Environmental Assessment

For

Brown(s) Creek-Lower Maumelle Project

Responsible Agency:
US Forest Service, Ouachita National Forest
Jessieville-Winona-Fourche Ranger District

Responsible Official:
Megan Moynihan, District Ranger
PO Box 189 – 8607 Hwy 7 N
Jessieville, AR 71949

For Further Information Contact:
Paula Homan, NEPA Planner
(501) 984-5313 ext. 107

This project is subject to subparts A and B of *36 CFR Part 218 Project-Level Predecisional Administrative Review Process* (objection process); it is not authorized under the Healthy Forest Restoration Act (HFRA).

TABLE OF CONTENTS

LISTING OF FIGURES & TABLES

Chapter 1
Purpose of and Need for the Proposed Action

Proposed Action

The Jessieville-Winona-Fourche Ranger District proposes to implement the following management activities*:

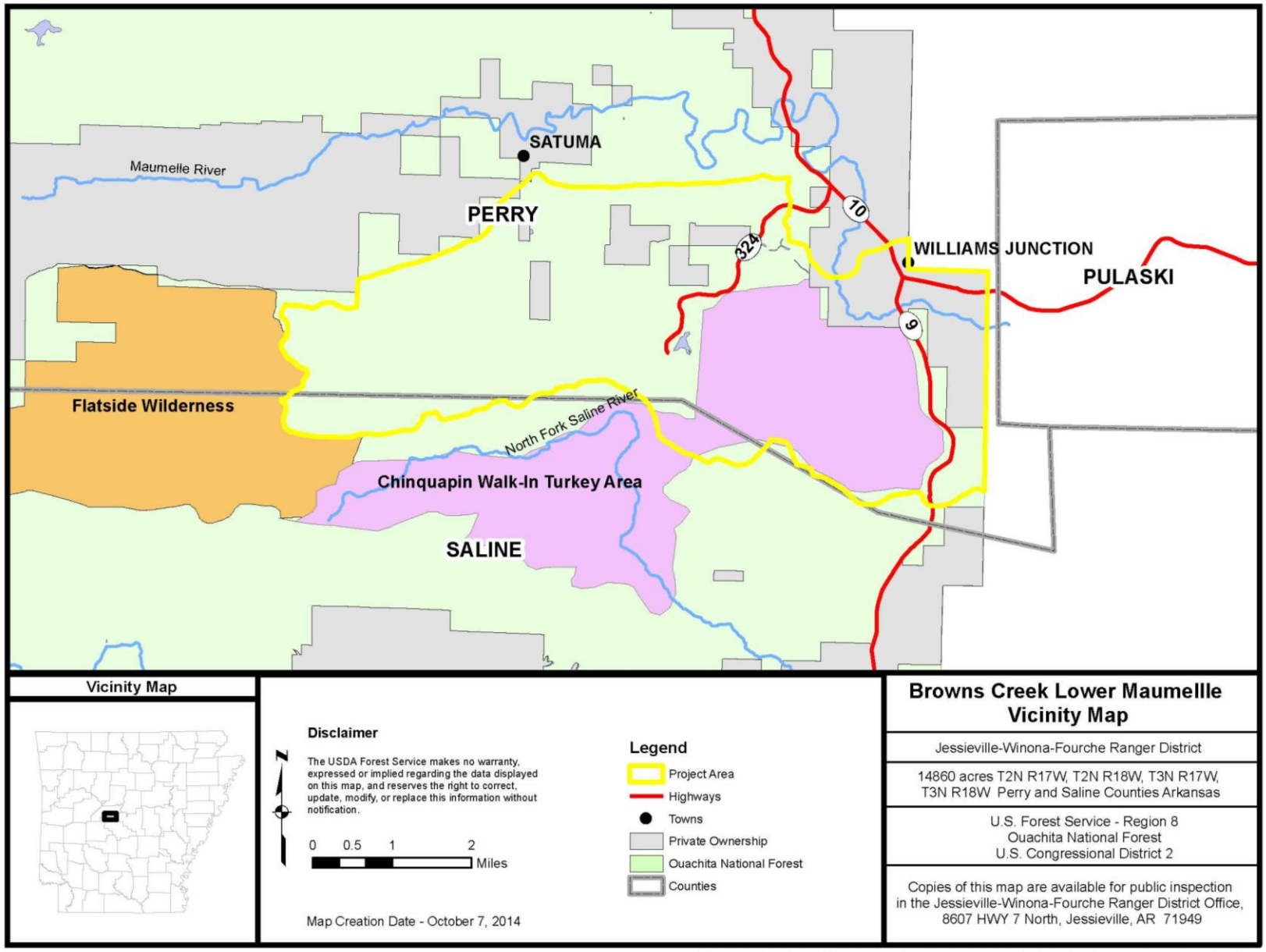
- Shortleaf pine restoration (clearcut loblolly pine plantation) – 13 acres
- Seedtree regeneration harvest – 268 acres
- Shelterwood regeneration harvest – 255 acres
- Commercial thinning – 1,778 acres (includes 212 acres of woodland restoration including midstory removal and burning)
- Group Selection - 19 acres[1]
- Site preparation herbicide – 642 acres
- Site preparation prescribed burn – 723 acres
- Hand plant shortleaf pine seedlings (if necessary) – 536 acres
- Pre-commercial thinning – 39 acres
- Stand improvement-midstory removal– 1,354 acres
- Stand improvement-regeneration release – 995 acres
- Ecosystem prescribed burning – 11,144 acres
- Fire line construction – 5.32 miles
- Fire line maintenance – 14.1 miles
- Wildlife pond maintenance/reconstruction – 21 ponds
- Nest box installation – 42 units
- Wildlife habitat improvement-midstory removal – 1,396 acres
- Road reconstruction or maintenance – 6.28 miles
- Temporary road construction – 12.74 miles

*All figures are approximate.

The Brown(s) Creek-Lower Maumelle Project (BCLMP) is located approximately eight miles south of Perryville, Arkansas in parts of Perry and Saline Counties in T2N R17W, T2N R18W, T3N R17W, and T3N R18W. Of the 14,860 acre project area, 12,726 acres are located on National Forest system lands. The BCLMP is comprised of Compartments 1419, 1420 and 1430-1434. The proposed action will occur in Management Areas (MA) 3, 6, 9, 14 and 17.

[1] Total acreage of individual groups; remainder of group selection stand acreages are included in commercial thinning.

Figure 1. BCLMP Vicinity Map



Purpose of and Need for the Action

Overall guidance for the BCLMP is found in the 2005 Revised Land and Resource Management Plan (Revised Forest Plan) for the Ouachita National Forest. The primary goal of the Revised Forest Plan is to promote diverse, healthy, productive, and sustainable ecosystems. The purpose of this action is to restore the health and vigor of the project area by providing for a diversity of plant and animal communities, early seral habitat in a well-distributed grass/forb or shrub/seedling stage, reduction in fuel accumulation, and production of a sustainable yield of wood products.

Need for the Action

- Current conditions in the BCLMP area do not meet the desired conditions for the forest MA's and the ecological systems that occur within.
- Past fire suppression activities have removed the natural role of fire from the landscape. This absence of fire has resulted in excessive fuel accumulations, increasing the risk of damage to resources in the event of wildfire.
- The absence of fire has resulted in reduced open understories necessary for the growth of many native plant communities, wildlife foods, and the natural regeneration of pine and oak.
- Pine stands contain damaged, poorly formed and diseased trees. The trees are overcrowded or densely stocked, which reduces growth and crown development. These conditions result in stress and reduced vigor and health, and increases susceptibility to insects and disease.
- There is limited access to those stands in need of silvicultural treatment, resulting in the need for temporary road construction. Some existing roads are not useable by log trucks for hauling, creating the need for road re-construction.
- There is a lack of high quality forage and a lack of nesting habitat for species requiring early successional habitat within the project area.
- There is a lack of suitable natural cavities for nesting within the project area.
- There is need for standing water to be available throughout the BCLMP area year-round for consumption by wildlife and as reproductive sites for native amphibian species.

Existing Conditions Contrasted to the Desired Conditions (Table 1.1)

Desired Conditions	Existing Conditions	Site Specific Needs	Propsed Management Activities
Improve forest health by maintaining conditions that would reduce insect and disease caused losses (Revised Forest Plan, pp. 58-59).	Trees in many pine stands are crowded or densely stocked; many Forest stands are older than 50 years. This results in stress, reduced vigor and health, increasing susceptibility to insects and disease.	Need to restore healthy conditions by limiting overstory, removing unhealthy trees, and reducing stocking.	Commercial Thinning of shortleaf pine. 1,778 acres.
Remove offsite species (Revised Forest Plan, pp. 60, OBJ 11; pp. 82 FR010).	There is one 13 acre stand of offsite loblolly pine.	Need to remove offsite loblolly pine and replant with native shortleaf pine.	Clearcut and plant with native shortleaf. 13 acres.
Have between 6% and 10% in MA 17 and not more that 14% in MA 14 of the suitable land in the 0-10 year age class. (Revised Forest Plan, pp. 78).	Currently, there is no 0-10 year age class within the project area.	Need to increase early seral stage habitat.	Shelterwood Seed Tree. 533 acres.
Have suitable seedbeds in regeneration stands.	Conditions do not exist for successful natural regeneration.	Need to create a suitable seedbed for seed fall after the regeneration harvests.	Prescribed Burning Site Prep by Hand tools Site Prep by Mechanical Scarification with hand planting of shortleaf pine if needed. Herbicides optional. 11,144 acres.
Have food available for wildlife (Revised Forest Plan pp. 78).	New browse is limited within the project area.	Need to provide new growth for wildlife throughout the project area.	Shelterwood, Seed Tree, Prescribed Burning. 11,144 acres.
Reduce wildfire hazards (Revised Forest Plan pp. 68).	A lack of prescribed burning, natural fuel buildup, have increased wildfire hazards.	Need to reduce fuel loading throughout the project area.	Prescribed Burning. 11,144 acres.
Increase growth rate and quality of desired trees (Revised Forest Plan pp. 83).	Competition among species is reducing growth rate.	Need to decrease competition for nutrients and water among species.	Hand Tool Release w/herbicide option. 995 acres.
Provide at least one permanent water source per 160 acres for wildlife objectives (Revised Forest Plan, pp. 79).	There are currently 21 existing water sources.	Need to add at least 58 water sources.	Pond Maintenance & Rehabilitation 21 ponds.

Existing Conditions Contrasted to the Desired Conditions (Table 1.1)

Desired Conditions	Existing Conditions	Site Specific Needs	Propsed Management Activities
Open stand conditions to allow improved development of grasses and forbs on the forest floor (Revised Forest Plan, pp. 78).	Stand conditions are in many areas heavily stocked, reducing sunlight to the forest floor which inhibits development of grasses and forbs.	Reduce midstory on areas slated for thinning and reestablish fire.	Wildlife stand improvement midstory reduction with cutting tools or herbicides, and prescribed burning. 212 acres.
Provide for areas of mast production. (Revised Forest Plan, pp. 78)	Many mast producing trees are crowded and densely stocked.	Thin mast producing trees.	Wildlife stand improvement overstory thinning. 1,396 acres.
Provide bird nesting structures where suitable natural cavities do not occur and when needed. (RLRMP, WF009, p.79)	There is a lack of suitable natural nesting cavities for wildlife within the project area.	Provide nesting structures throughout the project area.	Install additional nesting structures. 42 structures.
Contribute to the economic base of local communities by providing a sustained yield of wood products at a level consistent with sound economic principles and appropriate multiple use objectives. (RLRMP p. 68)	Pine plantations contain damaged and poorly formed trees. These plantations are also overcrowded and densely stocked which results in reduced growth and crown development. These conditions result in poor quality wood products.	Reduce basal area levels in pine plantations and other overstocked stands.	Commercial thinning. 1,778 acres.

Scope of This Environmental Analysis

Relevant Planning Documents

The following documents directly influence the scope of this environmental analysis.

- Revised Land and Resource Management Plan (RLRMP or Revised Forest Plan) for the Ouachita National Forest (USDA Forest Service, 2005a)
- Final Environmental Impact Statement (FEIS), Revised Land and Resource Management Plan, Ouachita National Forest (USDA Forest Service, 2005b)
- Travel Analysis Report for the BCLMP

The Revised Forest Plan guides all natural resource management activities for the Ouachita National Forest. The forest management direction, communicated in terms of Desired Conditions (pp. 6-26); Strategies (pp. 27-72); and Design Criteria (pp. 73-123) that apply to the forest lands identified in this proposal are incorporated by reference.

Reference for Revised Forest Plan Standards by Management Area (Table 1.2)

Management Area Number	Management Area Description	Project Area National Forest System Acres	Revised Forest Plan Reference Management Area Design Criteria*
3	Developed Recreation Areas	117	Part 2, p. 31; Part 3, p. 102
6	Rare Upland Communities	30	Part 2, p. 32-33; Part 3, p. 102
9	Water and Riparian Area	399	Part 2, pp.34; Part 3, pp. 103-108
14	Ouachita Mountains, Habitat Diversity Emphasis	7,789	Part 2, p. 35; Part 3, p. 108
17	Semi-Primitive Areas	4,391	Part 2, pp 37-38, Part 3, pp 111-112

* Part 3–Design Criteria of the Revised Forest Plan (pp. 73-97) present standards applicable Forest-wide.

History of the Planning and Scoping Process

The BCLMP was first listed in the Schedule of Proposed Actions (SOPA) on January 1, 2015. A Project Announcement Letter (PAL) or "scoping letter" was mailed to interested publics on August 28, 2015, requesting input on the proposed actions regarding management of the PHMP area. The PAL was also published to the Forest's website at that time. Three comments were received. Two of these comments were to acknowledge the project. The third comment was outside the scope of the project.

The draft EA was released for public review and comment on February 3, 2016; a legal notice of the 30-day comment period was published in the *Arkansas Democrat Gazette*. One letter was received from Central Arkansas Water (CAW) and their comments were responded to and incorporated into the project as appropriate.

Issues

No site-specific concerns regarding the use of herbicides were raised during scoping; however Forest policy requires analysis of alternatives to herbicide use. For this reason, the following issue will be analyzed in depth:

- **Issue 1:** Herbicide use may create a safety hazard to workers and forest visitors. *Method of measurement:* Hazard quotient values of herbicides

Decisions to Be Made

The District Ranger must decide which alternative to select. The District Ranger must also determine if the selected alternative would or would not be a major Federal action, significantly affecting the quality of the human environment.

Chapter 2
Alternatives Including the Proposed Action

Alternative Design

Alternatives to be Documented in Detail

Three (3) alternatives were identified by the ID Team and approved by the Responsible Official to be evaluated and documented in detail:

- No Action Alternative
- Proposed Action
- No Herbicide

No Action

No-Action does not mean that activities in the project area would not occur. Road maintenance for public safety would continue. The area would continue to be accessible for outdoor recreation purposes. The Forest Service would respond to wildfires. Salvage operations and/or suppression of insect or disease outbreaks could take place. It is also possible that management activities qualifying as categorical exclusions (36 CFR Part 220) could take place in the project area.

Proposed Action

See Appendix A for list of activities by compartment and stand; see Appendix B for maps displaying activity locations.

Shortleaf Pine Restoration. A clearcut regeneration harvest is proposed on 13 acres of acquired loblolly pine plantations and is optimal treatment for the primary purpose of restoring native forest in the Project Area. The Revised Forest Plan (FR010, p. 82) specifies that clearcutting may be utilized in certain instances, including restoration of native forests on lands that currently support non-native tree species. Cutting or harvest in streamside management areas (SMAs) could occur for the purpose of reducing vulnerability to southern pine and/or ips beetle and/or restore native vegetation (9.02/Table 3.10, p. 104). A hardwood component of 10% to 30% would be developed with the regeneration of the native shortleaf pine.

Revised Forest Plan design criteria FR005, FR0009/Table 3.2, and Table 3.11 identify parameters associated with even-aged management. The management practice of clearcut harvest has been selected to accomplish replacement of this forest type that is outside its natural range (OBJ11, p. 60). The Revised Forest Plan provides that maximum size of regeneration areas may be exceeded with approval of the Forest Supervisor up to a maximum of 80 acres for pine and pine-hardwood forest types (FR009/Table 3.2, page 80; Table 3.11, page 108). The Revised Forest Plan also

authorizes utilization of clearcutting for the purpose of restoring native forests on lands that currently support non-native tree species (FR010, page 82). The proposed clearcut is based on reasonable and prudent silvicultural practices of Ouachita National Forest lands. Utilization of clearcutting as a harvest method is consistent with the objective of the Revised Forest Plan to replace off-site loblolly pine with shortleaf pine and native hardwoods.

Connected activities include:

Site Preparation with Herbicide and Prescribed Burning. Following the clearcut harvest of pine trees, site preparation treatment of residual hardwood, such as oaks, hickory, maple, elm, and other species, and loblolly pine in all age classes, would consist of herbicide (triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate) application (cut surface and/or directed foliar spray) and prescribed burning to further ready the soil for planting. An overstory hardwood component of 5 BA would be retained if available. A hardwood component would be established in the regenerated stand at a rate of 10% to 30% of the total trees per acre. Fruit-bearing and den trees when available will be favored in order to obtain a desired hardwood component.

Reforestation−Hand Planting. After the harvest of the loblolly pine, shortleaf pine would be planted at a rate of 302 to 908 seedlings per acre, depending on site requirements. These seedlings will be monitored for survival with a first and third year survey. If survival of pine seedlings is less than 300 seedlings per acre, replanting would be scheduled.

Seedtree Harvest with Reserves. In this even-aged management method, overstory pine trees would be reduced to approximately 10 to 15 square feet of basal area per acre and serve as seed trees to produce a new age class of regeneration. Residual seed trees would be retained for the life of the regenerated stand as older sawtimber legacy trees.

Shelterwood Harvest with Reserves. In this even-aged management method, overstory pine trees would be reduced to approximately 30 square feet of basal area per acre and serve as a seed source as well as shelter or shade to a new age class of regeneration. A subsequent removal cut of some shelter trees would occur after the regeneration is established; the remainder of overstory trees would be retained for the life of the regenerated stand as older sawtimber legacy trees.

Connected activities include:

Site Preparation with Herbicide and Prescribed Burning. Treatment for the purpose of preparing sites for natural pine regeneration involves felling and/or herbicide treatment of residual hardwoods such as oaks, hickory, maple, elm, and other species in all size age classes after harvest has occurred. Chainsaw and/or other manual tools would be used to fell hardwood stems. Herbicide (triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate) would be used to treat cut stumps and/or foliage of hardwoods that are less than six feet in height. The area

then would be prescribed burned. A hardwood component would be retained in the regenerated stand at a rate of 10% to 30% of the total trees per acre. Fruit-bearing and den trees when available would be favored in order to obtain the hardwood component. Following the harvest of overstory pine trees the hardwood components of these stands would be reduced to a basal area of approximately 5 square feet per acre.

Reforestation−Hand Planting. These sites would be monitored and, if an adequate amount of pine natural regeneration (target level of 250-500 seedling per acres–Revised Forest Plan, Table 3.5, p. 83) is not established in a timely manner after the seed tree harvest, hand planting shortleaf pine would be used to achieve desired stocking levels.

Commercial Thinning. Pine stands would be thinned to a residual basal area of 60-75 square feet per acre based on the average stand diameter. Damaged, diseased, suppressed, and poorly formed trees would be targeted first for removal. Post-thinning stocking levels would meet the basal area guides listed in the Revised Forest Plan, Table 3.6, Thinning Guide by Community Group. Pursuant to Revised Forest Plan Design Criteria FI005, deviations from these guides are allowable if site-specific conditions warrant, subject to approval by the project Responsible Official. **Plantations**. Pine plantations ranging from 20 to 40 years of age would be thinned to an approximate spacing of 20 feet by 20 feet.

Connected activity:

Midstory Removal. Following commercial thinning, some pine trees measuring less than five inches in diameter at breast height (dbh), and some hardwood stems measuring one inch and larger dbh, would be felled with chainsaw or other hand tools, or treated with herbicide (triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate) using frill girdle (hack and squirt), injection, or cut surface application methods.

Stand Improvement-Release. To ensure a viable stand, a minimum of 300 shortleaf pine seedlings per acre and 25 hardwood seedlings (preferably a hard mast species) per acre should be free to grow without direct competition from vegetation for sunlight, moisture and nutrients. Pine and hardwood seedlings would be released, with treatment consisting of felling hardwood stems such as oaks, hickory, maple, elm, and other species with chainsaws or other hand cutting tools. Herbicide (triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate) would be applied using frill girdle (hack and squirt), injection, cut surface, or directed foliar spray methods. Treatment would occur in all size classes.

Stand Improvement-Pre-commercial Thinning. Pine plantations averaging three inches in diameter at breast height would be thinned to approximately 440 trees per acre. A hardwood component would be retained at 10% to 30% of the total trees per acre.

Prescribed Burning-Fuel Reduction and Ecosystem Restoration. This activity would be implemented during the dormant and growing seasons (described below). Proposed burn areas would be burned as needed to reach a natural fire regime in this area. The

prescribed burn frequency would be based on the current fuel loads, the priority of the unit and reasonable accessibility to achieve the desired condition. These are also considered when determining timing or season and intensity of the prescribed burn.

Growing Season Prescribed Burning – These burns are implemented during the spring and summer months between leaf emergence in late March and April and leaf fall in late October and November. The burns involve application of controlled, low to moderate intensity fire to control competing vegetation (hardwoods), prepare sites for seeding, and perpetuate fire dependent species (shortleaf pine – bluestem). Vegetation three inches and less in diameter at the ground level is targeted for eradication; however, some larger diameter vegetation may be damaged. This will result in less competition for pine seedlings and other desirable fire-dependent species while creating an open understory to stimulate growth of native grasses and forbs and increased foraging opportunities for browsing animals. Prescribed burning would follow standards set forth by the USFWS Biological Opinion (August 2015) for the Northern-long eared bat.

Dormant Season Prescribed Burning – These burns are implemented after leaf fall and before leaf emergence during late fall and winter months. Moderate to high intensity fire is employed to reduce accumulated fuels, stimulate growth of native vegetation, and improve wildlife habitat. Approximately 80 percent of the area is burned with expected fuel reduction of approximately 30 percent. Some duff would be retained for soil protection. Some larger vegetation may be lost, however, two inches in dbh and less in diameter is targeted for reduction to create an open understory, stimulating growth of native grasses and forbs, and increased foraging opportunities for browsing animals.

Fireline Construction. A line up to 10-feet wide would be bladed to bare minimum soil using a bulldozer, removing ground vegetation and small trees. The fireline would meander around large trees, leaving them in place. After the burns are completed, these firelines would be waterbarred and seeded with native grasses and forbs where needed to restore vegetative cover to the exposed soil.

Fireline Reconstruction/Fireline Maintenance. Up to a 10-foot wide swath of brush and ground vegetation would be removed from existing firelines by blading using a bulldozer. After the burns are completed, these firelines would be waterbarred and seeded with native grasses and forbs where needed to restore vegetative cover to the exposed soil.

Wildlife Habitat Improvement-Midstory Removal. In pine forest types, designated midstory hardwood and pine would be eliminated by severing the stems with chainsaw or other hand tools or by application of the herbicide (triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate) applied by frill girdle (hack and squirt), stem injection, cut surface, or foliar spray. Soft-mast producing trees in the midstory such as dogwood and serviceberry, and trees containing vines of wild grapes are typically not treated, depending upon their densities within the area treated. Snags and den trees (living trees

with cavities) would be retained. Residual hardwoods in the overstory and midstory would include representatives of the red oak, white oak and hickory groups to ensure a variety of hard (acorns/nuts) and soft mast (fruits/berries) types are available for wildlife consumption. Treatment would transition stand composition toward historic open, pine-bluestem conditions

Wildlife Pond Maintenance & Reconstruction. Some of the small wildlife ponds in this watershed are 40+ years old. Soil and vegetation would be removed from dams, and leaks from roots and trees would be repaired.

Nest Box Installation. Eastern Blue Bird, Carolina Wren, and Wood Duck nest boxes and bat boxes would be installed throughout the project area, concentrating in openings and near wildlife waterholes. This is primarily for secondary cavity nesters but other species may also use them.

Temporary Road Construction. Road would be constructed to access and haul timber from stands proposed for commercial harvest. Per TH009 on page 86 of the Revised Forest Plan, temporary roads will be decommissioned and revegetated upon termination of management activity. Effectively block them to normal vehicular traffic within 50 feet of the beginning of the road and include dips and/or waterbars for erosion control. Remove all temporary crossings. Restore the natural contours and slope on temporary road segments that have grades of 14 percent or greater (USDA Forest Service, 2005a)

Road Reconstruction. System road reconstruction would be required to support management activities, reduce erosion and sedimentation, and ensure safe travel on the existing road network. Activities could include any road improvements or realignment that results in an increase of an existing road's traffic service level, expands its capacity, changes its original design function, or relocates an existing road or portions of an existing road and treatment of the old roadway.

No Herbicide

This alternative addresses Forest direction requiring analysis of an alternative to herbicide use when feasible and practical to accomplish management purposes. The No Herbicide Alternative is the same as the Proposed Action except that chainsaws or other hand tools, instead of herbicide application, would be utilized for site preparation, release, midstory removal, and overstory development.

Technical Requirements

The technical requirements described below apply to the Proposed Action and the No Herbicide Alternative.

Cultural Resources

HP1: Site Avoidance During Project Implementation

For cultural resource sites that are eligible for NRHP inclusion and for sites that the NRHP eligibility is undetermined: avoidance of historic properties would require the protection from effects resulting from the undertaking. Effects would be avoided by establishing clearly defined site boundaries and buffers around archeological sites where activities might result in an adverse effect. Buffers would be of sufficient size to ensure that integrity of the characteristics and values which contribute to the properties' significance would not be affected.

HP2: Site Protection During Prescribed Burns

(1) *Firelines.* Historic properties located along existing non-maintained woods roads used as fire lines will be protected by hand-clearing those sections that cross the sites. Although these roads are generally cleared of combustible debris using a small dozer, those sections crossing archeological sites will be cleared using leaf blowers and/or leaf rakes. There will be neither removal of soil, nor disturbance below the ground surface, during fireline preparation. Historic properties and features located along proposed routes of mechanically-constructed firelines, where firelines do not now exist, will be avoided by routing fireline construction around historic properties. Sites that lie along previously constructed dozer lines from past burns where the firelines will be used again as firelines, will be protected during future burns by hand clearing sections of line that cross the site, rather than re-clearing using heavy equipment. Where these activities will take place outside stands not already surveyed, cultural resources surveys and regulatory 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, as necessary, by burning out around the feature prior to igniting the main burn, creating a fuel-free zone. Burn out is accomplished by constructing a set of two hand lines around the feature, approximately 30 to 50 feet apart, and then burning the area between the two lines while the burn is carefully monitored. Combustible features located in a burn unit will also be documented with digital photographs and/or field drawings prior to the burn. Historic properties containing above ground, non-combustible cultural features and exposed artifacts will be protected by removing fuel concentrations dense enough to greatly alter the characteristics of those cultural resources. No additional measures are proposed for any sites in the burn interior that have been previously burned or that do not contain combustible elements or other above ground features and exposed artifacts as

proposed prescribed burns 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.

(4) *Burial sites* will be protected during prescribed burning activities.

HP3: Other Protection Measures

If it is not feasible or desirable to avoid an historic property that may be harmed by a project activity (HP1), then the following steps will be taken: (1) In consultation with the Arkansas SHPO, the site(s) will be evaluated against National Registry 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, tribes and nations, and with the Advisory Council of Historic Preservation (ACHP) if required, mitigation measures will be developed to minimize the adverse effects on the site, so that a finding of No Adverse Effect results; (3) the agreed-upon mitigation measures will be implemented prior to initiation of activities having the potential to affect the site.

HP4: Discovery of Cultural Resources during Project Implementation

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

Soils

Allow heavy equipment operations on hydric soils, soils with a severe compaction hazard rating, and floodplains with frequent or occasional flooding hazard only during the months of July through November. Operations during December through June are allowed with the use of methods or equipment that do not cause excessive soil compaction. This standard does not apply to areas dedicated to intensive use, including but not restricted to administrative sites, roads, primary skid trails, log decks, campgrounds, and special use areas. (Revised Forest Plan, SW001, p. 74)

Allow heavy equipment operations on soils that have a high compaction hazard rating only during the months of April through November. Operations during December through March are allowed with the use of methods or equipment that does not cause excessive soil compaction. This standard does not apply to areas dedicated to intensive

use, including but not restricted to administrative sites, roads, primary skid trails, log decks, campgrounds, and special use areas. (Revised Forest Plan, SW002, p. 74)

These standards apply to operations in the stands displayed in the table below.

Stands With a Limited Operating Season (Table 2.1)

Compartment	Stands
Severe Compaction	
1419	9, 16, 21, 23
1420	2, 4, 5, 13, 14, 18, 29, 33
1431	21, 26
1432	3, 6, 25, 29
1433	8, 9, 12, 20
1434	8, 12, 23, 25, 28
Moderate-High & High Compaction	
1419	3, 5, 7, 9, 14, 15, 16, 21, 23
1420	2, 4, 5, 13, 14, 20, 29, 33
1431	1, 21, 26
1432	20, 29
1433	12, 13
1434	28

A sedimentation run off barrier will be installed along the harvest area for Stand 17, Compartment 1430 near the river and maintained to protect water quality.

Recreation

No commercial logging will be allowed in the Chinquapin Mountain Walk-In Turkey Hunting Area one month prior to and during the spring turkey hunting season.

Scenery

Proposed road reconstruction, temporary road construction, commercial thinning and midstory removal would be conducted in an area designated with a high scenic integrity objective. The Scenery Treatment Guide – Southern Regional National Forests (April 2008) would be followed to reduce impacts to scenic quality, as detailed below.

General Unit Mitigation Measures:

- No activity would occur within a 200 foot wide buffer around the Ouachita National Recreation Trail. Flowering and other visually attractive trees and understory shrubs should be favored when leaving vegetation.
- Native wildflowers and/or shrubs and/or trees with showy flowers and/or fruits should be favored or introduced. Cut and fill slopes should be revegetated to the extent possible.

- In seen areas, consider seasonal color of vegetation. For instance, using warm season grass mixes that turn seasonally brown or gray instead of green.
- During temporary road construction, slash and root wads should be eliminated or removed from view in the immediate foreground to the extent possible.
- Special road and landing design should be used. When possible, log landings, roads and bladed skid trails should be located out of view to avoid bare mineral soil observation from Concern Level 1 and 2 travel routes.
- Slash may be aligned parallel to roads at the base of fill slopes to collect silt, but usually only if it provides this function.
- Root wads and other unnecessary debris should be removed or placed out of sight within 200 feet of key viewing points.
- Stems should be cut to within 6 inches of the ground in the immediate foreground.
- Leave tree marking or unit boundary marking should be applied so as to not be visible within 200 feet of Concern Level 1 and 2 travel routes.
- Consider scheduling work outside of major recreation seasons.
- The scenery impact of roads and constructed fire lines should be blended so that they remain subordinate to the existing landscape character in size, form, line, color, and texture.
- Cut banks should be sloped to accommodate natural revegetation.
- Along private property lines, leave some hardwoods along a 100 foot buffer.

Unit –Specific Mitigation Measures:

Stands 5 and 7, Compartment 1419, SIO – HIGH, with some MEDIUM to the west: In these organically shaped midstory reduction units, Slash will be treated to within an average of 4 feet of the ground in the seen areas within 100 feet of the travelway.

Stands 14 and 21, Compartment 1419, SIO – MEDIUM: In these organically shaped seedtree units, leave some (including large) hardwoods within the seen area, or 200 feet, of travelways and viewing points from the private land. Flowering and other visually attractive trees and understory shrubs should be favored when leaving vegetation. Slash will be treated to within an average of 4 feet of the ground in the seen areas within 100 feet of the travelway.

Stand 3, Compartment 1419, SIO – MEDIUM: In this organically shaped group selection unit, do not select any hardwoods within the seen area of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas within 100 feet of the travelway.

Stands 1, 14, and 33, Compartment 1420, SIO – HIGH: In these organically shaped midstory removal units, cut fewer pine trees within the seen area, or 200 feet, from travelways. Slash will be removed, burned, chipped or lopped to within an average of 2 feet of ground, in the seen areas within 100 feet of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas from 100 to within 200 feet of the travelway.

Stand 23, Compartment 1420, SIO – HIGH, VAC - LOW: This proposed seedtree unit is within the middleground seen area of viewpoints from Flatside Wilderness. Any non-wilderness acreage seen from wilderness must be managed as though it is part of the wilderness experience. The unit will have organically shaped boundaries with edges shaped and/or feathered where appropriate to avoid a contrasting or shadowing effect within the cut unit.

Stand 26, Compartment 1431, SIO – HIGH, VAC - MEDIUM: This organically shaped seedtree unit, leave the hardwoods within the seen area, or 200 feet, of travelways and viewing points from the private land. Slash will be removed, burned, chipped or lopped to within an average of 2 feet of ground, in the seen areas within 100 feet of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas from 100 to within 200 feet of the travelway. This unit is also within the middleground seen area from viewpoints on the Ouachita National Recreation Trail. The unit will have organically shaped boundaries with edges shaped and/or feathered where appropriate to avoid a contrasting or shadowing effect in the cut unit.

Stand 21, Compartment 1431, SIO – HIGH: In this organically shaped thinning unit, leave some hardwoods within the seen area along the upslope areas of the travelway. Slash will be removed, burned, chipped or lopped to within an average of 2 feet of ground, in the seen areas within 100 feet of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas from 100 to within 200 feet of the travelway.

Stand 20, Compartment 1431, SIO – HIGH: In this organically shaped release unit, leave some hardwoods within the seen area along the upslope areas of the travelway. Slash will be removed, burned, chipped or lopped to within an average of 2 feet of ground, in the seen areas within 100 feet of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas from 100 to within 200 feet of the travelway.

Stands 9 and 16, Compartment 1419, SIO – HIGH: In this organically shaped thinning unit, leave some hardwoods within the seen area of the travelway to eliminate any view into the gravel pit. Slash will be removed, burned, chipped or lopped to within an average of 2 feet of ground, in the seen areas within 100 feet of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas from 100 to within 200 feet of the travelway.

Stands 5 and 25, Compartment 1432, SIO – HIGH: In these organically shaped midstory removal units, leave some oak trees within the seen area, or 200 feet, from travelways. Slash will be removed, burned, chipped or lopped to within an average of 2 feet of ground, in the seen areas within 100 feet of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas from 100 to within 200 feet of the travelway.

Stand 18, Compartment 1432, SIO – HIGH: This unit already has great landscape character for this travelway and a release would enhance its integrity. Give the unit an organic shape. Slash will be removed, burned, chipped or lopped to within an average of 2 feet of ground, in the seen areas within 100 feet of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas from 100 to within 200 feet of the travelway.

Stand 20, Compartment 1432, SIO – HIGH: Currently this proposed thinning unit has the perfect landscape character desired for trail and road travelways adjacent to a recreation area and with this SIO. Harvest activity on this stand will be deferred at this time.

Stands 6 and 29,Compartment 1432, SIO – HIGH: These proposed seedtree and shelterwood units are within the middleground seen area from viewpoints on the Winona Scenic Drive and the Ouachita National Recreation Trail. The unit will have organically shaped boundaries with edges shaped and/or feathered where appropriate to avoid a contrasting or shadowing effect within the cut unit.

Stands 17 and 20, Compartment 1433, SIO – HIGH: These proposed shelterwood units are within the middleground seen area from viewpoints on the Winona Scenic Drive and the Ouachita National Recreation Trail. The unit will have organically shaped boundaries with edges shaped and/or feathered where appropriate to avoid a contrasting or shadowing effect within the cut unit.

Stand 31, Compartment 1434, SIO – MEDIUM: This proposed seedtree unit is within the middleground seen area from viewpoints on the Winona Scenic Drive and the Ouachita National Recreation Trail. The unit will have organically shaped boundaries with edges shaped and/or feathered where appropriate to avoid a contrasting or shadowing effect within the cut unit.

Stand 8, Compartment 1434, SIO – HIGH: In this organically shaped midstory reduction unit, leave the seen area along the travelway which is very steep to cliffy in nature.

Stand 28, Compartment 1434, SIO – MEDIUM, with some HIGH to the south: In this organically shaped thinning unit, leave the seen area along the travelway which is very steep to cliffy in nature (center of unit). Slash will be removed, burned, chipped or lopped to within an average of 2 feet of ground, in the seen areas within 100 feet of the travelway. Slash will be treated to within an average of 4 feet of the ground in the seen areas from 100 to within 200 feet of the travelway.

Public Health and Safety

During prescribed burning activities, sign travel-ways as needed notifying the public there may be smoke along the road. Flaggers or warning signs would be

positioned along the travel ways during active flaming. Inform the public of potential burn days, times, information contacts, and suggested alternatives for those concerned with smoke. Notify local, county and state law enforcement that burning will take place.

Alternatives Considered But Eliminated from Detailed Study

Proposed Action without Harvest Activity

An alternative similar to the Proposed Action but without harvest applications was considered by the ID Team but eliminated from detailed analysis because the ID Team concluded that a No Action Alternative adequately addressed the overall effects of a no harvest alternative.

Proposed Action without Prescribed Burning

An alternative similar to the Proposed Action, but without the application of prescribed burning (other than existing authorized burn decisions), was considered by the ID Team but eliminated from detailed analysis. The ID Team concluded that a No Action Alternative adequately addressed the overall effects of a no prescribed burning alternative.

Other Past, Present, and Reasonably Foreseeable Future Actions

A pending 2016 decision for the Upper Lake Winona Project, located just to the southwest of the Brown Creek-Lower Maumelle Project, may authorize ecosystem management activities, including 3,376 acres of timber harvest and 16,239 acres of prescribed burning.

Salvage operations and/or suppression of insect or disease outbreaks would be authorized under the following decisions: Program and Procedure for Salvage of Dead, Down, Damaged, or Hazard Trees (USDA, 2008); Implementation of Forest Insect and Disease Suppression Actions (USDA, Implementation of Forest Insect and Disease Suppression Actions, 2009).

Summary Comparison All Alternatives

The following tables provide a comparison of alternatives utilizing both quantitative and qualitative measures.

Summary Comparison of Management Activities by Alternative (Table 2.3)

Activity and Measure	No Action	Proposed Action	No Herbicide
Clearcut Harvest (acres)	0	13	13
Seed Tree Harvest (acres)	0	268	268
Shelterwood Harvest (acres)	0	255	255
Commercial Thinning Harvest (acres)	0	1,778	1,778
Reforestation Site Preparation Prescribed Burning and Herbicide (acres)	0	1,365	0
Reforestation Site Preparation Prescribed Burning and Chainsaw (acres)	0	0	1,365
Hand plant shortleaf pine seedlings (if necessary)	0	536	536
Pre-commercial Thinning (acres) (Chainsaw)	0	39	39
Stand Improvement Regeneration Release (Chainsaw and Herbicide) (acres)	0	995	0
Stand Improvement Regeneration Release (Chainsaw) (acres)	0	0	995
Stand Improvement Midstory Removal (acres) (Chainsaw and Herbicide)	0	1,354	0
Stand Improvement Midstory Removal (acres) (Chainsaw)	0	0	1,354
Prescribed Burning Fuel Reduction (acres)	0	11,144	11,144
Fire line Construction (miles)	0	5.32	5.32
Fire line Maintenance (miles)	0	14.1	14.1
Wildlife Pond Maintenance (ponds)	0	21	21
Nest Box Installation (boxes)	0	42	42
Wildlife Habitat Improvement Midstory Removal (acres) (Chainsaw Cut and/or Girdle and Herbicide)	0	1,396	1,396
Road reconstruction (miles)	0	6.28	6.28
Temporary Road Construction (miles)	0	12.74	12.74

Summary Comparison of Effects on Environment by Alternative (Table 2.4)

Effect	No Action	Proposed Action	No Herbicide
Revenue/Cost Ratio	N/A	1.3	1.32
Open Road Density			
Management Area 14	1.6	1.6	1.6
Management Area 17	1.2	1.2	1.2
Soil Loss Below Threshold	Yes	Yes	Yes
Risk Level to Beneficial Uses			
Browns Creek-Maumelle River 6th level HUC *111102070101*	Low	Low	Low
Bringle Creek-Maumelle River 6th Level HUC *111102070102*	Low	Low	Low
Acres of Early Seral Habitat Created	0	499	499
Herbicide Application/ Human Exposure Scenario Hazard Quotients > 1	No	Yes	No

Chapter 3
Affected Environment and Environmental Consequences

Analysis Methods

Air Quality – The emissions were calculated using a range of consumption values (in tons per acre) for the largest unit based on best available information and professional judgment (Region 8 Air Quality Specialist Melanie Pitrolo). Consumption is assumed to be between two and four tons per acre, with an average emission factor of 12 pounds of fine particulate matter per ton of fuel consumed.

#acres x consumption (4 tons/acre) x emission factor (12 lbs/ton) divided by 2000

Soils – The Ouachita National Forest Universal Soil Loss Equation (USLE) model was used to predict whether soil loss from proposed management actions would be below maximum allowable thresholds. The model was developed by ONF personnel, and modified by Forest Soil Scientists.

Water Quality – The Aquatic Cumulative Effects model was used to determine the possible cumulative impacts of management activities on water quality. This model addresses the effects of timber harvesting, roads and wildlife management activities on water quality and fisheries. The model calculates sediment loadings resulting from proposed management activities. The model also assigns a risk rating of low, medium or high for adverse effects to aquatic beneficial uses. The model was developed for the Ouachita National Forest in Arkansas and Oklahoma and is specific to the physiographic zones within the Ouachita National Forest.

Financial Efficiency – Quick-Silver (version 7.0) was used to determine the financial efficiency of each Alternative. This program is a project analysis tool that utilizes a Microsoft Access database for use by forest managers to determine the economic performance of long-term investments.

Public Health and Safety – SERA (Syracuse Environmental Research Associates, Inc.) Pesticide Human Health and Ecological Risk Assessments were used to analyze the risks associated with the herbicides proposed for use in this project. Project specific SERA worksheets were completed for herbicides triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate to determine HQs (Hazard Quotients) for the proposed application rates of these herbicides. An HQ is the ratio of a projected level of human exposure divided by some index of acceptable exposure or an exposure associated with a defined risk. HQs of 1.0 or less indicate scenarios with acceptably low risk.

Air Quality

Current Conditions

The project area lies within lands designated as Class II with respect to the air resource. The Clean Air Act defines a Class II area as "a geographic area designated for a moderate degree of protection from future degradation of the air quality." A Class I Area is a geographic area designated for the most stringent degree of protection from future degradation of air quality. The closest Class I Area is the Caney Creek Wilderness Area, approximately 90 miles southwest of the project area. The Upper Buffalo Wilderness area is located approximately 100 miles north.

Existing emission sources occurring within the project area consist mainly of mobile sources. These would include, but are not limited to, combustion engines (such as those found in motor vehicles); dust from unpaved surfaces; smoke from local, county, agricultural, and forest burning; restaurants; and other activities. Arkansas state air regulators monitor ozone and fine particulate matter at several locations near the project area; none of these monitors have measured values greater than air quality standards set by the EPA. Of the six criteria air pollutants, one county in the state (includes the town of West Memphis) is designated a non-attainment area for ozone (US Environmental Protection Agency, 2015).

No Action

Direct and Indirect Effects

The prescribed fire proposed in this project would not occur, therefore there would be no additional smoke generated from the proposed prescribed burning, and no degradation of air quality. The amount of fuel consumed on each of the prescribed burning blocks would average 4 tons per acre. Under the No Action Alternative, this reduction in fuels would not take place. In the event of a wildfire, this fuel would be present, and because wildfires occur without regard to a prescription, climatic conditions might exist that could contribute to the creation of high levels of ozone, PM-10, and PM-2.5 downwind of the fire.

Cumulative effects

No cumulative effects would occur because no prescribe burning would be conducted under the No Action Alternative; there would be no additive effect.

Proposed Action and No Herbicide

Direct and Indirect effects

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 can, however,

be a very serious matter. Human health effects related to particulate matter in smoke include: increased premature deaths; aggravation of respiratory system or cardiovascular illnesses; and changes in lung function, structure, and natural defense. Smoke also becomes a safety issue when it affects visibility on roadways. Smoke can also have a nuisance odor.

Smoke can have negative short-and long-term health effects. Fire management personnel 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 can result in impaired alertness and judgment. The probability of this happening on a prescribed fire is, however, virtually nonexistent because of limited exposure time.

Smoke is composed of hundreds of chemicals in gaseous, liquid and solid forms, some of which are toxins including carbon monoxide, particulate matter, acrolein and formaldehyde. Over 90 percent of the particulate emissions from prescribed fire are small enough to enter the human respiratory system. The repeated, lengthy exposure to relatively low smoke concentrations over many years can contribute to respiratory and cardiovascular problems.

Calculations of emissions from the proposed project were conducted to assess the increase in emissions loading in the project area. Consumption is assumed to be four tons per acre, with an average emission factor of 12 pounds of fine particulate matter per ton of fuel consumed. Calculations of emissions show that the resulting increase as a result of this project would be 88.2 tons from the largest prescribed burn unit.

All prescribed burning activities would be conducted in accordance with the Region 8 Smoke Management Guidelines (Guidelines) in order to alleviate the smoke related impacts outlined above. Smoke management planning in accordance with the Guidelines has been successful in protecting health and safety during past activities. The Guidelines require that smoke dispersion modeling be conducted for most burn units to ensure that the smoke management objectives are met. If modeling shows potential impacts, adjustments or mitigations would be necessary in order to go forward with the burn. Each burn unit would be planned in accordance with the Guidelines such that specific parameters are met, including wind speeds and wind directions. While a few larger units would have the potential to transport smoke beyond the National Forest, potential impacts would be mitigated by burning with a wind direction away from the Forest boundary.

Based on existing air quality information, no long-term adverse impacts to air quality standards are expected from the proposed project. The proposed project is designed to ensure that the Guidelines are followed, and as such does not threaten to lead to a violation of any Federal, State or Local law or regulation related to air quality.

Cumulative effects

The cumulative effects of prescribed burning on air quality consist of the downwind impact of multiple simultaneous prescribed burns, in addition to the other emissions in the area. These cumulative effects are rather short-lived. Once the burn is over and the smoke

dissipates, the effect is over. Impacts to air quality would generally be confined to no more than a few hours or at most, 1-2 days. It is acknowledged that multiple simultaneous prescribed burns could cumulatively increase particulate levels. While it is difficult or nearly impossible to quantify such emissions in a planning analysis, voluntary compliance with the State of Arkansas Smoke Management Program insures compliance with applicable Federal and State regulations governing open burning.

Cultural and Historical Resources

Current Conditions

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 proposed 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 and road maintenance or reconstruction where ground disturbance takes place outside existing right-of-way area.

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.

Direct & Indirect Effects

No Action

There would be no change in effects from the current condition, and the potential threat to integrity of cultural resources would remain unchanged.

Proposed Action and No Herbicide

In general, proposed 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 may also include increased or

decreased vegetation on protected sites due to increased light with canopy layer reduction outside of the protected buffer.

Proposed access changes, soil restoration work and opening of forested areas from timber harvest can impact cultural resources. Surface artifacts or features may be exposed, disturbed or removed due to increased access and visibility.

Project components that have potential to directly affect archeological sites are primarily timber, prescribed fire, road management, and some wildlife management activities. Adverse effects to cultural resources resulting from proposed activities could be avoided provided site avoidance and site protection measures are properly applied to the known historic properties (see Chapter 2, technical requirements). In that instance, project activities would not be expected to adversely affect archeological sites.

Cumulative Effects

Proposed Action and No Herbicide

There would be no additive effect from this project because there are no past, present or reasonably foreseeable future actions affecting cultural resources.

Recreation, Scenery, Wilderness, Roadless Areas

Current Conditions

The project area is located approximately 45 miles from Little Rock, Arkansas, the state capital, and is heavily used by the public for recreation. The project area contains the only developed recreation located on the eastern end of the forest. The main recreation uses are camping, hiking, scenic touring, and dispersed hunting. The area is utilized by large groups through special use permits for running and mountain bike events throughout the year. There are two developed recreation areas within the watershed, Lake Sylvia Recreation Area and Camp Ouachita, a National Historic Registered Girl Scout Camp. Both areas are open to the public each year from April thru October. Approximately 12 miles of the Ouachita National Recreation Trail (ONRT), a spur trail from Lake Sylvia to the ONRT (0.5 miles), the Lake Sylvia Trails (2.1 miles), and the Trees of the Forest Trail (0.4 miles) are all located within the area. Trails are open year round for public use. Also located within the area is the Winona Scenic Drive, an auto tour route which follows Forest Service Road 132, traveling from Arkansas State Hwy 9 west for approximately 8 miles until it leaves the project area. The closest wilderness area, Flatside, is located adjacent to the west end of the project area. Little Blakely, the closest roadless area, is located 21 miles southwest of the project area, and North Fork Saline River, the closest Wild and Scenic River (eligible), is located approximately ½ mile south of the project area.

Characteristics of the watershed include moderate to strongly rolling hills and long low ridges with narrow valleys positioned east to west. Dense forested slopes are visible from valley bottoms and ridgetops. The dominant species is shortleaf pine-oak in the uplands, and hardwood dominated forest in the bottoms and drainages. There are a number of hardwood dominated stands scattered throughout the project area.

The Brown's Creek area contains the Scenic Integrity Objective (SIO) levels of High (71%), Medium (27%), and Low (2%). High scenic integrity refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident. Moderate scenic integrity refers to landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed. And Low scenic integrity refers to landscapes where the valued landscape character "appears moderately altered." Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetation type changes or architectural styles outside the landscape being viewed.

An SIO of High is assigned to a 200-foot corridor on each side of level one trails, which includes the Ouachita National Recreation Trail. National Forest land within this trail corridor is identified as unsuitable for timber production at this time. The foreground area along sensitivity level one and two roads, which includes Hwy 9, Hwy 324, and the Winona Scenic Drive, will not exceed ¼ mile and will contain both suitable and unsuitable acres for timber production.

Direct and Indirect Effects

No Action

There would be no disturbance to forest visitors or an effect on scenery because the proposed action would not occur.

Proposed Action and No Herbicide

Recreation

Forest visitors may have a disturbance in the recreation experience from the sights and sounds of management activities such as logging trucks, machinery noise, and dust. Campers and trail users may be temporarily displaced during prescribed fire activities. Increases in wildlife food sources due to prescribed burning and wildlife habitat improvement may result in enhanced hunting and wildlife viewing opportunities. Harvest activities will be coordinated with low recreation seasons to help mitigate disturbances to the recreation experience.

The biggest impact would occur in Stand 20, Compartment 1432 due to heavy recreational use of trails and the high scenic integrity objective. Harvest activity in this stand will be

deferred at this time.

Scenery
A large portion of the project area falls within the High Scenic Integrity Objective (SIO) level. In the short term, vegetation removal through harvest, wildlife habitat improvement, stand improvement, and prescribed burning would negatively impact the scenic quality of the area. These management activities would result in dead and dying vegetation, slash and root wads. In the long term, these same activities would provide a more open view of the forest, enhancing the viewing depth where needed. Mitigation factors outlined in the Scenery Treatment Guide – Southern Regional National Forests (USDA, 2008) will be followed to reduce impacts to scenic integrity.

Wilderness
Flatside Wilderness lies adjacent to the project area on the west end. The visitor's wilderness experience may be affected by the sights and sounds of harvest activities which occur adjacent to the wilderness. Harvest activities will be coordinated during low wilderness use seasons to help mitigate disturbances to the wilderness experience.

Roadless
There are no roadless areas within the project. The nearest one is approximately 21 miles away. Due to the distance from the project area there will be no effects on roadless areas.

Cumulative Effects

Wilderness
Visitors to Flatside Wilderness would be impacted by disturbances from the sights and sounds of harvest activities proposed in this project, and in the Upper Lake Winona project, located along the southern wilderness boundary. Both projects are scheduled to be implemented in the same year.

Local Economy and Financial Efficiency

Current Conditions

93% of the project area is in Perry County and the remaining 7% is in Saline County Arkansas. Education, health care, and social assistance industries are the largest employers in Perry County (20% of total jobs) followed by manufacturing (15%) and construction (12%). Jobs associated with timber (agriculture, forestry, fishing & hunting, mining) make up 3.7% of total jobs in the county. Forest Service land comprises 12% of the county's land base. Education, health care, and social assistance industries are the largest employers in Saline County (25% of total jobs) followed by retail trade (13%) and construction (9%). Jobs associated with timber (agriculture, forestry, fishing & hunting, mining) make up 1% of total jobs in the county. Forest Service land comprises 2% of the county's land base (Headwaters Economics, 2015).

Direct and Indirect Effects

No Action

No additional jobs or revenue would be generated for the local community.

Proposed Action and No Herbicide

Many management actions are performed by contractors (site preparation, stand improvement, etc.). These activities would provide jobs to the local community and create a stream of revenue to local businesses.

Under The Proposed Action and the No Herbicide Alternative, there would be both costs and revenues associated with the sale of timber. Costs include activities that are directly involved with timber management (site preparation, timber sale administration, road maintenance, etc.) Revenues are generated from the sale of timber. QuickSilver7 was used to evaluate the financial efficiency of each alternative; these results are displayed in the table below.

Comparison by Financial Efficiency (Table 3.1)

Financial Measure	Proposed Action	No Herbicide
Present Value of Revenues ($)	597,263	597,263
Present Value of Costs ($)	-460,556	-453,104
Present Net Value ($)	136,707	144,159
Revenue/Cost Ratio	1.30	1.32

The Revenue/Cost Ratio is highest for the No Herbicide Alternative.

Due to the scenic integrity and the presence of multiple trails in Stand 20, Compartment 1432 harvest activity will be deferred for a future date.

Cumulative Effects

No Action

Future Forest Service contracts located within Perry and Saline Counties would occur, but there would be no additive effects on the local economy from not implementing the proposed actions.

Proposed Action and No Herbicide

Near the project area, ecosystem management activities were approved in 2005 for Upper

Maumelle and 2010 for Middle Fork/Alum Fork. Additionally, Upper Lake Winona is currently undergoing analysis for potential approval in 2016. The economic effects of the Proposed Action and No Herbicide Alternative would be additive to the jobs and revenue provided by these ongoing and future activities.

Transportation and Infrastructure

Current Conditions

The project area encompasses approximately 14,860 acres (2,134 acres of privately owned and 12,726 acres of Forest Service lands). There are approximately 24.5 miles of national forest roads in the project area. There are also 7.5 miles of state highway and 4.8 miles of county roads. The current Motor Vehicle Use Maps (MVUM) designates 5.5 miles of road open year around to highway legal vehicles. Approximately 1 mile of forest service roads are open to highway legal vehicles seasonally coinciding with the operating season of Lake Sylvia recreation area. Another 5.5 miles of forest service roads are closed.

There are approximately 15 miles of designated trails within the Project Area including approximately 12 miles of the Ouachita National Recreation Trail.

Motorized mixed use occurs when a NFSR is designated for use by both highway-legal and non-highway-legal motor vehicles (FSM 7705). Motorized mixed use is allowed on 12.5 miles of roads within the project area.

Open Road Density (ORD) is calculated by converting the acres within the project area into square miles (total acres/640 acres) and then dividing that figure into the linear measure of open roads within the project area. Any open road, regardless of jurisdiction, contributes to a project area's open road density. Many of the open roads within the project area are under county or state jurisdiction and cannot be closed because they serve as important travel ways for people and goods. The current open road density (ORD) for the project area, as a whole, is 1.4 mi/mi^2. The current ORD for National Forest system lands is also 1.4 mi/mi^2. The ORD for MA-14 is currently 1.6 mi/mi^2 and the ORD for MA-17 is currently 1.2 mi/mi^2 above Revised Forest Plan density objectives.

Direct and Indirect Effects

No Action

Other than routine road maintenance, no other transportation-related activities would occur.

Proposed Action and No Herbicide

No road decommissioning or new construction would occur. No change in ORD or public motor vehicle use designations would occur.

Cumulative Effects

There are no other past, present or reasonably foreseeable future actions within the project area that would contribute effects to the transportation system.

Soil Resource

Current Conditions

Soil maps and mapping unit descriptions and interpretations are based upon the fact that different soil types result from different combinations of geology, geomorphology, topography, vegetation and climate which influence land use activities, capabilities, and various interpretations for management. The nature, patterns and extent of these soils give each mapping unit its own set of interpretations for use and management. The Soil Resource Report for the Brown's Creek Project Area has identified and described 43 soil mapping units within the project area. Soil properties and associated management implications/precautions of these soil units were analyzed with respect to the proposed practices within each alternative. See project file for the Soil Mapping Unit Legend, Soil Mapping Unit Descriptions, Soil Map and other maps of interest.

Wetlands and Floodplains

Soil mapping units, which are subject to flooding (indicated in the unit name) and/or as having hydric soils as a major component, require special management considerations and evaluations so that proposed actions will not adversely alter the natural values of these areas. Soil mapping units 36, 54, 55, 60, 69, 101, 128, and 142 delineate areas that contain floodplains and possibly other areas that have a risk of flooding. These units represent a total of 1096 acres of the project area and give an approximate determination of areas in which the probability of flooding in any given year is at least 1 percent at higher elevations and increases as elevation decreases within the mapping unit. Evaluations should be made on all floodplains and wetland locations involving existing or planned structures (i.e. Bridges, roads, buildings, or other development) regardless of floodplain width or wetland size. In this analysis area, there are no hydric soils or jurisdictional wetlands mapped. For detailed information, reference E.O. 11988, E.O. 11990, FSM 2526 and FSM 2527.

No Action

Erosion - Only the undisturbed natural erosion would be expected to continue. This, however, does not consider the potential indirect effects of accelerated erosion rates that could occur in the event of a wildfire. Under this scenario, as existing high fuel loadings along with more limited fire suppression equipment access into this area would equate to the most acres that would be expected to burn at the high severity level.

Compaction and Displacement - This alternative would result in no additional compaction or displacement as no heavy equipment use is planned.

Nutrient Loss - This alternative would result in no direct nutrient loss.

Cumulative Effects

There are no cumulative effects since no other activities will occur in the vicinity at the same time.

Proposed Action and No Herbicide

Erosion – Erosion is the detachment and transport of individual soil particles by wind, water, or gravity. Soils are considered detrimentally eroded when soil loss exceeds soil loss tolerance (Forested T-factor) values. Ground disturbing management practices influence erosion principally because they remove vegetative ground cover and often concentrate and channel runoff water. Forested T-factors and the soils susceptibility to erosion vary by soil and mapping unit. Soils with higher K-factor values and those soil map units with severe erosion hazard ratings require more intensive management efforts to reduce the potential for accelerated erosion both during and after the soil disturbing activity. Erosion can best be managed to stay within the Forested T-factor values by leaving sufficient amounts of the forest floor, slash and other onsite woody debris material which typically dominates an effective surface cover, not overly compacting soils which would reduce water infiltration rates and result in increased overland flow rates, and not allowing water to concentrate and channel on roads, skid trails and landings.

The Revised Forest Plan Forest-wide design criteria identify maximum allowable soil loss thresholds (pp. 74-75). In order to determine whether the proposed actions meet these criteria, the Universal Soil Loss Equation (USLE) was used to calculate soil loss resulting from proposed treatments. For this analysis, worst case-modeling scenarios were analyzed for proposed management actions on soil map units with a severe erosion hazard potential. In addition, the most intensive soil disturbing management action proposed (shortleaf pine restoration - clearcut with site preparation) was also analyzed.

The total calculated soil loss for the proposed management activities and the maximum allowable soil loss for three-year recovery period are displayed in the table below. These values are based on adequate implementation of erosion control treatment of log decks, temporary roads and primary skid trails (deep tillage, waterbar and seed).

Comparison of Proposed Action and Allowable Soil Loss (Table 3.2)

Soil Map Unit	Compartment /Stand	Treatment	Soil Loss (tons/acre)	
			Proposed Action	Allowable
119	1345/21	Seed Tree	7.44	7.80
134	1347/29	Shelterwood	5.92	7.20
118	1350/29	Shelterwood	3.54	8.25
119	1345/21	Clearcut	6.92	7.80

These scenarios meet the Forest criteria of staying within the allowable soil loss Forested T-factor. These treatment units, along with other proposed treatment units of less intense soil disturbing management actions, would remain within acceptable limits over the entire project area when erosion control measures are adequately implemented. (All stands requiring erosion treatment beyond waterbar and seed are listed in Chapter 2, technical requirements).

Compaction – Compaction increases soil bulk density and decreases porosity as a result of the application of forces such as weight and vibration. Compaction can detrimentally impact both soil productivity and watershed condition by causing increased overland flow during storm events and reduced plant growth due to a combination of factors including reduced amounts of water entering the soil and its reduced availability to plant growth, a restricted root zone, and reduced soil aeration. It is generally acknowledged that all soils are susceptible to soil compaction or decrease soil porosity. The soils in this planning area are most susceptible to compaction when wet.

For this analysis area: there are soils with a severe compaction rating in which equipment operation should be limited to July through November. There are also soils with a high or moderate-high compaction hazard rating in which equipment operation should be limited to April through November. Even during these drier periods, extra care would be taken to monitor soil conditions and suspend operations when soils become wet. Given this mitigation, soil compaction would be limited and is not expected to impair soil productivity. See Chapter 2, technical requirements.

Fire. Any long-term negative effects to the soil would be related to high severity burns or very short (less than three years) frequency of the burns. Typical burn severity would be limited by established burning parameters and mitigation measures designed to protect soils and overstory trees and to minimize risk of escape. These parameters result in retention of enough leaf litter to protect soil from the negative effects listed above in most cases. Proposed burn areas would be burned as needed to reach a natural fire regime in this area. The prescribed burn frequency would be based on the current fuel loads, the priority of the unit and reasonable accessibility to achieve the desired condition. These are also considered when determining timing or season and intensity of the prescribed burn.

Cumulative effects

Effects from past actions are no longer impacting the soil resource. There are no present actions impacting the soil resource. There is always the potential for a wind or insect/disease event that would result in salvage or sanitation harvests within the same areas proposed for harvest under this project. Because salvage or sanitation harvests in response to these natural events would also follow the Revised Forest Plan guidance designed to protect the soil resource, any additive effect would be minimal.

Water Quality

Current Conditions

The project area is incorporated by two 12-digit HUC sixth-level subwatersheds. They are Browns Creek-Maumelle River (111102070101) and Bringle Creek-Maumelle River (111102070102). The current risk level for sediment increase is low for both watersheds. Creeks within the project area drain from west to east into the Maumelle River. The Maumelle River provides surface water for public consumption upon flowing into Lake Maumelle, from which Central Arkansas Water gets approximately 65% of its water. There are no impaired waterbodies (ADEQ 303(d) listing), or designated ground sources (wells) for public drinking water.

Direct and Indirect Effects

No Action

Proposed soil disturbing activities resulting in stream sedimentation would not occur.

Proposed Action

Direct effects of management activities would result from logging equipment and vehicles traversing stream crossings, fireline and road construction through streams, etc. These activities could place pollutants directly into a watercourse. While it is impractical to eliminate all soil from entering a stream, it is possible to limit the amount that directly enters streams by designing and implementing BMPs found within the RLRMP and Arkansas Forester's BMPs. When herbicides are transported, mixed, and applied, there is a risk that the herbicide could be spilled. Herbicides may enter streams, ponds, and lakes during treatment by direct application or drift.

Indirect effects to water quality are those occurring at a later time or distance from the triggering management activity. Indirect effects are from management activities that do not have a direct connection to a stream course.

Timber harvest and fire can increase nutrients released to streams, with potentially positive or negative effects. Research studies in the Ouachita Mountains have shown increases in concentrations of some nutrients following timber harvest, but increases are generally small and short-lived, particularly where partial harvests are implemented (Oklahoma Cooperative

Extension Service, 1994). Small increases in nutrient concentrations may have a beneficial effect on these typically nutrient-poor stream systems. Van Lear and others (1985) examined soil and nutrient export in ephemeral streamflow after three low-intensity prescribed fires prior to harvest in the Upper Piedmont of South Carolina. Minor increases in stormflow and sediment concentrations in the water were identified after low-intensity prescribed fires. It was suggested that erosion and sedimentation from plowed fire lines accounted for the majority of sediment from all watersheds.

Road maintenance and/or construction, fireline construction and reconstruction and timber management activities such as construction of skid trails, temporary roads and log landings could result in increases in erosion and sedimentation. Roads contribute more sediment to streams than any other land management practice (Lugo & Gucinski, 2000).

Increases in water yield are generally proportional to decreases in vegetative cover. Because vegetative cover would to some extent decrease, water yield increases are expected to be minor (Oklahoma Cooperative Extension Service, 1994). Stream channels in the area are capable of withstanding small increases in flow.

Forest monitoring has demonstrated that indirect effects from vegetation manipulation from harvest or stand improvement with buffers did not have a significant effect on water quality (Clingenpeel, 1989). Beasley et al. (1987) showed a statistically significant increase in nutrient concentrations of orthophosphorus, potassium and calcium for only the first year after clearcutting. There was no effect from selection harvesting. Because of the short period of increases (one year) and the dilution of untreated areas, there was no meaningful impact to water quality.

The Proposed Action includes the use of the herbicides triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate for site preparation and release. When herbicides are applied, there is a risk that the chemical could move offsite, possibly entering streams, ponds, lakes, or infiltrate ground water by vertical seepage into aquifers. The Forest Service has specific regulations for the use and application of herbicides, and the Ouachita NF adheres to additional design criteria for herbicide application in the RLRMP. When all BMPs or regulations are implemented, there should be little movement of herbicide offsite. The introduction of herbicides into the water is treated as an indirect effect since standards and guidelines (BMPs) do not permit direct application for silvicultural purposes. Herbicide monitoring across the Forest has found that only trace amounts of herbicide have ever been detected in streams (Clingenpeel, 1993).

Herbicide applications were monitored for effectiveness in protecting water quality over a five-year period on the Ouachita NF (Clingenpeel, 1993). The objective was to determine if herbicides are present in water in high enough quantities to pose a threat to human health or aquatic organisms. From 1989 through 1993, 168 sites and 348 water samples were analyzed for the presence of herbicides. The application of triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate for site preparation and release was included in the analysis. Of those samples, 69 had detectable levels of herbicide. No concentrations were detected that would pose a meaningful threat to beneficial uses. Based on this evaluation, the BMPs used in the

transportation, mixing, application and disposal are effective at protecting beneficial uses. Based on the results of these research and monitoring efforts and the mandatory implementation of BMP's an adverse direct or indirect effect resulting from these proposed management actions is unlikely.

No Herbicide

The effects of management activities would be the same as those described above except the listed effects from herbicide would not occur.

Cumulative Effects

Proposed Action, No Herbicide and No Action

The Aquatic Cumulative Effects (ACE) model was used to determine the watershed condition of the two 12-digit HUC sixth-level subwatersheds, as well as assess proposed project impacts. Watershed Condition Ranking (WCR) is a risk ranking integrated in the model that returns a High, Moderate, or Low ranking based on predicted sediment delivery to streams and effects on fish community diversity and abundance. The primary variables driving ACE, and subsequently the WCR, are road density, urban areas, pasture lands and project treatments.

Local research has shown that the effects of increased sediment as a result of timber harvests are identifiable for up to 3 years (Beasley, Miller, & Lawson, 1987). The timeframe of this model is bound by three years prior and one year following implementation. This captures the effects of other management activities that may still affect the project area. This is consistent with most project level environmental analyses that have an operability of five years. Proposed actions are constrained to a single year. This expresses the maximum possible effect that could occur. Past activities that have a lasting effect (such as roads and changes in land use) are captured by modeling the sediment increase from an undisturbed condition. The predicted sediment delivery and risk level for each subwatershed is displayed in the table below.

Sediment Delivery By Alternative (Table 3.3)

Subwatershed *6th level HUC ID#*	Alternative	Sediment Delivery		Risk Level
		Tons Per Year	% Increase*	
Brown Creek-Maumelle River *111102070101*	*Current Condition*	3,394	713	Low
	No Action	3,584	753	Low
	Proposed Action & No Herbicide	4,445	934	Low
Bringle Creek-Maumelle River *111102070102*	*Current Condition*	3,563	632	Low
	No Action	3,907	693	Low
	Proposed Action & No Herbicide	4,271	758	Low

*Percent increase over sediment delivery from undisturbed watershed condition

The risk level to aquatic beneficial uses would remain low for both subwatersheds. There is no risk that effects would rise to a level threatening violation of any water quality standards or administrative limits. Effects are well understood, and mitigation in past projects has demonstrated effects are either not detectable or have no effect on beneficial uses. The application of forest standards and Best Management Practices (USDA, 2015) is assumed.

Vegetation

Current Conditions

Based on recent forest inventories, the current acreage of the various age classes and the percentage of the Project Area they comprise are tabulated by forest type in the table below. This distribution is only forested land.

Current Age Class Distribution by Forest Type (Table 3.4)

Age Class (years)		Forest Type					Total	
		Loblolly	Shortleaf	Pine-Hardwood	Hardwood-Pine	Hardwood	Acres	Percent
0-10			0	0	0	0	0	0%
11−20			71.25	0	0	0	71.25	1%
21−30			400.03	39	0	0	439.03	3%
31−40		12.63	596.61	0	0	0	596.61	5%
41−50			530.38	0	0	0	530.38	4%
51−60			21.84	262.92	0	0	284.76	2%
61−70			60.6	457.57	0	26.93	545.1	4%
71−80			477.55	602.77	281.17	159.59	1521.08	12%
81-90			1780.97	465.44	1026.29	1448.4	4721.1	37%
91-100			1543.87	809.43	284.71	334.87	2972.88	23%
101+			651.74	248.79	35.19	93.75	1029.47	8%
Total	Acres	12.63	6,135	2,886	1,627	2,064	12,724	100.00%
	%	0.10%	48.21%	22.60%	12.78%	16.22%		

Early Seral Conditions (Revised Forest Plan, WF001)**.** There are approximately 0 acres of early seral stage habitat (0-10 year age class) in the pine forest type. There are 26.7 acres of closed roads; there are no acres of utility right-of-way or permanent wildlife openings. This total area of 26.7 acres of existing early seral condition comprises approximately .2% of the total acres.

Mature Growth (Revised Forest Plan, WF006)**.** There are approximately 5,500 acres of pine and pine hardwood mature-growth (80 plus years of age), totaling nearly 60.8% of the total pine/pine-hardwood forest type. There are 129 acres of hardwood and hardwood-pine mature-growth (100 plus years of age), totaling 3.5% of the forest type.

Retention and Recruitment of Hardwoods. There are approximately 3,691 acres of hardwood and hardwood-pine forest type representing 29% of the timber resource within the Project Area. These forest types would be managed for retention (leave) and recruitment (addition) of hardwoods.

Hardwood Mast Production (Revised Forest Plan, WF003)**.** There are approximately 3,691 acres of 50+ year old hardwood and hardwood-pine stands totaling 100% of the timber resource within the Project Area.

Stand Vigor and Health. Trees in most of the pine stands are crowded or densely stocked. This condition results in stress, reduced vigor and health, and increased susceptibility to insects and diseases. Hardwood stands, especially those near ridgelines, are stressed from

periodic drought and are also overstocked resulting in reduced vigor and health with increasing susceptibility to infestations by insects such as the Red oak borer *Enaphalodes rufulus*.

Direct and Indirect Effects

No Action

In the absence of natural disturbance, through time the current age classes would retain the same distribution in relation to one another, but the distribution would be increasingly skewed to the older age classes. The forest would continue to age, moving more pine and hardwood acreage into mature growth. In the absence of fire or other vegetation management activity, trees would grow in and grow up and shade out shrubs, forbs and grasses and reduce their quantities. In the absence of thinning and regeneration harvests, forest health would be at risk due to increased potential for pest infestations such as the southern pine beetle. Forest health and stand vigor would continue to decline.

Proposed Action

The table below details the age class distribution of the project area after implementation of harvest activities. Age class distributions are shown for pine types and for all forested land (total of all forest types). There would be no change to hardwood forest type age class distributions.

Post-Harvest Age Class Distribution Pine Types (Table 3.5)

Age Class (years)		**Forest Type**				**Total**	
		Shortleaf	**Pine-Hardwood**	**Hardwood-Pine**	**Hardwood**	Acres	Percent
0-10		496	40	0	0	536	4%
11−20		0	0	0	0	0	0%
21−30		71.25	0	0	0	71.25	1%
31−40		400.03	39	0	0	439.03	3%
41−50		596.61	0	0	0	596.61	5%
51−60		530.38	0	0	0	530.38	4%
61−70		21.84	262.92	0	0	284.76	2%
71−80		60.6	457.57	0	26.93	545.1	4%
81-90		477.55	602.77	281.17	159.59	1521.08	12%
91-100		1583	425	1026.29	1448.4	4482.69	35%
101+		1910	1058.22	319.9	428.62	3716.74	29%
Total	Acres	6,147	2,885	1,627	2,064	12,724	
	%	48%	23%	13%	16%		

The 0-10 year age class would increase to approximately 5.5% of pine types and 4% of all land after even-aged regeneration harvests. Mature growth pine would decrease approximately 10% of the pine types. Diseased, damaged and suppressed trees would be removed through commercial thinning activities on approximately 1,778 acres of pine stands including 212 acres of woodland restoration. By reducing stand densities through thinning, stand vigor would improve. During the regeneration of pine stands, the hardwood sprout/seedling component objective is 10 to 30 percent of stems in hardwoods, primarily oaks and hickories (RLRMP, FR003, p.80). Hardwoods would be removed in pine regeneration harvest areas through subsequent seedling release treatments; however a minimum of 10 percent hardwood would be retained or maintained through the life of the stand where possible. Recruitment of hardwoods within these stands could also be impeded by these activities. Within the stands proposed for midstory reduction, selected suppressed and intermediate trees would be released from competition, thus increasing mast production on released trees.

Ground-disturbing activities such as timber harvest, road construction, road maintenance, fireline construction, fireline maintenance, and wildlife opening construction could increase the population and spread of non-native invasive species by destroying individual stems which would result in prolific sprouting. They would also provide seedbeds for NNIS germination. Mechanical equipment could also dislodge seeds and transport them to unaffected areas. Implementation of Best Management Practices would reduce the possibility of introducing or spreading non-native invasive plants during project implementation.

No Herbicide

The effects of this alternative would be the same as those listed for the Proposed Action except only manual or mechanical methods would be used in vegetation management activities. Site preparation and release activities would be less successful, making stand establishment more difficult.

Cumulative Effects

Past, present, and reasonably foreseen future actions would total an 820 acre reduction in mature forest. Implementation of this project would further reduce mature forest by 478 acres, a 1,298-acre reduction. This loss of mature forest would be offset each year by the acres moving into mature forest conditions.

Past, present, and reasonably foreseen future actions would total 1,498 acres of shortleaf pine restoration. Implementation of this project would convert an additional 13 acres of loblolly pine to shortleaf pine.

Management Indicator Species and Habitat (MIS)

As part of the overall effort to ensure that habitat requirements of all native vertebrates, invertebrates, and plants are considered in the planning, implementation, and monitoring of Forest management practices, the Revised Forest Plan lists 24 species that should adequately address the effects of Forest management practices on fish and wildlife populations and their habitat needs, as well as demand species and species of special interest. These 24 species, termed "Management Indicator Species" (MIS), represent a broad array of habitats covering diverse geographic areas within the ONF, as well as inhabiting areas with diverse management objectives.

Management Indicator Species (MIS) Selected for This Project: The entire list of 24 MIS was reviewed and a subset was selected as MIS for the actions proposed in this EA. The MIS selected include 6 terrestrial species and 6 fish species. Species not known to occur within the action area, lacking suitable habitat, or not tied to an appropriate evaluation objective were not selected, as indicated in the far right column of the table below.

Potentially Affected Management Indicator Species (Table 3.6)

Life	Common Name	Scientific Name	Selected?
Mammal	White-tailed deer	*Odocoileus virginianus*	**Yes**
Bird	Northern Bobwhite	*Colinus virginianus*	**Yes**
Bird	Eastern Wild Turkey	*Meleagris gallapavo*	**Yes**
Bird	Red-cockaded Woodpecker	*Picoides borealis*	No
Bird	Pileated woodpecker	*Dryocopus pileatus*	**Yes**
Bird	Scarlet Tanager	*Piranga olivacea*	**Yes**
Bird	Prairie Warbler	*Dendroica discolor*	**Yes**
Fish	Largemouth bass	*Micropterus salmoides*	No
Fish	Smallmouth bass	*Micropterus dolomieu*	**Yes**
Fish	Bluegill sunfish	*Lepomis macrochirus*	No
Fish	Redear sunfish	*Lepomis microlophus*	No
Fish	Yellow bullhead	*Ameiurus natalis*	**Yes**
Fish	Highland stoneroller	*Campostoma spadiceum*	**Yes**
Fish	Redfin darter	*Etheostoma whipplei*	**Yes**
Fish	Green sunfish	*Lepomis cyanellus*	**Yes**
Fish	Longear sunfish	*Lepomis megalotis*	**Yes**
Fish	Johnny darter	*Etheostoma nigrum*	No
Fish	Orangebelly darter	*Etheostoma radiosum*	No
Fish	Channel darter	*Percina copelandi*	No
Fish	Pirate perch	*Aphredoderus sayanus*	No
Fish	Creek chubsucker	*Erimyzon oblongus*	No
Fish	Northern Studfish	*Fundulus catenatus*	No
Fish	Northern hog sucker	*Hypentilium nigricans*	No
Fish	Striped shiner	*Luxilus chrysocephalus*	No

Terrestrial MIS

Terrestrial MIS and Associated Purposes (Table 3.7)

Life Form	Scientific Name	Common Name	Primary Reason for Selection
Bird	*Colinus virginianus*	Northern Bobwhite	To help indicate effects of management on meeting public hunting demand, and to help indicate effects of management on the pine-oak woodland community
Bird	*Dendroica discolor*	Prairie Warbler	To help indicate effects of management on the early successional component of forest communities
Bird	*Meleagris gallopavo*	Eastern Wild Turkey	To help indicate effects of management on meeting public hunting demand
Mammal	*Odocoileus virginianus*	White-tailed deer	To help indicate effects of management on meeting public hunting demand
Bird	*Dryocopus pileatus*	Pileated Woodpecker	To help indicate effects of management on snags and snag-dependent species
Bird	*Piranga olivacea*	Scarlet Tanager	To help indicate effects of management on mature forest communities

Northern Bobwhite

Current Conditions

This species was selected to help indicate effects of management on meeting public hunting demand, and to help indicate effects of management on the pine-oak woodland community. Northern Bobwhites require a diverse, heterogeneous habitat that includes open areas of herbaceous vegetation for foraging, grassy areas for nesting, heavy brush or woody cover, and bare ground with little litter cover (Rosene, 1984) (Roseberry & Sudkamp, 1998) (Brennan, 1999). They also readily use early pine and pine-hardwood forest conditions for foraging, hiding, nesting, and rearing young (Brennan, 1999). Bobwhites are usually associated with early successional plant communities, and their abundant herbaceous plants, seed crops, fruits, and insect prey items are vital to their life history (Brennan, 1999) (Dimmick, Gudlin, McKenzie, & Wells, 2004).

Inventory tools collectively indicate a declining bobwhite population and approximately stable habitat capability (USDA Forest Service, 2011). From 2002-2012, the Arkansas population has declined 6% (Sauer et al. 2014). Regional and range-wide declines for Northern Bobwhite are primarily attributed to the loss of agricultural land and changes in agricultural practices (Brennan, 1999) (Dimmick, Gudlin, McKenzie, & Wells, 2004). Population decline in the Ouachita Mountains is attributed to a reduction in available early forest stage cover habitat conditions (Thompson & DeGraaf, 2001) (Riddle, Moorman, &

Pollock, 2008) (USDA Forest Service, 2011).

Direct and Indirect Effects

No Action

The No Action Alternative would have an overall negative effect on the forest-wide population trend for this species by lack of creation of foraging opportunities.

The retention of the overstory without disturbance would have several negative effects on bobwhite. As crowns continued to develop and increase in volume, mast production in the form of acorns would also increase until crown closure and competition for sunlight, moisture, and nutrients limited productivity and stressed trees. Hardwood and pine habitats would become homogeneous with little diversity. Shade-tolerant species such as red maple (no nutritive value to bobwhite) would flourish in the mid and understory with significant root development already established while waiting for the opportunity to occupy the overstory in tree-fall gaps or when stand replacement events such as wildfire, insect infestation or ice storms occurred. Such replacement would result in loss of hard mast (Zaczek, Groninger, & Van Sambeek, 2002). Other shade tolerant midstory species such as dogwood, serviceberry and farkleberry would provide soft mast, but over time the volume would decline as availability of sunlight decreased with overstory closure. Herbaceous and grassy ground cover would fade and essentially disappear, resulting in loss of brood range and associated seeds and berries and insect and spider populations important to poult growth and development (Dimmick, Gudlin, McKenzie, & Wells, 2004) (Masters & Wilson, Effects of midstory vegetation removal and fire on breeding birds and plant community composition in Red-cockaded woodpecker clusters, 1994) (Fenwood, Urbston, & Harlow, 1984). The additive beneficial impacts of fire, herbicide and road and fireline corridors and associated early seral habitat often used for nesting cover and travel ways would not occur.

Proposed Action

Timber, Silvicultural/Wildlife Activities:
Existing nests with eggs could be damaged or destroyed if operations occur during nesting season. However, the majority of stands that would receive treatment do not currently offer suitable nesting habitat because they are too dense and the presence of nesting birds is unlikely (Brennan, 1999). Bobwhites may be temporarily displaced during resource management activities and females may abandon nests (Brennan, 1999).

Habitat conditions for retained hardwood (soft and hard mast-producing trees) would be enhanced (Perry & Thill, 2003) (Perry R. W., Thill, Peitz, & Tappe, 1999). The reduction in the density of trees and associated shade would provide better nesting and brooding habitat due to increased food and cover plant development (Yarrow & Yarrow, 2005) (Dimmick, Gudlin, McKenzie, & Wells, 2004). Herbicide application would inhibit re-sprouting of targeted vegetation, thereby prolonging the desirable effects of these harvests and silvicultural treatments.

Existing nests with eggs may be damaged or destroyed if operations occur during the nesting season. The majority of stands where site preparation treatment occurs would typically not have time to develop suitable herbaceous conditions between harvest completion and implementation. Stands to receive release treatments are older and well established and would have already developed pine and hardwood woody structure and an herbaceous understory. However, woody stems are often dense and do not offer appropriate nesting habitat. A reduction of woody stems, particularly hardwood stems, would reduce shade and enhance herbaceous ground cover. Bobwhites may be temporarily displaced during resource management activities and females may abandon nests.

Habitat conditions for nesting and brooding would be improved. Herbicide application to felled stems would prevent re-sprouting of targeted vegetation and prolong use of these resulting habitat conditions, especially when combined with prescribed fire and/or mechanical treatments (Jones & Chamberlain, 2004) (Welch, Miller, Palmer, & Harrington, 2004).

Prescribed Fire:
Fire helps maintain, restore, and enhance early forest stage ground cover conditions important to this bird (Burger Jr, 2001) (Cox & Widener, Lightning-Season Burning: Friend or Foe of Breeding Birds?, 2008) (Dimmick, Gudlin, McKenzie, & Wells, 2004) (Jones & Chamberlain, 2004) (Klaus, Rush, Keyes, Petrick, & Cooper, 2010)
(Palmer, Robertson, & Masters, 2004). Direct effects of dormant or growing season burns are unlikely to affect this bird, except for rare occasions, because adults are highly mobile and chicks are born precocial (with a compliment of feathers) and are active and mobile soon after hatching (Martin, Palmer, Grimes, & Carroll, 2010). If prescribed burns occur during the nesting season (April to September in Arkansas) there is a potential that nests and eggs could be destroyed (James & Neal, 1986). If this occurs, bobwhites may attempt to renest, though they generally have lower nest success on subsequent efforts (Burger, Hamrick, & Godwin, 2005).

Transportation System and Fireline Construction:
Nests with eggs may be destroyed or abandoned by mobile adults when roads or firelines are constructed in nesting habitat during nesting season. Bobwhites may be displaced during construction and periods of high activity, such as during forest product removal.
Roads and firelines, when closed, provide additional early seral habitat, resulting in an increase in nesting and/or foraging habitat.

Herbicide Application:
Direct effects of herbicide application on birds or nests with eggs are not likely because the primary target in these applications would be felled hardwood brush cut surfaces (stumps or girdle furrows) located in dense forest stands. Neither hardwood brush nor dense stands are preferred nesting habitat due to a lack of grass and herbaceous plants important for nest construction and concealment. Adults and fledglings are highly mobile and would not be directly impacted.

Herbicide application has the potential to temporarily negatively impact foraging and nesting opportunities in small, specific treatment areas by reducing the availability of seeds from woody plants and broadleaf herbaceous species contacted by herbicide.

No Herbicide

The No Herbicide Alternative would have an overall positive effect on the forest-wide population trend for this species. The effects of this alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Cumulative Effects

Northern Bobwhite Quail use a wide variety of habitats and can have varying home ranges depending on habitat quality; however, the average range for an adult is approximately 160 acres (Pierce, 2005). Because the homerange of this species lies completely within the boundary of this project, and there are no additional past or future activities planned within this project area, there will be no cumulative effects resulting from this project. The Proposed Action would have an overall positive effect on the forest-wide population trend for this species by increasing foraging opportunities. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Prairie Warbler

Current Conditions

This species was selected to help indicate effects of management on the early successional component of forest communities. A Neotropical migrant, it selects early forest stage habitats such as regenerating old fields, pastures, clearcuts, and utility rights-of-way habitats (King, Chandler, Collins, Petersen, & Lautzenheiser, 2009). Habitat conditions for nesting occur in the later stages of early forest cover, when vegetation has grown out of the grass/herbaceous phase.

Prairie Warbler Breeding Bird Survey data for Arkansas show a 3.0% decrease in the state from 1966-2012 (Sauer, et al., 2014). Further, Prairie Warbler populations have been declining on the Ouachita National Forest over the past ten years (USDA Forest Service, 2011). The 2011 Monitoring Report states, "Throughout the Prairie Warbler range, a downward trend is indicated." This decline is considered directly related to the reduction in acres of early forest stage cover habitat in pine forest types.

Direct, Indirect, and Cumulative Effects

The early forest cover habitat needs and effects of alternatives on this species are analogous to those for the Northern Bobwhite, with prescribed fire and timber treatments having an overall beneficial effect on this species (Askins Z. a., 2007). The prairie warbler does have a larger home range of up to 1 mile. See Northern Bobwhite above for effects disclosure. (Comer, Bell, Oswald, Conway, & Burt, 2011)

No Action
The No Action Alternative would have an overall negative effect on the forest-wide population trend for this species by lack of creation of foraging and nesting opportunities.

Proposed Action
The Proposed Action would have an overall positive effect on the forest-wide population trend for this species by increasing foraging and nesting opportunities.

No Herbicide
The No Herbicide Alternative would have an overall positive effect on the forest-wide population trend for this species

Eastern Wild Turkey

Current Conditions

Eastern Wild Turkey was selected to help indicate effects of management on meeting public hunting demand. This species is a highly prized game animal that uses a wide range of habitat types (generalist) with habitat diversity needs that include grass and forb openings (seeds, fruits, berries, insects) interspersed with older timber stands capable of producing hard (acorns) and soft (fruits/berries) mast (Eaton, 1992). Various successional forest conditions, ranging from early forest stage cover to mature growth, are required to meet the needs of turkey populations (Yarrow & Yarrow, 2005).

Long-term turkey harvest, habitat capability modeling, and BBS data indicate overall positive trends for the turkey population. In Arkansas the Wild Turkey has increased 6.49% from 1966–2012 (Sauer, et al., 2014). Although there are variations in poult production and habitat capability from year to year, this species is not likely in danger of falling significantly below desired population levels and it is not of viability concern at this time (USDA Forest Service, 2005b). Wild Turkey appear to be doing well in the Ouachita Mountain region, where population trends are stable.

Direct and Indirect Effects

No Action

The No Action Alternative would have a neutral to slightly negative effect on the forest-wide population trend for this species.

The retention of the overstory without disturbance would have several effects on turkey. As crowns continued to develop and increase in volume, mast production in the form of acorns would also increase until crown closure and competition for sunlight, moisture, and nutrients would result in limited productivity and stressed trees. Hardwood and pine habitats would become homogeneous with little diversity. Shade-tolerant species such as red maple would flourish in the mid and understory, with significant root development already established and

waiting for the opportunity to occupy the overstory in tree-fall gaps or when stand replacement events such as wildfire, insect infestation or ice storms occurred. Such replacement would result in loss of hard mast (Zaczek, Groninger, & Van Sambeek, 2002). Other shade tolerant midstory species such as dogwood, serviceberry and farkleberry would provide soft mast, but over time the volume would decline as availability of sunlight decreased with overstory closure. Herbaceous and grassy ground cover would fade and essentially disappear, resulting in loss of brood habitat and its bounty of seeds, berries and insect and spider populations important to poult growth and development (Dickson, 2001) (Masters & Wilson, Effects of midstory vegetation removal and fire on breeding birds and plant community composition in Red-cockaded woodpecker clusters, 1994) (Fenwood, Urbston, & Harlow, 1984). The additive beneficial impacts of fire, herbicide and road and fireline corridors and associated edge habitat often used for nesting cover and travel ways would not occur.

Proposed Action

The Proposed Action would have an overall positive effect on the forest-wide population trend for this species by increasing foraging opportunities.

Timber, Silvicultural/Wildlife Activities:
There would be no direct effects on mobile adult birds or poults, but existing nests with eggs may be damaged or destroyed if operations occur during nesting season and in nesting habitat. Turkeys may be temporarily displaced during resource management activities and nests may be abandoned.

The major reduction in the density of trees and associated shade in stands treated by these methods would increase the herbaceous and grass species important for the food and cover requirements of Wild Turkey (Eaton, 1992). A loss of some to all hard and soft mast production capability from hardwood trees could occur for an extended period of time where hardwood trees are removed during harvest and/or silvicultural activities to reestablish pine forest types (as in clearcut and seed-tree harvests and creation of permanent openings). Hens tend to select areas of sparse overstory and midstory with abundant ground cover that provides plenty of seeds, fruits and arthropod prey species (Eaton, 1992). Commercial and non-commercial thinning sites and wildlife habitat improvement stands are examples of such areas. Nesting habitat and brood range, currently in short supply throughout the Project Area, would be created. Areas treated by these methods would not result in dense, residual stands of tree cover preferred in fall and winter. However, the majority of residual non-treated stands would provide adequate winter habitat well distributed in the Project Area. The response of herbaceous biomass to harvest, in declining order by method, would be clearcut, seed tree, and thinnings. A good mix of these harvest types would provide for excellent turkey habitat (Yarrow & Yarrow, 2005) (Eaton, 1992) (Dickson, 2001). Habitat conditions for retained hardwood overstory and midstory soft and hard mast producers would be enhanced by reducing competition for growing space, nutrients and water. Dogwood, blackgum and farkleberry fruits, and acorns from hardwood trees of mast producing age would provide important fall and winter cover and foods (Steffen, LaFon, & Norman, 2002) (Dickson, 2001).

There would be no direct effects on adult birds or mobile chicks from site preparation or release activities (hand tools or herbicide). Existing nests with eggs may be damaged, destroyed or abandoned if operations occur during the nesting season. The majority of stands to receive site preparation treatment would not have time to develop suitable nesting habitat conditions between harvest completion and the implementation of site preparation activities, although grassy patches used for nesting could exist. Stands to receive release treatments would have already developed pine and hardwood woody structure and an herbaceous understory but woody stems could be too dense to offer good nesting habitat. Prior to release, utilization of untreated stands would be unlikely. Turkey may be temporarily displaced during resource management.

Due to reduced stem density habitat conditions for nesting and brooding would be improved (Eaton, 1992). Herbicide application to felled stems would prevent re-sprouting of targeted vegetation and prolong habitat available for use by this bird as would prescribed fire treatments.

Prescribed Fire:
Due to the NLEB restrictions, most burning now will take place outside the nesting season. Burning will restricted by Forest Acres from April to July 15 non-flying pups, allowing for greater nesting time for the turkey. Direct effects of dormant or growing season burns on this bird are likely to be minimal because adults are highly mobile and poults are precocial and able to follow the hen within one to two days of hatching. Nests, eggs, and non-mobile hatchlings may be destroyed by growing season burns, but the benefits of improved habitat outweigh the nests lost, and in many cases females would likely re-nest (National Wild Turkey Federation, 2006). In September 2008 a letter supporting application of prescribed fire on the Ouachita National Forest was sent to Arkansas Senators Blanche Lincoln and Mark Pryor from Dr. Earl Kennamer, Senior Vice President for Conservation Programs, National Wild Turkey Federation (Kennamer, 2008). In May 2009, Dennis Daniel, Regional Biologist, National Wild Turkey Federation, submitted a letter in support of prescribed burning to local area newspapers in response to complaints and queries from the public (Daniel, 2009).

Fire helps maintain, restore and enhance early forest stage ground cover plants especially after timber thinning in middle-aged to older pine stands. Many important wild turkey foods such as native legumes are fire adapted and promoted by fire (Dickson, 2001). Fire also plays an important role in the development and maintenance of oak forests that provide important winter foods (acorns) used by turkeys (Van Lear & Brose, 2002) (Cooper, Van Lear, & Brose, 2000) (Crow, Johnson, & Adkisson, 1994) and fruit yields of woody plants consumed at other times of the year (Stransky & Hall, 1979). Turkeys prefer to forage in southern pinelands; especially those burned within the past two years, because of an increase in insects they may prefer to nest there as well (Yarrow & Yarrow, 2005) (Cox & Widener, Lightning-Season Burning: Friend or Foe of Breeding Birds?, 2008).

Transportation System and Fireline Construction:
Nests with eggs may be destroyed or abandoned by mobile adults when roads or firelines are constructed in nesting habitat during nesting season. Bobwhites may be displaced during construction and periods of high activity, such as during forest product removal. Roads and firelines, when closed, provide additional early seral habitat, resulting in an increase in nesting and/or foraging habitat.

Herbicide Application:
Direct effects of herbicide application on birds or nests with eggs are not likely because the primary target in these applications would be felled hardwood brush cut surfaces (stumps or girdle furrows) located in dense forest stands. Neither hardwood brush nor dense stands are preferred nesting habitat due to a lack of grass and herbaceous plants important for nest construction and concealment. Adults and fledglings are highly mobile and would not be directly impacted.

Herbicide application has the potential to temporarily negatively impact foraging and nesting opportunities in small, specific treatment areas by reducing the availability of seeds from woody plants and broadleaf herbaceous species contacted by herbicide.

No Herbicide

The No Herbicide Alternative would have an overall positive effect on the forest-wide population trend for this species. The effects of this alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Cumulative Effects

The wild turkey uses many habitats and varied food sources depending on age and the habitat quality. Other projects within the range of this species would total an 820 acre reduction in mature growth habitat. Implementation of this project would further reduce mature forest habitat by 478 acres, a 1,298 acre reduction. This loss of mature forest would be offset each year by the acres moving into mature forest conditions. Conversely, implementation of this project would add these acres to early seral habitat conditions. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

White-tailed Deer

Current Conditions

White-tailed deer was selected as an MIS species based on its big game status, and because its population levels can be evaluated along with habitat trends (USDA Forest Service, 2005b). This opportunistic herbivore has a diet that includes annual and perennial forbs, fruits, hard mast, grasses, flowers and fungi. Food utilization studies of deer in the southern U.S. show that use of woody twigs, even in winter, is insignificant (Miller, 2001). The quality and quantity of forage (grasses and herbaceous vegetation) have the greatest impacts on whitetail populations. The Ouachita Mountains are considered sub-optimal habitat for

deer due to reduced soil fertility and productivity, particularly the level of soil phosphorus that is a useful predictor of potential physiological condition (Miller, 2001). Phosphorus levels of browse in the Ouachita Mountains are considered low (Fenwood, Urbston, & Harlow, 1984).

Forest-wide, according to the 2011 Monitoring report, "the estimated habitat capability for deer for fiscal years 2006-2011 shows a downward trend; and has fallen below the desired habitat capability of 48,250 acres for FY 2015.

Direct and Indirect Effects

No Action

The No Action Alternative would have a neutral to slightly negative effect on the forest-wide population trend for this species. Succession would continue in all forest types, with habitat becoming more homogeneous and less diverse. Dense stands would provide excellent escape and winter cover. Though the forest types would continue to be a source of hard mast, the early forest stage cover also needed by white-tailed deer would only occur through natural events such as wildfire, ice damage, insect infestation, etc.

Proposed Action

The Proposed Action would have a positive effect on the forest-wide population trend for this species.

Timber, Silvicultural/Wildlife Activities:
Deer may be temporarily displaced from harvest areas during resource management activities, though no direct loss would occur.

When followed by related silvicultural treatments and fire, the persistence of the early seral habitat conditions would be extended. The reduction in the density of trees and associated shade would result in improved habitat conditions for forest floor food and cover plants benefiting deer (Fenwood, Urbston, & Harlow, 1984). These previously described food items are more important than browse (twigs, shoots, and leaves of shrubs, trees and vines) which constitutes only a moderate portion of a deer's diet (Miller, 2001). The response of herbaceous forage species to harvest, in declining order by method, would be clearcut, permanent openings, seed tree, then, thinnings. A good mix of these harvest methods would provide excellent deer habitat (Yarrow & Yarrow, 2005).

Stands receiving site preparation treatment would be those where clearcut and seed-tree harvest had occurred. An increase in sunlight to almost complete openness would enhance herbaceous and grass diversity and growth, providing excellent foraging conditions for deer (Yarrow & Yarrow, 2005). Stands receiving release treatments would have developed pine and hardwood woody structure and an herbaceous understory, but woody stems would be dense. Following treatment and stem reduction these stands would offer similar food items as site prepared stands, but the volume of food would not be as great and would decline more

quickly due to crown closure by residual trees.

Prescribed Fire:
Deer may be temporarily displace during activities but would return to the area with the increase in vegetation and browse.

Prescribed fire would increase browse, forbs, grass and legume production, palatability, and nutrition (Masters, Lochmiller, McMurry, & Buckenhofer, 1998) (Masters & Waymire, 2000). Fire also plays an important role in the development and maintenance of oak forests that provide important winter deer foods (acorns) (Van Lear & Brose, 2002).

Transportation System and Fireline Construction:
Deer may be temporarily displaced during construction and periods of high traffic volume during product removal.

Closed roads and fireline corridors provide additional edge habitat, travel ways, escape routes, and potential foraging areas and bedding sites. Typical forest open roads have very low traffic levels except during the fall deer season and generally would have little to no effect on deer activity.

***Herbicide Application*:**
Use of herbicide in silvicultural and wildlife treatments involves low concentrations (pounds per acre) of chemicals and specific application sites in the form of cut stumps and the furrows girdled into tree boles. Deer may be displaced during application of herbicide (due to human disturbance) but this will be for a relatively short period of time in any treatment area.

The application of herbicides will lengthen the duration of early seral habitat where applied, thus maintaining appropriate habitat patches for white-tailed deer.

No Herbicide

The No Herbicide Alternative would have an overall positive effect on the forest-wide population trend for this species. The effects of this alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Cumulative Effects

The white-tailed deer uses many habitats and varied food sources depending on age and the habitat quality. Other projects within the range of this species would total an 820 acre reduction in mature growth habitat. Implementation of this project would further reduce mature forest habitat by 478 acres, a 1,298 acre reduction. This loss of mature forest would be offset each year by the acres moving into mature forest conditions. Conversely, implementation of this project would add these acres to early seral habitat conditions. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Pileated Woodpecker

Current Conditions

This woodpecker was selected as an MIS to help indicate the effects of management on snags and snag-dependent species. The Pileated Woodpecker is a member of the cavity nesting, tree trunk probing, insectivore guild that is found in open, upland mature pine and pine-hardwood stands and dense mature to over-mature hardwood and hardwood-pine forest types (Degraaf, Scott, Hamre, Ernst, & Anderson, 1991) (Hamel, 1992) (Bull & Jackson, 2011). A year-round resident of the Ouachita Mountains, this bird is a primary excavator of cavities important to obligate secondary cavity nesters (animals that do not themselves excavate cavities), and is a key indicator for the retention of a complete community of cavity nesting species that include other birds, mammals, reptiles, and amphibians (Bonar, 2000) (Trauth, Robison, & Plummer, 2004).

Population trend and habitat capability data for this bird are mixed (USDA Forest Service, 2011). BBS data indicate a downward trend of 1.18% for Arkansas from 1966–2012 with a less intense decrease of 0.99% in most recent years, from 2002–2012 (Sauer, et al., 2014). The 2000 - 2009 Forest Data show a slight decrease in the number of Pileated Woodpeckers observed and a slight increase in habitat capability (USDA Forest Service, 2010). Phase II research data from the Winona Unit of the District indicated an upward population trend within pine and pine-hardwood forest types, primarily because the timber is aging, growing larger, and providing more suitable habitat conditions (USDA Forest Service, 2010). They are an adaptable species and frequently disperse widely throughout their range, thus, viability is not in question (Edworthy, Drever, & Martin, 2011).

Direct and Indirect Effects

No Action

The No Action Alternative would have an overall positive effect on the forest-wide population trend for this species due to the retention of dead and dying trees found throughout the landscape.

The retention of the existing forested conditions without disturbance would offer suitable nesting and foraging habitat. All timber would increase in size eventually providing snags of suitable size for cavity excavation and basal areas would remain high and less open than treated stands in other alternatives. Snags would be recruited as logs without potential loss due to consumption by prescribed fire. Hard mast production would increase until overcrowding and competition for nutrients, water and space occurred, and then level-off and/or decline. Age of timber would also factor in reduced mast production levels as trees move past their maximum reproduction potential. Soft mast from trees would be produced but at lesser levels due to shading from the overstory. Soft mast from herbaceous plants and shrubs would decline and eventually fade as openings were shaded except in tree-fall gaps and where stochastic events occurred.

Proposed Action

Timber, Silvicultural/Wildlife Activities:
The Proposed Action would have no effect on the forest-wide population trend for this species.

Felling/damaging large snags during the nesting season could result in loss of eggs or nestlings. Abandonment of nests and/or displacement of adult woodpeckers may occur during resource management activities, but mobile adult and juvenile birds would not be directly impacted.

Thinning harvests in older pine types may offer areas for nest establishment when snags and trees of suitable dbh are available. Not retaining large diameter snags during follow-up silvicultural activities would negatively affect nesting opportunities. The acreage of older, larger pine trees would be reduced following commercial timber sales, especially in clearcut and seed tree areas and where permanent openings were established and maintained. Clearcut and seed-tree harvested areas and pre-commercially thinned young stands would not offer suitable nesting habitat or adequately sized snags for decades, depending on site productivity.

Areas where stem density was significantly reduced would result in elevated fruit and seed production and insect populations that could provide foraging sites for up to a decade (Edworthy, Drever, & Martin, 2011). Treatment of some hardwood stands for midstory removal and overstory development of residual trees would provide long-term benefits to this bird by allowing residual stems to grow larger due to reduced competition, resulting in large numbers of snags. Not treating other hardwood stands would provide for a diverse mix of hardwood stands and stem densities. Meeting Revised Forest Plan design criteria WF005 (snags), WF006 (mature growth) and WF007 (woody debris) would provide preferred Pileated Woodpecker habitat in the project area.

Small diameter woody debris generated through release activities would not provide preferred or typical foraging substrate for this bird, which prefers large diameter logs and snags that have deteriorated to the point where invasion by insect prey is possible (Hura & Crow, 2004). Larger diameter woody debris generated by site preparation could eventually provide habitat for insects and foraging substrate for this woodpecker, but not immediately. Increased forest floor light levels would enhance growth of herbaceous plant and grass species important in the production of soft mast and vegetative cover for various prey populations.

Prescribed fire:
Adult birds are highly mobile and would experience no direct effects. Growing season burns could directly affect nests with eggs and nestlings if the cavity tree in which they occur is damaged or felled due to burn-through, or perhaps abandoned if exposed to prolonged periods of smoke. However, it should be noted the Ouachita Mountains is a fire-maintained ecosystem, resulting in organisms that are adapted to frequent fire events.

Indirect effects may include the loss of large snags (and potential nest sites) felled as a result of burning activities, but snags are rarely consumed and if felled by burn-through would contribute to foraging substrate as logs. On rare occasions, hot spots within prescribed burns may cause tree mortality, eventually providing replacement snags that serve as vertical foraging substrate and potential cavity excavation sites. Prescribed fire would also enhance and encourage growth of herbaceous and woody ground cover responsible for berry and seed production and resulting enhanced insect populations.

Transportation System and Fireline Construction:
Nests with eggs may be destroyed or abandoned if road or fireline construction results in the removal of snags containing nests. Mobile adults would not be impacted. Woodpeckers may be displaced from nest sites if road construction and prolonged use occur adjacent to occupied snags during nesting season. Disturbance from fireline construction would be brief as equipment quickly passes through any particular area. Firelines receive minimal and infrequent use and have less disturbance impact than roads. Closed roads and fireline would provide flight corridors through dense timber.

Herbicide Application:
Given the low risk of toxicity exhibited in invertebrates, no indirect impacts to this bird are expected from consumption of insects within treated areas. Logs and snags used as primary foraging substrate would not be treated. Indirect effects would most likely be due to temporary loss of some woody shrubs, and annual and perennial broadleaf herbaceous plant species that provide shelter and food sources for insect and spider populations that may contribute to this bird's diet. Acute oral and dietary studies of the listed chemicals exhibit a range in analysis toxicity from practically nontoxic to slight toxicity to birds.

No Herbicide

The No Herbicide Alternative would have no effect on the forest-wide population trend for this species. The effects of this alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Cumulative Effects

Because the homerange of this species lies within the boundary of this project, and there are no additional past or future activities planned within this project area, there will be no cumulative effects resulting from this project. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

<u>Scarlet Tanager</u>

Current Conditions

Preferred habitat for this Neotropical migrant is composed of older growth, uneven-aged forests with a well-developed but broken canopy and a well-developed woody and

herbaceous understory. This species is abundant in mature hardwood stands and hardwood stands harvested by single tree selection in the central hardwood forests of the nearby Ozarks, but it is uncommon or not present in loblolly and shortleaf pine forests (Rosenberg, et al., 1999) (Hunter, Dickson, Pashley, & Hamel, 2001). However, in a study area that included the Ouachita Mountains of Arkansas, this species did not show a preference between mixed deciduous/coniferous forest habitats. Further studies have found that Scarlet Tanagers typically inhabit areas with high canopy, dense canopy cover, a large variety of tree species, a high density of large trees, and steep slopes (Mowbray, 1999). This species is insectivorous during the breeding season, with prey items including caterpillars, moths, bees, wasps and beetles. Foraging primarily occurs in the mid-canopy. From late summer their diet includes many berries and other fruits that appear to be especially important for fat deposition before fall migration.

Forest Service trends are showing slight population increases overall (USDA Forest Service, 2011). Breeding Bird Survey results from 1966–2012 in Arkansas indicate a slightly declining population, with a 0.33% reduction in population levels (Sauer, et al., 2014). However, in the most recent time period, from 2002–2012, populations in Arkansas have seen a 0.10% increase (Sauer, et al., 2014). Forest-wide, this species appears to be secure and its viability is not in question.

Direct and Indirect Effects

No Action

The No Action Alternative would have no effect on the forest-wide population trend for this species. The retention of existing pine and hardwood forested conditions without human-caused disturbance would continue to offer nesting and foraging habitat.

Proposed Action

The Proposed Action would have no effect on the forest-wide population trend for this species.

Timber, Silvicultural/Wildlife Activities:
The felling of timber from hardwood or mixed stands of older pine and hardwood may result in loss of eggs or nestlings, if present, but would have no effect on mobile adult birds. Direct effects on nests with eggs or hatchlings would be unlikely to occur in commercially harvested pine forest types because pine forests are not preferred nesting habitat. Direct effects to nests with eggs or nestlings could occur in hardwood stands receiving midstory and/or overstory treatments where stems may be felled. Ideally this would be avoided by performing these actions outside of the primary nesting season.

The reduction in trees in seed-tree and clearcut harvest areas would increase the herbaceous and grass species important for fruit, berry and seed production and insect and spider populations. Such areas would provide good foraging habitat during nesting season (insects) and as birds fatten for migration (fruits/berries/seeds), especially when located adjacent to

their preferred, mature hardwood or hardwood-pine conditions (Mowbray, 1999). However, early seral created near mature hardwood might create an edge-effect and could cause nest parasitism by brown-headed cowbirds. Wildlife Habitat Improvement (midstory removal and overstory development in hardwood/hardwood-pine forest types) would indirectly impact this bird in two ways: the removal of some but not all of the midstory would reduce the areas available for nest placement. Further, the spacing of overstory trees would enhance future development of older growth and old growth conditions readily used by this bird, due to the well-developed but broken forest canopy conditions that result from this treatment.

Released sites would offer some foraging opportunities. Site prep areas would set the stage for abundant ground cover with increased foraging opportunities. However, these opportunities would fade in less than 10 years.

Prescribed fire:
Prescribed fire during the nesting season could temporarily displace adults or cause nest abandonment by adults. It would not be intense enough to destroy nests, eggs or nestlings because nests would be located well above ground level (Mowbray, 1999).

Beneficial impacts to fruit and seed production would result from prescribed fire, especially in pine forest types. Prescribed fire would have little effect on hardwood stands because of higher moisture levels in the soil, increased shading, reduced fire intensity, and reduced levels of fine fuels, other than leaves needed to carry fire.

Transportation System and Fireline Construction:
The felling and removal of timber during road building and fireline construction activities could result in loss of eggs or nestlings, if present, but would have no effect on mobile adult birds.

Birds may be displaced from nest sites, especially if road construction and prolonged use occurs adjacent to occupied nests. Fireline construction would occur quickly, receive little use, and would have less impact than open roads. Closed roads and firelines would provide flight corridors through dense timber and possibly areas to forage for fruits and insects.

Herbicide:
Herbicide would not be applied to midstory vegetation at a height where nests would occur. Felled stems in midstory and overstory would have herbicide applied to girdled furrows and/or stumps. Given the low risk of toxicity exhibited in invertebrates, no indirect effects to this bird are expected from consumption of insects or fruits/berries/seeds within treated areas.

No Herbicide

The No Herbicide Alternative would have no effect on the forest-wide population trend for this species. The effects of this alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Cumulative Effects

Because the homerange, while nesting and breeding, of this species lies completely within the boundary of this project, and there are no additional past or future activities planned within this project area, there will be no cumulative effects resulting from this project. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Aquatic MIS

Stream MIS potentially affected by the Proposed Action are shown in the following table with annotations. Each species is addressed in detail but grouped for effects analysis. Comments regarding comparisons of managed and reference or unmanaged streams are from long-term Basin Area Stream Survey data for the forest (USDA Forest Service, 2011).

Aquatic MIS and Associated Purposes (Table 3.8)

Life Form	Scientific Name	Common Name	Primary Reason for Selection
Fish	*Ameiurus natalis*	Yellow Bullhead	To help indicate effects of management activities on aquatic habitat and water quality in streams within the Ouachita Mountain and Arkansas River Valley Ecoregions.
Fish	*Campostoma spadiceum*	Highland Stoneroller	
Fish	*Etheostoma whipplei*	Redfin Darter	
Fish	*Lepomis cyanellus*	Green Sunfish	
Fish	*Lepomis megalotis*	Longear Sunfish	
Fish	*Micropterus dolomieu*	Smallmouth Bass	To help indicate effects of management activities on meeting public fishing demand in streams

Current Conditions

Brown's Creek, South Fork of Brown's Creek, Narrow Creek run through the project area mainly into the Maumelle River. Project Area streams are for the most part intermittent and tend to pool or dry-up during hot summer months, a common phenomenon in the Ouachita Mountains (Homan, Girondo, & Gagen, 2005). Because these streams may temporarily resume flow following rain events, the alternating dry and wet conditions constitute a pulsating environment (Rose, Simpson, Ott, Manning, & Martin, 2010) which undoubtedly affects fish species composition and presence in these upland waterways.

Yellow Bullhead. The Yellow Bullhead is a heavy-bodied, small-eyed catfish widely distributed and found throughout the state. This species occupies a variety of habitats but prefers clear, gravel and rocky-bottomed, permanent streams where it avoids strong current. This fish is also common in reservoirs. Although viability of this species is not in question, managed and unmanaged streams have seen declines in percent occurrence of bullheads in BASS samples, possibly due to siltation of streams from travel-ways due to inadequate road maintenance (USDA Forest Service, 2011).

Highland Stoneroller. The Highland Stoneroller is a small non-game fish found throughout the Ouachita Mountains. It is often the most abundant species in small, clear, upland streams where it occurs in schools. Population densities in managed and unmanaged streams are similar in most sample years and appear stable with few exceptions. Highland Stonerollers are common across the Forest and although populations may fluctuate from year-to-year they appear to be stable. The conservation of this species is not in question (USDA Forest Service, 2011).

Redfin Darter. The redfin darter is abundant in Ouachita Mountain and Arkansas River Valley streams. Population densities of managed and unmanaged reference streams are similar. Populations of this species fluctuate from year-to-year, but are considered stable. There appear to be no adverse effects on redfin darters from forest management activities and the conservation of the species is not in question (USDA Forest Service, 2011).

Green Sunfish. The green sunfish is a highly adaptable game species capable of tolerating a wide range of ecological conditions and is found in a variety of aquatic environments. This fish is common in the Ouachita Mountains. Population densities have been shown to be similar in managed and unmanaged streams during most sample years. Populations of Green Sunfish fluctuate from year-to-year but appear to be increasing on the Forest. The conservation of the species is not in question (USDA Forest Service, 2011).

Longear Sunfish. The Longear Sunfish is a game species found most commonly in small clear upland streams with rocky bottoms and permanent to semi-permanent flow, but also occurs in a variety of other aquatic habitats. Populations of Longear Sunfish fluctuate from year-to-year but appear stable over time. Forest management activities appear to have no adverse effect on longear populations and there are no viability concerns for their population (USDA Forest Service, 2011).

Smallmouth Bass. The Smallmouth Bass is an inhabitant of cool, clear mountain streams with permanent flow and rocky bottoms. It is more intolerant of habitat alteration than any other of the black basses and is especially intolerant of high turbidity and siltation. It is considered a key indicator species for the Ouachita Mountains by ADEQ. There appear to be wide fluctuations in populations of smallmouth bass with no apparent trends. Populations in reference and managed streams are comparable and the conservation of this species is not in question.

Direct and Indirect Effects

No Action

The Action Alternative would have no effect on the Forest-wide population trends of these species. This alternative would have no effects on aquatic MIS. No action would be taken, leaving only natural disturbances affecting aquatic communities in the Project Area. The No Action would be neither "detrimental" nor "beneficial" to aquatic MIS species.

Proposed Action

The Proposed Action would have no effect on the Forest-wide population trends of these species.

As discussed in the Water Quality section of this document, proposed activities (soil disturbing actions and prescribed burning) would result in sediment entering streams, negatively affecting these aquatic species.

Herbicides would be applied to upland terrestrial habitats. When herbicides are applied, there is a risk that the chemical could move offsite, possibly entering streams or ponds. Herbicides would not be applied to vegetation in Streamside Management Areas, within 100 feet of perennial streams, nor within 30 feet of intermittent stream channels (USDA Forest Service, 2005a). These SMAs would buffer streams and other waterbodies by arresting movement of run-off water and preventing entry of herbicide into the aquatic ecosystem.

No Herbicide

The No Herbicide Alternative would have no effect on the Forest-wide population trends of these species. The effects of this alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Cumulative Effects

Although the Proposed Action and No Herbicide Alternatives would contribute 4,445 tons of sediment per year, the risk to aquatic beneficial uses would not change from low levels for the two sub-watersheds of Brown's Creek/Maumelle and Bringle Creek/Maumelle. Environmental effects would be measurable and observable for short periods of time following storm flow events. These effects would be short-term (less than a few weeks) and would not affect large portions of the watershed. Recovery would be complete and beneficial uses would be disrupted only for short periods in localized areas. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Proposed, Endangered, Threatened and Sensitive Species (PETS)

All 80 PETS species that occur on the Ouachita National Forest (USDA, Amended Regional Forester's Sensitive Species list , 2007a) (USDI-Fish and Wildlife Service, 2007) were considered. Of this number, 10 are designated federally endangered, 6 are designated federally threatened, and 64 are designated as Forest Service sensitive species. Sixty-eight (68) species were eliminated from further evaluation due to one or more of the following factors: (1) the Project Area is not within their known, documented geographic range; (2) the species has never been documented from within the Project Area or its sphere of influence in field surveys, monitoring activities, reports, or scientific literature; and (3) the Project Area does not provide habitat conditions known to be needed or used by these species. See the PETS Checklist for this Project Area for an explanation as to why species were eliminated

from further consideration or brought forward in this document for evaluation.

The remaining twelve (12) species are known, expected, or may occur within the project area and/or the area of its influence. These species will be considered during analyses of effects of the Proposed Action. This group is composed of two (2) terrestrial vertebrates, one (1) terrestrial invertebrate, eight (8) terrestrial plant species and one (1) aquatic vertebrate.

PETS Species Considered		
Common Name	**Scientific Name**	**Classification***
Northern long-eared bat	*Myotis septentrionalis*	Threatened
Bachman's Sparrow (bird)	*Peucaea aestivalis*	Sensitive
Diana fritillary(butterfly)	*Speyeria diana*	Sensitive
Ozark chinquapin (tree)	*Castanea pumila ozarkensis*	Sensitive
Nuttall's cornsalad (plant)	*Valerianella nuttalli*	Sensitive
Open ground draba (plant)	*Draba aprica*	Sensitive
Ouachita false indigo (plant)	*Amorpha ouachitensis*	Sensitive
Palmer's cornsalad (plant)	*Valerianella palmerii*	Sensitive
Sand grape (plant)	*Vitis rupestris*	Sensitive
Shinner's sunleaf (plant)	*Helianthus occidentalis plantagineus*	Sensitive
Waterfall's sedge (plant)	*Carex latebracteata*	Sensitive
Ouachita Madtom (fish)	*Noturus lachneri*	Sensitive

* Sensitive: USDA-Forest Service Designation

Northern long-eared Bat-Federally Endangered

Current Conditions

The northern long-eared bat (*Myotis septentrionalis*) is a small (6-9 g) insectivorous bat found in eastern North America (Foster & Kurta, 1999). It was considered a subspecies of the Keen's long-eared myotis (*Myotis keenii*) until 1979 when it was recognized as a distinct species, based on geographic separation and differences in morphology (USDI Fish and Wildlife Service, 2011). On October 2, 2013, the northern long-eared bat was proposed for listing as endangered under the Endangered Species Act and was subsequently published in the Federal Register (USDI Fish and Wildlife Service, 2013). The final BO was issued on 7/24/15 in FWS Log#04E00000-2015-F-003.

Within Arkansas, the northern long-eared bat is known to occur in Baxter, Benton, Garland, Independence, Jackson, Marion, Montgomery, Newton, Pike, Polk, Scott, Stone, Washington, and Yell counties (Saugey, et al., 1993). It was also found in abundance in Saline County. In addition, all counties within the Ouachita National Forest in Arkansas have recorded NLEB specimen, including Le Flore and McCurtain Counties in Oklahoma (ODWC, 2013).

Direct and Indirect Effects

No Action

The retention of existing pine and hardwood forested conditions without human-caused disturbance would continue to offer roosting and nesting habitat. Diversity of foraging conditions would decline as succession continued. Without the creation of early successional habitat, insect diversity and abundance would likely decline, resulting in a loss of foraging opportunities for the Northern long-eared bat.

Proposed Action

Timber, Silvicultural/Wildlife Activities*:*
Cutting trees for the various proposed timber treatments may result in death and injury to bats and their young during the maternity period, when pups are non-volant (Wisconsin DNR, 2013), and may also disrupt roosting and maternity behavior. NLEBs are highly mobile and are capable of fleeing to avoid danger, unless they are in torpor (during the cooler winter months), in which case it may take up to 30 minutes to arouse and escape.

The habitat of northern long-eared bats may be impacted indirectly by noises associated with timber, silvicultural, and wildlife activities, such as the sound of saws and/or general human interaction (USDI Fish and Wildlife Service, 2013a). The BO identifies April 1 to October 31 and the period where bats can fly and can be harassed by smoke or noise. Further, potential indirect effects to the northern long-eared bat may include disturbance and/or habitat degradation from the cutting activities associated with the Proposed Action. May 1 to July 15 is when pups cannot fly and NLEB could be harmed or killed by heat, smoke or felling and unknown roost tree. The forest has been given maximum acres not to exceed as a form of 'take' for timber harvest during volant and non-volant season. Ponds will be reconstruction so no trees will be taken out over 3 inches at any time.

Conversely, the resulting canopy and midstory openings will increase the amount of sunlight to the forest floor, resulting in a diverse and abundant assemblage of vegetation, which will increase the general biodiversity of the insects the NLEB forages upon. Additionally, the reduced clutter and lower basal area associated with the proposed activities will result in improved habitat for NLEBs, and will also increase the small openings preferred for foraging (Lacki & Schwierjohann, Day-roost characteristics of northern bats in mixed mesophytic forest, 2001) (Perry & Thill, Roost selection by male and female northern long-eared bats in a pine-dominated landscape, 2007) (Perry, Thill, & Leslie, 2007) (Perry, Thill, & David Jr., 2008).

Prescribed Fire:
Prescribed burns may occur during the dormant season or during the growing season. For dormant season burns, NLEBs are generally found in hibernacula such as caves. For these individuals, direct effects are unlikely and may be limited to smoke intrusion into the hibernacula. This has the potential to rouse bats from hibernation, though mortality is

unlikely (Perry R. , 2011). This period of harassment is April 1 to October 31. However, during May 1 to July 15, individuals may be killed by smoke, heat or burning down an unknown occupied roost tree during growing season burns. NLEBs may be displaced from existing roosts due to smoke intrusion and human disturbance. However, NLEBs switch roost trees every 2-4 days and are capable of escaping danger, so direct effects are unlikely. If burns occur during the lactation period, however, mortality may occur in non-volant young, which are incapable of escaping burn areas (Perry R. , 2011). The forest was given 'take" in the form of acres allowed during these seasons.

NLEBs have been hypothesized to be a fire-adapted species (Lacki, Cox, Dodd, & Dickinson, 2009). Prescribed burning creates stands with less understory growth, more open areas, and generally more snags. These are all conditions preferred by NLEBs in southeastern forests (Perry R. , 2011). In fact, in multiple studies, NLEBs were found more commonly in stands on a frequent (approximately every 3 years) burn rotation (Perry & Thill, Roost selection by male and female northern long-eared bats in a pine-dominated landscape, 2007) (Perry, Thill, & Leslie, 2007) (Lacki, Cox, Dodd, & Dickinson, 2009). In addition to creating habitat more favorable to NLEBs, prescribed burns create better foraging habitat with a more abundant and diverse prey base (Perry R. , 2011).

Herbicide Application:

Due to the NLEB's emergence times, it is highly unlikely that individuals themselves will come into contact with recently sprayed vegetation. By dusk, herbicides should be dried on the substrate they were sprayed on (Lacki, Hayes, & Kurta, 2007). However, there is a possibility that NLEBs can consume insects that have been contaminated or sickened by the herbicide treatments. Herbicides would be applied at the lowest effective rate in meeting project objectives in an attempt to reduce any potential negative effects to the environment. All label instructions and Forest Plan standards and guidelines will be followed.

Herbicide application will decrease woody vegetation growth and increase native vegetation, resulting in the overall enhancement of wildlife habitat (Guynn, Guynn, Wigley, & Miller, 2004). In studies conducted in the southeastern United States, herbicide application combined with a regular prescribed burn rotation restored forests to their native overstory pine/understory grass communities, producing the habitat type NLEBs prefer in this region (Guynn, Guynn, Wigley, & Miller, 2004) (Perry, Thill, & David Jr., 2008). Further, the changes that result should provide a more abundant and diverse insect population, thus increasing foraging opportunities for the NLEB (Lacki, Hayes, & Kurta, 2007).

Transportation System and Fireline Construction:

Individual bats may be injured or killed when roost trees are cut during the maternity season (Wisconsin DNR, 2013), especially threes 3 inches or greater in diameter. These activities also have the potential to disrupt roosting and maternity behavior. Removal of trees along new roads and/or skid trail corridors may result in a loss of roosting habitat. However, during the foraging period roads and trails are frequently used as foraging corridors, and the grasses seeded for erosion control in all firelines, skid trails, log landings and decommissioned roads will provide beneficial foraging habitat. These seeded areas will also help increase the diversity and abundance of insect populations. Finally, it has been suggested that road noise

can negatively impact "passive listening" bat species, such as the NLEB (Schaub, Otswald, & Siemers, 2008). The decommissioning of roads will help decrease anthropogenic noise, while retaining the open areas used by NLEBs for foraging (Perry, Thill, & David Jr., 2008) (Perry R. , 2011). Any noise associated with timber removal activities will not occur during the foraging period for NLEBs.

No Herbicide

The effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects resulting from herbicide application would not occur.

Cumulative Effects

In addition to the activities in this PA, in 2017, there will be similar watershed activities adjacent to this PA. If the proposed future actions take place, it will occur near known historical roost trees in the Alum Creek Research Area. Prescribed fire, small group selection cutting, large group selection, thinning, midstory removal, etc. will occur within the agreed time-frames and take limits of the BA. Effects will be similar to the effects for this PA, only there will be cumulative creation of habitat and snags, while also losing possible roosting trees during the winter after the young can fly. Some of these activities could occur during the non-volant season. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Bachman's Sparrow-Sensitive

Current Conditions

This bird has been listed as a Forest Service Sensitive species because of the limited amount of preferred early seral habitat and its limited distribution. The overall viability risk for this species is low (USDA Forest Service, 2005b).

Bachman's Sparrow prefers pine habitats that are found at opposite ends of the silvicultural spectrum – early seral forest and open mature growth (pine savanna) with an early forest stage ground cover component primarily composed of *Andropogon* spp grasses (Dunning, 2006). This species is rarely encountered outside of early seral forest [0-10 years of age] (Thill, Craig, & Koerth, 2004) and has been shown to disappear from stands within 3-5 years following prescribed fire (Tucker, Robinson, & Grand, 2006) (Cox & Jones, 2008) (Jones, Cox, Toriani-Moura, & Cooper, 2013).

Direct and Indirect Effects

No Action

The retention of the overstory without disturbance would have several potentially detrimental effects on this sparrow. As crowns continued to develop and increase in volume, mast production in the form of acorns would also increase until crown closure and competition for sunlight, moisture and nutrients limited productivity and stressed trees. Hardwood and pine habitats would become homogeneous with little diversity. Shade-tolerant species such as red maple would flourish in the mid and understory with significant root development already established while waiting for the opportunity to occupy the overstory in tree-fall gaps or when stand replacement events such as wildfire, insect infestation or ice storms occurred. Such replacement would result in loss of hard mast (Zaczek, Groninger, & Van Sambeek, 2002). Other shade tolerant midstory species such as dogwood, serviceberry and farkleberry would provide soft mast, but over time the volume would decline as availability of sunlight decreased with overstory closure. Herbaceous and grassy ground cover would fade and essentially disappear resulting in loss of brood range and its bounty of seeds, berries and insect and spider populations important to poult growth and development (Dimmick, Gudlin, McKenzie, & Wells, 2004) (Masters & Wilson, 1994) (Fenwood, Urbston, & Harlow, 1984). The additive beneficial impacts of fire, herbicide and road and fireline corridors and associated edge habitat often used for nesting cover and travel ways would not occur.

Proposed Action

Timber, Silvicultural/Wildlife Activities*:*
Timber, silvicultural/wildlife activities are not likely to directly affect adult birds or nests with eggs or nestlings because timbered stands to be harvested or receive timber, silvicultural/wildlife treatments do not offer suitable nesting habitat at the time of treatment (Dunning, 2006). Adults are highly mobile and if located within a stand to be treated can easily move to another location. Loss of nests, eggs, or nestlings is possible if located within the treatment area. Creation of openings will occur in older stands proposed for harvest or in non-harvested stands too old to provide nesting habitat, resulting in no direct effects.

The reduction of basal areas in treated stands will allow increased light levels to reach the forest floor, increasing suitable nesting and foraging habitat by promoting the growth of grasses, herbaceous vegetation and the production of fruits, seeds and associated insect prey. Peak beneficial vegetative response to regeneration harvest, thinning and follow-up treatments will likely occur 2-4 years post treatment then rapidly decline. The magnitude of these beneficial responses will vary by treatment and residual basal areas with greatest benefits from clearcut and seed-tree harvests, commercial thinning of old growth and mature growth pine resulting in open conditions, and the least from thinning of younger, more dense stands (Blair & Feduccia, 1977) (Fenwood, Urbston, & Harlow, 1984) (Masters, Wilson, Bukenhofer, & Payton, 1996) (Askins R. , 2000) (Masters & Waymire, 2000). Permanent openings, if periodically maintained and allowed to re-vegetate naturally, will offer small areas of foraging habitat but are not likely to benefit reproduction due to their small size (Brooks & Stouffer, 2011).
Prescribed Fire:
Stands containing suitable nesting habitat (clearcut/seed-tree), are typically not burned once forest regeneration has been established and at a time when grasses and forbs have become

dominant forest floor vegetation. Prescribed burns may be conducted in older, thinned stands at any time following harvest. Prescribed fires conducted during the non-nesting season will have no direct effect on adult birds, eggs or nestlings, since individuals are volant and able to escape burn areas. Growing season burns occurring during nesting season could result in the loss of nesting females, eggs and/or nestlings.

The application of prescribed fire will create and maintain the early successional habitat required by Bachman's Sparrows (Cox & Jones, 2007) (Jones, Cox, Toriani-Moura, & Cooper, 2013). In fact, it has been found that Bachman's Sparrows are dependent on frequent fire regimes and prefer to nest in areas that have burned within the past year (Jones, Cox, Toriani-Moura, & Cooper, 2013). These beneficial effects may be magnified when the application of fire occurs following timber harvest and/or silvicultural/wildlife treatments.

Herbicide Application:

The following herbicide active ingredients have been proposed for site preparation, release, silvicultural timber stand improvement, pre-commercial thinning, and wildlife habitat improvement: triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate. Since no risk assessment studies have been conducted specific to Bachman's Sparrow, Northern Bobwhite, which has similar natural history, habitat use and habitat needs, was chosen as the closest analog. Specific information on all herbicides proposed for use in the project area is available from Syracuse Environmental Research Associates Inc. (www.sera-inc.com/).

Herbicide LD50 and Toxicity Risk to Birds (Table 3.9)

Active Ingredient	***LD_{50}****	***Toxicity Risk to Bobwhite and or Mallard***	***Risk Assessment***
Glyphosate	>2000mg/kg of body weight	U.S. EPA/OPP (1993) classifies glyphosate as no more than ***slightly toxic*** to birds	Syracuse Environmental Research Associates, Inc. 2011
Imazapyr	>2150mg/kg of body weight	All acute exposure studies in birds show that imazapyr has ***very low toxicity***	Syracuse Environmental Research Associates, Inc. 2011
Triclopyr	849mg/kg to 2055 mg/kg of body weight	U.S. EPA/OPP (1998b) has classified triclopyr as being ***slightly toxic to birds***	Syracuse Environmental Research Associates, Inc. 2011

LD_{50}*- lethal dose for 50% of population tested

Acute oral and dietary studies of the listed chemicals exhibit a range in analysis toxicity from practically nontoxic to slight toxicity to birds. These determinations were based on concentrations of herbicides in quail diets that would in all cases far exceed concentrations in

field treatment applications.

Direct effects of herbicide application on nests with eggs or nestlings are not likely to occur because the primary target of the majority of applications will be hardwood brush located in dense forest stands typically beyond the useful condition for this bird. Neither hardwood brush nor dense stands are preferred nesting habitat for this bird due to a lack of grass and herbaceous plants important for nest construction and concealment. Adults and fledglings are highly mobile and will not be directly impacted.

Herbicide application has the potential to temporarily negatively impact foraging and nesting opportunities in small, specific treatment areas by reducing the availability of seeds from woody plants and broadleaf herbaceous species contacted by herbicide. Treatment of individual targeted plants will reduce the potential impact to non-target, beneficial vegetation. Some but not all of these herbicides affect grasses. However, without using herbicide a monoculture of a particular species may occur, which has little to no benefit to wildlife populations.

Transportation System and Fireline Construction:
There will be no direct effect on this bird, eggs or nestlings if road and fireline activities occur outside the nesting period. If old roads provide nesting habitat and are occupied by birds when re-opened and utilized during project implementation, eggs and nestlings may be destroyed but highly mobile adults will not be impacted.

When roads are closed upon completion of management activities and re-vegetated, they may offer ephemeral nesting and foraging habitat. Similarly, if fireline is located adjacent to early forest stage cover habitat it may enhance use by providing disturbed soil and growth opportunities for herbaceous and grassy cover during fireline re-vegetation.

No Herbicide

The effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects resulting from herbicide application would not occur.

Cumulative Effects

Because the home range of this species lies completely within the boundary of this project, and there are no additional past or future activities planned within this project area, there will be no cumulative effects resulting from this project. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

<u>Diana fritillary butterfly-Sensitive</u>

Current Conditions

The overall viability risk for this species is low (USDA Forest Service, 2005b). The Global Status for this butterfly is G3G4 and State Status S2S3. These ratings imply this species is thought to be secure but still vulnerable to extirpation and extinction (NatureServe Explorer, accessed 2015).

This butterfly is considered a forest species by most researchers. Female adults are often found in moist, wooded ravines and valleys while adult males range widely in search of females. This butterfly is single-brooded with eggs laid singly and haphazardly near various species of violets in late summer and hatching in fall. This wide dispersal of offspring may maximize survival in fire dependent ecosystems. Caterpillars overwinter without feeding until the following spring when they feed at night on newly leafed-out violets and complete their development (Carlton & Nobles, 1996) (Opler & Malikul, 1998) (Glassberg, 2002) (Spencer, 2006). At least five of the eight species of violets in the state occur within the Ouachita Mountains and are found in a variety of moist to xeric habitats (Hunter C. , 2001). This species is attracted to sources of high quality nectar-producing plants that typically occur in more open habitat conditions.

Direct and Indirect Effects

No Action

No direct effects would result from this alternative. Indirectly, forest health would likely decline due to overstocking of trees. Initially, dense canopy closure could cause a decrease in herbaceous plants needed for nectar food sources and egg-laying sites used by this species. Overstocked forests could promote disease and insect outbreaks, and wildfires which would eventually open the forest canopy. If such openings were created, this would temporarily promote a flush of herbaceous growth which may include high quality nectar producers and violets for egg deposition used by this species. Periodicity and intensity of these events would be unpredictable under this alternative.

Proposed Action

Timber, Silvicultural/Wildlife Activities*:*
There will be no direct effects to this species unless felled trees and equipment impact larvae and eggs on the ground. Adults are highly mobile. Timber/silvicultural/wildlife activities and creation and maintenance of permanent openings will reduce basal areas and the shading effect of trees, allowing for herbaceous plant growth. These may include the high quality nectar producers that Diana fritillaries require for food and egg deposition (Wells & Smith, 2013). Early forest stage habitat found in seed-trees, clearcuts, and beneath older timber stands with low basal area is ephemeral and will become unsuitable habitat if not maintained by fire or other means (Weber, Preston, Dlugos, & Nelson, 2008).

Prescribed Fire:
Females lay eggs haphazardly on the landscape in late summer with eggs hatching in early fall. Eggs are not likely to be present during the application of winter prescribed fire based

on typical burning activities on the Ouachita NF. Overwintering caterpillars are more likely to occur in the lower levels of leaf litter near the upper soil layer than in the upper portions of litter typically consumed by dormant season fire. Spring, growing season, burns may impact larvae (Huebshmann & Bragg, 2000). Caterpillars are not known to occur in groups, and large numbers of animals are unlikely to be impacted at any given time or by any particular burn.

The reduction of small diameter woody stems that produce shade and the resulting release of nutrients into the soil from the combustion of woody debris, leaf litter and dead herbaceous materials will enhance herbaceous plant growth. Nectar producing plants used by adult butterflies and violets used by larvae and caterpillars should increase as a result.

Herbicide Application:
The following herbicide active ingredients have been proposed for site preparation, release, silvicultural timber stand improvement, pre-commercial thinning, and wildlife habitat improvement: Given the great diversity of species of terrestrial invertebrates, the use of data from a single species (Bee - *Apis mollifera*) for the risk characterization obviously leads to uncertainty in the risk assessment. However, given the lack of scientific studies available this information is applicable and represents the best science resource to date.

Herbicide LD50 and Toxicity Risk to Insects (Table 3.10)

Active Ingredient	***LD_{50}****	***Toxicity Risk to Bee - Apis mollifera***	***Risk Assessment***
Glyphosate	>100 µg/bee	***Relatively Nontoxic***	Syracuse Environmental Research Associates, Inc. 2011
Imazapyr	>100 µg/bee	***Relatively Nontoxic***	Syracuse Environmental Research Associates, Inc. 2011
Triclopyr	No LD50 stated	***No toxicity risk stated***	Syracuse Environmental Research Associates, Inc. 2011

LD_{50}*- lethal dose for 50% of population tested

Bioassay studies of the listed chemicals proposed for use in the Project Area all exhibit very low toxicity to invertebrate species (bees). These determinations were based on concentrations of herbicides applied to bees that would far exceed concentrations applied in field treatment applications.

Given the low risk of toxicity exhibited in invertebrate testing no direct impact to Diana fritillary is anticipated. Indirect effect of herbicide application would most likely come in the temporary loss of some woody shrubs, and annual and perennial broadleaf herbaceous plant species that provide shelter and food sources (nectar) for this butterfly species. While some butterfly habitats may be impacted by the treatment activities, maintaining or expanding suitable habitat would be "beneficial" in the long-term.

Transportation System and Fireline Construction:
Roads and firelines may be constructed at any time during the year. Road and fireline construction will have no direct effect on mobile, adult butterflies but may impact eggs or larva due to their immobility. Roadbeds, ditch-lines, and constructed firelines, when closed and re-vegetated, may provide habitat for plant species used by this butterfly.

No Herbicide

The effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects resulting from herbicide application would not occur.

Cumulative Effects

Because individuals of this species will occupy the same suitable habitat throughout their life cycle, if available, effects of management actions would be contained within the project area. There are no other actions proposed or currently affecting this species within this geographic bound. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Ozark Chinquapin-Sensitive

Current Conditions

Due to the threat of destruction of individual trees by the Chestnut Blight, the Ozark chinquapin is listed as a Forest Service Sensitive Species. The overall viability risk for this species is considered very high range-wide, primarily due to the blight for which there is no known treatment (USDA Forest Service, 2005b).

This fire-dependent tree is abundant and widespread in the Interior Highlands of Arkansas, where it is found in successional and old growth vegetation types and typically occurs in dry deciduous and mixed hardwood-pine communities on rocky dry slopes and ridge tops. On the Ouachita National Forest and elsewhere it occurs largely as stump sprouts and has been observed to reach its fastest growth rate where abundant sunlight reaches the forest floor. Fruiting trees and large individuals are rare (Hunter C. , Trees, shrubs and vines of Arkansas, 1995) (Arkansas Native Plant Society, 1998) (USDA Forest Service, 2005b) (Arkansas Natural Heritage Commission, 2012).

Direct and Indirect Effects

No Action

There would be no effects except for instances involving stochastic events. Potentially beneficial or detrimental effects of action alternatives would not occur.

Proposed Action

***Timber, Silvicultural/Wildlife Activities**:*
During timber harvest and related activities individual chinquapins may be physically impacted by felled timber and subsequent removal of forest products (tires, logs being removed) however, the likelihood of detrimentally affecting viability is low because this tree readily sprouts and is rarely encountered on operable timberlands.

Timber, silvicultural/wildlife activities will reduce basal areas and the shading effect of overstory/midstory trees, potentially enhancing growth opportunities, especially when combined with prescribed fire treatments that further reduce competition from small woody stems for nutrients, space and water. Where this tree is known to occur and where similar management activities have occurred in the past, habitat conditions appear to have been improved (USDA Forest Service, 2005b). Timber harvests without ground disturbing site preparation activities, such as ripping or roller chopping, are considered viable management methods to enhance sprouting, flowering, and seed production without damaging rootstock (NatureServe, 2013).

Prescribed Fire:
Prescribed fire may cause bole injury to this species, depending on the tree's location, intensity of fire, and season of burn. In the event of injury this tree will readily sprout from a well-developed root system. This species is known to occur in areas with past fire history and is considered a fire-dependent species (USDA Forest Service, 2005b) (Paillet & Cerny, 2012). The release of nutrients into the soil from the reduction of woody debris, leaf litter and dead herbaceous materials may enhance growth and vigor. The potential removal of competing small diameter stems and the associated reduction in shade will benefit this tree (NatureServe, 2013).

Herbicide Application:
Direct effects to this tree are unlikely due to its rare occurrence in managed timber stands where most applications of herbicide will occur. This tree's physical form is easily recognized allowing avoidance in hardwood stands where mid-story reduction activities will occur. Furthermore, the Forest Plan states under Objective TE008 that "Herbicides will not be applied to Ozark chinquapin, and stems of this species will be individually flagged or otherwise marked in the field by qualified personnel prior to herbicide application within the stand. Use of soil active, mobile herbicides should not be applied where they might move to the root system of this species (USDA Forest Service, 2005a). A buffer of 30 feet would be required if trees are found and flagged in an application area if foliar application is used.

This tree responds well to an increased level of light and a reduction in competition for water, space and nutrients when adjacent vegetation is reduced during herbicide or other treatments resulting in similar indirect effects. Use of soil active, mobile herbicides should not be applied where they might move to the root system of this species (USDA Forest Service, 2005a).

Transportation System and Fireline Construction:
Construction of roads and firelines has the potential to uproot individual trees. Existing

roadbeds are highly unlikely to harbor this tree, meaning that reconstruction and maintenance will have no direct effects. Transportations systems and firelines constructed near this species may create openings in the canopy, resulting in a release of nutrients and an increase in the availability of sunlight, improving growing conditions for the Ozark chinquapin.

Pond Reconstruction/Maintenance:

Direct effects: Pond reconstruction is a ground disturbing activity that has the potential to uproot individual trees; however, each pond site is ground checked for the presence of the Chinquapin oak or any other PETS species by a qualified individual. Many Ozark chinquapin sites on the Fourche unit of the District occur on rocky outcroppings, which are not suitable for pond-building. If Ozark chinquapin is found within a proposed pond site, the pond site will be moved to an area free of Ozark chinquapins.

Indirect effects: Indirect effects will be minimal, due to the small amount of midstory and overstory canopy removed during pond-building activities. The wildlife ponds originally constructed are between 1/8 to ¼ acres in size.

No Herbicide

The effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects resulting from herbicide application would not occur.

Cumulative Effects

Any effects of this project, when combined with effects from other past, present and reasonably foreseeable future actions are of no consequence due to the vulnerability to chestnut blight and the low reproduction rate of this species. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Terrestrial Plants-Sensitive

Because these species are immobile, an effects analysis will occur for pond construction.

Nuttall's cornsalad (*Valerianella nuttallii* (USDA, (Torr. & A. Gray) Walp, 2016)) – This annual herbaceous plant is restricted to western Arkansas and eastern Oklahoma with a global ranking of G2 (Imperiled) and a state ranking of S2 (Imperiled). Nuttall's cornsalad is a small, upright plant with simple leaves found mostly at the basal portion of the plant. Leaves tend to be broader towards their apex. Flowers are born in flat-topped clusters well above the leaves and are pure white on the inside and out. The base of the flower is a tube which flares out to form 5 petals at its apex (Kores, 2000). Nuttall's cornsalad is normally found in open shale glades, prairies, and woodlands with shale substrate, rocky hillsides embankments, roadsides, and ditches. It prefers areas where vegetative competition is low. Due to its preferred habitat, it is likely a disturbance-dependent species (NatureServe Explorer Database 2015).

Open-ground draba (*Draba aprica* Beadle) – This plant is an herbaceous annual with a global status of G3 (Vulnerable) and status in Arkansas of S2 (Imperiled). Open-ground draba is in the mustard family (Brassicaceae) and grows to a height of 3 to 35 cm tall. It is unbranched or with short branches and covered with small star-shaped (stellate) hairs. It has both basal and stem leaves that gradually decrease in size as they spiral up the stem. The inflorescence is a raceme with flower clusters born in the axils of the leaves. Each small white flower has 4 notched petals and 6 stamens. The fruit is linear-elliptic silique (4-6 mm long) with stellate hairs. Open-ground draba germinates in the late fall and forms a basal rosette of leaves which overwinters and sends up a flowering stem in the early spring. It then flowers, seeds and goes dormant before the onset of hot, dry conditions of summer (NatureServe Explorer Database 2015).

Open-ground draba is found on thin sandy soils with some organic content overlying siliceous rocks. In Arkansas, populations tend to occur in barrens or glades on very thin soil, often on rocky glade/barren margins; sites include shale barrens of Ouachita Mountains, dolomite areas in the Ozarks, and some sites on sandstone. Population sizes can vary greatly depending on weather conditions in the winter and spring. In wetter years, plants are found in a little more out in the open as the species seems to dislike when soil is too moist (NatureServe Explorer Database 2015). Plants are often found on the outer edge of cedar trees where a moderate amount of needlecast is found.

Threats to this species include encroachment of woody plants in fire-suppressed areas, site preparations (like ripping) for pine plantations, and trampling from logging operations. Of these, woody encroachment is most the important threat as most foresters have realized that glades (where open-ground draba grows) are not suitable for growing pine trees. It was not found during watershed surveys.

Ouachita false indigo (*Amorpha ouachitensis* Wilbur) – The Ouachita leadplant is a small shrub endemic to southwestern Arkansas and Oklahoma. Distribution of this species is limited to several counties in west and west-central Arkansas and southeast Oklahoma. Flowering occurs in June and July with fruits maturing by August. This species is found in riparian areas and gravel bars along perennial streams and in some instances on moist ridges (Rich Mountain) and occasionally in oak-pine Forests. On the Ozark St. Francis NF they occur along an intermittent stream and rocky ridgetops in full sun or light shade, having reliable soil moisture. Its global status is G3 (Vulnerable) and state status in Arkansas is S3 (Vulnerable) (Natureserve Explorer Database 2015). There are 33 known locations on the Ouachita National Forest in Arkansas and Oklahoma. The majority (90%) of the sites on the Ouachita NF are within riparian habitat. Habitat information is based on the Arkansas Natural Heritage Inventory database.

Palmer's cornsalad (*Valerianella palmeri* Dyal) – This annual herbaceous plant's range is restricted to western Arkansas and eastern Oklahoma. Palmer's cornsalad has a global ranking of S3 (Vulnerable) and a state ranking in Arkansas of S3 (Vulnerable). It inhabits a variety of sites including gravelly areas near streams, rocky ledges in open woods and mesic oak woods (Natureserve Explorer Database 2015). Whereas Palmer's cornsalad prefers a

moister environment than Nuttall's cornsalad, they can occur together. Viability risk is very high for this species. (USDA Forest Service, 2005b).

Sand grape (*Vitis rupestris* Scheele) – This species is found along cherty streambeds, rocky banks, and gravel bars (Natureserve 2015). These sites are alternately xeric and inundated. Populations are relatively secure in the Ozark region of southern Missouri and northern Arkansas, but it is rare in the Ouachita NF. Sand grape spreads vegetatively as a clonal shrub so some relatively large populations may be vulnerable because they have very little genetic diversity. Hybridization with native grapes is also degrading the gene pool. Low seed production and the narrow habitat range of this species makes establishment of new occurrences difficult. This species has been found on National Forest lands along Buzzard Creek on the Kiamichi Ranger District, along Buchanan Creek near Steve, Arkansas, on the border of the Fourche and Jessieville Ranger Districts, and along Wheat Creek, West Fork Big Cedar Creek and Little Joe Creek on the Oden Ranger District. This plant is a Forest Service Sensitive species with a global ranking of G3 (Vulnerable) but the state ranking for Arkansas is under review (NatureServe 2015). Threats include the changing of hydrology (dams) that prevent the periodic riverbank cycle of flooding and scouring as well as the movement of invasive plants into its habitat. It was not found during watershed surveys.

Shinner's sunflower (*Helianthus occidentalis* Riddell subsp. *Plantagineus.* The Shinner's sunflower is known from Arkansas and Texas and is thought to be extirpated from Louisiana. It has a global ranking of T2 (Imperiled) and is ranked statewide as S1 (Critically imperiled). It is an herbaceous perennial that grows and spreads through the use of rhizomes (Cronquist, 1980). Shinner's sunflowers are found in areas with thin sand on top of clay, such as post oak (*Quercus stellata*) and blackjack oak (*Quercus marilandica*) savannas. In Arkansas it is found in two kinds of habitats: upland sandstone woodlands and high quality cobble bar/terraces of mountain streams, often with Cumberland sandreed (*Calamovilfa arcuata*) and Harperella (*Ptilimnium nodosum*) (Natureserve Explorer Database 2015). As a number of historic sites are located near or in urban areas habitat loss due to suburban sprawl is a serious threat. This sunflower has not been found during botanical watershed surveys, but has the potential to occur within the Project Area.

Waterfall's sedge (*Carex latebracteata* Waterf.) – This plant species is endemic to the Ouachita Mountains of western Arkansas and eastern Oklahoma and is locally abundant. Waterfall's sedge is in the Cyperaceae (sedge family) with a basal clump of bluish green leaves and flower spike subtended by a large bract. It is found in a variety of habitats such as shale roadsides, dry shale woodlands, riparian areas, mesic oak forests, pine and pine-hardwood forests, and novaculite glades. Often, Waterfall's sedge is found in areas that have had recent silviculture activities (Natureserve 2015). Threats to this species include clear cutting and the conversion of oak-pine forests to pine plantations by timber companies. It has a global ranking of G3 (Vulnerable) and a state ranking of S3 (Vulnerable) in Arkansas. This plant has been found within the Project Area.

Effects Analysis

No Action

There would be no effects except for instances involving stochastic events. Potentially beneficial or detrimental effects of action alternatives would not occur.

Proposed Action

***Timber, Silviculture/Wildlife Activities*:**

Direct effects: Large commercial timber harvest and silviculture/wildlife practices will not take place in glade, savannah, or riparian habitat. Skidding during harvest may directly affect individuals, though, when possible, trees will be removed and carried to the landing without skidding along the ground. Of the plant species mentioned previously in this section, *Draba aprica*, is one that has been found to be affected by mechanical site preparation activates (Kral 1983). However, sites appropriate for this plant are generally on slopes too steep and rocky for this form of timber production. Finally, tree removal will not occur in riparian areas.

Indirect effects: Riparian areas within the 30-100 foot range will continue to be excluded from these management activities. The proposed activities aim to restore woodlands that occur in the Project Area. With some canopy removal and frequent burning, the indirect effects would be positive for these species' habitats. There should be minimal indirect effects to riparian species due to the protection afforded to them by SMA guidelines.

Prescribed Fire:

Direct effects: There would be a direct effect on existing plants if burning was performed during a growing season and individual plants were top-killed. Since glade species occur in shallow soils and on generally bare ground where there is very little competition, the prescribed fire might burn around plant clusters. Fire has the potential to have a direct effect on riparian plants, though riparian areas are usually wetter than surrounding forest which lowers fire behavior or stops it altogether. At a result fire rarely travels far enough into riparian areas to cause direct effects to these species.

Indirect effects: Prescribed fire will open the canopy and reduce vegetative competition, thus improving habitat for these species. The plant species listed are fire-dependent, and have therefore evolved in an environment shaped by fire and require it to maintain their preferred habitat. In particular, maximum positive effects would be seen if habitats such as woodlands are burned on a 3-4 year rotation basis, along with timber or silviculture/wildlife treatments.

Herbicide Application:

Direct effects: Treatments will occur according to HU003 and HU010 in the Forest Plan by using individual stem treatments, directed spraying, and crop tree release instead of broadcast release for silviculture/wildlife release. These species would not be affected because treatments would not occur in riparian areas or glade/shale woodland habitat. Also, the use of herbicides is prohibited in the immediate vicinity of any PETS species.

Indirect effects: These plants respond well to increased light levels and reduced competition for water, space and nutrients when adjacent vegetation is reduced during herbicide and/or other treatments resulting in similar indirect effects. The use of soil active, mobile herbicides should not be applied where they might move to the root system of this species (USDA-Forest Service 2005a, pg. 77).

Transportation System and Fireline Construction:

Direct effects: No roads or firelines will occur in riparian areas or woodland glades. Any firelines for burning the ecosystem will occur outside the glade. Construction of roads and firelines outside designated habitats has the potential to uproot individual plants. Reconstruction and maintenance should have no direct effects since existing roadbeds are highly unlikely to harbor these plants.

Indirect effects: Transportations systems and firelines constructed near these species may create openings in the canopy resulting in an increase in sunlight. Roads (temporary and permanent) do not occupy a large area on the landscape and the likelihood of damage to individuals will be remote due to their rare occurrence in timberlands suitable for harvest (where road construction is most likely to occur). Likewise, the footprint of fireline on the landscape is small and the likelihood of damage to individuals is remote due to their rare occurrence. The construction of ground-disturbing fireline is not a certainty. When firelines are initially established in the best possible locations, there should be little to no future incremental increase in the acreage occupied because those locations will be used again. When possible and feasible, permanent features such as roads and streams will be employed to reduce disturbance of soils and impacts to these species. No roads or firelines will be built in a riparian area or a woodland glade.

***Pond Reconstruction & Maintenance*:**

Direct effects: Pond construction is a ground disturbing activity that has the potential to uproot individual plants; however, each pond site is ground checked for the presence of terrestrial PETS. The majority of these plants sites occur in glade/shale woodland or riparian areas, which are not potential pond building locations. If a sensitive plant is found within a proposed pond site, then the pond site would be moved to an area where no plants or their habitat occur.

Indirect effects: Indirect effects will be minimal, due to the small amount of midstory and overstory canopy removed during pond-building activities. The wildlife ponds constructed are between 1/8 to ¼ acres in size. The small pond size combined with the rarity of the plants listed means that cumulative effects should be minimal to nonexistent. Further, all pond locations are ground-checked in advance for potential PETS.

No Herbicide

The effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects resulting from herbicide application would not occur.

Cumulative Effects

There are no past, present, or reasonably foreseeable future actions that would affect riparian area or woodland glade habitats; there would be no cumulative effects on these species. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Vertebrates-Stream Fish

The Ouachita madtom is a small, endemic, catfish documented in the North Fork Saline River. Generally, this species occurs in small-to-moderate sized gravel-bottomed streams of the Saline River system that are clear and high gradient. This fish frequents quiet backwater areas with substrates varying in size from cobblestone-sized rocks to small gravel and on occasion has been found to use large rocks for cover in very shallow riffle areas. This species seeks smaller headwater tributaries for spawning during the summer period (Robison, 1988) (Robison a. A., 1995) which may also make them extremely vulnerable to extirpation as streams dry. This species is listed as sensitive because it is an aquatic endemic to the Ouachita Mountains and is known to occur in headwater streams within four watersheds (Alum, Middle, South and North Forks of the Saline River). The viability risk for this species is moderately high solely because of its restricted distribution and range within the Forest. The risk to species viability due to sedimentation is considered low. Global and State status is G2/S2 meaning this species is considered imperiled because of its small range and loss and degradation of habitat (NatureServe Explorer 2015). No madtoms were found in watershed stream surveys; however, the southern tip of the project area could drain water into Ouachita madtom known waters.

No Action

There would be no effects except for instances involving stochastic events. Potentially beneficial or detrimental effects of action alternatives would not occur.

Proposed Action

Timber Silvicultural/Wildlife Activities:

Direct effects: There will be no direct effects anticipated for the Ouachita madtom as a result of the proposed timber/silvicultural/wildlife activities. The proposed actions will cause no impacts because the application of provisions within MA9 (Water and Riparian Communities), Forest-wide Normal Timber Harvesting Operating Standard TH001, and Transportation Standards TR003 and TR008 will provide for protection of water quality and protection of Streamside Management Area Communities (USDA-Forest Service 2005a).

Indirect effects: There will be no indirect effects anticipated for the Ouachita madtom as a result of the proposed timber/silvicultural/wildlife activities. The proposed actions will cause no impacts because the application of provisions within MA9 (Water and Riparian Communities), Forest-wide Normal Timber Harvesting Operating Standard TH001, and Transportation Standards TR003 and TR008 will provide for protection of water quality and protection of Streamside Management Area Communities (USDA-Forest Service 2005a).

Prescribed Fire:

Direct effects: There will be no direct effects anticipated for the Ouachita madtom as a result of the proposed prescribed fire activities. The proposed actions will cause no impacts because the application of provisions within MA9 (Water and Riparian Communities), Forest-wide Normal Timber Harvesting Operating Standard TH001, and Transportation Standards TR003 and TR008 will provide for protection of water quality and protection of Streamside Management Area Communities (USDA-Forest Service 2005a).

Indirect effects: There will be no indirect effects anticipated for the Ouachita madtom as a result of the proposed prescribed fire activities. The proposed actions will cause no impacts because the application of provisions within MA9 (Water and Riparian Communities), Forest-wide Normal Timber Harvesting Operating Standard TH001, and Transportation Standards TR003 and TR008 will provide for protection of water quality and protection of Streamside Management Area Communities (USDA-Forest Service 2005a).

Herbicide Application:

Direct effects: There are no direct effects to aquatic vertebrates like the Ouachita madtom from herbicide application.

Indirect effects: There are no indirect effects to this fish or its habitat from the application of triclopyr-amine, triclopyr-ester, imazapyr, and glyphosate in upland terrestrial habitats. Treated vegetation will be exposed to rainfall and ultra-violet light that assist in rapid degradation of these herbicides (SERA 2011a, b, c). Streamside Management Areas, other vegetated stands and leaf litter will buffer aquatic systems by arresting movement of run-off water and preventing entry of herbicide into the aquatic ecosystem. Herbicides will not be applied to vegetation in Streamside Management Areas, within 100 feet of perennial streams such as the Petit Jean River, nor within 30 feet of intermittent stream channels (USDA-Forest Service 2005a, p. 103, Table 3.9). Objective HU014 of the Forest Plan states that "soil applies herbicides are not used within 30 feet of undefined channels, nor are they used on solids less than 20 inches deep to bedrock or on other soils with more than 35 percent rock content that are 20-40 inches deep to bedrock. Objective HU011 states that no application will occur within a 300-foot buffer of any source waters without a site-specific analysis (USDA 2005a).

The risk characterizations for triclopyr-amine, triclopyr-ester, and glyphosate indicate acute and chronic risks to aquatic animals (fish and invertebrates) are low. At the highest application rates considered in testing (10 lbs per acre), risks to aquatic animals remained

substantially below the level of concern and risks to aquatic species are low over the entire range of application rates that may be used in Forest Service programs (SERA 2011a, b,c). Similar findings for Imazapyr indicate that available data are sufficient to assert that no adverse effects associated with the toxicity of this product can be anticipated in aquatic animals from the use of this compound in Forest Service programs (SERA 2011a, b, c). The concentrations of any herbicide entering the aquatic ecosystem would be rapidly reduced by the mixing and diluting actions of flowing water. These herbicides are considered to have no cumulative effects on the Ouachita madtom (USDA 2005c) (USDI 2005a) (USDI 2007).

Transportation System and Fireline Maintenance:

Direct effects: Individuals may be impacted by heavy equipment crossing ephemeral streams, though this action is avoided when possible. Soil will not be moved by equipment in stream zones; when fireline is required on either side of the streams (from 30-100 feet) it is accomplished with handline. However, Ouachita madtom are not generally found in these small, ephemeral streams. Other proposed actions will cause no impacts because the application of provisions within MA9 (Water and Riparian Communities), Forest-wide Normal Timber Harvesting Operating Standard TH001, and Transportation Standards TR003 and TR008 will provide for protection of water quality and protection of Streamside Management Area Communities (USDA-Forest Service 2005a).

Indirect effects: There will be no indirect effects anticipated for the Ouachita madtom as a result of the proposed transportation system or constructed fireline. The proposed actions will cause no impacts because the application of provisions within MA9 (Water and Riparian Communities), Forest-wide Normal Timber Harvesting Operating Standard TH001, and Transportation Standards TR003 and TR008 will provide for protection of water quality and protection of Streamside Management Area Communities (USDA-Forest Service 2005a).

No Herbicide

The effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects resulting from herbicide application would not occur.

Cumulative Effects

The risk to aquatic beneficial uses would not change from low levels for the two sub-watersheds of Brown's Creek/Maumelle and Bringle Creek/Maumelle. Environmental effects would be measurable and observable for short periods of time following storm flow events. These effects would be short-term (less than a few weeks) and would not affect large portions of the watershed. Recovery would be complete and beneficial uses would be disrupted only for short periods in localized areas. The cumulative effects of the No Herbicide Alternative would be the same as the Proposed Action except the effects attributed to herbicide application would not occur.

Public Health and Safety

Current Conditions

Refer to the present conditions described in the Air Quality section and the Water Resources & Quality section of this chapter.

Direct and Indirect Effects

No Action

The prescribed burning and the application of herbicides prescribed in the Proposed Action would not take place; therefore, there would be no effects to public health and safety in regards to the use of prescribed burning or the application of herbicides.

Proposed Action

Refer to the Air Quality section of this chapter for disclosure of effects on public health and safety from prescribed burning.

Accidents or other unforeseen events might occur during herbicide transportation, mixing, and application. Public safety in and around areas of herbicide use is a high priority concern. Measures are taken to help ensure that the general public does not come in contact with herbicides, which would eliminate the risk entirely. These include posting warning signs on areas that have been treated; selectively targeting vegetation that needs to be controlled rather than using broadcast application; establishing buffer zones of non-treatment around private property, streams, roads, and hiking trails; carefully transporting only enough herbicide for one day's use; mixing it on site away from private land, open water, or other sensitive areas; properly maintaining and operating equipment (e.g. no leaks); and having good accident pre-planning and emergency spill plans in place. Enforcement and administration will be effective in reducing the risk of accidental contamination to humans or the environment. In the event of an accidental spill, the Emergency Spill Plan (USDA, Forest Service Handbook 2109, 1994) would be followed. The Plan contains procedures for spill containment and cordoning-off of the spill area. These measures along with others given in the RLRMP are incorporated into contracts and through good enforcement and administration would be effective in reducing the risk of accidental contamination of humans or the environment.

Herbicide applications were monitored for effectiveness in protecting water quality over a five-year period on the Ouachita NF (Clingenpeel, 1993). The objective was to determine if herbicides are present in water in high enough quantities to pose a threat to human health or aquatic organisms. From 1989 through 1993, 168 sites and 348 water samples were analyzed for the presence of herbicides. Of those samples, 69 had detectable levels of herbicide. No concentrations were detected that would pose a meaningful threat to human health or aquatic organisms.

SERA Human Health and Ecological Risk Assessments were used to analyze the risks associated with the seven herbicides proposed under this Alternative. Project specific SERA worksheets were completed for glyphosate, imazapyr, triclopyr-amine, and triclopyr-ester.

Project specific SERA worksheets (version 5.00.64) were completed for glyphosate at the maximum prescribed rate of 2 pounds of active ingredient per acre. The lower application volume is 5 gallons per acre, central application volume is 10 gallons per acre, and upper application volume is 25 gallons per acre. Hazard Quotients are at acceptable levels (less than 1) for all exposure scenarios except for the following: The risk characterization of acute/accidental exposures to water consumption, accidental spill for a child at upper level applications.

Project specific SERA worksheets (version 6.00.07) were completed for imazapyr at the maximum prescribed rate of 0.75 pounds of active ingredient per acre. The lower application volume is 5 gallons per acre, central application volume is 20 gallons per acre, and upper application volume is 100 gallons per acre. All Hazard Quotients are at acceptable levels (less than 1) for all worker exposure scenarios and all general public exposure scenarios.

Project specific SERA worksheets (version 5.00.64) were completed for triclopyr-ester (BEE) formulation at the maximum prescribed rate of 2 pounds of active ingredient per acre. The lower application volume is 5 gallons per acre, central application volume is 25 gallons per acre, and upper application volume is 40 gallons per acre. Hazard Quotients are at acceptable levels (less than 1) for all exposure scenarios except for the following: general exposure for 8 hours of application per day for a backpack worker treating 1 acre per hour. The Hazard Quotient can be reduced to an acceptable level for backpack workers applying triclopyr-ester formulation by limiting application to 7 hours a day, or reducing the area treated to 0.625 acres per hour. Hazard Quotients are at acceptable levels (less than 1) for all exposure scenarios except the following: acute (short term) exposures for the direct spray of a whole child at upper level applications; the direct spray of an adult female's feet and lower legs at upper level applications; the consumption of contaminated fruit by an adult female at upper level applications; the consumption of contaminated vegetation by an adult female at central and upper level applications; Chronic (longer term) exposures for the consumption of contaminated vegetation or fruit by an adult female at upper level applications.

Project specific SERA worksheets (version 5.00.64) were completed for triclopyr-amine (TEA) formulation at the maximum prescribed rate of 4 pounds of active ingredient per acre. The lower application volume is 5 gallons per acre, central application volume is 25 gallons per acre, and upper application volume is 40 gallons per acre. Hazard Quotients are at acceptable levels (less than 1) for all exposure scenarios except for the following: general exposure for 8 hours of application per day for a backpack worker treating 1 acre per hour. The Hazard Quotient can be reduced to an acceptable level for backpack workers applying triclopyr-amine formulation by limiting application to 7 hours a day, or reducing the area treated to 0.625 acres per hour. Hazard Quotients are at acceptable levels (less than 1) for all exposure scenarios except the following: acute (short term) exposures for the direct spray of an adult female's feet and lower legs at upper level applications; the consumption of

contaminated fruit by an adult female at upper level applications; the consumption of contaminated vegetation by an adult female at central and upper level applications; Chronic (longer term) exposures for the consumption of contaminated fruit or vegetation by an adult female at central and upper level applications

No Herbicide

Refer to the Air Quality section of this chapter for disclosure of direct, indirect, and cumulative effects on public health and safety from prescribed burning.

Since no herbicides would be utilized under this alternative, there would be no direct, indirect, or cumulative effects on public health and safety resulting from herbicide use.

Cumulative Effects

There are no other past, present or reasonably foreseeable future applications of herbicide within the project vicinity that would be additive to the effects of this project.

Climate Change

Current Conditions

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 & 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 may 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 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 and more recently changes are due to conversions from forest to urban development, dams, highways, and other infrastructure (Malmsheimer, Heffernan, & Brink, 2008).

Direct and Indirect Effects

Proposed Action and No Herbicide

The proposed harvest operations 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 wood-decay CO_2 emissions from wood products are delayed (Malmsheimer, Heffernan, & Brink, 2008). Prescribed burning activities, although a carbon neutral process, would release CO_2, other greenhouse gases, and particulates into the atmosphere. However, implementing the proposed prescribed burns on approximately 3 to 7 year cycle would reduce fuel loading and could be expected to reduce fire intensity and severity as well.

Indirectly, implementation of the proposed actions would increase the overall health, vitality and growth 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.

No Action

No management activities would occur under Alternative A, therefore no direct effects on greenhouse gases (GHG) emissions and carbon cycling would occur. Because no management activities would take place, carbon would continue to be sequestered and stored in forest plants, trees, (biomass) and soil. Unmanaged, older forests can become net carbon sources, especially if probable loss due to wildfires is included (Malmsheimer, Heffernan, & Brink, 2008). 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 forests ability to sequester carbon from the environment because live, vigorous stands of trees retain 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 impact 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 can be specifically attributed to the cumulative effects on global climate change.

Effects of Climate Change on the Proposed Project

For some management proposals, climate change may affect the project. For example: the effects of decreased snowfall on a ski area expansion proposal at a marginal geographic location, such as a southern aspect or low elevation. However, no direct, indirect, or cumulative effects from climate change on the proposal are anticipated.

Chapter 4
Persons and Agencies Consulted

Coordination

Diana Angelo	Archeologist
Becky Finzer	Fire Management Officer
Paula Homan	NEPA Coordinator
Brent Hummel	Forester
Coy Longshore	Timber Management Assistant
Mary Lynn Mentz	Wildlife Biologist
Jeff Olson	Forest Soil Scientist
Hunter Speed	Silviculturist
Chip Stokes	Geographic Information System Technician
Sarah Thompson	Wildlife Biologist
Robin Vaughn	Other Resources Assistant

Consultation

Lisa Cline	Forest NEPA, Objections & Litigation Coordinator
Susan Hooks	Forest Botanist
Ron Krupa	Retired Forest Landscape Architect
Mary Lane	Forest T&E Species Program Manager

State Historic Preservation Office
Arkansas Archeological Survey
Osage Nation
Chickasaw Nation
Quapaw Tribe of Oklahoma
Caddo Nation of Oklahoma
Choctaw Nation of Oklahoma

Chapter 5
References Cited

Arkansas Native Plant Society. (1998, August). Rare plant conference. Hot Springs, AR, USA.

Arkansas Natural Heritage Commission. (2012). *Rare species search for Yell county; natural history information and county distribution records for PETS species*. Retrieved from www.naturalheritage.com

Askins, R. (2000). *Restoring North America's Birds.* New Haven: Yale University Press.

Askins, R., Zuckerberg, B., & Novak, L. (2007). Do the size and landscape context of forest openings influence the abundance and breeding success of shrubland songbirds in southern New England? *Forest Ecology and Management, 250*, pp. 137-147.

Askins, Z. a. (2007). Do the size and context of forest openings influence the abundance of breeding success of songbirds in southern New England? *Forest Ecology and Management, Volume 250, Issue 3*, 137-147.

Beasley, R., Miller, E., & Lawson, E. (1987). *Chemical Properties of Soils and Streams in Natural and Disturbed Forest Ecoysystems in the Ouachita Mountains.* Arkansas Water Resources Research Center. Publication No. 132.

Blair, R., & Feduccia, D. (1977). Midstory hardwoods inhibit deer forage in loblolly pine plantations. *Journal of Wildlife Mangement, 41*(4), 677-684.

Bonar, R. (2000). Availability of pileated woodpecker cavities and use by other species. *Journal of Wildlife Management, 64*(1), 52-59.

Brennan, L. A. (1999). Northern Bobwhite. In *The Birds of North America* (Vol. No. 397, pp. 1-28).

Brooks, M., & Stouffer, P. (2011). Interspecific variation in habitat preferences of grassland birds wintering in southern pine savannas. *Wilson Journal of Ornithology, 123*(1), 65-75.

Bull, E., & Jackson, J. (2011). *Pileated Woodpecker (Dryocopus pileatus).* Retrieved from The Birds of North America Online: http://bna.birds.cornell.edu/bna/species/148

Burger Jr, L. (2001). Northern bobwhite. In L. Burger Jr, & J. Dickson (Ed.), *Wildlife of Southern forests: habitat and management* (pp. 122-146). Blaine, Washington, USA: Hancock House Publishers.

Burger, L., Hamrick, R., & Godwin, D. (2005, November). Land use changes in Mississippi: what does it mean for bobwhite restoration? *Mississippi Woods and Waters, 8*(4), pp. 21-23.

Carlton, C., & Nobles, N. S. (1996). Distribution of Speyeria diana (Lepidoptera: Nymphalidae) in the highlands of Arkansas, Missouri and Oklahoma, with comments on conservation. *Entomological News, 107*(4), pp. 213-219.

Clingenpeel, J. A. (1989). *Above and Below Storm Sampling BMP Effectiveness FY 1989 Monitoring Results.* Ouachita National Forest. Hot Springs AR: Ouachita National Forest.

Clingenpeel, J. A. (1993). *Herbicide Effectiveness Monitoring on the Ouachita National Forest for Water Quality in the Fiscal Years of 1989 through 1993.* Hot Springs AR: Ouachita National Forest.

Comer, C., Bell, A., Oswald, B., Conway, W., & Burt, D. (2011). Vegetation and avian response to prescribed fire on glade habitats in the Missouri Ozarks. *The American Midland Naturalist, 165*, pp. 91-104.

Cooper, R., Van Lear, D., & Brose, P. (2000). Oak advanced regeneration following seasonal prescribed fires in mixed hardwood shelterwood stands. Shreveport: 10th Biennial Southern Silvicultural Conference.

Cox, J., & Jones, C. (2007). Home range and survival characteristics of male Bachman's Sparrows in an old-growth forest managed with breeding season burns. *Journal of Field Ornithology, 78*, 263-269.

Cox, J., & Jones, C. (2008, May/June). Bachman's sparrow and the order of the Phoenix. *Birding Magazine*, pp. 38-45.

Cox, J., & Widener, B. (2008). *Lightning-Season Burning: Friend or Foe of Breeding Birds?* Tall Timber Research Station and Land Conservancy.

Cronquist, A. (1980). *Asteraceae. Vascular flora of the southeastern United States, vol. 1.*

Crow, T., Johnson, W., & Adkisson, C. (1994). Fire recruitment of Quercus in a post agricultural field. *American Midland Naturalist, 131*, pp. 84-97.

Daniel, D. (2009). Letter written to the Ouachita National Forest in support of prescribed burning for local newspapers. National Wild Turkey Federation Regional Biologist.

Degraaf, R., Scott, V., Hamre, R., Ernst, L., & Anderson, S. (1991). Forest and rangeland birds of the United States; natural history and habitat use. In *USDA Forest Service Agriculture Handbook No. 668* (p. 625).

Dickson, J. (2001). Wild turkey. In J. Dickson, *Wildlife of southern forests: habitat and management* (pp. 108-121). Blaine, Washington, USA: Hancock House Publishers.

Dimmick, R. W., Gudlin, M., McKenzie, D., & Wells, R. (2004). *The northern bobwhite conservation initiative; a plan for quail population recovery.* Columbia SC: Northern Bobwhite Conservation Initiative.

Dunning, J. (2006). *Bachman's sparrow (Peucaea aestivalis).* (A. Poole, Ed.) Retrieved from The Birds of North America Online: http://bna.birds.cornell.edu

Eaton, S. (1992). *Wild Turkey (Meleagris gallopavo).* (A. Poole, Ed.) Retrieved from The Birds of North America Online: http://bna.birds.cornell.edu/bna/species/022

Edworthy, A., Drever, M., & Martin, K. (2011). Woodpeckers increase in abundance but maintain fecundity in response to an outbreak of mountain pine bark beetles. *Forest Ecology and Management, 261*, pp. 203-210.

Fenwood, J., Urbston, D., & Harlow, R. (1984). Determining deer habitat capability in Ouachita National Forest pine stands. *Proceedings Annual Conference Southeastern Fish and Wildlife Agencies*, *38*, pp. 13-22.

Foster, R., & Kurta, A. (1999). Roosting ecology of the Northern Bat (Myotis septentrionalis). *Journal of Mammology, 80*(2), 659-672.

Glassberg, J. (2002). *Butterflies of North America.* New York: Michael Friedman Publishing Group, Inc.

Guynn, D., Guynn, S., Wigley, T., & Miller, D. (2004). Herbicides and forest biodiversity-what do we know and where do we go from here? *Wildlife Society Bulletin, 32*(4), pp. 1085-1092.

Hamel, P. (1992). *Land manager's guide to the birds of the South.* Chapel Hill, NC, USA: The Nature Conservancy, Southeastern Region.

Headwaters Economics. (2015). Economic Profile System-Human Dimensions Toolkit (EPS-HDT). Bozeman, MT. Retrieved 2014, from www.headwaterseconomics.org

Homan, J., Girondo, N., & Gagen, C. (2005). Quantification and predicted stream dryness in the Interior Highlands. *Journal of the Arkansas Academy of Science, 59*, 95-100.

Huebshmann, J., & Bragg, T. (2000). Response of Regal fritillary (Speyeria idalia Drury) to spring burning in an eastern Nebraska tallgrass prairie, USA. *Natural Areas Journal, 20*(4), 386-388.

Hunter, C. (1995). *Trees, shrubs and vines of Arkansas.* Little Rock: The Ozark Society Foundation.

Hunter, C. (2001). *Wildflowers of Arkansas* (6th ed.). Little Rock: The Ozark Society Foundation.

Hunter, W., Dickson, J., Pashley, D., & Hamel, P. (2001). Bird communities of southern forests. In J. Dickson (Ed.), *Wildlife of southern forests: habitat and management* (pp. 322-349). Blaine: Hancock House Publishers.

Hura, C., & Crow, T. (2004). Woody debris as a component of ecological diversity in thinned and unthinned northern hardwood forests. *Natural Areas Journal, 24*, 57-64.

James, D., & Neal, J. (1986). *Arkansas birds: Their distribution and abundance.* Fayetteville: University of Arkansas Press.

Jones, C., Cox, J., Toriani-Moura, E., & Cooper, R. (2013). Nest-site characteristics of Bachman's Sparrows and their relationship to plant succession following prescribed burns. *Wilson Journal of Ornithology, 125*(2), 293-300.

Jones, J. D., & Chamberlain, M. J. (2004). Efficacy of herbicides and fire to improve vegetative conditions for northern bobwhites in mature pine forests. *Wildlife Society Bulletin*(32), pp. 1077-1084.

Kennamer, J. (2008, September 17). Letter to Arkansas Senators Blanche Lincoln and Mark Pryor fully supporting the use of prescribed fire in turkey management on the Ouachita National Forest. Edgefield, SC, USA: National Wild Turkey Federation Headquarters.

King, D., Chandler, R., Collins, J., Petersen, W., & Lautzenheiser, T. (2009). Effects of width, edge and habitat on the abundance and nesting success of shrub-scrub birds in powerline corridors. *Biological Conservation, 142*, pp. 2672-2680.

Klaus, N., Rush, T., Keyes, T., Petrick, J., & Cooper, R. (2010). Short-term effects of fire on breeding birds in Southern Appalachian upland forests. *The Wilson Journal of Ornithology, 122*(3), 518-531.

Kores, P. (2000). *Survey of Valerianella Nuttallii, Nuttall's cornsalad, in Oklahoma. Oklahoma Natural Heritage Inventory, Oklahoma Biological Survey. Online. Available: http://wwwobs.ou.edu/report.htm.* University of Oklahoma, Norman, OK.

Kral, R. (1983). A report on some rare, threatened, or endangered forest-related vascular plants of the south. *Technical Publication R8-TP2*. Atlanta: US Forest Service.

Krankina, O. N., & Harmon, M. E. (2006). Forest, carbon, and climate change: a synthesis of science findings. 79-85. Oregon Forest Resources Institute, Oregon State University College of Forestry, Oregon Department of Forestry.

Lacki, M., & Schwierjohann, J. (2001). Day-roost characteristics of northern bats in mixed mesophytic forest. *Journal of Wildlife Management, 65*(3), 482-488.

Lacki, M., Cox, D., Dodd, L., & Dickinson, M. (2009). Response of northern bats (Myotis septentrionalis) to prescribed fires in Eastern Kentucky forests. *Journal of Mammalogy, 90*(5), 1165-1175.

Lacki, M., Hayes, J., & Kurta, A. (2007). *Bats in Forest: Conservation and Management.* JHU Press.

Lugo, A., & Gucinski, H. (2000). Function, Effects, and Management of Forest Roads. *Forest Ecology and Management, 133*, pp. 249-262.

Malmsheimer, R. W., Heffernan, P., & Brink, S. (2008, April/May). Forest management solutions for mitigating climate change in the United States. *Journal of Forestry*, 141-156.

Martin, J., Palmer, W., Grimes, D., & Carroll, J. (2010). Mortality of adult Colinus virginianus L. (Northern Bobwhite) from prescribed fire. *Southeastern Naturalist, 9*(1), pp. 181-183.

Masters, R., & Waymire, J. (2000). The effects of timber harvest and fire frequency on wildlife and wildlife habitat in the Ouachita Mountains. Oklahoma State University & Oklahoma Department of Wildlife Conservation.

Masters, R., & Wilson, C. (1994). *Effects of midstory vegetation removal and fire on breeding birds and plant community composition in Red-cockaded woodpecker clusters.* Hot Springs: Ouachita National Forest.

Masters, R., Lochmiller, R., McMurry, S., & Buckenhofer, G. (1998). Small mammal response to pine-grassland restoration for red-cockaded woodpeckers. *Wildlife Society Bulletin, 26*(1), pp. 148-158.

Masters, R., Wilson, C., Bukenhofer, G., & Payton, M. (1996). Effects of pine-grassland restoration for red-cockaded woodpeckers on white-tailed deer forage production. *Wildlife Society Bulletin, 24*(1), pp. 77-84.

Miller, K. (2001). White-tailed deer. In *Wildlife of southern forests: habitat and management* (pp. 95-107). Blaine: Hancock House Publishers.

Moser, E. (2014). Aquatic Cumulative Effects (ACE) Output Analysis Protocol. *Draft*. A&B Ecosystems Enterprise Unit, USFS.

Moser, E. (2014). Aquatic Cumulative Effects (ACE) Output Analysis Protocol. *Draft*. A&B Ecosysstems Enterprise Unit, USFS.

Mowbray, T. 1. (1999). *Scarlet Tanager (Piranga olivacea).* (A. Poole, Ed.) Retrieved from The Birds of North America Online: http://bna.birds.cornell.edu/bna/species/479

National Wild Turkey Federation. (2006, March 15). *Spring burns help wildlife habitat and wild turkeys.* Retrieved from National Wild Turkey Federation: www.nwtf.org

NatureServe. (2013). Retrieved June 2013, from NatureServe Explorer: An Online Encyclopedia of Life: http://www.natureserve.org/explorer

ODWC. (2013). Bat of Oklahoma Field Guide. 36. Oklahoma Department of Wildlife Conservation.

Oklahoma Cooperative Extension Service. (1994). *Forestry and Water Quality: A Review of Watershed Research in the Ouachita Mountains.* Circular, Oklahoma State University, Division of Agricultural Sciences and Natural Resources.

Opler, P., & Malikul, V. (1998). Genus Speyeria. In *Eastern butterflies Peterson Field Guide* (p. 236). New York: Houghton Mifflin Company.

Paillet, F., & Cerny, K. (2012). Reconstructing the development of two Ozark chinquapin (Castanea ozarkensis) stands in the pre-blight forests of northwest Arkansas. *The Journal of the Torrey Botanical Society, 139*(2), 211-225.

Palmer, W., Robertson, K., & Masters, R. (2004). The culture of fire in the southeast. *Transactions of the Sixty-ninth North American Wildlife and Natural Resources Conference* (pp. 354-368). Spokane: Wildlife Management Institute.

Perry, R. (2011). Fidelity of bats to forest sites revealed from mist-netting recaptures. *Journal of Fish and Wildlife Management, 2*(1), 112-116.

Perry, R. W., & Thill, R. E. (2003). Initial effects of reproduction cutting treatments on residual hard mast production in the Ouachita Mountains. *Southern Journal of Applied Forestry*(27), 253-258.

Perry, R. W., Thill, R. E., Peitz, D. G., & Tappe, P. A. (1999). Effects of different silvicultural systems on initial soft mast production. *Wildlife Society Bulletin*(27), pp. 915-923.

Perry, R., & Thill, R. (2007). Roost selection by male and female northern long-eared bats in a pine-dominated landscape. *Forest Ecology and Management, 247*, 220-226.

Perry, R., Thill, R., & David Jr., M. (2008). Scale-dependent effects of landscape structure and composition on diurnal roost selection by forest bats. *Journal of Wildlife Management, 72*(4), 913-92.

Perry, R., Thill, R., & Leslie, D. (2007). Selection of roosting habitat by forest bats in a diverse forested landscape. *Forest Ecology and Management, 238*, pp. 156-166.

Pierce, G. (2005). Ecology of the Northern Bobwhite Quail in Missouri. *MU Columbia Extension*.

Riddle, J. D., Moorman, C. E., & Pollock, K. H. (2008). The importance of habitat shape and landscape context to Northern Bobwhite populations. *Journal of Wildlife Management*(72), 1376-1382.

Robison, a. A. (1995). *Only in Arkansas: A study of the endemic plants and animals of the state.* University of Arkansas Press.

Robison, H. W. (1988). *Fishes of Arkansas.* University of Arkansas Press; 1st edition (1609).

Rose, F., Simpson, T., Ott, J., Manning, R., & Martin, J. (2010). Survival of Western Cottonmouths (Agkistrodon piscivorus leucostoma) in a pulsating environment. *The Southwestern Naturalist, 55*(1), pp. 11-15.

Roseberry, J. L., & Sudkamp, S. D. (1998). Assessing the suitability of landscapes for northern bobwhite. *Journal of Wildlife Management*(62), 895-902.

Rosenberg, K., Rohrbaugh, R., Barker, S., Lowe, J., Hames, R., & Dhondt, A. (1999). A land manager's guide to improving habitat for scarlet tanagers and other forest-interior birds. The Cornell Lab of Ornithology.

Rosene, W. (1984). *The bobwhite quail: Its life and management.* Hartwell GA: The Sun Press.

Salwasser, H. (2006). Forest, carbon, and climate change: a synthesis of science findings. Oregon Forest Resources Institute, Oregon State University College of Forestry, Oregon Department of Forestry.

Sauer, J., Hines, J., Fallon, J., Pardieck, K., Ziolkowski JR, D., & Link, W. (2014). The North American Breeding Bird Survey, Results and Analysis 1966-2012. *Version 02.19.2014*. Laurel, MD, USA: USGS Patuxent Wildlife Research Center.

Saugey, D. A., McDaniel, R. V., England, D. R., Rowe, M. C., Chandler-Mozisek, L. R., & Cockran, B. G. (1993). Arkansas range extensions of the Eastern small-footed bat (Myotis leibii), Northern long-eared bat (Myotis septentrionalis), and additional county records for the Silver-haired bat (Lasionycteris noctivagans), Hoary bat (Lasiurus cinereus) . . . *Proceedings Arkansas Academy of Science, 47*.

Schaub, A., Otswald, J., & Siemers, B. (2008). Foraging bats avoid noise. *Journal of Experimental Biology, 211*, 3174-3180.

SERA. (2011a). Glyphosate-Human Health and Ecological Risk Assessment - Final Report. Syracuse, NY, USA: Syracuse Environmental Research Associates, Inc. Retrieved from http://www.fs.fed.us/foresthealth/pesticide/pdfs/Glyphosate_SERA_TR-052-22-03b.pdf

SERA. (2011b). Imazapyr - Human health and Ecological Risk Assessment - Final Report. Syracuse, NY, USA: Syracuse Environmental Research Associates, Inc. Retrieved from http://www.fs.fed.us/foresthealth/pesticide/pdfs/Imazapyr_TR-052-29-03a.pdf

SERA. (2011c). Triclopyr-Revised Human health and Ecological Risk Assessment -Final Report. Syracuse, NY, USA: Syracuse Environmental Research Associates, Inc. Retrieved from http://www.fs.fed.us/foresthealth/pesticide/pdfs/052-25-03aTriclopyr.pdf

Spencer, L. (2006). *Arkansas butterflies and moths.* Little Rock: Ozark Society Foundation.

Steffen, D., LaFon, N., & Norman, G. (2002). Turkeys, acorns, oaks. In W. McShea, & W. Healy (Eds.), *Oak forest ecosystems: ecology and management for wildlife* (pp. 241-255). The Johns Hopkins University Press.

Stransky, J., & Hall, L. (1979). Effects of a winter fire on fruit yields of woody plants. *Journal of Wildlife Management, 43*, 1007-1010.

Thill, R., Craig, R., & Koerth, N. (2004). Shortleaf pine-bluestem restoration for Red-cockaded woodpeckers in the Ouachita Mountains: implications for other taxa. In R. Costa, & S. Daniels (Eds.), *Red-cockaded woodpecker: road to recovery* (pp. 657-671). Blaine: Hancock House Publishers.

Thompson, F. R., & DeGraaf, R. M. (2001). Conservation approaches for woody, early successional communities in the eastern United States. *Wildlife Society Bulletin*(29), pp. 413-424.

Trauth, S., Robison, H., & Plummer, M. (2004). *The amphibians and reptiles of Arkansas.* Fayetteville: University of Arkansas Press.

Tucker, J., Robinson, W., & Grand, J. (2006). Breeding productivity of Bachman's sparrows in fire-managed longleaf pine forests. *The Wilson Journal of Ornithology, 118*(2), 131-137.

US Environmental Protection Agency. (2014). *Criteria Pollutant Maps.* Retrieved from http://www.epa.gov/airquality/greenbk

USDA. (1994). *Forest Service Handbook 2109.*

USDA. (2005c). *Biological Evaluation for Land Resource Management Plan.* Ouachita National Forest.

USDA. (2007a). *Amended Regional Forester's Sensitive Species list .*

USDA. (2008). *Mitigation factors outlined in the Scenery Treatment Guide – Southern Regional National Forests .*

USDA. (2008). *Program and Procedure for Salvage of Dead, Down, Damaged, or Hazard Trees.*

USDA. (2009). *Implementation of Forest Insect and Disease Suppression Actions.*
USDA. (2015). *Best Management Practices.*
USDA. (2016). *(Torr. & A. Gray) Walp.* http://plants.usda.gov/core/profile?symbol=VANU.
USDA Forest Service. (2005a). Revised Land and Resource Management Plan, Ouachita National Forest, Arkansas and Oklahoma. Forest Service, Southern Region.
USDA Forest Service. (2005b). Final Environmental Impact Statement, Revised Land and Resource Management Plan, Ouachita National Forest, Arkansas and Oklahoma. Forest Service, Southern Region.
USDA Forest Service. (2010). *Fiscal year 2009 monitoring and evaluation report for the Land and Resource Management Plan.* Hot Springs: Ouachita National Forest, Southern Region.
USDA Forest Service. (2011). *Five-Year Review of the 2005 Forest Plan.* Hot Springs AR: Ouachita National Forest.
USDI - US Fish and Widlife. (2005a). *Concurrence to Programmatic Biological Assessment of Ouachita National Forest Revised Land and Resource Management Plan.* Conway, AR: Arkansas Field Office.
USDI Fish and Wildlife Service. (2001, October 9). Endangered and Threatened Wildlife and Plants: Determination of Endangered status for the scaleshell mussel. Final rule. *Federal Register, 66, 195*, 51322-51339.
USDI Fish and Wildlife Service. (2011, June 29). Endangered and Threatened Wildlife and Plants; 90-day Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Threatened or Endangered. *Federal Register, 76, 125*, 38095-38106.
USDI Fish and Wildlife Service. (2013, October 2). Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Threatened or Endangered. *Federal Register, 78(191)*, 61045-61080.
USDI Fish and Wildlife Service. (2013a, September 27). Northern long-eared bat fact sheet.
USDI-Fish and Wildlife Service. (2007). *Endangered and Threatened Wildlife and Plants: Removing the Bald Eagle in the Lower 48 States from the list of Endangered and Threatened Wildlife.* Federal Register, Final Rule. Volume 72, Number 130.
Van Lear, D., & Brose, P. (2002). Fire and oak management. In W. McShea, & W. Healy (Eds.), *Oak forest ecosystems: ecology and management for wildlife* (pp. 269-279). The John Hopkins University Press.
Weber, P., Preston, S., Dlugos, M., & Nelson, A. (2008). The effects of field mowing on adult butterfly assemblages in central New York state. *Natural Areas Journal, 28*(2), 130-143.
Welch, J. R., Miller, K. V., Palmer, W. E., & Harrington, T. B. (2004). Response of understory vegetation important to the northern bobwhite following imazapyr and mechanical treatments. *Wildlife Society Bulletin*(32), pp. 1071-1076.
Wells, C., & Smith, E. (2013). Observations of resource use by the threatened Diana fritillary butterfly (Speyeria diana) in the Southern Applachian Mountains, USA. *Journal of Insects*(Article ID 130694), 4.
Wisconsin DNR. (2013). Wisconsin northern long-eared bat species guidance. *PUB-ER-700*. Madison, Wisconsin, USA: Bureau of Natural Heritage Conservation, Wisconsin Department of Natural Resources.

Yarrow, G. K., & Yarrow, D. T. (2005). *Managing wildlife: managing wildlife on private lands in Alabama and the southeast.* Alabama Wildlife Federation.

Zaczek, J., Groninger, J., & Van Sambeek, J. (2002). Stand dynamics in an old-growth hardwood forest in Southern Illinois, USA. *Natural Areas Journal, 22*, 211-219.

Appendices

Appendix A: Activities by Compartment and Stand

The following tables list the specific actions proposed for each Forest compartment and stand. All treatments, except nest structures, are given in acres. Acreage values are estimates based on best available data; actual treated area may be revised to reflect more accurate field information and stand analysis.

The No Herbicide Alternative would consist of the same treatments as the Proposed Action, except that hand tool or mechanical methods would be employed to accomplish site preparation, release, midstory removal, and overstory mast development.

Proposed Activities by Compartment and Stand (Table A.1)

Compartment 1419

Stand	Total stand Acres	Plant Seedlings if necessary (Seed Tree Harvest)	Plant seedlings if necessary (Shelterwood Harvest)	Commercial Thinning (Woodland)	Group Selection	Midstory Reduction	Precommercial Thin	Release (herbicide) (Stand Improvement)	Site Preparation (herbicide) (Stand Improvement/Regeneration	Prescribed Burning (Site Preparation)	Hand Planting	WSI and Burning *denotes herbicide use in lieu of burning	Existing Pond Maintenance (includes 2 nest boxes/pond)	Additional Wildlife Burning	Ecosystem Burning/Fuel Reduction
		acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	#	acres	acres
1	32	0	0	0	0	0	0	0	0	0	0	0	0	0	32
2	46	0	0	0	0	0	0	0	0	0	0	0	0	0	46
3	35	0	0	28	7	28	0	7	7	7	0	0	1	0	35
4	22	0	0	22	0	22	0	0	0	0	0	0	0	0	22
5	70	0	0	70	0	70	0	0	0	0	0	0	0	0	70
6	105	0	0	0	0	0	0	0	0	0	0	0	3	0	105
7	67	0	0	67	0	67	0	0	0	0	0	0	1	0	67
8	52	0	0	0	0	0	0	0	0	0	0	0	0	0	52
9	24	0	0	24*	0	0	0	0	0	0	0	24	0	0	24
10	45	0	0	0	0	0	0	0	0	0	0	0	1	0	45
11	34	0	0	0	0	0	0	0	0	0	0	0	0	0	34
12	28	0	0	0	0	0	0	0	0	0	0	0	0	12	22
13	135	0	0	0	0	0	0	0	0	0	0	0	0	0	135
14	26	26	0	0	0	0	0	26	26	26	0	0	0	0	20
15	36	36	0	0	0	0	0	36	36	36	0	0	1	0	36

16	44	0	40	0	0	0	0	40	40	40	0	0	0	0	44
17	5	0	0	5	0	5	0	0	0	0	0	0	0	0	5
18	24	0	0	0	0	0	0	0	0	0	0	0	0	0	24
19	130	0	0	0	0	0	0	0	0	0	0	0	0	0	115
20	10	0	0	0	0	0	0	0	0	0	0	0	0	10	10
21	26	26	0	0	0	0	0	26	26	26	0	0	0	0	26
23	61	0	0	61*	0	0	0	0	0	0	0	61	0	0	61
Total		88	40	277	7	192	0	135	135	135	0	85	7	22	1030

Compartment 1420

Stand	Total stand Acres	Plant Seedlings if necessary (Seed Tree Harvest)	Plant seedlings if necessary (Shelterwood Harvest)	Commercial Thinning (Woodland)	Group Selection	Midstory Reduction	Precommercial Thin	Release (herbicide) (Stand Improvement)	Site Preparation (herbicide) (Stand Improvement/Regeneration	Prescribed Burning (Site Preparation)	Hand Planting	WSI and Burning *denotes herbicide use in lieu of burning	Existing Pond Maintenance (includes 2 nest boxes/pond)	Additional Wildlife Burning	Ecosystem Burning Fuel Reduction
		acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	#	acres	acres
1	54	0	0	0	0	0	0	0	0	0	0	0	0	54	0
2	65	0	0	53	12	53	0	12	12	12	0	0	0	0	65
3	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	127	40	0	0	0	0	0	40	40	40	0	0	0	0	120
5	92	0	0	92	0	92	0	0	0	0	0	0	0	0	0
6	87	0	0	0	0	0	0	87	87	87	0	0	0	0	0
7	139	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	73	0	0	0	0	0	0	0	0	0	0	0	0	73	73
9	263	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	232	0	0	0	0	0	0	0	0	0	0	232*	0	0	0
11	82	0	0	0	0	0	0	0	0	0	0	0	0	82	60
12	231	0	0	0	0	0	0	0	0	0	0	0	0	115	115
13	97	40	0	0	0	0	0	40	40	40	0	0	0	0	80
14	31	0	0	31	0	31	0	0	0	0	0	0	0	0	15

15	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	60	40	0	20	0	20	0	40	40	40	0	0	0	0	55
19	39	0	0	0	0	0	39	0	0	0	0	0	1	0	32
20	75	0	0	75	0	75	0	0	0	0	0	0	0	0	72
21	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	77	0	40	0	0	0	0	40	40	40	0	0	0	0	0
24	33	0	0	0	0	0	0	0	0	0	0	33	0	0	33
25	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	78	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	112	0	40	0	0	0	0	40	40	40	0	0	0	0	0
30	35	0	35	0	0	0	0	35	35	35	0	0	0	0	0
31	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	55	0	0	55	0	55	0	0	0	0	0	0	0	0	0
34	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	38	0	0	0	0	0	0	0	0	0	0	0	0	38	38
37	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	30	0	0	0	0	0	0	0	0	0	0	0	0	0	12
41	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	71	0	0	0	0	0	0	0	0	0	0	0	0	0	30
Total		120	115	326	12	326	39	334	334	334	0	232*	1	362	800

Compartment 1430

Stand	Total stand Acres	Plant Seedlings if necessary (Seed Tree Harvest)	Plant seedlings if necessary (Shelterwood Harvest)	Commercial Thinning (Woodland)	*Group Selection*	Midstory Reduction	Precommercial Thin	Release (herbicide) (Stand Improvement)	Site Preparation (herbicide) (Stand Improvement/Regeneration	Prescribed Burning (Site Preparation)	Hand Planting	WSI and Burning *denotes herbicide use in lieu of burning	Existing Pond Maintenance (includes 2 nest boxes/pond)	Additional Wildlife Burning	Ecosystem Burning/Fuel Reduction
		acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	#	acres	acres
1	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	9	0	0	0	0	0	0	0	0	0	0	0	0	9	9
3	19	0	0	0	0	0	0	0	0	0	0	0	0	19	19
4	41	0	0	41	0	41	0	0	0	0	0	0	0	0	41
5	45	0	0	0	0	0	0	0	0	0	0	0	0	0	45
6	24	0	0	0	0	0	0	0	0	0	0	0	0	0	24
7	35	0	0	0	0	0	0	0	0	0	0	0	0	0	35
8	71	0	0	0	0	0	0	0	0	0	0	0	0	0	71
9	42	0	0	0	0	0	0	0	0	0	0	0	0	42	42
10	68	0	0	0	0	0	0	0	0	0	0	0	0	0	62
11	129	0	0	0	0	0	0	0	0	0	0	0	0	0	129

12	79	0	0	0	0	0	0	0	0	0	0	0	0	79	79
13	97	0	0	0	0	0	0	0	0	0	0	0	0	97	97
14	62	0	0	0	0	0	0	0	0	0	0	0	1	62	62
15	34	0	0	0	0	0	0	0	0	0	0	0	1	0	34
16	22	0	0	0	0	0	0	0	0	0	0	0	0	0	22
17	13	0	0	0	0	0	0	0	0	0	0	0	0	0	13
18	18	0	0	0	0	0	0	0	0	0	0	0	0	18	18
19	78	0	0	0	0	0	0	0	0	0	0	0	0	78	78
20	24	0	0	0	0	0	0	0	0	0	0	0	0	0	24
21	45	0	0	0	0	0	0	0	0	0	0	0	0	0	45
22	19	0	0	0	0	0	0	0	0	0	0	0	0	0	19
23	39	0	0	0	0	0	0	0	0	0	0	0	0	23	39
24	38	0	0	0	0	0	0	0	0	0	0	0	0	38	38
25	26	0	0	0	0	0	0	0	0	0	0	0	0	0	26
26	58	0	0	0	0	0	0	0	0	0	0	0	0	0	58
27	27	0	0	0	0	0	0	0	0	0	0	0	0	27	27
28	19	0	0	0	0	0	0	0	0	0	0	0	0	19	19
29	15	0	0	0	0	0	0	0	0	0	0	0	0	15	15
30	21	0	0	0	0	0	0	0	0	0	0	0	0	21	21
31	33	0	0	0	0	0	0	0	0	0	0	0	0	33	33
32	26	0	0	0	0	0	0	0	0	0	26	0	26	26	
33	7	0	0	0	0	0	0	0	0	0	0	0	0	0	7
34	25	0	0	0	0	0	0	0	0	0	0	0	0	25	25
35	17	0	0	0	0	0	0	0	0	0	0	0	0	0	17
36	49	0	0	0	0	0	0	0	0	0	0	0	0	0	49
37	23	0	0	0	0	0	0	0	0	0	0	0	0	23	23
38	29	0	0	0	0	0	0	0	0	0	0	0	0	0	29
39	25	0	0	0	0	0	0	0	0	0	0	0	0	0	25
Total		0	0	41	0	41	0	0	0	0	0	26	2	654	1445

Compartment 1431

Stand	Total stand Acres	Plant Seedlings if necessary (Seed Tree Harvest)	Plant seedlings if necessary (Shelterwood Harvest)	Commercial Thinning (Woodland)	Group Selection	Midstory Reduction	*Precommercial Thin*	*Release (herbicide) (Stand Improvement)*	*Site Preparation (herbicide) (Stand Improvement/Regeneration*	Prescribed Burning (Site Preparation)	*Hand Planting*	WSI and Burning * denotes herbicide use in lieu of burning	Existing Pond Maintenance (includes 2 nest boxes/pond)	Additional Wildlife Burning	Ecosystem Burning/Fuel Reduction
		acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	#	acres	acres
1	10	0	0	10	0	10	0	0	0	0	0	0	0	0	0
2	86	0	0	0	0	0	0	0	0	0	0	86	0	0	86
3	161	0	0	0	0	0	0	0	0	0	0	0	0	0	161
4	10	0	0	0	0	0	0	0	0	0	0	10	0	0	10
5	75	0	0	0	0	0	0	0	0	0	0	75	0	0	75
6	58	0	0	0	0	0	0	0	0	0	0	58	0	0	58
7	9	0	0	0	0	0	0	0	0	0	0	0	0	0	9
8	26	0	0	0	0	0	0	0	0	0	0	0	0	0	26
9	44	0	0	0	0	0	0	0	0	0	0	0	0	0	44
10	49	0	0	0	0	0	0	0	0	0	0	0	0	0	49
11	250	0	0	0	0	0	0	0	0	0	0	250	0	0	250
12	22	0	0	0	0	0	0	0	0	0	0	0	0	0	22

13	16	0	0	0	0	0	0	0	0	0	0	0	0	16
14	78	0	0	0	0	0	0	0	0	0	0	70	0	0	78
15	18	0	0	0	0	0	0	0	0	0	0	18	0	0	18
16	41	0	0	0	0	0	0	0	0	0	0	0	0	41	41
17	31	0	0	0	0	0	0	0	0	0	0	0	0	0	31
18	50	0	0	0	0	0	0	0	0	0	0	50	0	0	50
19	171	0	0	0	0	0	0	0	0	0	0	0	0	0	16
20	118	0	0	0	0	0	0	118	0	0	0	0	0	0	118
21	56	0	0	56*	0	0	0	0	0	0	0	56	0	0	56
22	36	0	0	0	0	0	0	36	0	0	0	0	0	0	36
23	36	0	0	0	0	0	0	36	0	0	0	0	0	0	32
24	16	0	0	0	0	0	0	0	0	0	0	0	0	0	16
25	27	0	0	0	0	0	0	0	0	0	0	27*	0	0	0
26	216	0	40	0	0	0	0	40	40	40	0	0	0	0	162
27	16	0	0	0	0	0	0	0	0	0	0	16	0	0	16
28	88	0	0	0	0	0	0	0	0	0	0	0	0	0	88
29	29	0	0	0	0	0	0	0	0	0	0	0	0	0	29
30	26	0	0	0	0	0	0	0	0	0	0	0	0	0	26
31	34	0	0	0	0	0	0	0	0	0	0	0	0	0	34
32	18	0	0	0	0	0	0	0	0	0	0	0	0	0	18
33	50	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Total		0	40	66	0	10	0	230	40	40	0	689	0	41	1721

Compartment 1432

Stand	Total stand Acres	Plant Seedlings if necessary (Seed Tree Harvest)	Plant seedlings if necessary (Shelterwood Harvest)	Commercial Thinning (Woodland)	Group Selection	Midstory Reduction	*Precommercial Thin*	*Release (herbicide) (Stand Improvement)*	*Site Preparation (herbicide) (Stand Improvement/Regeneration*	Prescribed Burning (Site Preparation)	*Hand Planting*	WSI and Burning * denotes herbicide use in lieu of burning	Existing Pond Maintenance (includes 2 nest boxes/pond)	Additional Wildlife Burning	Ecosystem Burning/Fuel Reduction
		acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	#	acres	acres
1	78	0	0	0	0	0	0	0	0	0	0	0	0	0	62
2	75	0	0	0	0	0	0	75	0	0	0	0	0	0	64
3	42	0	0	42	0	42	0	0	0	0	0	0	0	0	42
4	27	0	0	0	0	0	0	0	0	0	0	0	0	0	27
5	63	0	0	63	0	63	0	0	0	0	0	0	0	0	63
6	65	0	20	0	0	0	0	20	20	20	0	0	0	0	65
7	90	0	0	0	0	0	0	0	0	0	0	0	0	90	90
8	52	0	0	0	0	0	0	0	0	0	0	0	0	0	52
9	87	0	0	0	0	0	0	0	0	0	0	0	0	87	87
10	67	0	0	0	0	0	0	0	0	0	0	0	0	0	67
11	217	0	0	0	0	0	0	0	0	0	0	0	0	217	184
12	32	0	0	0	0	0	0	0	0	0	0	0	0	32	32
13	135	0	0	0	0	0	0	0	0	0	0	0	0	135	135
14	72	0	0	0	0	0	0	0	0	0	0	0	0	0	72
15	23	0	0	0	0	0	0	0	0	0	0	23	0	0	23
16	149	0	0	0	0	0	0	0	0	0	0	149	0	0	149
17	43	0	0	0	0	0	0	0	0	0	0	0	0	0	43
18	88	0	0	0	0	0	0	88	0	0	0	0	0	0	88

19	22	0	0	0	0	0	0	0	0	0	0	0	0	0	22
20	66	0	0	0	0	0	0	0	0	0	0	0	0	0	66
21	54	0	0	0	0	0	0	0	0	0	0	0	1	0	54
22	15	0	0	0	0	0	0	0	0	0	0	0	0	0	15
23	134	0	0	0	0	0	0	0	0	0	0	0	0	0	108
24	58	0	0	0	0	0	0	0	0	0	0	0	0	0	58
25	24	0	0	24	0	24	0	0	0	0	0	0	0	0	24
26	20	0	0	0	0	0	0	0	0	0	0	0	0	0	20
27	14	0	0	0	0	0	0	0	0	0	0	14	0	0	14
28	27	0	0	0	0	0	0	0	0	0	0	0	0	27	27
29	92	0	20	72	0	72	0	20	20	20	0	0	0	0	92
30	48	0	0	0	0	0	0	0	0	0	0	48	0	0	48
Total		0	40	201	0	201	0	203	40	40	0	234	1	588	1893

Compartment 1433

Stand	Total stand Acres	Plant Seedlings if necessary (Seed Tree Harvest)	Plant seedlings if necessary (Shelterwood Harvest)	Commercial Thinning (Woodland)	Group Selection	Midstory Reduction	*Precommercial Thin*	*Release (herbicide) (Stand Improvement)*	*Site Preparation (herbicide) (Stand Improvement/Regeneration*	Prescribed Burning (Site Preparation)	*Hand Planting*	WSI and Burning * denotes herbicide use in lieu of burning	Existing Pond Maintenance (includes 2 nest boxes/pond)	Additional Wildlife Burning	Ecosystem Burning/Fuel Reduction
		acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	#	acres	acres
1	138	0	0	0	0	0	0	0	0	0	0	138	0	0	69
2	104	0	0	0	0	0	0	0	0	0	0	104	1	0	104
3	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	68	0	0	0	0	0	0	0	0	0	0	0	0	68	68
5	38	0	0	0	0	0	0	0	0	0	0	0	0	38	38
6	57	0	0	0	0	0	0	0	0	0	0	0	0	0	57
7	56	0	0	0	0	0	0	0	0	0	0	0	0	56	56
8	37	0	0	37	0	37	0	0	0	0	0	0	0	0	0
9	75	0	0	75	0	75	0	0	0	0	0	0	0	0	67
10	54	0	0	54	0	54	0	0	0	0	0	0	0	0	54
11	103	0	0	103	0	103	0	0	0	0	0	0	0	0	103
12	73	0	0	73	0	73	0	0	0	0	0	0	1	0	73
13	52	0	0	52	0	52	0	0	0	0	0	0	0	0	52
14	92	0	0	0	0	0	0	0	0	0	0	0	0	0	92
15	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	12	0	0	0	0	0	0	0	0	0	0	0	0	12	0

17	50	0	20	0	0	0	0	20	20	20	0	0	0	0	50
18	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	44	0	0	0	0	0	0	0	0	0	0	0	0	0	44
20	115	40	0	0	0	0	0	40	40	40	0	0	0	0	115
21	159	0	0	0	0	0	0	0	0	0	0	0	0	0	59
22	32	0	0	0	0	0	0	0	0	0	0	0	0	0	32
23	21	0	0	0	0	0	0	0	0	0	0	0	0	0	21
24	10	0	0	0	0	0	0	0	0	0	0	0	0	10	10
25	6	0	0	0	0	0	0	0	0	0	0	0	0	0	6
26	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	10	0	0	0	0	0	0	0	0	0	0	0	0	0	10
28	8	0	0	0	0	0	0	0	0	0	0	0	0	0	8
29	15	0	0	15	0	15	0	0	0	0	0	0	0	0	15
34	10	0	0	0	0		0	0	0	0	0	0	0	0	10
Total		40	20	409	0	409	0	60	60	60	0	242	2	184	1213

Compartment 1434

Stand	Total stand Acres	Plant Seedlings if necessary (Seed Tree Harvest)	Plant seedlings if necessary (Shelterwood Harvest)	Commercial Thinning (Woodland)	Group Selection	Midstory Reduction	Clearcut	Precommercial Thin	*Release (herbicide) (Stand Improvement)*	*Site Preparation (herbicide) (Stand Improvement/Regeneration*	*Prescribed Burning (Site Preparation)*	Hand Planting	*WSI and Burning * denotes herbicide use in lieu of burning*	Existing Pond Maintenance (includes 2 nest boxes/pond)	Additional Wildlife Burning	Ecosystem Burning/Fuel Reduction
		acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	#	acres	acres
1	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	87
2	111	0	0	0	0	0	0	0	0	0	0	0	0	2	0	111
3	258	0	0	0	0	0	0	0	0	0	0	0	0	1	0	258
4	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33
5	66	0	0	0	0	0	0	0	0	0	0	0	66	0	0	66
6	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49
7	74	0	0	0	0	0	0	0	0	0	0	0	0	2	0	74
8	57	0	0	57	0	57	0	0	0	0	0	0	0	0	0	0
9	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
12	13	0	0	0	0	0	13	0	13	13	13	13	0	0	0	0
13	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
14	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75
16	68	0	0	0	0	0	0	0	0	0	0	0	0	1	0	68

17	192	0	0	0	0	0	0	0	0	0	0	0	0	0	180	176
18	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
21	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
22	36	0	0	0	0	0	0	0	0	0	0	0	0	1	36	36
23	27	0	0	27	0	27	0	0	0	0	0	0	0	0	0	0
24	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	25	0	0	25	0	25	0	0	0	0	0	0	0	0	0	0
26	34	0	0	0	0	0	0	0	0	0	0	0	34	0	0	0
27	50	0	0	0	0	0	0	0	0	0	0	0	0	1	0	50
28	71	0	0	71*	0	0	0	0	0	0	0	0	71	0	0	71
29	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
30	78	0	0	0	0	0	0	0	0	0	0	0	0	0	78	78
31	25	20	0	0	0	0	0	0	20	20	20	0	0	0	0	25
33	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		20	0	180	0	109	13	0	33	33	33	13	171	8	294	1359

Appendix B: Project Maps

Revised Forest Plan Management Areas
Proposed Harvests
Proposed Stand Improvements
Proposed Wildlife Habitat Improvements
Proposed Burn Units

Maps are not embedded into document due to file size constraints.
Maps are same as scoping maps available at:
www.fs.usda.gov/project/?project=45954