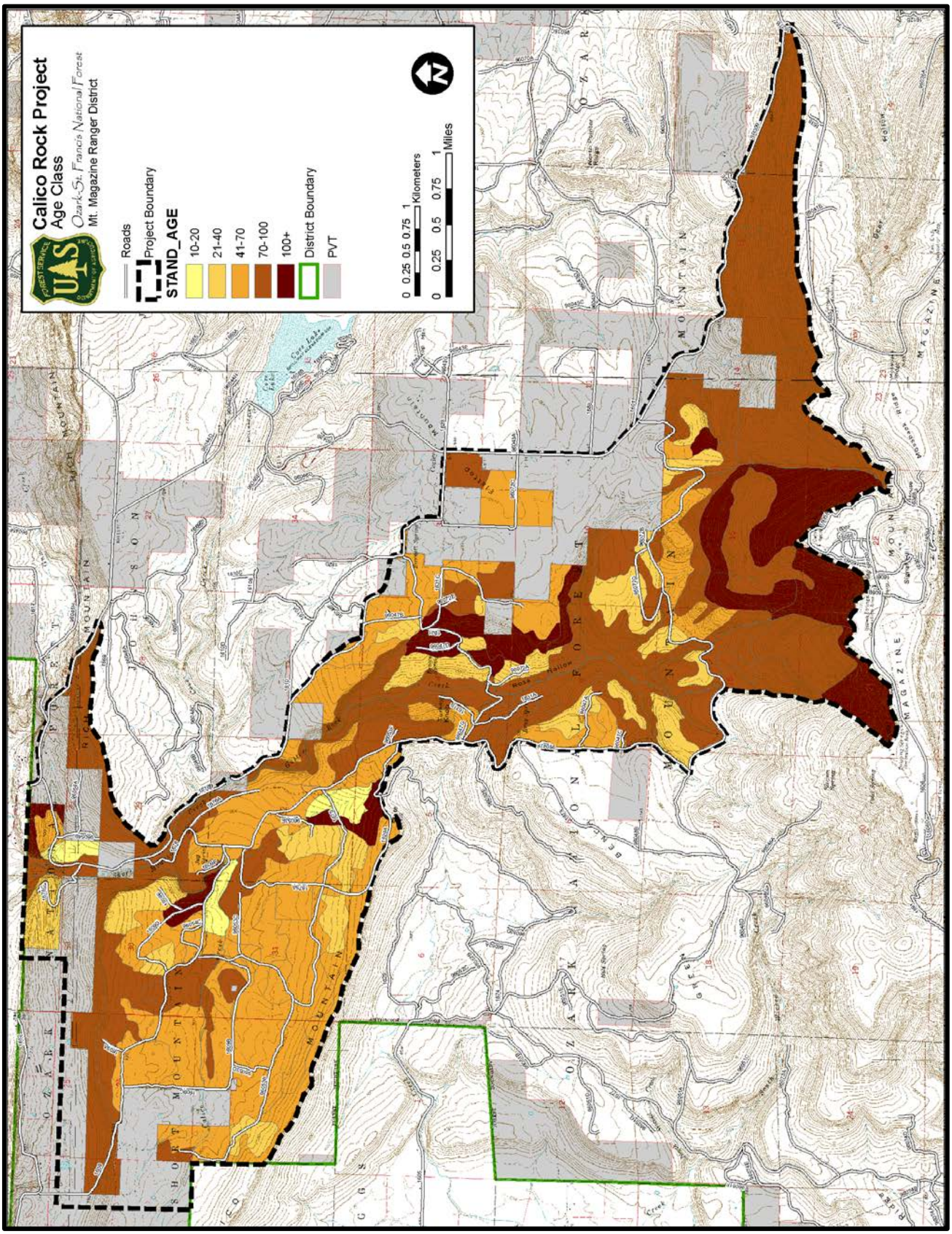
Map 6. Recreation Opportunity Spectrum Map



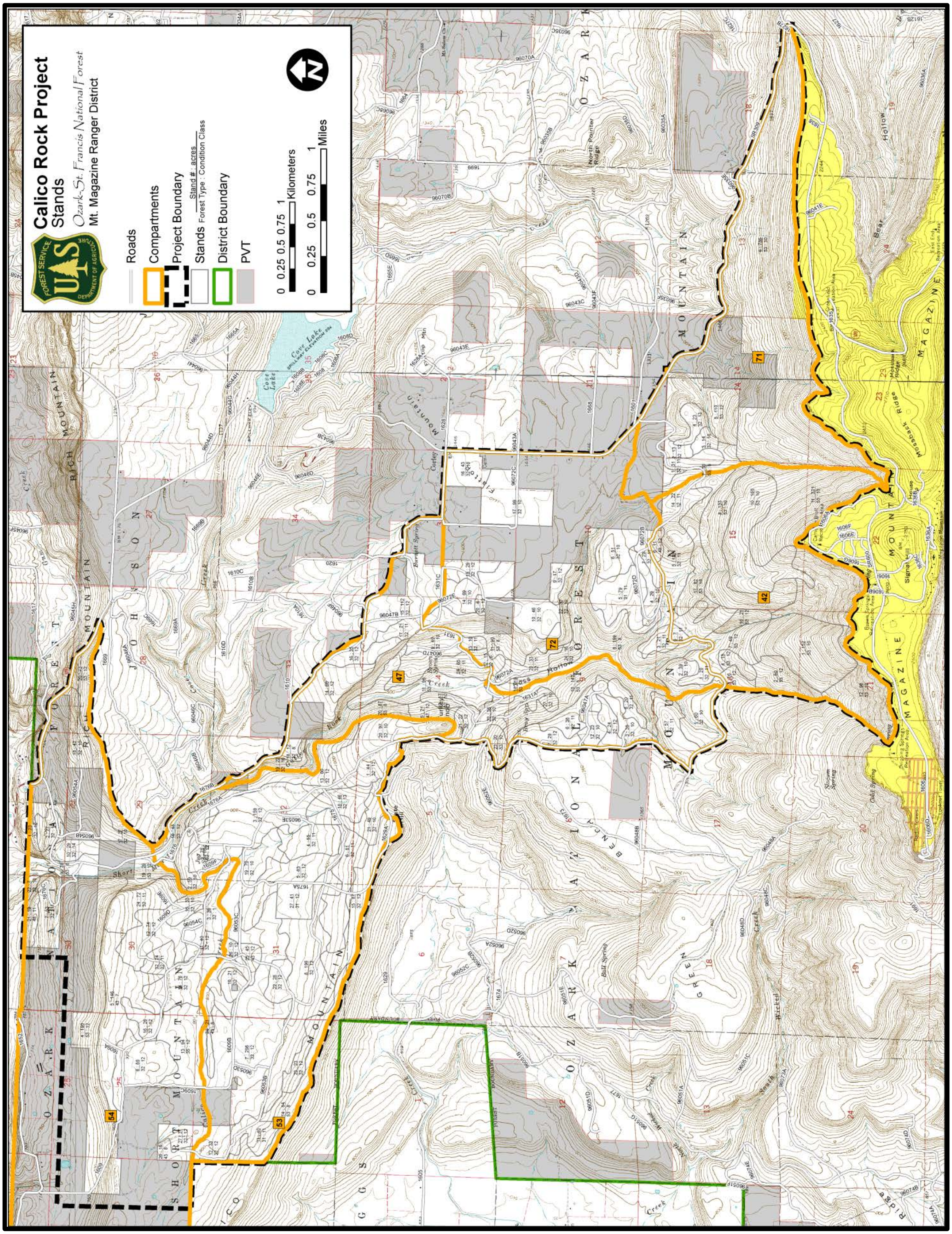
Map 7. Forest Type Map



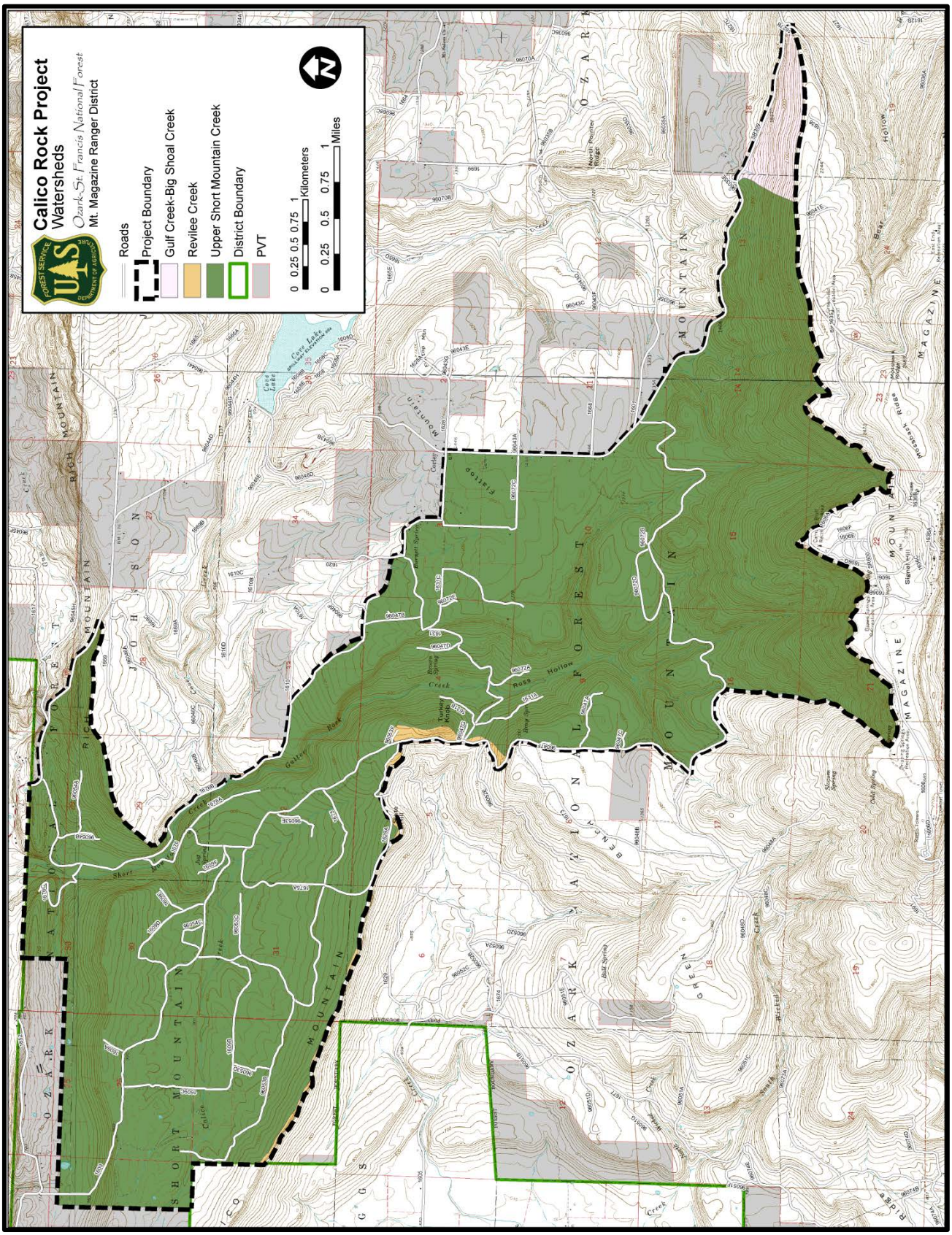
Map 8. Age Class Distribution Map



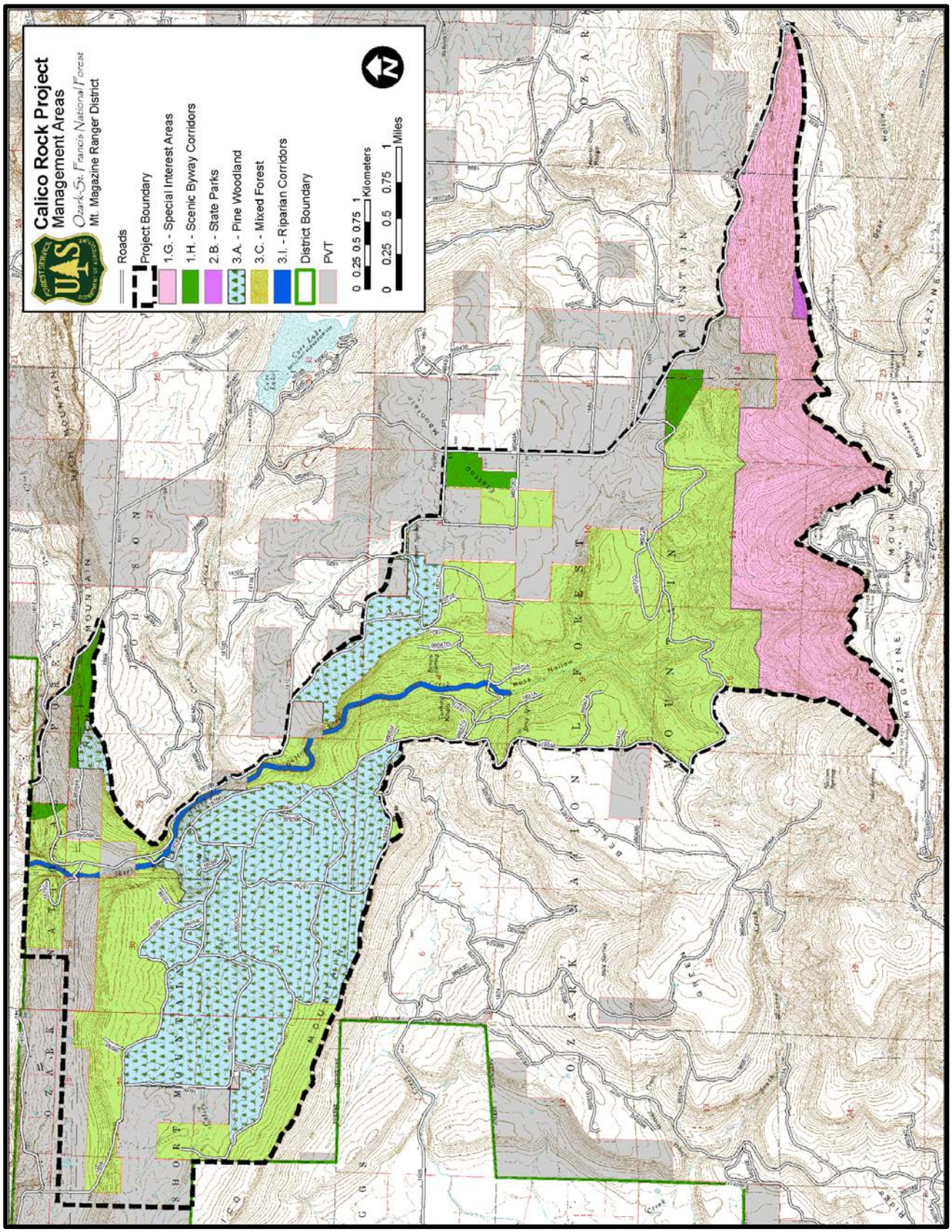
Map 9. Stand Map



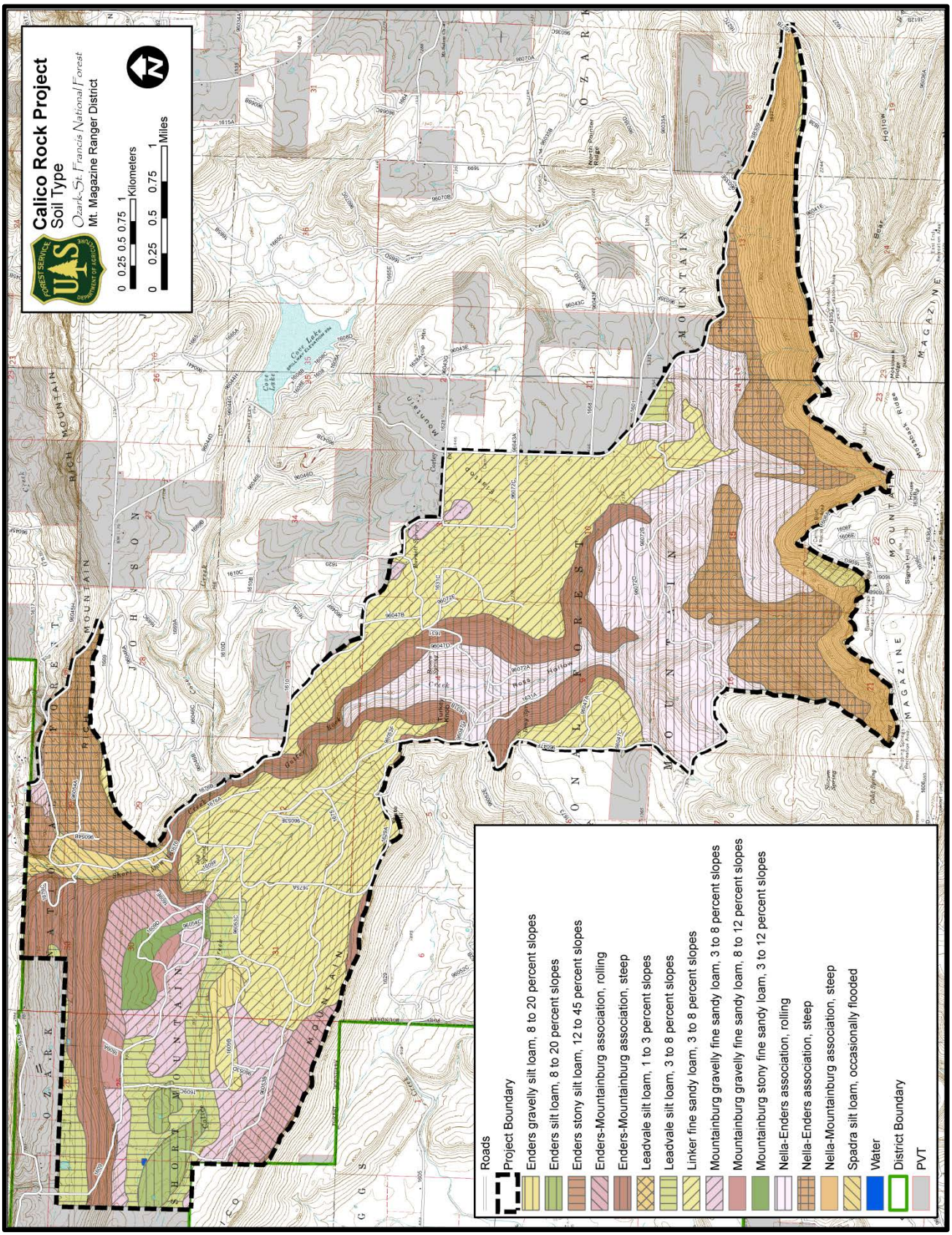
Map 10. Watershed Map



Map 11. Management Areas



Map 12. Soil Type Map



APPENDIX B. TRANSPORTATION SYSTEM

Alternative 1 (Proposed Action)

Road	Current Status	Miles	Future Status	Miles	Decommissioned
1605	Open	3.8	Open	3.8	
1609	Open	6.2	Open	6.2	
1609A	Closed	0.2	Closed	0.2	
1609B	Open	1.5	Open	1.5	
1609C	Closed	0.8	Closed	0.8	
1609D	Closed	0.9	Closed	0.9	
1609E	Closed	0.2	Decommission		0.2
1609F	Closed	0.3	Decommission		0.3
1610	Open	0.8	Open	0.8	
1620	Open	1.0	Open	1.0	
1629	Closed	0.5	Closed	0.5	
1629A	Closed	1.0	Closed	1.0	
1631	Open	1.9	Open	1.9	
1631A	Closed	0.5	Closed	0.5	
1631B	Closed	0.4	Closed	0.4	
1631C	Open Closed	1.0 0.2	Open Closed	1.0 0.2	
1652	Open	3.3	Open	3.3	
1675	Open Closed	0.3 1.4	Open Closed	0.0 1.7	
1675A	Open Closed	0.3 0.6	Open Closed	0.3 0.6	
1676	Open	2.1	Open	2.1	
1676A	Open	0.6	Closed	0.6	
1676B	Open	0.9	Open	0.9	
1676C	Closed	0.7	Closed	0.7	

Road	Current Status	Miles	Future Status	Miles	Decommissioned
96046F	Open	0.3	Open	0.0	
	Closed	0.1	Closed	0.4	
96047A	Closed	0.5	Closed	0.5	
96047B	Open	1.2	Open	1.2	
96047C	Closed	0.1	Closed	0.1	
96047D	Closed	0.3	Closed	0.3	
96047E	Closed	0.1	Closed	0.1	
96047F	Closed	0.1	Closed	0.1	
96047G	Closed	0.1	Closed	0.1	
96053B	Open	2.2	Open	1.0	
	Closed	0.0	Closed	1.2	
96053C	Closed	0.4	Closed	0.4	
96053D	Closed	0.3	Decommission		0.3
96053E	Closed	0.4	Closed	0.4	
96053F	Closed	0.1	Closed	0.1	
96054A	Open	0.1	Open	0.1	
	Closed	0.5	Closed	0.5	
96054B	Closed	0.2	Closed	0.2	
96054C	Closed	0.4	Closed	0.2	
			Decommission		0.2
96072A	Closed	0.3	Closed	0.3	
96072B	Open	0.1	Open	0.1	
96072C	Open	1.1	Open	1.1	
96072D	Closed	0.8	Decommission		0.8
96072E	Closed	0.1	Decommission		0.1
TOTAL		**40.2**		38.3	1.9

Alternative 2 (No Action)

The status of roads for this alternative would be the same as the current status listed in Alternative 1.

TACCIMO
Template for Assessing Climate Change Impacts and Management Options

TACCIMO Climate Report: Arkansas

06-13-2014

Introduction

The TACCIMO climate report gives an organizational framework of geospatial climate forecast data necessary to evaluate the literature and planning report outputs. The climate projections in this report provide context for considering potential effects, management options, and their planning implications. This climate report v2.0 is a standalone version of what will become an integrated TACCIMO report feature in future versions.

Considering differences among IPCC general circulation models (GCM) and emissions scenarios (SRES) is critical to understanding the full range of potential future climate anticipated for a given location. As such, the TACCIMO climate report is divided into three sections focusing on national, regional, and location specific trends in precipitation and temperature. Maps representing decadal averages* of precipitation and temperature are available through the GIS Viewer. Tables 1 and 2 summarize the GCMs and SRES available through TACCIMO. Strategies for selecting the appropriate GCMs and SRES are available in the User Guide, along with additional interpretive guidance.

Table 1. Summary of GCM model groups, GCMs, and qualitative description

Modeling Group	GCM	Description
Canadian Centre for Climate Modeling & Analysis	CGCM3.1	Wet and Cool
Hadley Centre for Climate Prediction and Research / Met Office	UKMO-HadCM3.1	Hot
US Dept of Commerce / NOAA / Geophysical Fluid Dynamics Laboratory	GFDL-CM2.0	Dry and Warm

Table 2. Summary of IPCC Scenarios, emission path, and description.

Scenario	Emissions Path	Description
SRES A2	higher emissions path	technological change and economic growth more fragmented; slower, higher population growth
SRES A1B	middle emissions path	technological change in the energy system balanced across all fossil and non-fossil energy sources, not relying too heavily on one particular energy source
SRES B1	lower emissions path	rapid change in economic structures toward service and information; emphasis on clean, sustainable technology

*Decadal averages were calculated from monthly averages of the five years before and after each referenced decade (e.g., 2010 decadal average is an average of monthly data from 2005 to 2014). Temperature is unaffected by reporting the monthly average, but precipitation values must be multiplied by 12 to obtain an annual average.

Historic

Figure 1 shows long-term historic averages for monthly precipitation and temperature. Monthly PRISM data from 1970 to 2000 were averaged to estimate the historic baseline, and the national averages for both variables are presented below the maps.

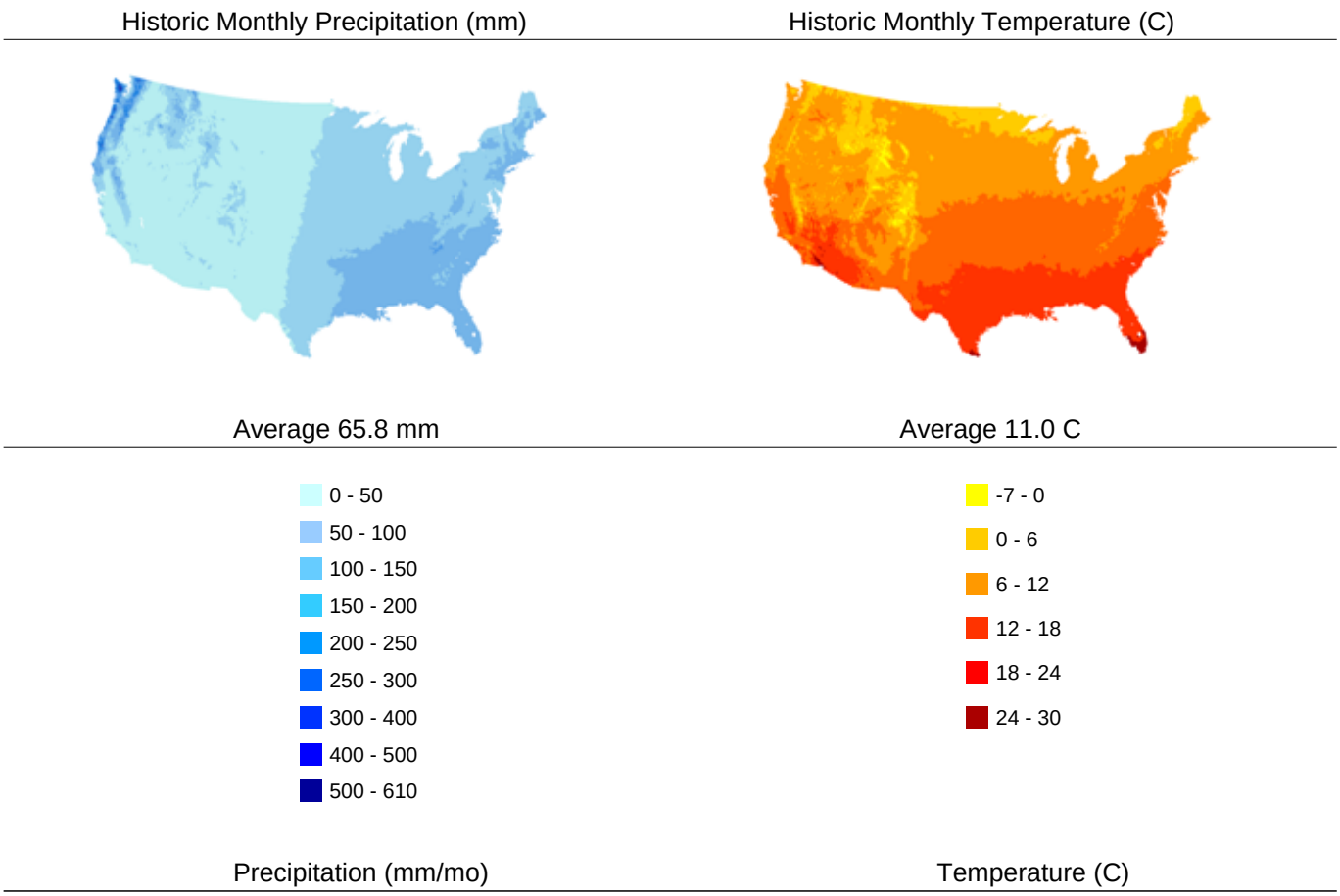


Figure 1. Historic precipitation and temperature (based on PRISM climate data, averaged from 1970 to 2000)

National: United States

Tables 3 and 4 present the projected national average precipitation and temperature among the GCMs and IPCC SRES for the period spanning 2009 to 2099. Green and yellow cells indicate the maximum and minimum precipitation projections. Red and blue cells indicate the maximum and minimum temperature projections. These maximum and minimum projections are shown in Figures 2 and 3 as decadal averages, which were calculated using monthly averages of the five years before and after each reference decade (e.g., 2010 is an average of monthly data from 2005 to 2014). Note that different GCM-SRES combinations may represent the driest / wettest or hottest / coolest projections at different spatial scales.

Table 3.
National average precipitation by GCM and SRES (mm, monthly average spanning 2009-2099, multiply by 12 to get annual total)

SRES/GCM	CGCM3.1	CM2.0	HadCM3.1
A2	69.3	62.1	63.9
A1B	69.1	62.9	66.4
B1	67.5	64.3	65.2
Average	68.6	63.1	65.2

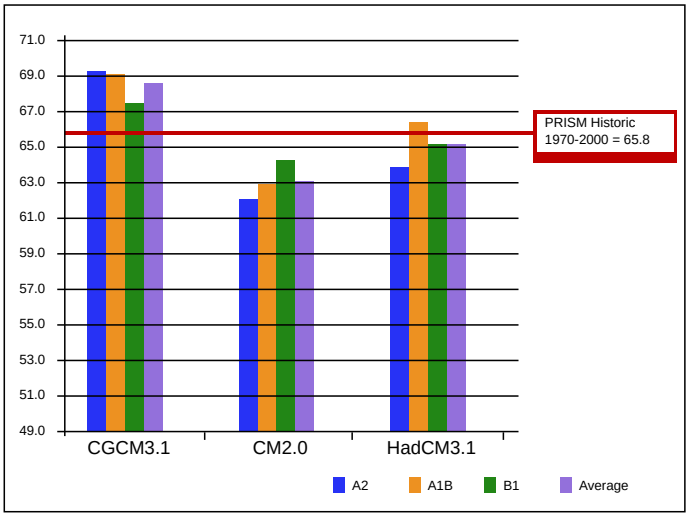
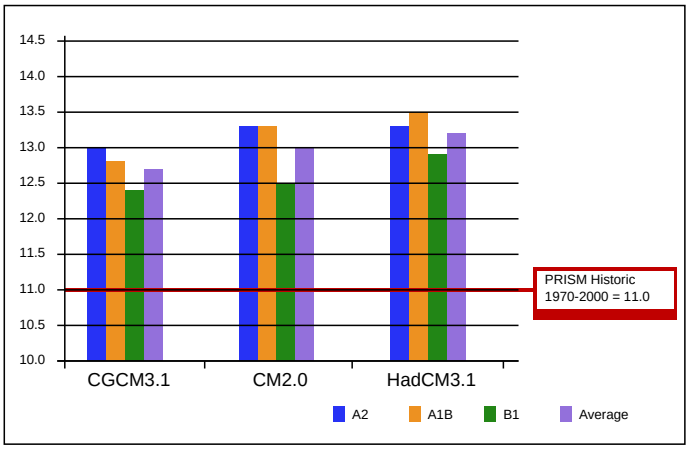


Table 4.
National average temperature by GCM and SRES (C, monthly average spanning 2009-2099)

SRES/GCM	CGCM3.1	CM2.0	HadCM3.1
A2	13.0	13.3	13.3
A1B	12.8	13.3	13.5
B1	12.4	12.5	12.9
Average	12.7	13	13.2



Projected Precipitation (mm)

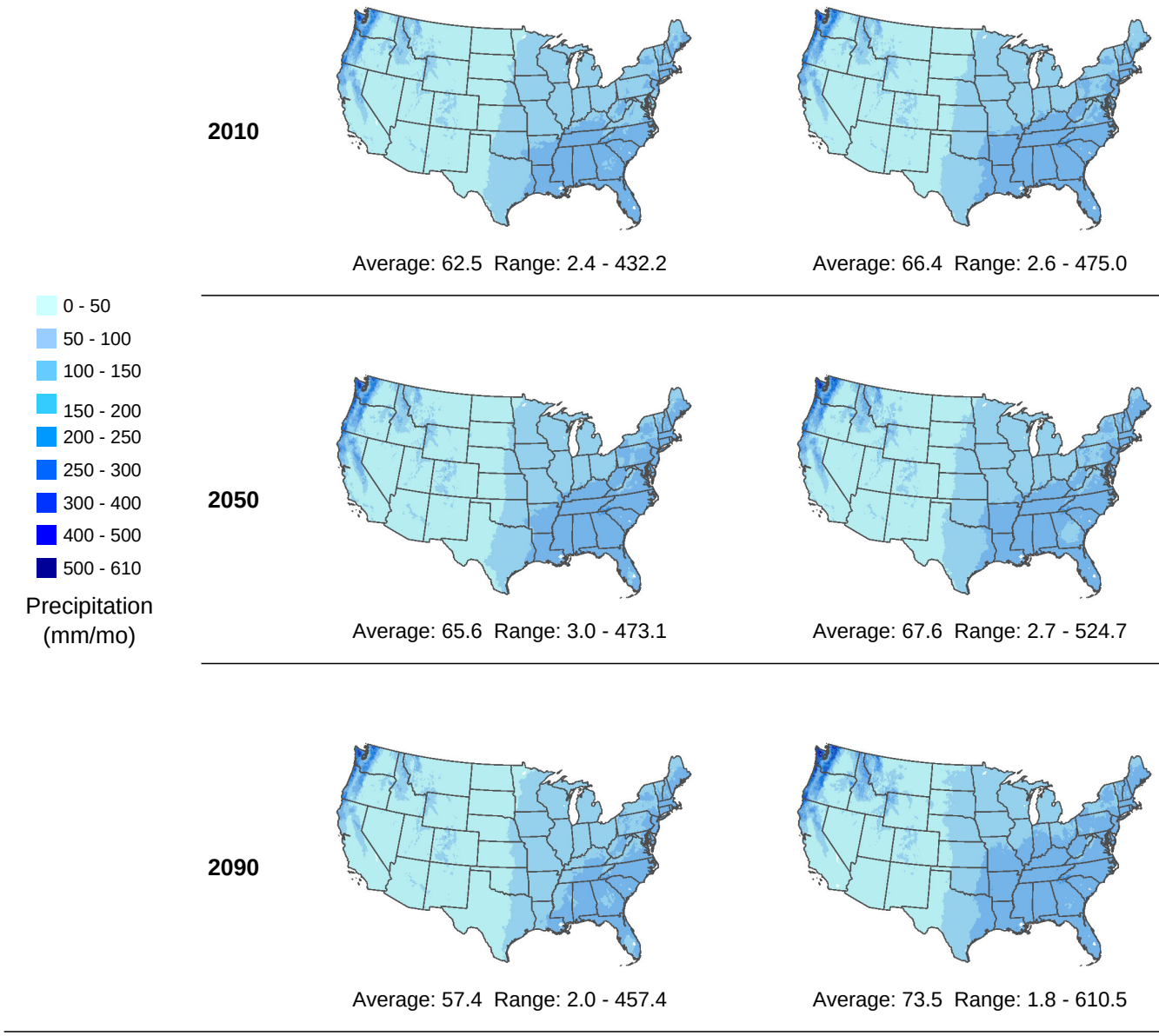
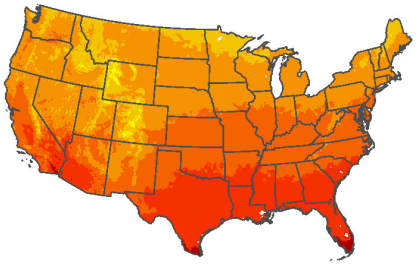
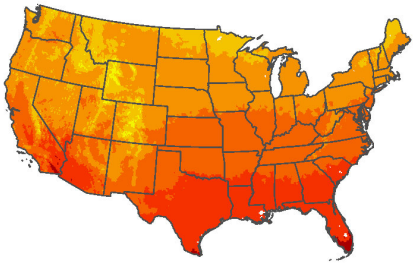
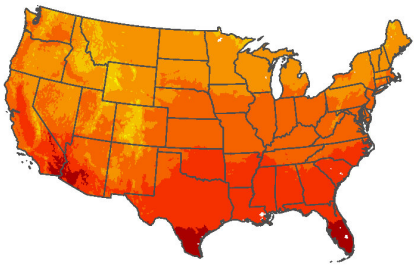
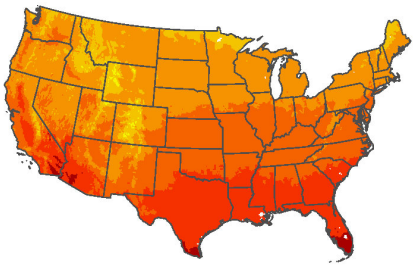
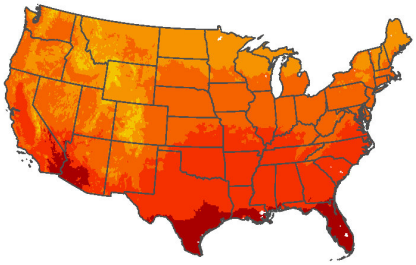
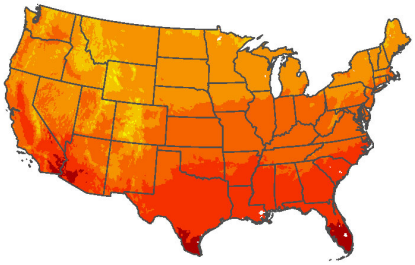


Figure 2. National scale decadal precipitation projections for driest and wettest GCM-SRES combinations

Projected Temperature (C)

Year	Hottest: HadCM3 A1B	Coolest: CGCM3 B1
2010		
	Average: 12.0 Range: -6.3 - 25.2	Average: 11.9 Range: -6.1 - 25.3
2050		
	Average: 13.9 Range: -4.2 - 27.3	Average: 12.6 Range: -5.4 - 26.2
2090		
	Average: 15.5 Range: -2.8 - 28.6	Average: 13.2 Range: -4.9 - 26.9

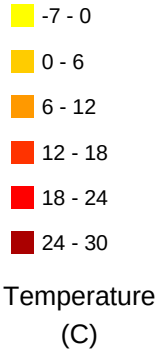


Figure 3. National scale decadal temperature projections for hottest and coolest GCM-SRES combinations

State: Arkansas

Tables 5 and 6 present the projected state average precipitation and temperature among the GCMs and IPCC SRES for the period spanning 2009 to 2099. Green and yellow cells indicate the maximum and minimum precipitation projections. Red and blue cells indicate the maximum and minimum temperature projections. These maximum and minimum projections are shown in Figures 4 and 5 as decadal averages, which were calculated using monthly averages of the five years before and after each reference decade (e.g., 2010 is an average of monthly data from 2005 to 2014). Note that different GCM-SRES combinations may represent the driest / wettest or hottest / coolest projections at different spatial scales.

Table 5.
State average precipitation by GCM and SRES (mm, monthly average spanning 2009-2099, multiply by 12 to get annual total)

SRES/GCM	CGCM3.1	CM2.0	HadCM3.1
A2	113.4	96.9	103.8
A1B	111.0	99.0	107.8
B1	109.6	102.0	104.6
Average	111.3	99.3	105.4

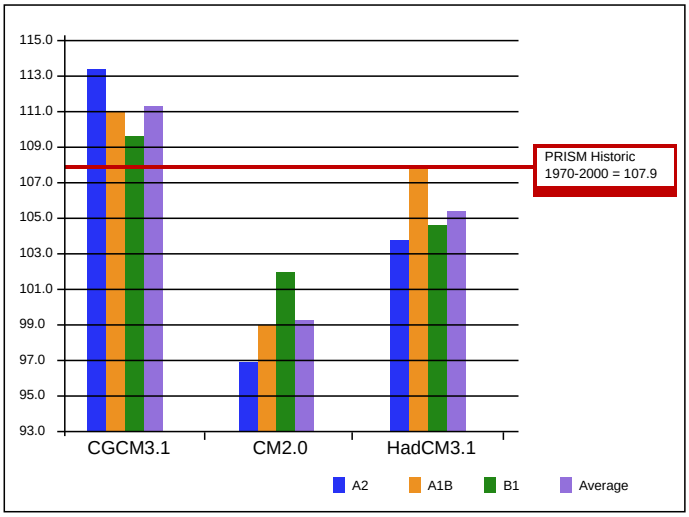
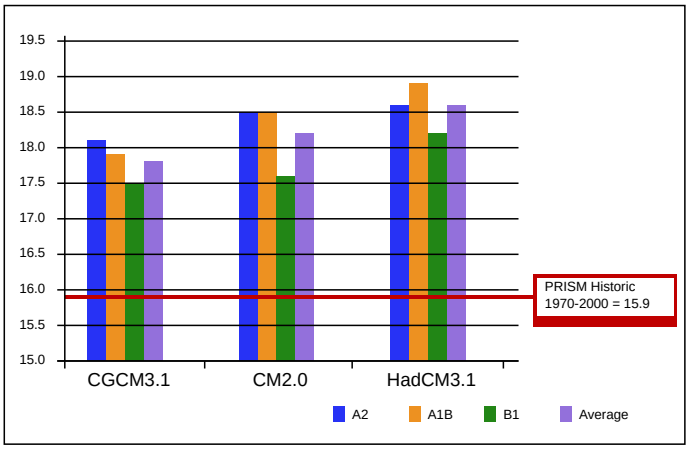


Table 6.
State average temperature by GCM and SRES (C, monthly average spanning 2009-2099)

SRES/GCM	CGCM3.1	CM2.0	HadCM3.1
A2	18.1	18.5	18.6
A1B	17.9	18.5	18.9
B1	17.5	17.6	18.2
Average	17.8	18.2	18.6



Projected Precipitation (mm)

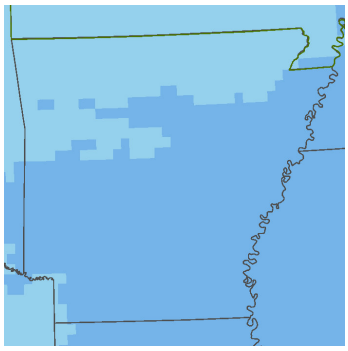
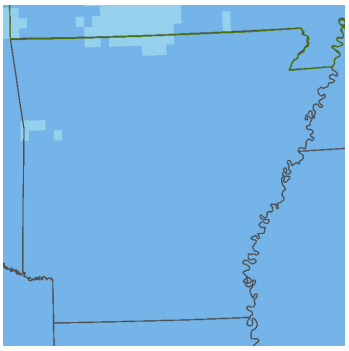
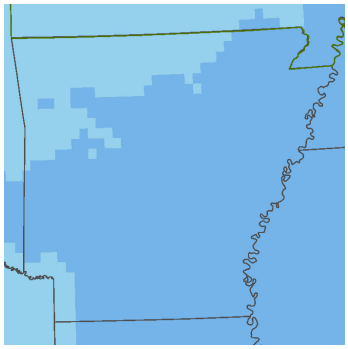
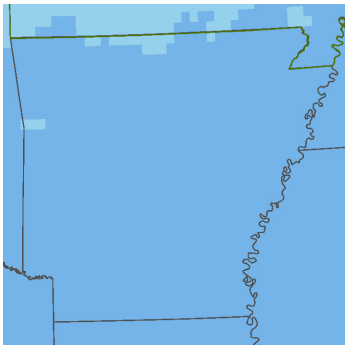
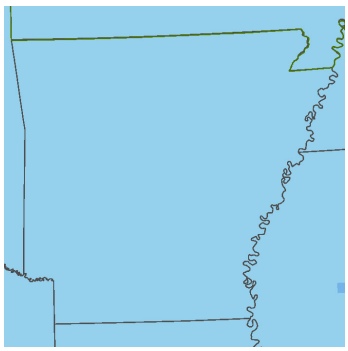
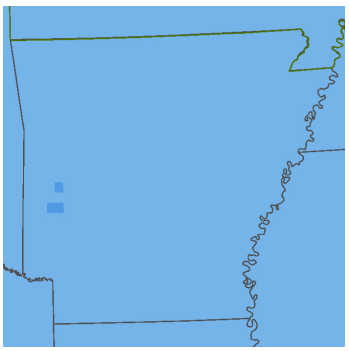
Year	Driest: CM2 A2	Wettest: CGCM3 A2
2010		
	Average: 101.3 Range: 82.9 - 131.6	Average: 111.3 Range: 96.6 - 144.6
2050		
	Average: 104.5 Range: 83.4 - 130.3	Average: 110.0 Range: 97.3 - 146.0
2090		
	Average: 79.2 Range: 61.5 - 97.9	Average: 119.1 Range: 104.3 - 155.3

Figure 4. State scale decadal precipitation projections for driest and wettest GCM-SRES combinations

Projected Temperature (C)

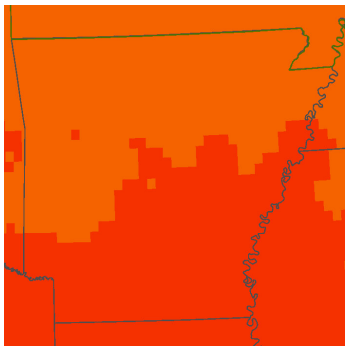
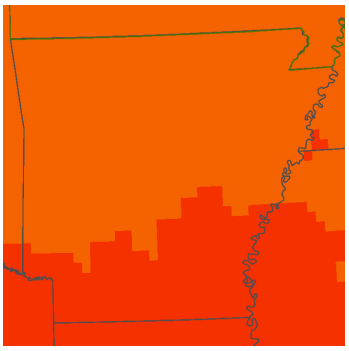
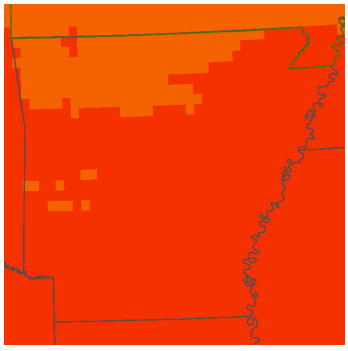
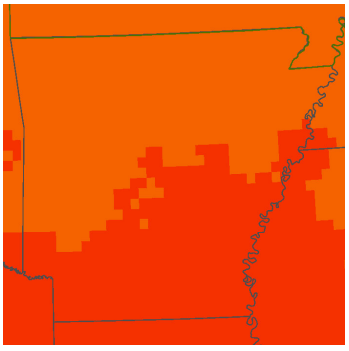
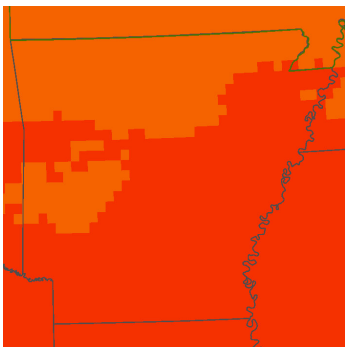
Year	Hottest: HadCM3 A1B	Coolest: CGCM3 B1
2010		
	Average: 17.7 Range: 15.1 - 19.6	Average: 17.2 Range: 14.5 - 19.1
2050		
	Average: 19.1 Range: 16.6 - 21.0	Average: 17.5 Range: 15.0 - 19.4
2090		
	Average: 21.0 Range: 18.5 - 22.8	Average: 18.2 Range: 15.6 - 20.1

Figure 5. State scale decadal temperature projections for hottest and coolest GCM-SRES combinations

Metadata and Interpretive Guidance

Historic climate data were derived from data provided by the PRISM Modeling Group at Oregon State University. Parameter-elevation regressions on Independent Slopes Model (PRISM) data have spatial resolution of 4 km, spatial extent of the conterminous US, temporal resolution of month, and temporal extent of 1895-1997. Data are described in detail in W.P. Gibson, C. Daly, T. Kittel, D. Nychka, C. Johns, N. Rosenbloom, A. McNab, and G. Taylor. 2002. Development of a 103-year high-resolution climate data set for the conterminous United States. In: Proceedings, 13th AMS Conference on Applied Climatology, American Meteorological Society, Portland, OR, May 13-16, 181-183. Data are available at http://www.prism.oregonstate.edu/products/.

Climate prediction data (IPCC GCMs) were derived from data provided by the World Climate Research Programme's Coupled Model Intercomparison Project Phase 3 (CMIP3) dataset. These downscaled data have spatial resolution of 12 km, spatial extent of the conterminous US, temporal resolution of month, and temporal extent of 2001-2099. E.P. Maurer, L. Brekke, T. Pruitt, and P.B. Duffy. 2007. Fine-resolution climate projections enhance regional climate change impact studies. Eos Trans AGU 88(47): 540. Data are available at http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html.

For additional metadata, please see the Metadata-Overview and Metadata-Details links on the TACCIMO GIS Viewer.

Guidelines and other background information necessary for the responsible use of TACCIMO are fully documented in the User Guide. The section entitled Interpreting Results provides a detailed explanation of the purpose, strengths, limitations, and intended applications of the provided information. The section entitled Content Production System fully explains methods and criteria for the inclusion of content in TACCIMO. Fully understanding these dimensions of TACCIMO is essential to the proper application of its information. It is critical that users apply the results within a broader science assessment process that is part of a larger decision support framework. The exact form of this process will vary with the scale and nature of the planning or management activity in question, but the bottom line is that TACCIMO is an initial supplement to a more involved decision support process and not a substitute for it.

This geospatial information was prepared by the USDA Forest Service. These data were been developed from sources of differing accuracy, based on modeling or interpretation, accurate only at certain scales, or incomplete while being created or revised. The Forest Service cannot assure the accuracy, completeness, reliability, or suitability of this information for any particular purpose. Using geospatial data for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service is not liable for any activity involving this information with respect to losses or damages.

APPENDIX D. TIERED DOCUMENTS AND REFERENCES

Tiered Documents

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