



Environmental Assessment

For
Bonnerdale
Project

Responsible Agency:
U.S. Forest Service
Ouachita National Forest
Caddo-Womble Ranger District

Responsible Official:
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Chapter 1

Purpose and Need for the Proposed Action

Proposed Action

The Caddo-Womble Ranger District proposes to implement the following management activities*:

- Regeneration harvest – 431 acres
- Site prep prescribed burn – 431 acres
- Site preparation (Chemical/Mechanical) – 431 acres
- Release (Chemical/Manual) – 768 acres
- Pre-Commercial Thinning – 768 acres
- Chop/Rip/Hand Plant shortleaf pine seedlings – 431 acres
- Intermediate harvest – 4,815 acres
- Wildlife stand improvement– 74 acres
- Pond improvement – 28 each
- Wildlife Opening Construction – 6 acres
- Wildlife opening improvements – 4 acres
- Nest boxes – 30 each
- Landscape burn – 9,285 acres
- Fire line construction – 34 miles
- Fire line maintenance – 12 miles
- Road construction – 0.7 miles
- Road reconstruction – 12.3 miles
- Temporary road construction – 19 miles
- Pre-haul road maintenance – 6.7 miles
- Watershed restoration treatment throughout project area
- Non-native invasive plant species treatment throughout project area

*All figures are approximate and are for total acres in a stand. Treatment acres would be less due to avoided slopes and/or riparian areas.

The Bonnerdale Project area is located in T3S, R22W, S21-23, 26-34; T3S, R23W, S25, 34-36; T4S, R22W, S3-9, 16-18; T4S, R23W, S1-4, 9-12, 14-16, 21, 22, 28 Garland, Hot Spring, and Montgomery Counties, Arkansas. This 16,520+/- acre area is comprised of Compartments 12, 16, 20-24, and 26-29. The proposed management activities would occur in Management Areas (MA) 6, 9, 14, and 21.

Purpose of the Action

The purpose of this action is to restore the health and vigor of the Bonnerdale Project area. These goals and objectives are designed to meet an ecosystem management approach. Each prescription is intended to foster a healthy native system, to create more natural appearing mixed pine and hardwood stands, increase biological diversity, reduce the threat of severe wildfires, minimize impacts of non-native invasive species and improve wildlife habitat. These management decisions are based on best available scientific research, ecological concepts and experience. By implementing these activities, we will provide for a diversity of plant and animal communities throughout the project area, provide early seral habitat in a well-distributed grass/forb or shrub/seedling stage, reduce fuel accumulation and produce a sustainable yield of wood products. All proposed activities will meet the requirements of the National Forest Management Act (NFMA).

Need for the Action

- Current conditions in the project area do not meet the desired conditions for the forest Management Areas (MAs) 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 also resulted in reduced open understories necessary for the growth of wildlife foods and the natural regeneration of pine and oak. The absence of fire has also caused loss of habitat conditions for plants adapted to fire.
- Pine stands contain damaged, poorly formed and diseased trees. The trees are overcrowded or densely stocked, reducing growth and crown development. These conditions result in stress and reduced vigor and health, thus increasing 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 need to reduce the amount of sedimentation from travel routes, resulting in road construction and watershed restoration treatments.
- There is a lack of high quality forage and a lack of nesting habitat for species requiring early successional habitat in the form of wildlife openings within the project area. Trees and shrubs are encroaching on the existing wildlife openings that occur within the area.
- There is a lack of suitable natural cavities for nesting within the project area.
- There are known populations of exotic and invasive plant species throughout the project area.

Existing Versus Desired Conditions

Contrasts between existing and desired conditions, as well as management activities designed to meet project objectives, are shown in Table 1.1. These management activities were determined to be within the scope of this analysis. Project activities would move the existing conditions toward the desired conditions as referenced in the Ouachita National Forest's Revised Forest Plan (RLRMP). Within the Proposed Management Activities column, the acres outlined for specific treatments are often given in total acres within a stand. **Sensitive areas such as riparian or steep slopes would be avoided, resulting in fewer actual acres disturbed.**

EXISTING CONDITIONS CONTRASTED TO DESIRED CONDITIONS (TABLE 1.1)

		Site Specific Needs	Proposed Management
Improve forest health by reducing the likelihood of insect infestations, disease outbreaks, and establishment of non-native, invasive species on National Forest System lands (RLRMP, p. 58).	58% of pine, pine-hardwood, hardwood and hardwood pine stands are above 70 years of age. This combined with overstocked conditions reduces the health and vigor of the stands and increases their susceptibility to damage from insects and disease.	Reduce basal area levels in stands that are overstocked. Reduce the percentage of older age classes in the project area. Provide healthy, young, vigorous stands.	• Regeneration harvests on 431 acres • Intermediate harvests on 4,815 acres • PCT/Release/TSI work on 768 acres. • 431 acres of site preparation • 431 acres hand planting shortleaf pine seedlings • Chemically release seedlings on 768 acres
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 and other overstocked stands contain damaged and poorly formed trees. These areas are also over-crowded 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.	• Regeneration harvests on 431 acres • Intermediate harvests on 4,815 acres
Within MA 14, grass-forb and seedling-sapling conditions are well represented, particularly in the portions suitable for timber management, where they make up at least 6% of the landscape (RLRMP, p.35). Limit even-aged regeneration cutting to no more than 14% of suitable acres managed under even-aged prescriptions, per 10-year entry. (RLRMP, WF002 p. 78)	There are 7,117 acres of suitable land within the project area, only 344 acres, or roughly 4.8%, qualifies as early seral (0-10 age year) habitat.	Provide at least 427 acres but not more than 1,400 acres of early seral (grass-forb or seedling-sapling) conditions.	• Regeneration harvests on 431 acres • Improve 4 acres of existing wildlife openings • Construct 6 acres of wildlife openings

Bonnerdale Project

Desired Conditions	Existing Conditions	Site Specific Needs	Proposed Management Activities
Provide for a diversity of plant and animal communities throughout the planning area. • Improve habitat for game and non-game species. (RLRMP, P.20) • Manage for identified natural plant communities. (RLRMP pp. 6-19) • Increase prescribed burning on the forest to help achieve and maintain desired future conditions. (RLRMP, OBJ011 p. 59)	Due to past fire suppression activities, the natural role of fire has been removed from the landscape. This has limited the amount of open understories necessary for wildlife foods, the lack of natural regeneration of pine and oak species, and the loss of habitat conditions for fire adapted plant species. Currently Warren Fields is in need of intense rehabilitation and habitat improvement.	Increase fire frequency to meet desired intervals for various ecosystems present in project area. (RLRMP, Part I) Ouachita Shortleaf Pine-Oak Forest Prescribed fire applied to at least 50% of the community every 5-7 years, with an occasional growing season fire. (RLRMP, p.7) Dry – Mesic Oak Forest Prescribed fire applied to at least 50% of the community every 4-5 years, with an occasional growing season fire. (RLRMP, p.8)	• Landscape prescribed burning on up to 9,285 acres. • At minimum 431 acres of site preparation prescribed burning. • Intermediate harvest on 4,815 • Wildlife stand improvement (WSI) midstory/overstory reduction on 74 acres • Wildlife Opening Construction 6 acres • Wildlife opening improvements on 4 acres • Wildlife pond improvement of 28 ponds • Installation of 30 nest boxes
Reduce fuel loads of National Forest System lands that have the greatest potential for catastrophic wildland fire (RLRMP, p. 68).	Fire suppression has resulted in excessive fuel accumulations, increasing the risk of damage to resources in the event of wildfire.	Minimize the risk of resource damage by reducing fuel loadings.	• Landscape prescribe burning on up to 9,285 acres. • 34 miles of fireline construction. • 12 miles of fireline maintenance
Where open habitats are not provided by other conditions, develop one permanent wildlife opening, one to five acres per 160 acres of habitat. (RLRMP, WF008 P. 78)	There is a lack of high quality forage and a lack of nesting habitat for species requiring early seral habitat.	Provide permanent open habitat for foraging and nesting within the project area.	• Wildlife opening Construction 6 acres • Wildlife opening improvements on 4 acres • Wildlife pond improvement of 28 ponds
Develop and operate the road system, maintained to the minimum standard needed to meet the requirements of the proposed actions, protect the environment, and provide for reasonable and safe access. (RLRMP p. 67)	There is no access to some of the stands proposed for harvest and silvicultural activities. Some of the roads would not support timber hauling in their current condition.	Provide access to stands in need of silvicultural treatment. Improve road conditions on travel ways proposed for timber hauling.	• Road construction of 0.7 miles • Road Reconstruction on approx. 12.3 miles • Temporary road construction on approx. 19 miles • Pre-haul road maintenance on approx. 6.7 miles
Treat forest to eliminate non-native, invasive species. (RLRMP, OBJ03, p. 59)	Non-native, invasive species present within the project area include <i>Sericea lespedeza</i> and <i>Albizia julibrissin</i>	Treat approximately 50 acres of NFS lands across the project area towards meeting the forest target of 300 acres per year.	• Mechanical removal • Removal with herbicide treatment

Desired Conditions	Existing Conditions	Site Specific Needs	Proposed Management Activities
Maintain or improve watershed health. Conduct watershed improvement on at least 40 acres per year. (RLRMP, OBJ14, OBJ15, p. 62)	Roads, unclassified trails, and other areas have been identified as having active erosion.	Replace eroded culverts and restore fish passage. Clean up illegal dump sites and restrict access where applicable. Prevent/repair resource damage along roads, trails, gravel pits, and other areas identified with appropriate erosion control measures.	• Watershed restoration treatment throughout project area

Scope of This Environmental Analysis

History of the Planning and Scoping Process

The Caddo-Womble District interdisciplinary team (IDT) initiated internal scoping June 29th, 2015. External scoping was initiated on July 31st, 2015. Project announcement letters requesting comments on the proposal were distributed to interested government agencies, groups and individuals. The project was also published in the Ouachita National Forest Schedule of Proposed Actions. Two responses to the Project announcement letter were received:

- Arkansas Department of Health requested notification of the Engineering Section and the Amity Waterworks prior to herbicide application within the Caddo River watershed.
- One individual expressed concern over adverse effects of logging and road construction on forest resources, and opposed glyphosate (herbicide) use for vegetation management.

Relevant Planning Documents

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

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

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 (RLRMP, pp. 6-26); Strategies (RLRMP, pp. 27-72); and Design Criteria (RLRMP, pp. 73-123) that apply to the forest lands identified in this proposal are incorporated by reference.

The treatments described in the Bonnerdale Project Environmental Assessment are consistent with the management direction of the RLRMP and are typical of those for which environmental effects are disclosed in the FEIS. This assessment tiers to these documents.

Issues

Based on the site-specific concerns raised during scoping, the following issues 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
- **Issue 2:** Logging and road construction may harm natural resources.
Method of measurement: Universal Soil Loss Equation (USLE) values, Aquatic Cumulative Effect (ACE) model values

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

Alternatives Documented in Detail

Alternative A: No Action

In this alternative, no management activities other than those previously permitted and approved activities would continue in the project area:

- Road maintenance – normal and emergency road maintenance would continue on all existing roads.
- Power line right of way (ROW) maintenance would continue on existing ROW's.
- Fire suppression – natural caused fires may be suppressed unless appropriate conditions allow for it to be used as a management tool to accomplish resource needs. Human caused fires by accident or intention (arson) would be suppressed.
- Off road vehicle use – ORV use of the area would continue under the Travel Management Project for the Ouachita National Forest.
- Camping would continue under the current rules of the Ouachita National Forest. Special restrictions would apply during times of wildfire threat.
- Hunting and Fishing would continue under the rules of the Arkansas Game and Fish Commission.
- Firewood cutting would continue under the permitting rules of the Ouachita National Forest, the public would continue to harvest firewood.
- Rock gathering would continue under the permitting rules of the Ouachita National Forest, the public would continue to collect rock for personal use.
- Maintenance of previously established wildlife openings would occur.
- Existing quartz, shale and gravel mining would continue in approved locations.

Alternative B: Proposed Action

Description of Treatments (See Appendix A for list of activities by compartment and stand. See Appendix B for maps displaying activity locations).

Even Age Regeneration Harvest (Modified Seed Tree Regeneration - ST) – A timber harvest cut designed to obtain natural regeneration from seed trees left for that purpose. Approximately 10-15 sq. ft. of pine, 5-10 sq. ft. of hardwood basal area per acre is retained in the overstory. Seed trees are retained indefinitely. This cut would establish a two-aged stand. This treatment differs from a traditional seed tree by retaining a mix of hardwoods and pines in the overstory after regeneration. Trees harvested in these areas may be utilized for public firewood or commercial sale.

To facilitate natural pine regeneration, adequate site preparation is needed to disturb the soil surface in the newly created openings. Competing vegetation may be removed manually with chainsaws, heavy equipment, scarifying, ripping, prescribed fire, herbicide application and/or the use of a large steel drum pulled behind a bulldozer to chop. If warranted, the herbicide triclopyr, imazapyr, imazapic and/or glyphosate may be applied using either hack-and-squirt or foliar spray by hand method. Prescribed fire will be employed in late summer/early fall months for best results. However, prescribed burning may be conducted during the winter or early spring months to combine activities with other wildlife habitat/fuel reduction prescribed burning. When burning is not possible, a mechanical treatment such as scarification or ripping of the area may be used. When possible, site preparation activities will coincide with adequate cone crops. If after five years there are fewer than 150 pine seedlings per acre, the area will be hand planted with genetically improved shortleaf pine seedlings. Where established regeneration is present, seedlings may regenerate too densely causing overcrowded conditions, requiring pre-commercial thinning and/or release.

Chemical Site Preparation - After pine regeneration harvest, hardwoods would be reduced to 20% of the residual basal area of pine using herbicide application in the form of foliar spray, stem injection, and/or chainsaw fell and cut surface spray. A minimum of 5 square feet per acre of basal area of overstory hardwoods would be retained where available. In modified seed tree harvest areas one-half acre clumps of hardwoods per 20 acres of harvest area would be retained in order to create den trees. These areas may be made available for firewood or commercial sale.

Mechanical Site Preparation - Competing vegetation may be removed manually with chainsaws, heavy equipment and/or ripping. This will be used in lieu of or in addition to other site prep methods to ensure areas are properly prepared for future seed/seedlings. These areas may be made available for firewood or commercial sale.

Prescribed Burn Site Preparation - After chemical or mechanical site preparation activities have been conducted, prescribed burning may be employed in the even-aged regeneration harvest areas. This treatment would further reduce brush, downed-woody fuels, and duff and litter accumulations that may impede regeneration establishment. A detailed description of burning is provided later in this document under ecosystem prescribed burning.

Hand Plant Shortleaf Pine - Hand planting of shortleaf pine seedlings will be 8 X 10 spacing. If adequate amounts of pine regeneration (150 trees per acre) are not established, within 5 years in natural regenerated areas, these areas would be chopped, ripped and pine seedlings would be re-planted to meet target stocking levels.

Pre-commercial Thinning (PCT)/Release - Regenerated pine stands between 5 and 10 years of age would be thinned to a maximum of 700 trees per acre, averaging a 10 x 10 foot spacing, using hand tools or herbicide application as described on the previous page. Leave trees would be free of all competing vegetation such as vines and woody stems to ensure survival, reduced susceptibility to insects and disease, and increase growth of the

residual stand. Poorly formed trees would also be removed. This may be accomplished manually with hand tools (e.g. chainsaws) or with the herbicides applied as a foliar spray or cut surface application to remove the overtopping and competing vegetation and brush. A foliar spray may be applied to areas with vegetation less than six feet tall and with pine regeneration that does not require thinning. A cut surface application is employed in areas with vegetation greater than six feet tall and/or with pine regeneration requiring thinning. During any activities, sufficient hardwood trees would be left scattered throughout the stand to ensure a 10 to 30 percent hardwood component in the stand. When selecting hardwood trees, preference would be given to mast producers. Final stocking after treatments would be 250-500 pine stems per acre. These areas may be made available for commercial sale.

Intermediate Harvest/Commercial Thinning (CT) - Stands are thinned to a total residual basal area of 60-70 square feet per acre based on the average stand diameter and community type as listed in Table 3.6 Thinning Guide by Community Group (RLMP). Damaged, diseased, suppressed, and poorly formed trees would be targeted first for removal. These areas may be made available for commercial sale. Hardwood will be thinned and will be made available for commercial or firewood sale.

Densely stocked loblolly and shortleaf pine plantations would be thinned to a residual basal area of 50-60 ft² per acre. For mechanical harvesting equipment to operate within these stands and to reduce the amount of damage to the remaining stand, a minimum spacing between trees of 18 to 20 feet is required. These stands, with average diameters less than 10 inches will be thinned below the basal area guides listed in Table 3.6 Thinning Guide by Community Group (RLMP). Pursuant to RLMP Design Criteria FI005, deviations from these guides are allowable if site-specific conditions warrant, subject to approval by the project Responsible Official. Stands with an average diameter of six inches would be thinned to a basal area of 30 square feet. Damaged, diseased, suppressed, and poorly formed trees would be targeted first for removal. These stands are subject to severe Southern pine and ips beetle hazards. Should an outbreak of either pest occur, control would be extremely difficult with expectations of large outbreaks and severe damage to these and adjacent stands. Control of wildfires in dense stands such as these is extremely difficult. Firelines are difficult to construct and the dense stands present dense vertical as well as horizontal fuels. Few hardwoods have been able to compete with the dense and vigorously growing pine. The appearance of these stands is a very dense monoculture of pine timber. These areas may be made available for commercial sale. Hardwood, if present, will be thinned and made available for commercial or firewood sale.

Intermediate Harvest / Woodland Stand Restoration (WSR) - Using a combination of fire, chainsaws, and/or herbicides; the overall basal area will be reduced as listed in Table 3.6 Thinning Guide by Community Group (RLMP). to allow for the development of a grass/forb understory. These areas may be made available for firewood or commercial sale. Subsequent treatments will be required whenever there are more than 150 seedlings per acre over three feet tall covering more than half the area or whenever grass/forbs comprise less than half of the ground cover.

Pond Improvement - Activities would include repairing spillways, improving parking areas, installing signs, building fishing piers, clearing vegetation, and restocking of native fish species. Traditional methods of controlling nuisance vegetation within and surrounding ponds have proven unsuccessful or impracticable. With Forest Supervisor approval, the use of aquatic labeled herbicides would be used to control invasive or nuisance aquatic vegetation.

Wildlife Opening Improvement & Creation – Activities would include timber harvest, brush hogging, disking, fertilizing, and seeding existing wildlife openings with native warm and cool season grasses and forbs. These areas may be made available for firewood or commercial sale.

Wildlife Stand Improvement/Midstory Removal – This is achieved by using a combination of fire, chainsaws and/or herbicides to remove suppressed and intermediate trees. By reducing the mid story, it will allow more light to filter throughout the forest canopy and spur the growth of understory vegetation. These areas may be available for firewood.

Watershed Restoration - Roads, trails, gravel pits, and areas with active erosion would be stabilized. Disturbed soil areas would be re-vegetated with native species, water barred and fertilized. Identified dump sites would be cleaned up and rehabilitated.

Invasive/Noxious Plant Species Control – Identified invasive species, but not limited to, fescue, Japanese honeysuckle, stiltweed, Chinese privet, multi-flora rose) would be eliminated from the road surface, ditches, and forest floor throughout the project area using various techniques. These techniques would include a combination of herbicide application, prescribed burning, light disking, and seeding with native warm season grasses.

Ecosystem Prescribed Burning - 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. Areas are currently in a Condition Class 2 and 3 with the objective to reach and maintain Condition Class 1. The prescribed burn frequency is 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.

In order to minimize fireline construction, some of the burn blocks extend beyond the project area to utilize natural or existing man-made fuel breaks such as streams and roads.

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.

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.

Road Construction – Roads would be constructed to accommodate access for management activities. These roads would be added to the system as classified roads, but would be closed to vehicular traffic after use with a gate or berm. It would be maintained as needed and retained for administrative use only.

Temporary Road Construction – Temporary road construction is necessary to access harvest areas. After harvest, these roads would be closed with earthen berms or gates, fertilized, seeded and planted with native warm and cool season grasses and nonpersistent cultivars and utilized as temporary wildlife openings.

System 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.

System Road Pre-haul Maintenance – Pre-haul maintenance would be required prior to timber hauling. Activities include brush removal, spot gravel, surface protection, blading, culvert replacement and drainage reconditioning as necessary to restore the road to its original design function.

Install Road Closure Devices – Metal gates or earthen berms would be installed to provide road closure. The closure devices would be installed on roads built as temporary access.

Rock Resources – Permits would be offered to the public for collection of rocks by private individuals within existing mine areas or road construction and reconstruction corridors. Rocks may be collected within areas of disturbance associated with existing mine areas or road construction and reconstruction.

Alternative C: No Herbicide Use

Herbicide application for invasive species control, site preparation and pre-commercial thinning/release would not occur. These activities would be accomplished manually with chainsaws and/or other mechanical means. All other activities are the same as those proposed under Alternative B.

Technical Requirements

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

Cultural Resources

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

HP1: Site Avoidance During Project Implementation

Avoidance of historic properties (HP) will require the protection from effects resulting from the undertaking. Effects will be avoided by (1) establishing clearly defined site boundaries and buffers around archeological sites where activities occur that might result in an adverse effect. Buffers will be of sufficient size to ensure that integrity of the characteristics and values which contribute to, or potentially contribute to, the properties' significance will not be affected, and (2) routing proposed new roads, temporary roads, log landings and skid trails away from historic properties;

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 significantly 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.

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 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, SW002, p. 74)

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

STANDS REQUIRING A LIMITED OPERATING SEASON (TABLE 2.1)

Compartment	Stand	Operating Season	Compartment	Stand	Operating Season
12	5	July-November	23	7	July-November
12	8	July-November	23	11	April-November
16	2	July-November	23	12	July-November
16	5	April-November	23	13	April-November
16	6	July-November	23	20	July-November
16	14	July-November	23	30	April-November
16	17	July-November	23	49	April-November
16	18	April-November	24	7	July-November
21	2	July-November	24	8	July-November
21	3	July-November	24	11	April-November
21	5	July-November	24	13	April-November
21	6	July-November	26	1	July-November
21	7	July-November	26	3	July-November
21	9	July-November	27	6	July-November
21	10	July-November	27	7	July-November
21	11	July-November	27	8	July-November
21	12	July-November	27	9	July-November
21	13	July-November	27	12	July-November
21	14	July-November	27	18	July-November
21	20	July-November	27	20	July-November
21	22	July-November	27	21	July-November
22	2	July-November	28	2	July-November
22	14	July-November	29	5	July-November
23	5	July-November	29	11	July-November

Soil loss from management actions will not exceed the estimated Forested T-factor for each soil or soil map unit, based on the cumulative time period between soil disturbing management actions. (Revised Forest Plan, SW003 (3), p. 74)

To meet this standard, in addition to installing water bars and seeding, deep tillage would be required on log decks, as well as- temporary roads and primary skid trails with slope grades of 15% or less, in the stands displayed in the table below.

STANDS REQUIRING ADDITIONAL EROSION CONTROL MEASURES (TABLE 2.2)

Compartment	Stand
16	6

Scenery

- Flowering and other visually attractive trees and understory shrubs are favored when leaving vegetation.
- For areas with a moderate to high SIO, leave tree marking or unit boundary is applied so as not to be visible within 100 feet of concern level 1 and 2 open roads.
- For areas with a moderate to high SIO, log landings, roads, and bladed skid trails should be located out of view, when possible, to avoid bare mineral soil being seen from concern level 1 and 2 open roads.
- Utility rights-of-ways are located and maintained to conform with natural-appearing patterns of vegetation to the extent possible.
- The visual impact of roads and constructed firelines should be blended so they remain subordinate to the existing landscape character in size, form, line, color, and texture.
- Openings should be organically shaped. Edges should be shaped and/or feathered where appropriate to avoid a shadowing effect in the cut unit.
- Cut and fill slopes are re-vegetated to the extent possible.

Where commercial timber operations fall adjacent to C27A, Pigeon Roost Rifle Range Road, the following treatments will be implemented.

- Trees should be selectively removed to improve scenery within high use areas. Stems should be cut to within 6 inches of the ground within the immediate foreground (within 100 ft) where practicable.
- Slash should be treated to within an average of 2 feet to the ground when visible within 100 feet on either side of roads.
- During temporary road construction or permanent road construction/reconstruction within these stands, slash and root wads should be eliminated or removed from view in the immediate foreground (within 150 ft) to the extent possible.
- Flowering and other visually attractive trees and understory shrubs are favored when leaving vegetation.
- Root wads and other unnecessary debris should be removed or placed out of sight within 150 feet of key viewing areas.

- Leave tree marking or unit boundary is applied so as not to be visible within 100 feet of open roads.
- Log landings, roads, and bladed skid trails should be located out of view, when possible, to avoid bare mineral soil being seen from open roads.
- Utility rights-of-ways are located and maintained to conform with natural-appearing patterns of vegetation to the extent possible.
- The visual impact of roads and constructed firelines should be blended so they remain subordinate to the existing landscape character in size, form, line, color, and texture.
- Openings should be organically shaped. Edges should be shaped and/or feathered where appropriate to avoid a shadowing effect in the cut unit.
- Cut and fill slopes are revegetated to the extent possible.
- All harvest areas within a high SIO will be cut to an irregular shape and following the landscape/contours.

Public Health and Safety

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

Proposed, Endangered, Threatened & Sensitive Species (PETS)

To reduce impacts to federally listed mussel species, no new road construction will occur during the months of April and May.

The Forest Service must comply with the following terms and conditions carrying out the reasonable and prudent measures described in the Northern Long-eared Bat (NLEB) Programmatic Biological Opinion:

1. Tree cutting and clearing within new road construction right-of-way is not permitted when NLEB pups are non-volant (May 15-July 31).
2. If weather and site conditions are suitable for right-of-way clearing, cut and clear trees within new road right-of-way during the NLEB winter period (October 15-April 1).

Monitoring

The RLRMP lists monitoring activities for the Ouachita National Forest. The Forest's monitoring program is designed to evaluate the environmental effects of actions similar to those proposed in this project and also serves to assess the effectiveness of treatments.

Trained contract administrators and inspectors will conduct routine on-site assessments throughout the implantation phases of the project, ensuring that the appropriate design criteria are followed to protect soil stability, water quality and other resources.

Activities that utilize herbicides will be monitored to ensure that all herbicides are used in accordance to label instructions. Form R8-FS-2100-1, Herbicide Treatment and Evaluation Record would be used to monitor all work involving herbicides. Stream samples would also be taken to monitor for offsite movement.

Other Alternatives Considered

An alternative was considered that would include no road construction, including temporary roads. Eight out of ten areas proposed for even-aged regeneration harvest would be inaccessible if temporary roads were not constructed; the Purpose and Need for early seral habitat would not be met. Approximately 0.7 miles of system road construction is proposed to relocate existing road that is poorly located and is producing sediment. For these reasons, a no road construction alternative was not further analyzed.

Other Past, Present and Reasonably Foreseeable Future Actions

Within this region, the potential for tornado outbreaks or ice storms are high for reoccurrence. Additionally, seedling release/thinning could occur as a result of Southern Pine Beetle outbreak. Salvage timber for ice and tornado damage and the control of southern pine beetles would continue as necessary.

Special use authorizations for roads that are currently approved are: CAD0106, CAD527001 and CAD100712; requests for additional special use permits will be reviewed as necessary.

Private land ownership – Private owners can be expected to continue their current land use practices (i.e. residential, agriculture, crystal mining). Persons with vacation homes along the Caddo River would continue to use the river for recreation. Private landowners may develop land *adjacent* to river and/or National Forest System within project area.

Other past activities within the Bonnerdale Project area are evident in descriptions of the present conditions for each resource section analyzed in Chapter 3. Other ongoing activities are listed above in the description of the No Action Alternative.

Summary Comparison of Alternatives

COMPARISON OF ACTIONS BY ALTERNATIVE (TABLE 2.3)

Action (measure)	No Action	Alt B	Alt C
Regeneration Harvest (acres)	0	431	431
Chemical Site Preparation (herbicides) (acres)	0	431	0
Mechanical Site Preparation (no herbicides) (acres)	0	0	431
Mechanical Site Preparation (acres)	0	431	431
Prescribed Burn Site Preparation (acres)	0	431	431
Hand Plant Shortleaf Pine Seedlings (acres)	0	431	431
Seedling Release (herbicides) (acres)	0	768	0
Seedling Release (manual) (acres)	0	768	768
Pre-Commercial Thinning (acres)	0	768	768
Intermediate Thinning (acres)	0	4,815	4,815
Wildlife Stand Improvement - midstory(acres)	0	74	74
Wildlife Opening Improvement (acres)	0	4	4
Wildlife Opening (acres)	0	6	6
Pond Improvement (ponds)	0	28	28
Watershed restoration (location)	0	T/O*	T/O
Invasive Plant Species Control (acres)	0	52	52
Landscape Prescribed Burning (acres)	0	9,285	9,285
Fireline Construction (miles)	0	33.1	33.1
Fireline Maintenance/Reconstruction (miles)	0	11.9	11.9
Road Construction (miles)	0	0.7	0.7
Road Reconstruction (miles)	0	12.3	12.3
Temporary Road Construction (miles)	0	19	19
System Road Pre-haul Maintenance(miles)	0	6.7	6.7
Total area potentially treated with herbicides (acres)	0	431	0

*Denotes throughout project area

COMPARISON OF ENVIRONMENTAL EFFECTS BY ALTERNATIVE (TABLE 2.4)

Environmental Effect (measure)	No Action	Alt B	Alt C
Sediment Delivery by Watershed (tons/year)			
<i>Sugar Loaf 080401020303</i>	184.93	593.02	593.02
<i>Mazarn Creek-Lake Hamilton 080401010704</i>	241.25	256.08	256.08
<i>Little Mazarn Creek-Lake Hamilton 080401010802</i>	240.97	292.73	292.73
<i>Little Mazarn Creek 080401010801</i>	318.85	518.50	518.50
<i>Caney Creek Middle Caddo River 080401020302</i>	107.57	140.13	140.13
<i>Upper Mazarn 080401010703</i>	111.19	1,189.59	1,189.59
Air Quality Meets Air Quality Index	Yes	Yes	Yes
Early Seral Habitat Created (acres)	0	431	431
Open Road Density (mi/sq. mile)	0.5	0.5	0.5
Scenic Integrity Objectives Met	Yes	Yes	Yes
Estimated Volume Harvested (ccf)	0	49,540	49,540

COMPARISON OF OBJECTIVES MET BY ALTERNATIVE (TABLE 2.5)

Objective (measure)	No Action	Alt B	Alt C
Improve the health and vigor of forest stands and improve stand quality (acres of timber stands treated resulting in reduced basal areas)	0	5,246	5,246
Contribute to the economic base of local communities by providing a sustained yield of high-quality wood products. (volume harvested – 100 cubic feet (ccf))	0	49,440	49,440
Provide grass-forb and seedling-sapling habitat conditions. (percent of suitable acres in early seral habitat)	4.8	7	7
Provide for a diversity of plant and animal communities; reduce fuel loads. (acres of ecosystem/wildlife prescribed burning)	0	9,285	9,285
Maintain or Improve open habitats to provide high quality forage and nesting habitat for wildlife. (acres of wildlife openings maintained/created)	0	10	10
Maintain or restore community diversity. (acres of old growth stand restoration)	0	767	767
Watershed Improvement	0	Throughout	Throughout
Eliminate non-native, invasive species. (acres treated for invasive species eradication)	0	52	52
Develop, operate, and maintain the road system to meet the requirements of the proposed actions, protect the environment, and provide reasonable and safe access. (road construction: temp road construction : road reconstruction: pre-haul maintenance)	0	0.7:19: 12.3: 6.7	0.7:19: 12.3: 6.7

Chapter 3

Affected Environment and Environmental Consequences

Air Quality

Present 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 35 miles west of the project area.

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, 2014).

Alternative A: 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.

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.

Alternatives B and C: 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 23.7 tons from the largest prescribed burn unit.

All prescribed burning activities would be conducted in accordance with the Region 8 Smoke Management 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 & Historical Resources

Present Conditions

Archaeological investigations of the project area resulted in the survey of 1,371 acres in addition to previous surveys totaling 3,350 acres and the identification of 152 archaeological properties. The Ouachita Cultural Resources report No. 448 was prepared and submitted to the State Historic Preservation Office (SHPO), the Arkansas State Archeologist and the federally recognized tribes: Caddo Tribe, Quapaw Nation, Chickasaw Tribe, Choctaw Nation and Osage Nation.

Significant and undetermined sites will be protected from any proposed management activities. If any unknown heritage resources are discovered during stand treatments within the project areas, the District and Forest Archaeologists will be notified immediately. They will make an evaluation, in consultation with SHPO and the Tribal Historic Preservation Officers (THPOs), to determine appropriate action. Activity at that location will be suspended until that determination is complete.

Known Cultural Resources – One hundred fifty two archeological sites have been identified in or near the Project Area as a result of cultural resources inventory surveys. Of the identified properties, 39 were determined significant and eligible for inclusion on the National Register of Historic Places (NHRP); one is formally listed on the NHRP. Additionally, 10 archeological sites are of undetermined significance, but will be protected during project implementation.

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

- Burn boundary and fireline construction locations
- Temporary roads, skid trails, and log landings outside areas already surveyed
- Road construction, reconstruction, maintenance, conversion, or decommissioning activities involving ground disturbance occurring outside areas already surveyed
- New pond construction for wildlife water sources

These areas will be surveyed and regulatory and tribal consultation completed prior to implementation.

Effects Analysis

The scope of the analysis for potential effects to cultural resources includes the entire Bonnerdale Project area and considers the proposed activities within the treatment area (see Chapters 1 and 2), as well as access to these areas.

An effect to a cultural resource is the "...alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." (36 CFR 800.16(i)) Any project implementation activity that has potential to disturb the ground has potential to directly affect archeological sites, as does the use of fire as a management tool. Specific activities outlined in the Bonnerdale Project area 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, construction 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, and non-native invasive plant species control using non-ground disturbing methods.

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.

Alternative A: No Action

Direct and Indirect Effects

Currently, archeological surface and subsurface site integrity in the Bonnerdale Project area is subject to adverse effects from the buildup of hazardous fuels and the potential decline of unmanaged forest. These conditions pose the potential for increased tree mortality and wildfire intensity. Fires occurring in areas with dense concentrations of combustible material have the potential to burn with greater than normal intensity and duration, thereby altering the physical integrity and/or research value of archeological sites or site components. Resulting soil exposure can lead to an increase in erosion, thus disturbing or leading to a loss of archeological soil matrices and/or site components. Sites in currently accessible areas, such as along roads, are vulnerable to disturbance or vandalism due to accessibility. There would be no change in effects from the current condition, and the potential threat to integrity of cultural resources would remain unchanged.

Cumulative Effects

The existing schedule of burning under the Bonnerdale Pre-Mark Burn CE (2015) would maintain a level of fuel reduction through time and therefore reduce the risk of wildfire's damage to resources. With reduction of fuel loads, wildfires would be easier to control, thus reducing the risk to cultural resources.

Alternatives B and C: Proposed Action and No Herbicide

Direct and Indirect Effects

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/design criteria). In that instance, project activities would not be expected to adversely affect archeological sites.

Cumulative Effects

The existing schedule of burning under the Bonnerdale Pre-Mark Burn CE (2015) would maintain a level of fuel reduction through time and therefore reduce the risk of wildfire's damage to resources. With reduction of fuel loads, wildfires will be easier to control, thus reducing the risk to cultural resources.

Soils

Present Condition

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 Bonnerdale Project area has identified and described 37 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 identified as being in the 100-year flood plain or as being a hydric soil require special management considerations and evaluations so that proposed actions would not adversely alter the natural values of these areas. In this analysis area, there are no hydric soils or jurisdictional wetlands mapped. Soil map units 33, 36, 54, 55,

60, 101 and 142 depict floodplain landforms in this analysis area. These map units represent a total of 925 acres of the project area. These mapped areas help to give an approximate determination of the 100-year boundary where their width is determined to be more than 200 feet. No structures are proposed within 100-year floodplains or wetland locations. For detailed information, reference E.O. 11988, E.O. 11990, FSM 2526 and FSM 2527.

Alternative A: No Action

Only the undisturbed natural erosion would be expected to continue. Natural erosion from undisturbed forest soils is very low, generally in the neighborhood of 0.01 to 0.15 tons/acre/year (Soil Resource Report). There would be no management activities conducted on forest soils; no compaction would occur.

Alternatives B and C: 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 and moderate erosion hazard potential.

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 for compartment 16 stand 6; waterbar and seed only for remainder).

MAXIMUM ALLOWABLE SOIL LOSS (TABLE 3.1)

Soil Map Unit	Compartment/ Stand	Treatment	Soil Loss (tons/acre)	
			Proposed Action & No Herbicide	Allowable
55	23/5	Seedtree and Site Preparation	1.11	19.75
120	16/6	Commercial Thinning	8.32	9.50
130	28/2	Seedtree and Site Preparation	8.75	13.50

These worst-case 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 a decrease in soil porosity. The soils in this planning area are most susceptible to compaction when wet.

The soil resource inventory identified soil map units with a moderate-high compaction hazard rating on about 5% of the project area, about 5% with a high rating, and about 6% with a compaction hazard rating of severe. These hazard ratings are primarily due to low proportions of rock content in the top 6-inches of soil. This situation, when combined with heavy equipment operation on wet soils, can result in unacceptable levels of compaction. To ensure that compaction effects are kept within acceptable levels, additional mitigation would be implemented. On soils with a moderate-high or high compaction hazard rating, logging would be limited to the drier periods of the year, namely April through November. On soils with a severe compaction hazard rating, logging would be limited to a July through November operating season. Stands requiring limited operating seasons are listed in Chapter 2, technical requirements. 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.

Fire – Any long-term negative effects to the soil would be related to high severity burns or very short 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. Under burn frequencies will be determined to allow recovery of forest floors and soil biota and in order to not deplete soil nutrients.

Cumulative Effects

Effects from past actions could continue to impact soil resources. The existing schedule of burning under the Bonnerdale Pre-Mark Burn CE (2015) would have the potential to cause short term effects to the soil. However, any burning would follow the RLRMP guides and any additive effect would be minimal. 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 RLRMP guidance designed to protect the soil resource, any additive effect would be minimal.

Water Resources & Quality

Present Condition

The project area boundary encompasses portions of the Little Mazarn Creek, Little Mazarn Creek-Lake Hamilton, Mazarn Creek-Lake Hamilton, Upper Mazarn Creek and Sugarloaf Creek HUC 12 watersheds. Since watershed boundaries are not congruent with compartment or stand boundaries, some proposed actions such as prescribed burning and associated fireline construction or re-construction fall outside the boundaries of these watersheds.

The primary beneficial uses of waters within the project area are water sources for wildlife, amphibian spawning sites, native fisheries, drinking water and recreation. There are also ground water sources of an unknown number of privately owned water wells.

Section 303(d) of the Clean Water Act requires states to prepare a list of impaired surface waters. Category 5a (high priority) contains stream segments that are impaired and require Total Maximum Daily Load (TMDL) development. There are **6** segments of Little Mazarn Creek and Mazarn Creek (7.08 miles) identified as 5a within or adjacent to the project area.

Effects Analysis

Alternative A: No Action

Direct and Indirect Effects

A direct effect of management activities on water quality occurs when an activity places a pollutant directly into a watercourse. Roads contribute more sediment to streams than any other land management practice (Lugo and Gucinski, 2000). Stream crossings and some water diversion features serve as direct conduits for erosion from the road or road ditch directly into the channel. The proposed soil disturbing activities and vegetative treatments in this project would not occur; therefore there would be no direct effects to water quality from Alternative A.

Indirect effects are those impacts from management activities that do not have a direct connection to the stream course. Roads also provide an indirect source of sediment to the stream network. This alternative would not provide road treatment activity that would reduce sediment contributions. Although proposed soil disturbing activities and vegetative treatments in this project would not occur, watershed improvement activities would also not take place. Roads, trails, and gravel pits identified as having active erosion would not be stabilized and would therefore allow for sediment to continue or increase.

Methylmercury is highly bioaccumulative, especially in aquatic food webs. Nearly 100 percent of the mercury that bioaccumulates in upper-trophic-level fish (predator) tissue is methylmercury (EPA, 2001). Effects from a potential wildfire include possible increases in methylmercury accumulations in fish. Bioaccumulation of mercury requires anaerobic decomposition by bacteria. Anaerobic conditions in which the bacteria could methylate the mercury are present in

surface waters. Elemental mercury is available due to deposition as well as trace amounts from rock erosion (Standage, 2007). An intense wildfire could release increased trace amounts from erosion, increased losses from heating of soils and increased levels through volatilization of deposited mercury on vegetation over those levels associated with a low intensity prescribed burn.

Alternative B: Proposed Action

Direct and Indirect Effects

Direct effects of management activities proposed under Alternative B would result from the impacts of logging equipment and vehicles traversing stream crossings, fireline and road construction through streams, etc. These activities could place pollutants directly into a watercourse and result in direct sedimentation. 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 Best Management Practices (BMPs) found within the RLRMP and Arkansas Forester's BMPs.

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 and Gucinski, 2000).

Monitoring is used to determine implementation and effectiveness of management activities. Reviews of individual BMPs and combinations of BMPs across the ONF have shown that management activities such as temporary road crossings or timber harvest in combination with streamside management area (SMA) buffers do not have a significant adverse effect on beneficial uses (Clingenpeel, 1989; Clingenpeel, 1990; Neihardt, 1994; USDA Forest Service, 1994; Vestal, 2000). Based on results of research and monitoring efforts and mandatory implementation of RLRMP standards, an adverse direct effect resulting from these proposed management actions would be unlikely.

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.

Direct effects from prescribed burning include the volatilization of deposited mercury on vegetation and possible release of mercury from the "O" soil horizon. Based on what little data is available, it does appear that prescribed fire could have effects on mercury cycling and bioaccumulation in the aquatic food web (Witt et al., 2009). The results of a study in Florida suggest that prescribed fires in the southeastern United States mainly re-emit atmospherically deposited mercury and that such re-emission is small relative to the United States Environmental Protection Agency 1997 inventory of US anthropogenic emissions (estimated prescribed fire re-emission in southeastern United States is about 0.09-0.2% of US anthropogenic emissions). This suggestion is further supported by the fact that most forests are subjected to low severity prescribed burns in which the "O" horizon is only partially consumed (Dicosty, et al, 2006).

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. Potential indirect effects from prescribed burning include increases in methylmercury levels in fish in surface waters. The proposed prescribed burning is within acreage limits regularly occurring annually in the area over the last ten to fifteen years. Mercury depositions are expected to remain fairly constant over the period of the proposed action and increases in methylmercury are not anticipated. Since 1994, measured mercury levels in fish at several locations on Lake Ouachita varied from 0.82ppm and 0.41ppm in 1994, to 0.20ppm and 0.37ppm in 2002, and to 0.51ppm and 0.59ppm in 2008.

Ash from prescribed fire and nutrients leaching from logging slash are potential indirect sources of effects from activities proposed under Alternative B. 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, OCES, 1994). Nutrient leaching is expected to be minor increase under Alternative B. No stream or lake eutrophication is expected. 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.

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 (OCES, 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 significant impact to water quality.

Wildlife opening construction, road construction, fireline construction, timber harvest (construction of skid trails and log landings, and logging equipment traversing stream crossings) would result in exposed soil or soil disturbance. These activities would result in some erosion, increasing sedimentation. The projected sediment delivery to streams due to harvesting, site preparation, and erosion of forest roads in the Ouachita is about 0.070 tons per acre per year (OCES, 1994).

Alternative B proposes the use of the herbicides triclopyr and imazapyr, imazapic, glyphosate and picloram for site preparation, release and for the control of non-native invasive species. The control of non-native invasive terrestrial vegetation using herbicides within MA-9 would only be with an appropriately labeled formulation for both aquatic and terrestrial site use. 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 no significant 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 only trace amounts of herbicide have ever been detected in streams (USDA Forest Service, 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 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 significant 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.

Alternative C: No Herbicide Use

Direct and Indirect Effects

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

Cumulative Effects All Alternatives

A cumulative effects analysis must be bounded in space and time. For the purposes of project level planning, 6th level watersheds (10,000 to 40,000 acres) are the appropriate spatial bounds for cumulative effects analysis.

The objective of this analysis is to determine possible cumulative effects of management activities on water quality and its associated beneficial uses. Two methods were used to address cumulative effects. First, changes in land use and disturbance with respect to increases in sediment were modeled using the ACE model. Second, stream surveys were conducted and results were compared to reference watersheds within their respective sub eco-region.

The Aquatic Cumulative Effects (ACE) model is used at the 6th code HUC to initially determine watershed condition, as well as assess proposed project impacts. Watershed Condition Ranking (WCR) is a risk ranking integrated with the model that returns High, Moderate, or Low result based on predicted sediment delivery to the 6th code HUC stream 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. The current WCR (pre-treatment) for Sugar Loaf HUC 6 is high, Mazarn Creek-Lake Hamilton HUC 6 is high, Little Mazarn Creek-Lake Hamilton is high, Little Mazarn Creek is high, Caney Creek Middle Caddo River is high and for Upper Mazarn HUC 6 the ranking is moderate.

Local research has shown that the effects of increased sediment as a result of timber harvests are identifiable for up to 3 years (Beasley et al 1987). The timeframe of this model is bound by three years prior and one year following the implementation year. This captures the effects of other management activities that may still affect the project area. Proposed actions are constrained to a single year. This will express the maximum possible effect that could occur. This is consistent with most project level environmental analyses that have an operability of 5 years. 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.

A change in water yield is an effect that does not serve as a pollutant until a large change occurs. In addition, water yield models do not characterize the impacts of all management activities such as road construction and the increase in water yield is less than the natural variability. Miller et al. (1986) could not identify increases in peak flow as a result of timber harvest and site preparation, and could only determine significant increases in summer baseflow. Changes in water nutrients or nutrient fluxes within streams as a result of management activities are minor (Beasley et al. 1987) and not an appropriate consideration of cumulative effects at the project level.

Sediment is an appropriate measure to determine the effects of management activities on water quality and its associated beneficial uses on forested lands (Coats and Miller, 1981). Sediment increases can adversely affect aquatic biota and habitat including fish productivity and diversity (Alexander and Hansen, 1986), degrade drinking water, and affect the recreational values of streams and rivers.

Biotic integrity is the ability of an ecosystem to maintain a community of organisms that has a composition, diversity and functional organization similar to that of undisturbed stream habitats within the same region. An index of biotic integrity (IBI) provides the species diversity information needed to understand how stable a stream is, and therefore, its condition. Generally, the higher the IBI score, the less disturbed the condition.

The following table displays the predicted sediment delivery, risk level and potential to adversely affect aquatic beneficial uses based on the ACE model, and the IBI scores based on stream sampling.

SEDIMENT DELIVERY BY WATERSHED (TABLE 3.2)

Subwatershed 6 th level HUC ID#	Alternative	Sediment Delivery		Risk Level	IBI Score
		Tons Per Year	% Increase*		
Sugar Loaf 080401020303	<i>Current Condition</i>		2,260	High	X
	No Action	184.93	2,316	High	
	Proposed Action & No Herbicide	593.02	2,440	High	
Mazarn Creek-Lake Hamilton 080401010704	<i>Current Condition</i>		1,766	High	80%
	No Action	241.25	1,817	High	
	Proposed Action & No Herbicide	256.08	1,820	High	
Little Mazarn Creek-Lake Hamilton 080401010802	<i>Current Condition</i>		1,735	High	X
	No Action	240.97	1,779	High	
	Proposed Action & No Herbicide	292.73	1,789	High	
Little Mazarn Creek 080401010801	<i>Current Condition</i>		1,606	High	X
	No Action	318.85	1,699	High	
	Proposed Action & No Herbicide	518.50	1,758	High	
Caney Creek Middle Caddo River 080401020302	<i>Current Condition</i>		876	High	X
	No Action	107.57	894	High	
	Proposed Action & No Herbicide	140.13	899	High	
Upper Mazarn 080401010703	<i>Current Condition</i>		430	Moderate	70%
	No Action	111.19	441	Moderate	
	Proposed Action & No Herbicide	1,189.59	550	Moderate	

*Percent increase over sediment delivery from undisturbed watershed condition

Sugar Loaf, Little Mazarn Creek-Lake Hamilton, Little Mazarn Creek and Caney Creek Middle Caddo River Subwatersheds: The predicted sediment delivery from the Proposed Action and the No Herbicide Alternative would not change the current risk level from high. Environmental effects would persist and could change the hydrologic system with observable changes for as long as the causing actions persist. Effects can threaten exceedance of environmental thresholds for periods of time (years). If causative actions persist over time, permanent adjustments can occur to the hydrologic system (USDA Forest Service, 2015). The Ace Cumulative Effects (ACE) Output Analysis Protocol states that if predicted sediment is less than 2% increase over the current condition, then it is not considered to be a measurable change (Moser, 2014). The predicted sediment increases are 0.055, 0.006, 0.036, and 0.006%, respectively, above the current condition; these are not considered to be measurable changes.

Mazarn Creek-Lake Hamilton Subwatershed: For all alternatives, the risk level for Mazarn Creek-Lake Hamilton subwatershed remained high. In summer of 2013-2015, streams were sampled in the the subwatershed (see project file for report). Sampling resulted in the following IBI scores: 80% (2013, 2015) and 73% (2014). Stream sampling verified a “good” IBI score. Additional sampling or supplementary data may be needed to determine if such differences are actually significant; species richness is somewhat below expectation, especially due to loss of the most intolerant forms, some species are present with less than optimal abundances, trophic levels show some sign of stress (USDA Forest Service, 2015).

Upper Mazarn Subwatershed: For all alternatives, the risk level for Upper Mazarn subwatershed remained moderate. Environmental effects are measurable and observable for short periods of time following storm flow events. These effects are short term (less than a few weeks) and do not affect large portions of the watershed. Recovery is complete and beneficial uses are disrupted only for short periods in localized areas. The predicted sediment is a 2.5% increase over the current condition; an increase greater than 2% is considered a measurable change (Moser, 2014). Stream sampling occurred in the summers of 2013-2015. Sampling resulted in IBI scores of 70% (2013, 2015) and 73% (2014). These scores fall within a “fair” IBI category, probably indicating real differences in biotic integrity and environmental quality. Signs of additional deterioration include loss of intolerant forms, fewer species, and a highly skewed trophic structure (USDA Forest Service, 2015).

Transportation & Infrastructure

Present Conditions

Roads within the Bonnerdale Project area are used for a variety of purposes. US Hwy 70 accommodates travel east and west along the southern boundary of the project area. The northern boundary of the project area is County Road 34. There are no roads distinguishing landmarks for the east and west boundaries of the Project Area; they end at the management compartment boundaries. Commonly used roads that access the project area include Forest Roads 120, C16, C21, C22, C24, C25B, C & E and C27A.

There are approximately 29.1 miles of National Forest system roads in the project area. There are also 93.6 miles of Hwy and County roads. The current Motor Vehicle Use Map (MVUM) designates 8.12 miles of roads in the project area open to highway legal vehicles only; 13.5 miles open to all vehicles; and approximately 7.5 miles of FS roads are closed (administrative use only).

Motorized mixed use occurs when a National Forest System road (NFSR) is designated for use by both highway-legal and non-highway-legal motor vehicles (FSM 7705). Motorized mixed use is allowed on 13.5 miles of roads within the project area. Other project area road uses include: vehicle touring, fishing access, and hunting access. Other activities occurring in the area, which utilize Forest roads for access, include horseback riding, hiking, bird watching, and firewood gathering. There are no designated trails within the Project Area.

Bonnerdale Project

The Bonnerdale Project area currently has 0.785 mi/mi² of open road density (ORD) in MA 14 and 0.62 mi/mi² in MA 21. The RLRMP open road density objectives are 1.0 mi/mi² for MA 14 and 0.75 mi/mi² for MA 21 (OBJ05, p. 59). The ORD for the project area is currently below RLRMP density objectives.

Alternative A: No Action

Direct, Indirect and Cumulative Effects

No activities are proposed under Alternative A, therefore there would be no direct, indirect or cumulative effects to access or to ORD.

Alternatives B and C: Proposed Action and No Herbicide

Direct and Indirect Effects

There would be a slight change in ORD in the project area, but the total ORD would still fall below RLRMP objectives. New system road construction is proposed on 0.7 miles; temporary roads would be obliterated after management activities are completed. System road reconstruction and pre-haul maintenance would improve conditions sufficient to support management activities and restore routes to their original design function.

Cumulative Effects

There are no other past, present or reasonably foreseeable changes to the transportation system that would result in additional effects.

Vegetation

Present Conditions

The project area contains approximately 16,520 acres, of which, 8,899 acres are federally owned. Of the federally owned acres, 7,117 are considered suitable (for timber production). It includes compartments 12, 16, 20-24, and 26-29. Pine in almost pure stands dominates the project area:

- Pine forest = **6,456** acres.
- Pine hardwood forest = **70** acres.
- Hardwood pine forest = **281** acres.
- Hardwood forest = **310** acres.

The following table illustrates age class distributions on suitable lands:

FOREST TYPE BY AGE CLASS SUITABLE LAND (TABLE 3.3)

Age Class			Forest Type											
			Pine			Pine-Hardwood			Hardwood-Pine			Hardwood		
Years (2015)	Acres	% of Total	Acres	% of Type	% of Total	Acres	% of Type	% of Total	Acres	% of Type	% of Total	Acres	% of Type	% of Total
0-10	344	4.8	275	4.3	4.9	0	0	0	48	17.1	0.7	21	6.8	0.3
11-20	313	4.3	159	2.5	2.2	0	0	0	0	0	0	154	49.8	2.2
21-30	1,028	14.4	1,015	15.7	14.3	13	18.6	0.2	0	0	0	0	0	0
31-40	653	9.2	642	9.9	9.0	0	0	0	0	0	0	11	3.5	0.2
41-50	301	4.2	301	4.7	4.2	0	0	0	0	0	0	0	0	0
51-60	197	2.8	180	2.8	2.5	0	0	0	0	0	0	17	5.5	0.2
61-70	162	2.3	81	1.3	1.1	36	51.4	0.5	34	12.1	0.5	11	3.5	0.2
71-80	878	12.3	878	13.6	12.3	0	0	0	0	0	0	0	0	0
81-90	1,467	20.7	1,210	18.7	17.0	3	4.3	0.0	199	70.8	2.8	55	17.7	0.8
91-100	1,721	24.3	1,680	26.0	23.6	0	0	0	0	0	0	41	13.2	0.6
101-110	53	0.7	35	0.5	0.5	18	25.7	0.3	0	0	0	0	0	0
111+	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7,117	100	6,456	100	91.6	70	100	1	281	100	4	310	99.9	4.5

1 – Pine: At least 70% of the dominant and co-dominant crowns are softwoods.

Pine/Hardwood: 51-69% of the dominant and co-dominant crowns are softwoods.

Hardwood/Pine: 51-69% of the dominant and co-dominant crowns are hardwoods.

Hardwood: At least 70% of the dominant and co-dominant crowns are hardwoods.

Most stands have an average basal area of up to 130 square feet per acre, while trees per acre range from 2,000 to 3,000. The stand conditions are predominately immature pole timber, immature sawtimber, and mature sawtimber. These high basal areas and trees per acre have created an unhealthy forest environment inviting attacks by bugs, diseases and fire.

Non-Native Invasive Species (NNIS) - An invasive species is identified as “[a] species that can move into an area and become dominant either numerically or in terms of cover, resource use, or other ecological impacts. An invasive species may be native or non-native” (USDA-Forest Service 2005a p. 132; USDA-Forest Service 2005b p. 172). Several non-native invasive plant species have been identified throughout the Project Area. These species include, but are not limited to, Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), mimosa (*Albizia julibrissin*), autumn olive (*Elaeagnus umbellata*) and multiflora rose (*Rosa multiflora*).

Alternative A: No Action

Direct, Indirect and Cumulative Effects

Alternative A proposes no management activities that would result in the creation of additional early seral habitat within the watershed. No direct effects on forest health and stand vigor would occur. The only early seral habitat existing would be power line and road right of ways (ROWS). 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 management activities such as thinning and regeneration harvests, forest health would be at risk

due to increased potential for pest infestations such as the southern pine beetle. Over time, with no implementation of vegetation management, the amount of trees would increase, and the area in early seral habitat would decrease from the current 5% to less than 1%. Forest health and stand vigor would continue to decline.

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.

The lack of active NNIS control would allow plants to continue to produce seed and opportunistically spread throughout the area.

Alternative B: Proposed Action

Direct and Indirect Effects

The amount of early seral habitat within the project suitable acres would increase by approximately 100 acres, from 4.8% to 7% through even-aged regeneration harvests. Dormant season, low intensity prescribed burning top-kills woody stems of three inches and less. This would hinder the in-growth of trees and maintain existing early seral habitat.

Diseased, damaged and suppressed trees would be removed through commercial thinning activities on approximately 4,815 acres of pine stands. By reducing stand densities, through thinning, stand vigor would improve.

Existing mature growth pine habitat (80 years old or greater) would be reduced through even-aged regeneration harvests from 41% to 35% in pine and pine-hardwood stands. The percentage of mature growth hardwood habitat (100 years old or greater) would not change.

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 wildlife stand improvement, selected suppressed and intermediate trees would be released from competition, thus increasing mast production by those remaining that are in competition for resources. Removing hardwoods during site preparation activities could reduce hard mast production.

NNIS would be reduced by treating identified populations across the project area with a combination of herbicide application and prescribed burning. Conversely, 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.

Cumulative Effects

The existing schedule of burning under the Bonnerdale Pre-Mark Burn CE (2015) would maintain a level of fuel reduction through time and therefore reduce the risk of wildfire's damage to resources. With reduction of fuel loads, wildfires will be easier to control, thus reducing the risk to cultural resources.

Alternative C: No Herbicide Use

The effects of Alternative C would be the same as those listed under Alternative B except only manual or mechanical methods would be used in vegetation management activities. NNIS control would be more difficult, increasing the likelihood of continued spread. Site preparation and release activities would be less successful, making stand establishment more difficult.

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 8 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 following table.

POTENTIALLY AFFECTED MANAGEMENT INDICATOR SPECIES (TABLE 3.4)

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

Terrestrial MIS

TERRESTRIAL MIS AND ASSOCIATED PURPOSES (TABLE 3.5)

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

Terrestrial MIS Forest-wide Trends

The 6 selected terrestrial MIS were modeled using the CompPATS wildlife model to compare predicted future habitat capabilities over the next decade (2015-2025) for each of the 3 alternatives evaluated in the project area. Projected numbers of terrestrial MIS per square mile were compared against the current “pre-existing habitat condition” which serves as the baseline for the proposed activities.

TERRESTRIAL MIS RESPONSE BY ALTERNATIVE (TABLE 3.6)

Alternative Year*	Management Indicator Species					
	White-tailed Deer	Pileated Woodpecker	Eastern Wild Turkey	Northern Bobwhite	Scarlet Tanager	Prairie Warbler
	Individuals Per Square Mile					
Baseline	15	28	5	23	26	14
Alternative A – No Action						
Project 1 st year	15	28	5	23	26	14
Project at 10 years	13	30	5	12	29	6
Forest-wide trend	-	+	No Change	-	+	-
Alternative B - Proposed Action & Alternative C – No Herbicide						
Project 1 st year	28	21	8	91	27	70
Project at 10 years	16	29	5	25	28	16
Forest-wide trend	+	-	+	+	+	+

* It should be noted that this model assumes that all treatments occur within the same year (when, in fact, treatments may occur over the course of the 10 year planning period; therefore, actual habitat capability could differ from the projections presented here).

Northern Bobwhite (*Colinus virginianus*)

Northern Bobwhites require a diverse, 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 (Dimmick, Gudlin, McKenzie, & Wells, 2004).

This species has experienced population declines across Arkansas due to decreases in early seral stage habitat, loss of agricultural lands, and changes in agricultural practices. In the 2005 RLRMP, the population objective for the Northern Bobwhite is an average of 36.6 birds per square mile (USDA Forest Service 2005b). Bobwhite call counts, Breeding Bird Survey data indicate a slight increase for the Ouachita National Forest.

The Northern Bobwhite population viability on the Ouachita National Forest is not expected to be threatened and populations are expected to improve through 2005 RLRMP implementation. The Ouachita National Forest has pursued aggressive prescribed fire and thinning programs that are providing habitat improvements, especially associated with some 200,000 acres of shortleaf pine-bluestem grass ecosystem restoration. It is expected that these management actions will soon positively act to overcome the downward trends.

Direct and Indirect Effects

Alternative A: No Action

This alternative would have an overall negative effect on the forest-wide population trend for this species by lack of creation of foraging opportunities. No action would mean that no new open area would be created for these species resulting in no creation of early-seral habitats as overstory vegetation becomes established and shades out sub-canopy competition. Natural recruitment of early seral communities would also be limited in that suppression of wildfires and timber insect infestation would still occur.

Alternative B: Proposed Action

Timber Management (*regeneration harvest (seed-tree, shelterwood, shortleaf restoration) thinnings (pre-commercial, commercial, woodland), mechanical site preparation, chop/rip/hand plant shortleaf pine seedlings, mechanical timber stand improvement and midstory reduction*)

All proposed timber management activities will create several areas of early seral stage habitat and would open up the canopy, allowing sunlight to penetrate the forest floor, thus increasing the early seral vegetation which is essential to bobwhites. Overall the proposed actions would create a variety of habitats (foraging, nesting, brooding, escape cover, etc) within the ranges of this species. Habitat benefits derived from the various harvest treatments would depend directly on the size and type of harvest. Many treatments like seed tree and old growth restoration would provide more long term habitat benefits due to their size and varying landscape attributes. No direct effects should occur to adults since they are highly mobile. However, existing nest with eggs could be damaged and/or destroyed if timber activities occur during the nesting season. Re-nesting would also likely occur in most situations of disturbance thus offsetting overall losses in brood production.

Chemical Treatments (*chemical site preparation, chemical timber stand improvement and non-native invasive plant species control*)

Direct contact with herbicides (or feeding on insects and vegetation that have been exposed to herbicides) could potentially harm quail, glyphosate, imazapic, imazapyr, picloram and triclopyr are considered relatively non-toxic to birds when applied according to registered label directions. Based on these toxicity ratings, these herbicides should not have any substantial direct effects on quail. Potential exposure to herbicides from proposed treatments would likely fall below risk factors (LD₅₀ and LC₅₀ values) established in the risk assessments for birds. Given that adults are highly mobile and application most likely would occur outside the nesting season, it is improbable that there would be any direct effects to quails. Herbicide applications could help create and maintain additional patches of early successional habitat. The following table lists the toxicity ratings to bird species for each herbicide proposed for use.

SUMMARY OF LD₅₀ VALUES FOR BIRD SPECIES (TABLE 3.7)

Active Ingredient	LD₅₀*	Toxicity Risk to Bobwhite and or Mallard	Risk Assessment
Glyphosate	>5000mg/kg bw	Relatively non toxic	Syracuse Environmental Research Associates, Inc. 2011a
Imazapic	>5000 mg/kg bw	Relatively non toxic	Syracuse Environmental Research Associates, Inc. 2004d
Imazapyr	>5000 mg/kg bw	Relatively non toxic	Syracuse Environmental Research Associates, Inc. 2011b
Picloram	>4012 mg a.e./kg	Relatively non toxic	Syracuse Environmental Research Associates, Inc. 2011c
Triclopyr	>1000 mg/kg bw	Relatively non toxic	Syracuse Environmental Research Associates, Inc. 2011d

LD₅₀*: lethal dose for 50% of population tested

Prescribed Burning (fire restoration treatments and fuel reduction)

Prescribed burns would occur over the majority of the project area sometime during the 10 years following implementation of the proposed actions and would occur in both growing and dormant seasons. Direct effects to bobwhites are unlikely since these species are highly mobile and would be able to avoid burns. There is the potential for nest to be lost if burns occur during nesting season. Indirect effects of prescribed burning would be to consume woody debris which would encourage growth of shrubs and herbaceous plants essential for foraging and nesting.

Road/Fireline Construction, Reconstruction and Maintenance Treatments

Eggs and nest may be destroyed or abandon by adults when roads or firelines are constructed during nesting season. Bobwhites may be displaced during construction and periods of high activity, such as timber removal. After the use of roads and firelines, would provide additional early seral habitat, resulting in an increase in nesting and foraging habitat.

Pond Improvements

No direct effects are anticipated for pond improvements. Indirectly pond improvements would serve as important water sources and foraging area.

Wildlife Opening Construction/Improvement

Wildlife opening construction/improvement would increase and enhance the amount of available early seral habitat for these species within the watershed and provide areas of high nutrient forage as well as fawning and nesting habitat.

Nest Boxes Installation

Nest box installation should have no direct or indirect effects on this ground-nesting terrestrial species.

Watershed Restoration

Watershed restoration activities would be used to protect wildlife, soil and water resources. No direct impacts to bobwhites are anticipated since actions would be close to currently open roads; rehabilitate impacted areas. Indirect effects would be beneficial since the proposed activities would provide linear flight and travel corridors and allow these areas to re-vegetate thus providing potential foraging habitat.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the beneficial habitat effects, as well as the detrimental effects to individuals, of these ongoing activities.

Prairie Warbler (*Dendroica discolor*)

As a Neotropical migrant, Prairie Warbler uses early successional habitats such as regeneration old fields, pastures, and young forest stands. The vegetation selected may be deciduous, conifer, or mixed types. Habitats with scattered saplings, scrubby thickets, cutover or burned over woods, woodland margins, open brushy lands, mixed pine and hardwood, and scrub oak woodlands are most often selected.

Breeding Bird Survey data indicates a 3.0% decline from 1966-2012 (Sauer, et al., 2014). Further, 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 and Indirect Effects

Alternative A: No Action

This alternative would perpetuate conditions that could keep prairie warbler populations on a downward trend. This loss in numbers of prairie warblers is being observed Forest-wide. This alternative would likely have a negative impact on the Forest population trend for this species.

Alternative B: Proposed Action

Timber Management (*regeneration harvest (seed-tree, shelterwood, shortleaf restoration) thinnings (pre-commercial, commercial, woodland), mechanical site preparation, chop/rip/hand plant shortleaf pine seedlings, mechanical timber stand improvement and midstory reduction*)

All proposed timber management activities will create several areas of early seral stage habitat and would open up the canopy, allowing sunlight to penetrate the forest floor, thus increasing the early seral vegetation which is essential to warblers. Overall the proposed actions would create a variety of habitats (foraging, nesting, etc) within the ranges of this species. Habitat benefits derived from the various harvest treatments would depend directly on the size and type of harvest. Many treatments like seed tree and old growth restoration would provide more long term habitat benefits due to their size and varying landscape attributes.

No direct effects should occur to adults since they are highly mobile. However, existing nest with eggs could be damaged and/or destroyed if timber activities occur during the nesting season. Re-nesting would also likely occur in most situations of disturbance thus offsetting overall losses in brood production.

Chemical Treatments (*chemical site preparation, chemical timber stand improvement and non-native invasive plant species control*)

Direct contact with herbicides (or feeding on insects and vegetation that have been exposed to herbicides) could potentially harm warblers, glyphosate, imazapic, imazapyr, picloram and triclopyr are considered relatively non-toxic to birds when applied according to registered label directions. Based on these toxicity ratings, these herbicides should not have any substantial direct effects on warblers. Potential exposure to herbicides from proposed treatments would likely fall below risk factors (LD₅₀ and LC₅₀ values) established in the risk assessments for birds. Given that adults are highly mobile and application most likely would occur outside the nesting season, it is improbable that there would be any direct effects to warblers. Herbicide applications could help create and maintain additional patches of early successional habitat. Table 3.7 (above) lists the toxicity ratings to bird species for each herbicide proposed for use.

Prescribed Burning (*fire restoration treatments and fuel reduction*)

Prescribed burns would occur over the majority of the project area sometime during the 10 years following implementation of the proposed actions and would occur in both growing and dormant seasons. Direct effects to warblers are unlikely since these species are highly mobile and would be able to avoid burns. There is the potential for nest to be lost if burns occur during nesting season. Indirect effects of prescribed burning would be to consume woody debris which would encourage growth of shrubs and herbaceous plants essential for foraging and nesting.

Road/Fireline Construction, Reconstruction and Maintenance Treatments

Eggs and nest may be destroyed or abandon by adults when roads or firelines are constructed during nesting season. Warblers may be displaced during construction and periods of high activity, such as timber removal. After the use of roads and firelines, would provide additional early seral habitat, resulting in an increase in nesting and foraging habitat.

Pond Improvements

No direct effects are anticipated for pond improvements. Indirectly pond improvements would serve as important water sources and foraging area.

Wildlife Opening Construction/Improvement

Wildlife opening construction/improvement would increase and enhance the amount of available early seral habitat for these species within the watershed and provide areas of high nutrient forage habitat.

Nest Boxes Installation

No direct or indirect impacts are anticipated as a result of placing nest boxes in project area.

Watershed Restoration

Watershed restoration activities would be used to protect wildlife, soil and water resources. No direct impacts to warblers are anticipated since actions would be close to currently open roads; reassign designation of existing roads and rehabilitate impacted areas. Indirect effects would be beneficial since the proposed activities would provide linear flight and travel corridors and allow these areas to re-vegetate thus providing potential foraging habitat.

Alternative C: No Herbicide Use

This 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 applications would not occur.

Cumulative Effects

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the beneficial habitat effects, as well as the detrimental effects to individuals, of these ongoing activities.

Eastern Wild Turkey (*Meleagris gallapavo*)

This species is a highly prized game animal that uses a wide range of habitat types with habitat diversity needs that include grass and forb openings (seeds, fruits, berries and insects) interspersed with older timber stands capable of producing hard and soft mast.

Turkey harvest, poult production and Landbird point surveys data indicates a downward trend. These data would appear to indicate a reduction in the number of turkey while habitat capability modeling indicates a positive trend and remains above the level projected in the RLRMP. The sustained high levels for habitat capability would indicate that the drop in harvest levels,

reductions in poults per hen, and birds detected on the Landbird points are due to factors other than habitat. Research across the South has shown that prescribed fire treatment including growing season burn, improve turkey habitat by opening up dense forest, reducing shrub and brush, and improving nesting and brood rearing habitat (Cox, 2008). In addition, areas that were not burned for more than two years were almost devoid of turkey hens.

Direct and Indirect Effects

Alternative A: No Action

Under this alternative, the current habitat capability for turkeys would remain at levels just above the minimum projected levels in the Forest Plan.

Alternative B: Proposed Action

Timber Management (regeneration harvest (seed-tree, shelterwood, shortleaf restoration) thinnings (pre-commercial, commercial, woodland), mechanical site preparation, chop/rip/hand plant shortleaf pine seedlings, mechanical timber stand improvement and midstory reduction)

All proposed timber management activities will create several areas of early seral stage habitat and would open up the canopy, allowing sunlight to penetrate the forest floor, thus increasing the early seral vegetation. Overall the proposed actions would create a variety of habitats (foraging, nesting, brooding, escape cover, etc) within the ranges of this species. Habitat benefits derived from the various harvest treatments would depend directly on the size and type of harvest. Many treatments like seed tree and old growth restoration would provide more long term habitat benefits due to their size and varying landscape attributes.

No direct effects are anticipated since adult birds are highly mobile. However, existing nest, eggs and young poults could be damaged or destroyed. Turkeys may be temporarily displaced during timber management activities and nest may be abandon. Re-nesting would also likely occur in most situations of disturbance thus offsetting overall losses in brood production.

Chemical Treatments (chemical site preparation, chemical timber stand improvement and non-native invasive plant species control)

Direct contact with herbicides (or feeding on insects and vegetation that have been exposed to herbicides) could potentially harm turkeys, glyphosate, imazapic, imazapyr, picloram and triclopyr are considered relatively non-toxic to birds when applied according to registered label directions. Based on these toxicity ratings, these herbicides should not have any substantial direct effects on turkey. Potential exposure to herbicides from proposed treatments would likely fall below risk factors (LD₅₀ and LC₅₀ values) established in the risk assessments for birds. Given that adults are highly mobile and application most likely would occur outside the nesting season, it is improbable that there would be any direct effects to quails. Herbicide applications could help create and maintain additional patches of early successional habitat. Overall, any negative direct effects would be far outweighed by the beneficial indirect effects of this alternative. Table 3.7 (above) lists the toxicity ratings to bird species for each herbicide proposed for use.

Prescribed Burning (fire restoration treatments and fuel reduction)

Direct effects of dormant and growing season burns on this bird are likely minimal because adults are highly mobile and poults are precocial and able to follow the hen within one to two days of hatching. Nesting, 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.

Indirect effect of prescribed burning would be to consume woody debris allowing early forest stage and demand species easier access to browse. Burning would also encourage growth of herbaceous browse which is essential for growth and development of this species.

Road/Fireline Construction, Reconstruction and Maintenance Treatments

Eggs and nest may be destroyed or abandon by adults when roads or firelines are constructed during nesting season. Turkeys may be displaced during construction and periods of high activity, such as timber removal. After the use of roads and firelines, would provide additional early seral habitat, resulting in an increase in nesting and foraging habitat.

Pond Improvements

No direct effects are anticipated for pond improvements. Indirectly pond improvements would serve as important water sources and foraging area.

Wildlife Opening Construction/Improvement

Wildlife opening construction/improvement would increase and enhance the amount of available early seral habitat for these species within the watershed and provide areas of high nutrient forage habitat.

Nest Boxes Installation

Nest box installation should have no direct or indirect effects on this ground-nesting terrestrial species.

Watershed Restoration

Watershed restoration activities would be used to protect wildlife, soil and water resources. No direct impacts to warblers are anticipated since actions would be close to currently open roads; rehabilitate impacted areas. Indirect effects would be beneficial since the proposed activities would provide linear flight and travel corridors and allow these areas to re-vegetate thus providing potential foraging habitat.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the beneficial habitat effects, as well as the detrimental effects to individuals, of these ongoing activities.

White-tailed Deer (*Odocoileus virginianus*)

White-tailed deer 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 have the greatest impacts on deer populations.

The estimated habitat capability for deer for fiscal years 2006-2011 show a downward trend; yet it still exceeds the desired habitat capability of 48,250 acres for FY 2015. Habitat carrying capacity is calculated using acres within the Ouachita National Forest and is influenced by the amount of prescribed fire and early seral habitat created, including regeneration, thinning, timber stand improvement, mid-story removal, wildlife openings, and site preparation (USDA Forest Service, 2011).

For deer, the habitat capability model places a greater value on early seral stage habitat and gives lesser value to habitat created by thinning and prescribed fire. In contrast to the declines in even-age regeneration cutting, the acres of thinning and prescribed fire have increased.

Direct and Indirect Effects

Alternative A: No Action

The amount of early successional habitat needed by deer in this area would remain absent unless created through random natural disasters. However, the deer population is not currently facing any viability issues, and this alternative should have minimal impacts on the forest population trend for this species.

Alternative B: Proposed Action

Timber Management (*regeneration harvest (seed-tree, shelterwood, shortleaf restoration) thinnings (pre-commercial, commercial, woodland), mechanical site preparation, chop/rip/hand plant shortleaf pine seedlings, mechanical timber stand improvement and midstory reduction*)

After timber management activities are completed and it is followed up by fire and silvicultural treatments, 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 benefitting deer. The response of herbaceous forage species to harvest, in declining order by method, would be clearcut, permanent openings, seed tree and then thinnings. A good mix of these harvest methods would provide excellent deer habitat (Yarrow & Yarrow, 2005).

Chemical Treatments (chemical site preparation, chemical timber stand improvement and non-native invasive plant species control)

Direct contact with herbicides (or feeding on vegetation that has been exposed to herbicides) could potentially harm deer. This species may be displaced during application of herbicide, 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 deer.

Prescribed Burning (fire restoration treatments and fuel reduction)

Prescribed fire would increase browse, forbs, grass and legume production and overall nutrition. Fire also plays an important role in the development and maintenance of oak forests that provide important winter deer foods.

Road/Fireline Construction, Reconstruction and Maintenance Treatments

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

Pond Improvements

No direct effects are anticipated for pond improvements. Indirectly pond improvements would serve as important water sources and foraging area.

Wildlife Opening Construction/Improvement

Wildlife opening construction/improvement would increase and enhance the amount of available early seral habitat for these species within the watershed and provide areas of high nutrient forage habitat.

Nest Boxes Installation

No direct or indirect impacts are anticipated as a result of placing nest boxes in project area.

Watershed Restoration

Watershed restoration activities would be used to protect wildlife, soil and water resources. No direct impacts to deer are anticipated since actions would be close to currently open roads; rehabilitate impacted areas. Indirect effects would be beneficial since the proposed activities would provide linear flight and travel corridors and allow these areas to re-vegetate thus providing potential foraging habitat.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the beneficial habitat effects of these ongoing activities.

Pileated Woodpecker (*Dryocopus pileatus*)

Pileated Woodpecker is a member of the cavity nesting, tree trunk probing, insectivore guild, prefers dense, mature to over mature hardwood, hardwood-pine and mature pine forest types. The most important characteristics of forest used by pileated woodpeckers are forest contiguity, mature trees and snags, openness of forest floor, amount of decaying wood litter, and a relative humidity that promotes fungal decay and the ant, termite, and beetle populations upon which these birds feed (Bull and Jackson, 1995) Pileated woodpeckers are a primary excavator of cavities important to obligate secondary cavity nesters, and are a key indicator for the retention of a complete community of cavity nesting species. Nest cavities are constructed by both sexes usually in dead limbs and trunks in areas that are shaded most of the day.

Population trend and habitat capability data for this bird are mixed (USDA Forest Service, 2011). The Breeding surveys data indicates 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 CompPATS wildlife model takes into account the condition in all forest types, and it factors in management practices including prescribed fire and thinning. These data show a downward trend for the last 5 years, but a long-term upward trend. The overall situation should continue to improve as the unmanaged hardwood and hardwood-pine and the managed pine snag age. The current habitat capability that is estimated to support 11,580 birds exceeds the 2005 RLRMP bird population objectives of 11,265 for FY 2015 (USDA Forest Service 2005b) but is trending towards the FY 2015 desired capability.

Direct and Indirect Effects

Alternative A: No Action

Management activities would be deferred; preferred habitat, including a snag component, would continue to be available for this species.

Alternative B: Proposed Action

Timber Management (*regeneration harvest (seed-tree, shelterwood, shortleaf restoration) thinnings (pre-commercial, commercial, woodland), mechanical site preparation, chop/rip/hand plant shortleaf pine seedlings, mechanical timber stand improvement and midstory reduction*)

This species could lose active nests if harvest is conducted during the nesting season, but adults would be expected to move to undisturbed habitat and perhaps re-nest. These treatments would also have both negative and positive indirect effects on woodpeckers due to the removal of trees from the landscape reducing the upper tree canopy. Since this species prefer closed canopy forest they would be expected to abandon those portions of the harvest area with little or no closed tree canopy. However, standards established in the RLRMP (USDA Forest Service, 2005a) for the retention of hardwoods and snags in harvest areas would mitigate impacts to woodpeckers' foraging and nesting habitats. Fallen trees and snags created as a result of timber management activities would also enhance foraging and nesting habitat opportunities for woodpeckers.

Chemical Treatments (*chemical site preparation, chemical timber stand improvement and non-native invasive plant species control*)

Direct contact with herbicides (or feeding on insects that have been exposed to herbicides) could potentially harm woodpeckers. Vegetation impacted by herbicide treatment is not typically used as foraging substrate by woodpeckers because it decomposes rapidly and does not host preferred insect prey species. Overall, there should be no substantial direct effects on this woodpecker under this alternative.

Prescribed Burning (*fire restoration treatments and fuel reduction*)

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.

Indirect effect 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. 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.

Road/Fireline Construction, Reconstruction and Maintenance Treatments

Nest with eggs may be destroyed or abandon 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.

Pond Improvements

Pond improvements do not provide suitable foraging or nesting habitat for woodpeckers thus no impacts to woodpeckers are anticipated.

Wildlife Opening Construction/Improvement

Wildlife opening construction/improvement does not provide suitable foraging or nesting habitat for woodpecker and thus no impacts to woodpeckers are anticipated.

Nest Boxes Installation

No direct or indirect impacts are anticipated as a result of placing nest boxes in project area.

Watershed Restoration

Watershed restoration activities would be used to protect wildlife, soil and water resources. No direct impacts to woodpeckers are anticipated since actions would be close to currently open roads; rehabilitate impacted areas. Indirect effects would be beneficial since the proposed activities would provide linear flight and travel corridors.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the negative impacts on individuals, and beneficial habitat effects of these ongoing activities.

Scarlet Tanager (*Piranga olivacea*)

The preferred habitats for this Neotropical migrant are composed of various types of deciduous forest, pine-oak woodlands, parks, orchards, and large shade trees in suburban areas (Senesac, 1993; Bushman and Therres, 1988; Isler and Isler, 1987). Scarlet tanagers are most common in areas with closed canopy, a dense understory with high shrub diversity, and little ground cover (Bushman and Therres, 1988). Tanagers are insectivorous during the breeding season feeding on prey items such as aphids, weevils, woodborers, leaf beetles, cicadas, scale insects, dragonflies, ants, termites, caterpillars, moths, parasitic wasps, and bees. Foraging often occur mid-canopy with frequent sallies into the air to catch flying insects.

Forest Service trends are showing slight population increases overall (USDA Forest Service, 2001). Breeding Surveys 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).

Direct and Indirect Effects

Alternative A: No Action

Management activities would be deferred; mature forest habitat preferred by this species would remain unchanged.

Alternative B: Proposed Action

Timber Management (*regeneration harvest (seed-tree, shelterwood, shortleaf restoration) thinnings (pre-commercial, commercial, woodland), mechanical site preparation, chop/rip/hand plant shortleaf pine seedlings, mechanical timber stand improvement and midstory reduction*)

This species could lose active nests if harvest is conducted during the nesting season, but adults would be expected to move to undisturbed habitat and perhaps re-nest. These treatments would also have both negative and positive indirect effects on tanagers due to the removal of trees from the landscape reducing the upper tree canopy. Since this species prefer closed canopy forest they would be expected to abandon those portions of the harvest area with little or no closed tree canopy. The proposed timber activities would improve future nesting and foraging habitat for tanagers by helping to improve health and vigor of oak/hickory forest communities as a result of decreased competition.

Chemical Treatments (*chemical site preparation, chemical timber stand improvement and non-native invasive plant species control*)

Direct contact with herbicides (or feeding on insects that have been exposed to herbicides) could potentially harm tanagers. Since tanagers are primarily mid-to-upper canopy foragers it is unlikely that effects of herbicide application would be encountered. However, tanagers feed on a wide variety of insect prey, many of which spend time in or traveling through understory vegetation where herbicide application would occur. Although tanagers may consume some insect prey that has been exposed to herbicide treatments the realistic dose estimates for such exposures would be insignificant.

Prescribed Burning (*fire restoration treatments and fuel reduction*)

Prescribed fire during the nesting season could temporarily displace adults or cause nest abandonment by adults. 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.

Road/Fireline Construction, Reconstruction and Maintenance Treatments

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 nest. 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.

Pond Improvements

Pond improvements do not provide suitable foraging or nesting habitat for tanagers thus no impacts to tanagers are anticipated.

Wildlife Opening Construction/Improvement

Wildlife opening construction/improvement does not provide suitable foraging or nesting habitat and thus no impacts are anticipated.

Nest Boxes Installation

No direct or indirect impacts are anticipated as a result of placing nest boxes in project area. Placement would require minimal ground disturbance and would not result in a significant loss of habitat.

Watershed Restoration

Watershed restoration activities would be used to protect wildlife, soil and water resources. No direct impacts to tanagers are anticipated since actions would be close to currently open roads; rehabilitate impacted areas. Indirect effects would be beneficial since the proposed activities would provide linear flight and travel corridors.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the negative impacts on individuals, and beneficial habitat effects of these ongoing activities.

Aquatic MIS

This project is within the Ouachita Mountain Streams Ecoregion. Three of the MIS fish species of the Ouachita Mountain Ecoregion have no known occurrences in the drainages involved in the proposed analysis area, either at the project site, or downstream. As a result, Channel Darter (*Percina copelandi*), Redfin Darter (*Etheostoma whipplei*) and Johnny Darter (*Etheostoma nigrum*) were not selected as MIS (Caddo/Womble stream survey records 1991-2013 (Robison and Buchanan, 1988).

To determine status of the MIS listed below, the following information was used: fisheries data from ONF stream surveys; Basin Area Stream Survey (BASS) (USDA1994); summary and analysis of aquatic data (USDA 2008) and a five year review of the 2005 Forest Plan (USDA 2011).

AQUATIC MIS AND ASSOCIATED PURPOSES (TABLE 3.8)

Life Form	Scientific Name	Common Name	Primary Reason for Selection
Fish	<i>Camptostoma spadiceum</i>	Highland Stoneroller	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	<i>Etheostoma radiosum</i>	Orangebelly Darter	
Fish	<i>Etheostoma whipplei</i>	Redfin Darter	
Fish	<i>Fundulus catenatus</i>	Northern Studfish	
Fish	<i>Hypentilium nigricans</i>	Northern Hog Sucker	
Fish	<i>Lepomis cyanellus</i>	Green Sunfish	
Fish	<i>Lepomis megalotis</i>	Longear Sunfish	To help indicate effects of management activities on meeting public fishing demand in streams
Fish	<i>Micropterus dolomieu</i>	Smallmouth Bass	

Previous Forest-wide trends for the 8 aquatic MIS species selected will be discussed individually, based on the Final Environmental Impact Statement (FEIS) (USDA FS 2005b) for the Forest Plan, as well as the ONF Monitoring and Evaluation Report for the Land and Resource Management Plan (USDA Forest Service, 2011). These documents summarize monitoring information for MIS species over the past decade, while providing an assessment of each MIS species' current status and conservation needs.

Highland Stoneroller

Highland Stonerollers generally inhabit small to medium streams with cool, clear water and gravel, cobble or exposed bedrock substrates. They are sometimes found in upland impoundments and slow-moving, turbid water (Robison and Buchanan 1988). Highland Stonerollers are common across the Forest, with populations fluctuating from year to year. Many factors, biotic and abiotic and natural and man-caused contribute to these fluctuations. Over time, these populations appear to be stable. The conservation of this species across the forest is not in question. Based on Basin Area Stream Surveys (BASS) and other Forest stream surveys, there appear to be no adverse effect on highland stoneroller populations as a result of forest management activities.

Orangebelly Darter

Orangebelly Darters occur in a variety of habitats from small, gravelly, high-gradient streams, to larger, more sluggish lowland rivers. This darter is most common in clear, gravel cobble-bottomed streams with moderate to high gradient (Robison and Buchanan, 1988). Orangebelly Darters are relatively abundant in the ONF, particularly in the Lower Ouachita Mountain Ecoregion. Population densities appear to fluctuate but remain relatively stable over time. The

conservation of this species across this ecoregion is not in question. Based on BASS and other Forest stream surveys, there appears to be no adverse effect on Orangebelly Darter populations from forest management activities.

Northern Studfish

Northern Studfish occur in the Ouachita Mountains in clear streams and rivers of moderate to high gradient and permanent flow. It is usually found in quiet, shallow waters along the margins of pools having rock and gravel substrate. The conservation of this species is not thought to be in question because of its common occurrence across a wide area (Robison and Buchanan, 1988). Based on BASS and other Forest stream surveys, there appears to be no adverse implications for Northern Studfish populations as a result of Forest management activities.

Northern Hog Sucker

The Northern Hog Sucker occurs in clear, permanent streams with gravel or rocky substrate and generally prefers deep riffles, runs, or pools having a current. It is intolerant of pollution, silt, and stream channel modification (Robison and Buchanan, 1988). Based on stream monitoring data, it appears that Northern Hog Sucker populations on the ONF remain stable. There is no information to suggest that the Northern Hog Sucker has conservation concerns on ONF. There are also no indications to suggest that management activities are having a direct or indirect effect on populations of the Northern hog sucker.

Green Sunfish

The Green Sunfish is an adaptable species that occurs in a variety of aquatic habitats, and is tolerant of a wide range of ecological conditions, particularly to extremes of turbidity, dissolved oxygen, temperature, and flow (Robison and Buchanan 1988). Based on BASS inventory data, it appears that populations of Green Sunfish fluctuate from year to year. Many factors, biotic and abiotic, natural and man-caused, contribute to these fluctuations. Percent site occurrence and population densities indicate that managed streams and reference streams are similar for Green Sunfish. There are no indications that Green Sunfish are increasing as a result of management activities. The conservation of this species is not in question.

Longear Sunfish

Longear Sunfish occur in a variety of habitats but is most abundant in small, clear, upland streams with rocky bottoms and permanent or semi-permanent flow. It avoids strong current, turbid water, and silt substrate (Robison and Buchanan, 1988). Based on BASS inventory data, populations of Longear Sunfish fluctuate from year to year, but appear to be stable over time. Percent site occurrence and population densities indicate that managed streams and reference streams are similar for this species. Longear Sunfish are commonly distributed throughout much of the Upper and Lower Ouachita Mountain Ecoregions. There appears to be no adverse effect on Longear Sunfish from Forest management activities. The conservation of this species across these ecoregions is stable and is not in question.

Striped Shiner

The Striped Shiner is abundant in the Ouachita mountains and seems to prefer small to moderate-sized perennial streams with permanent flow, clear water, and rocky or gravel substrate. It occurs in some current, but avoids strong current preferring the pool habitats within the streams (Robison and Buchanan, 1988). Based on stream surveys and BASS inventory data, there appears to be wide fluctuations in populations of Striped Shiners on the Forest, with no apparent upward or downward trends. Striped Shiners are common throughout the Lower Ouachita Mountain Ecoregion. The conservation of this species in the ONF is not in question. Based on BASS inventory data and other Forest stream surveys, Forest management activities appear to have no adverse effect on Striped Shiner populations.

Smallmouth Bass

The Smallmouth Bass is mainly found in cool, clear mountain streams with permanent flow and rocky bottoms. This species is common only on the southern part of the ONF. The Smallmouth Bass does not tolerate habitat alteration in comparison to the other two black basses (Spotted and Largemouth Basses), and it is especially intolerant of high turbidity and siltation (Robison and Buchanan, 1988). The BASS data on the ONF indicate that both site occurrence percentages and population densities of Smallmouth Bass are similar between reference and managed watersheds. This implies that Forest Service management activities are having no adverse effects on Smallmouth Bass populations.

Direct and Indirect Effects

Many of the proposed activities are similar in nature, and more importantly, their effects are similar in nature. Basic impacts such as soil disturbance, heavy equipment, tree skidding, sedimentation, creation and maintenance of early seral habitat, prescribed burning and herbicide are described where appropriate. The effects of each alternative to the MIS fish species will be addressed as a group due to their similarities of response to management activities.

Alternative A: No Action

This alternative would have no effect on MIS fish species. Although, aquatic habitats are protected under all alternatives by management standards in the RLRMP indirect effects to MIS fish species under this alternative would continue to persist due to no action to improve primarily roads. Sediments to streams from sites with eroded soils not being stabilized and roads needing repairs would continue with this alternative. Thus, implementation of the no action alternative would have negative effects on future Forest-wide trends for these species.

Alternative B: Proposed Action

Timber Management: None of the proposed timber management actions are expected to have any effects on aquatic MIS. These species and its habitats are currently protected by streamside management areas, as defined in the RLRMP.

Chemical: Herbicide application and manual control methods for NNIS species would be allowed throughout the proposed planning area as needed for elimination/control of non-native invasive weeds. The District is proposing the use of the following herbicide active ingredients for site preparation, seedling release, and control of non-native invasive species: glyphosate, imazapic, imazapyr and triclopyr.

Neither the published literature nor the U.S. EPA files (U.S. EPA/OPP 1993, 1998) include data regarding the toxicity of any of these chemicals or their formulations specific to the aquatic MIS species listed here. Most all bioassay studies use various fish species, mainly Bluegill which will be used as the closest representative to this sensitive fish species.

LD50 VALUES FOR HERBICIDES (TABLE 3.9)

Active Ingredient	LD50*	Toxicity Risk to Bluegill	Risk Assessment
Glyphosate	70-170mg/L	Practically Nontoxic	Syracuse Environmental Research Associates, Inc. 2011
Imazapic	>100mg/L	Practically Nontoxic	Syracuse Environmental Research Associates, Inc. 2004
Imazapyr	>100mg/L	Practically Nontoxic	Syracuse Environmental Research Associates, Inc. 2011a
Triclopyr	Varies greatly with formulation	Appears to be somewhat toxic with great variation	Syracuse Environmental Research Associates, Inc. 2011b

LD50** - lethal concentration for 50% of population tested

Herbicide application in timber stand improvement areas is not likely to have any impacts on aquatic MIS. All streams perennial and intermittent would be protected, by 100 and 30-foot herbicide application buffers and; all source waters would be protected by 300-foot buffers. Buffers are to be clearly marked (herbicide standard HU006) before treatment so applicators can easily see and avoid them (USDA Forest Service, 2005a).

Effects to aquatic MIS could occur as a result of contact with herbicide or with personnel conducting mechanical and chemical control activities but are not likely due to approximately 99% of NNIS treatments are occurring outside streamside management area protection buffers (aquatic habitats) and following RFP protections and conservation measures:

The RFP only allows herbicide use within MA 9 for control of vegetation on dams or for control of invasive and/or exotic species. . Application would be approved by the Forest Supervisor following site-specific analysis and a monitoring plan (design criteria 9.13).

Prescribed Burning: Effects from prescribed fire would vary due to fire intensity, aspect, and slope and it would be expected that some degree of forest floor cover would be removed. Prescribed burns would occur over only portions of the analysis area over the 10 year timeline of the proposed project. This along with strict guidelines outlined in the RLRMP for protection of streams would limit the potential for any impacts to aquatic MIS or its habitats. The greatest concern from prescribed burns on aquatic environments is sediment deposition into the aquatic

ecosystems. As discussed previously in the Soils section of this Chapter, the RLRMP identifies maximum allowable soil loss thresholds. Using the Universal Soil Loss Equation (USLE) to predict the quantity of soil loss associated with common Forest management practices, activities from the “Proposed Action” alternative fell within the accepted soil loss rates. The model predicts the amount of soil loss resulting from these activities would be below the maximum allowable soil loss for all timeframes.

Roads and Firelines: Removal of vegetative cover and soil disturbance when roads/firelines are established, shaped and drainage structures installed would temporarily increase sedimentation, concentrate runoff, and potentially impact water quality, but failure to reconstruct some of these roads, maintain and decommission other roads would have more detrimental impacts than the proposed roadwork. Any new firelines and temporary road construction would be water barred and seeded after management activity completion to limit the potential for sediment runoff. These proposed treatments are anticipated to benefit aquatic organisms by decreasing stream siltation and sedimentation.

Wildlife Opening Construction/Improvement/Maintenance: Creation/maintenance of early successional habitat should have no effects on these species.

Watershed Erosion Control: Proposed actions of watershed erosion control will decrease sedimentation. Proposed soil stabilization and restoration treatments are not directly on a wet channel but rather along roads. However, these restoration treatments will reduce sedimentation from run off along roads and therefore benefit aquatics.

Alternative C: No Herbicide Use

Differences between the effects on MIS fishes under the “No Herbicides” alternative and those discussed above under the “Proposed Action” alternative are negligible. Under the “No Herbicides” alternative, the chemical site preparation and release activities would not be accomplished using herbicides, but would be replaced with manual site preparation and release activities. Even though different “tools” would be used (i.e. chainsaws versus herbicides), streamside zones would still be protected which would result in no impacts to these aquatic species.

Cumulative Effects

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. Sediment entering the aquatic ecosystem from the prescribed burning proposed in this project would be additive to the negative impacts of these ongoing activities.

Proposed, Threatened, Endangered and Sensitive Species (PETS) & Habitat

This discussion documents the possible effects of the proposed actions on known and potential populations and habitat on the Ouachita National Forest (ONF) of Proposed, Endangered, Threatened (USDI FWS 1999), and Sensitive (PETS) species. This discussion is based on the Biological Evaluation (BE) prepared for this project and incorporated by reference (USDA Forest Service 2015).

PETS SPECIES THAT OCCUR OR POTENTIALLY OCCUR IN THE PROJECT AREA (TABLE 3.10)

Common Name	Scientific Name	Status*
Arkansas Fatmucket	<i>Lampsilis powellii</i>	T
Louisiana Fatmucket	<i>Lampsilis hydana</i>	S
Southern Hickorynut	<i>Obovaria jacksoniana</i>	S
Purple Lilliput	<i>Toxolasma lividum</i>	S
Western Fanshell	<i>Cyprogenia aberti</i>	S
Ouachita Creekshell	<i>Villosa arkansasensis</i>	S
Peppered Shiner	<i>Notropis perpallidus</i>	S
Paleback Darter	<i>Etheostoma pallididorsum</i>	S
Caddo Madtom	<i>Noturus taylori</i>	S
Caddo Mountain salamander	<i>Plethodon caddoensis</i>	S
Northern long-eared bat	<i>Myotis septentrionalis</i>	T
Eastern small-footed bat	<i>Myotis leibii</i>	S
Diana fritillary	<i>Speyeria Diana</i>	S
Waterfall's sedge	<i>Carex latebracteata</i>	S
Ozark chinquapin	<i>Castanea pumila ozarkensis</i>	S
Southern lady-slipper	<i>Cypripedium kentuckiense</i>	S
Browne's waterleaf	<i>Hydrophyllum brownie</i>	S

*E – Federally Endangered

T – Federally Threatened

P – Proposed Federally listed species

S – Forest Service 'Sensitive' species

Many of the proposed activities are similar in nature, and more importantly, their effects are similar in nature. Basic impacts such as soil disturbance, heavy equipment, tree skidding, sedimentation, roads and firelines, creation and maintenance of early seral habitat, prescribed burning and herbicide are described where appropriate as well as specific impacts noted with each particular PETS species.

Mussels: Arkansas Fatmucket, Louisiana Fatmucket, Southern Hickorynut, Western Fanshell, Ouachita Creekshell and Purple Lilliput

All six of these mussels occur within the project area. The project area is within the Mazarn (Ouachita River) watershed and the Sugarloaf watersheds (Caddo River). Effects will be addressed with the mussels as a group due to their similar preferred habitat needs.

All mussels are intolerant of sedimentation and elevated water temperatures. Sedimentation that fills the interstitial areas in the stream substrate, and loss of canopy cover that results in increased stream temperatures are major threats to mussel viability and sustainability (Dr. John Harris, personal communication in May, 2014, Arkansas State University, adjunct professor, malacologist).

Direct and Indirect Effects

Alternative A: No Action

Proposed management activities would be deferred; there would be no effects on these species.

Alternative B: Proposed Action

Timber Management: Sedimentation and loss of canopy cover that would result in increased stream temperatures are the largest threats to mussels (John Harris, personal communication, May 2014). Sedimentation sources will occur from timber management activities. Riparian vegetation, which helps protect aquatic habitats are protected by streamside management areas, as defined in the Revised Forest Plan (USDA Forest Service, 2005a).

One federally listed mussel, the Arkansas fatmucket, occurs or was known to occur historically in the main stem of the Caddo River within the area of the confluence of Sugarloaf Creek and the Caddo River. Mussel surveys were conducted in 5 miles of the main stem of the Caddo River during August 2015 with US Fish and Wildlife Service. This survey was immediately above the confluence with Sugarloaf Creek to the beginning of backwaters of DeGray Reservoir. No Arkansas Fatmucket were found in this stretch where this mussel historically occurred. However, there is still suitable habitat remaining for the mucket. The closest proposed activities are about 8 miles from the main stem of the Caddo River. These activities are proposed within the Sugarloaf Creek Watershed. In the Mazarn Creek Watershed, Arkansas fatmucket is not known to occur or there is not suitable habitat. All of the sensitive mussel species except for the Western Fanshell occur within the Mazarn as well as its larger tributaries. All five sensitive mussel species occur in the Caddo River. Most of the ownership along the main stem of the Mazarn and the Caddo rivers is private.

The primary activity proposed within Sugarloaf watershed are thinnings. Of the almost 20,000 acres in Sugarloaf watershed, almost 1,200 acres are proposed for harvesting. There will be no new road construction within these stands of proposed activity within Sugarloaf watershed. Temporary roads within this watershed will be constructed, and post activity, the temporary roads will be seeded and closed.

These levels of management are not expected to have any direct impacts on the federally listed mussel or sensitive mussels (Dr. John Harris, personal communication in September 2015, malacologist). No direct impacts are expected from management activities to the federally listed and the Sensitive mussels that occur in the larger river sections or within the tributaries due to the distance and low intensity of activities and the protective riparian measures. Therefore, there should be no direct or indirect effects from vegetative treatments on any of the mussel species.

Chemical: All streams perennial and intermittent would be protected by 100 and 30-foot herbicide application buffers and all source waters would be protected by 300 foot buffers. Buffers are to be clearly marked (herbicide standard HU006) before treatment so applicators can easily see and avoid them (USDA Forest Service, 2005a). Herbicide applications will be conducted according to all applicable “Herbicide Use” Conservation Measures (HU001 – HU018) summarized in the RLRMP and FEIS. Given these conservation measures, mussels should be protected from herbicide applications and any associated direct or indirect effects. Overall, the effects would be beneficial, due to maintenance of quality habitat under the proposed activities.

Prescribed Burning: Direct or indirect effects from prescribed fire would vary due to fire intensity, aspect, and slope and it would be expected that some degree of forest floor cover would be removed. However, prescribed burns would only occur on portions of the analysis area over the 10 year timeline of the proposed project. In addition, strict guidelines outlined in the RLRMP protect streams, limiting the potential for any direct or indirect impacts to aquatic MIS or its habitats. The greatest concern from prescribed burns on aquatic environments is sediment deposition into the aquatic ecosystems. As discussed previously in the Soils section of this Chapter, the RLRMP identifies maximum allowable soil loss thresholds. Using the Universal Soil Loss Equation (USLE) to predict the quantity of soil loss associated with common Forest management practices, activities from the “Proposed Action” alternative fell within the accepted soil loss rates. The model predicts the amount of soil loss resulting from these activities would be below the maximum allowable soil loss for all timeframes.

Roads and Firelines: Removal of vegetative cover and soil disturbance when roads/firelines are established, shaped and drainage structures installed would temporarily increase sedimentation, concentrate runoff, and potentially impact water quality, but failure to reconstruct some of these roads and maintain roads other roads would have more detrimental impacts than the proposed roadwork. Approximately 12.3 miles of road will be reconstructed by surfacing, blading, repairing and cleaning out wing ditches, replacing or repairing culverts and constructing road crossings. These crossings and eroded road sections will be corrected as funding becomes available. Any new firelines and temporary road construction would be water barred and seeded after management activity completion to limit the potential for sediment runoff. These proposed treatments are anticipated to benefit aquatic organisms by decreasing stream siltation and sedimentation.

Wildlife Opening Construction/Improvement/Maintenance: Creation/maintenance of early successional habitat should have no direct or indirect effects on these species.

Watershed Erosion Control: Proposed actions of watershed erosion control will decrease sedimentation. Proposed soil stabilization and restoration treatments are not directly on a wet channel but rather along roads. However, these restoration treatments will reduce sedimentation from run off along roads and therefore reduce potential sediments from entering water courses which will benefit aquatics.

Alternative C: No Herbicide Use

Differences between the direct or indirect effects on these mussel species under the no herbicides alternative and those discussed above under the proposed action alternative are negligible. Under the no herbicides alternative, the site preparation/release activities would not be accomplished using herbicides and would be replaced with manual/mechanical site preparation and release activities such as chainsawing. Non-native, invasive plant treatment using herbicides would also be eliminated under this alternative. Although this alternative would eliminate the use of glyphosate, imazapic, imazapyr and triclopyr, these herbicides are considered only slightly toxic to practically non-toxic to aquatic invertebrates when applied according to registered label directions (US EPA 1993, 1998; SERA 2004, 2011, 2011a, 2011b; see *Appendix B* of the BE for specific toxicity ratings). This alternative would prevent any accidental spills of herbicide near streams. Under the proposed activities, management actions would protect overall forest health and provide long-term, mesic, closed-canopy habitat in streamside management areas. Any effects from the proposed activities would be minimal given that most management activities would take place outside of these species preferred habitat. Overall, the effects would be beneficial, due to maintenance of quality habitat under the proposed activities.

Fish: Paleback Darter, Caddo Madtom and Peppered Shiner

These fish will be considered together due to the Forest management impacts that have likely been most influential on aquatic organisms, in general, are indirect effects to the quality of the water in which they live. The decrease in water quality is usually caused by sedimentation from heavy equipment operation or exposed soils that have been cleared of vegetation. Any activity that disturbs the land surface, decreases cover, or alters vegetation can affect water quality. Protection of riparian zones is one of the most effective means of conserving aquatic systems. Implementation of Best Management Practices (BMPs) and habitat conservation measures established in the Forest Plan (USDA FS 2005a) and FEIS (USDA FS 2005b) for streamside management areas provide protection for the aquatic PETS species being evaluated.

Direct and Indirect Effects

Alternative A: No Action

Proposed management activities would be deferred; there would be no effects on these species.

Alternative B: Proposed Action

Timber Management: Sedimentation and loss of canopy cover that would result in increased stream temperatures are both detrimental threats to these fish. Sedimentation sources are potentially from timber activities management. Aquatic habitats are protected by streamside management areas, as defined in the RLRMP. Under the proposed activities, timber actions would protect overall forest health, and provide long-term, mesic, closed-canopy habitat in streamside management areas. There should be no direct or indirect effects to these fish from vegetative treatments.

Chemical: Herbicides are considered only slightly toxic to practically non-toxic to fish and aquatic invertebrates when applied according to registered label directions (US EPA 1993, 1998; SERA 2004, 2011, 2011a, 2011b; see *Appendix B* of the BE for specific toxicity ratings). All streams perennial and intermittent would be protected by 100 and 30-foot herbicide application buffers and all source waters would be protected by 300 foot buffers; except in treating non-native invasive species. Buffers are to be clearly marked (herbicide standard HU006) before treatment so applicators can easily see and avoid them (USDA Forest Service, 2005a). Herbicide applications will be conducted according to all applicable “Herbicide Use” Conservation Measures (HU001 – HU018) summarized in the RLRMP and FEIS. Given these conservation measures, fish should be protected from herbicide applications and any associated direct/indirect effects.

Prescribed Burning: Direct and indirect effects from prescribed fire would vary due to fire intensity, aspect, and slope and it would be expected that some degree of forest floor cover would be removed. Prescribed burns would occur over only portions of the analysis area over the 10 year timeline of the proposed project. This along with strict guidelines outlined in the RLRMP for protection of perennial streams would limit the potential for any direct or indirect impacts to aquatic MIS or its habitats. The greatest concern from prescribed burns on aquatic environments is sediment deposition into the aquatic ecosystems. As discussed previously in the Soils section of this Chapter, the RLRMP identifies maximum allowable soil loss thresholds.

Roads and Firelines: Removal of vegetative cover and soil disturbance when roads/firelines are established, shaped and drainage structures installed would temporarily increase sedimentation, concentrate runoff, and potentially impact water quality, but failure to reconstruct some of these roads and maintain other roads would have more detrimental impacts than the proposed roadwork. Approximately 12.3 miles of road will be reconstructed by surfacing, blading, repairing and cleaning out wing ditches, replacing or repairing culverts and constructing road crossings. Crossings and eroded road sections will be corrected as funding becomes available. Any new firelines and temporary road construction would be water barred and seeded after management activity completion to limit the potential for sediment runoff. These proposed treatments are anticipated to benefit aquatic organisms by decreasing stream siltation and sedimentation.

Wildlife Opening Construction/Improvement/Maintenance: Creation/maintenance of early successional habitat should have no direct or indirect effects on these species.

Watershed Erosion Control: Proposed actions of watershed erosion control will decrease sedimentation which will result in less turbidity in streams. Proposed soil stabilization and restoration treatments would be used to protect wildlife, soil and water resources. These restoration efforts are not directly on a wet channel but rather along roads. Sections restored along these roads with the installation of cross drain culverts will decrease the amount of run off along the roads and therefore decrease sedimentation into water courses. These restoration treatments are anticipated to benefit aquatics by decreasing stream siltation and sedimentation and improving water quality.

Alternative C: No Herbicide Use

Differences between the direct and indirect effects on these fish species under the no herbicides alternative and those discussed above under the proposed action alternative are negligible. Under the no herbicides alternative, the site preparation/release activities would not be accomplished using herbicides and would be replaced with manual/mechanical site preparation and release activities such as chainsawing. Non-native, invasive plant treatment using herbicides would also be eliminated under this alternative. This alternative would prevent any accidental spills of herbicide near streams. Any direct or indirect effects from the proposed activities would be minimal given that most management activities would take place outside of these species' preferred habitat.

Aquatic Cumulative Effects

As discussed in the Water Quality section of this EA, two methods were used to address cumulative effects of management activities on water quality and its associated beneficial uses (aquatic biota). First, changes in land use and disturbance with respect to increases in sediment were modeled using the ACE model. Second, stream surveys were conducted and results were compared to reference watersheds within their respective sub eco-region.

Biotic integrity is the ability of an ecosystem to maintain a community of organisms that has a composition, diversity and functional organization similar to that of undisturbed stream habitats within the same region. An index of biotic integrity (IBI) provides the species diversity information needed to understand how stable a stream is, and therefore, its condition. Generally, the higher the IBI score, the less disturbed the condition.

Sugar Loaf, Little Mazarn Creek-Lake Hamilton, Little Mazarn Creek and Caney Creek Middle Caddo River Subwatersheds: The predicted sediment delivery from the Proposed Action and the No Herbicide Alternative would not change the current risk level from high. Environmental effects would persist and could change the hydrologic system with observable changes for as long as the causing actions persist. Effects can threaten exceedance of environmental thresholds for periods of time (years). If causative actions persist over time, permanent adjustments can occur to the hydrologic system (USDA Forest Service, 2015). The Ace Cumulative Effects (ACE) Output Analysis Protocol states that if predicted sediment is less than 2% increase over the current condition, then it is not considered to be a measurable change (Moser, 2014). The predicted sediment increases are 0.055, 0.006, 0.036, and 0.006%, respectively, above the current condition; these are not considered to be measurable changes.

Mazarn Creek-Lake Hamilton Subwatershed: For all alternatives, the risk level for Mazarn Creek-Lake Hamilton subwatershed remained high. In summer of 2013-2015, streams were sampled in the the subwatershed (see project file for report). Sampling resulted in the following IBI scores: 80% (2013, 2015) and 73% (2014). Stream sampling verified a "good" IBI score. Additional sampling or supplementary data may be needed to determine if such differences are actually significant; species richness is somewhat below expectation, especially due to loss of the most intolerant forms, some species are present with less than optimal abundances, trophic levels show some sign of stress (USDA Forest Service, 2015).

Upper Mazarn Subwatershed: For all alternatives, the risk level for Upper Mazarn subwatershed remained moderate. Environmental effects are measurable and observable for short periods of time following storm flow events. These effects are short term (less than a few weeks) and do not affect large portions of the watershed. Recovery is complete and beneficial uses are disrupted only for short periods in localized areas. The predicted sediment is a 2.5% increase over the current condition; an increase greater than 2% is considered a measurable change (Moser, 2014). Stream sampling occurred in the summers of 2013-2015. Sampling resulted in IBI scores of 70% (2013, 2015) and 73% (2014). These scores fall within a “fair” IBI category, probably indicating real differences in biotic integrity and environmental quality. Signs of additional deterioration include loss of intolerant forms, fewer species, and a highly skewed trophic structure (USDA Forest Service, 2015).

Caddo Mountain salamander

Direct and Indirect Effects

Alternative A: No Action

Proposed management activities would be deferred; there would be no effects on these species.

Alternative B: Proposed Action

Timber Management: Under the proposed activities, heavy equipment and tree skidding may crush individual salamanders on the ground. However, given the mesic conditions preferred by this species, proposed management activities should occur predominantly outside of its preferred habitat. Heavy equipment use and tree skidding may indirectly cause soil disturbance and lead to temporary disruption of this salamander’s habitat, but most of this species’ mesic habitat is excluded from management actions. This salamander has also shown the ability to perpetuate in second growth forests. Sedimentation and patches of early successional habitat should have negligible effects on this terrestrial species. Under the proposed activities, management actions would protect overall forest health, providing long-term, mesic, closed-canopy habitat in streamside management areas preferred by this species. Soil disturbance, heavy equipment operation and tree skidding would occur predominantly outside of this species’ preferred habitat; therefore, any negative effects would be minimal.

Chemical: Although herbicide application could potentially harm individuals or their eggs, foliar application of herbicides will not be conducted in mesic areas protected under the RLRMP and FEIS. Additionally, the herbicides glyphosate, imazapic, imazapyr and triclopyr are considered relatively non-toxic to having low toxicity levels toward amphibians (US EPA 1993, 1998; SERA 2004, 2011, 2011a, 2011b; see *Appendix B* of the BE). Based on herbicide toxicity ratings and conservation measures established under the RLRMP and FEIS, this salamander should also be protected from effects related to herbicide applications.

Prescribed Burning: Prescribed fire may burn individual salamanders on the ground. However, given the mesic conditions preferred by this species, proposed activities should occur predominantly outside of its preferred habitat; therefore, there should be no direct or indirect

effects. Overall, effects would be beneficial, due to maintenance of quality habitat under the proposed activities and reduced risk of catastrophic wildfires which could destroy the closed canopy preferred by this amphibian.

Roads and Firelines: Road and fireline construction, maintenance and reconstruction will have effects such as increased sedimentation and loss of vegetation. Sedimentation from roads and firelines should have no direct, indirect or cumulative effects on this species. Indirectly and cumulatively this species will benefit from road reconstruction due to decreases in sedimentation which will overall protect the natural resources.

Wildlife Opening Construction/Improvement/Maintenance: Creation/maintenance of early successional habitat should have no direct, indirect or cumulative effects on this species.

Watershed Erosion Control: Proposed actions of watershed erosion control will decrease sedimentation which will result in less turbidity in streams. Proposed soil stabilization and restoration treatments would be used to protect wildlife, soil and water resources. These activities will not likely have any effects.

Alternative C: No Herbicide Use

Differences between effects on this salamander under the no herbicides alternative and those discussed above under the proposed action alternative are negligible. Under this alternative, the site preparation/release activities would not be accomplished using herbicides and would be replaced with manual/mechanical site preparation and release activities such as chainsawing. Non-native, invasive plant treatment using herbicides would also be eliminated under this alternative. No herbicides alternative would prevent any accidental spills of herbicide near streams. This alternative would eliminate any chance for Caddo Mountain salamanders or their eggs to come in contact with glyphosate, imazapic, imazapyr and triclopyr. Effects are expected to be minimal given that most management activities would take place outside of this species' preferred habitat.

Cumulative Effects

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the negative impacts on individuals, and beneficial habitat effects of these ongoing activities.

Bats: Northern Long-eared bat and Eastern small-footed bat

The effects will be addressed with the bats as a group due to their similar preferred habitat needs.

Direct and Indirect Effects

Alternative A: No Action

Proposed management activities would be deferred; there would be no effects on these species.

Alternative B: Proposed Action

Timber Management: Treatments have the potential to both positively and negatively affect both bat species within the project area. For instance, falling trees could directly affect roosting bats and/or maternity sites. Roosting and/or maternity sites could potentially be felled or damaged by cutting that would occur in approximately 431 acres of densely stocked offsite loblolly pine stands. These loblolly stands would be restored to shortleaf pine. However, direct effects are expected to be minimal because there are no known roost trees or maternity trees in the project area.

Direct impacts to small-footed bats would be highly unlikely since these bat species tends to prefer mesic old growth hardwood forest and rocky ridges and rock outcrops for roosting and maternity sites. Although the mentioned habitats are present within the proposed project area these habitats do not fall within areas suitable for timber production and thus would be protected from any potential direct effect/impact related to timber management.

Disturbance within treatment areas may also cause both bat species to temporarily abandon sites but actions would not likely exclude bats from foraging in areas. Thinning of forest stands could indirectly alter foraging areas and temporarily change insect populations and densities within treatment areas. Insect populations would likely increase with increased plant diversity due to more open conditions. Increased openness of the forest mid-story would also benefit foraging bats by easing movement through the forest. No direct or indirect effects would occur to wintering bats because there are no known hibernacula in the project area. The closest known northern long-eared bat hibernaculum is 2.9 miles from the project area and no suitable mine habitat is within the project area. Proposed actions for these forest management activities are consistent with the Interim 4(d) rules for northern long-eared bats (USDI FWS, 2015).

Chemical: Direct effects to northern long-eared and Eastern small-footed bats are unlikely due to herbicide applications for chemical site preparation, timber stand improvement and non-native invasive control treatments occurring during the day when bats are not active. Positive indirect effects could occur from potentially reducing hardwood vegetation during chemical site prep and increasing early seral vegetation and consequently the insect population numbers and/or diversity in treatment areas. Reduction of non-native invasive species would also improve the native plant populations and which could increase insect populations in the area.

Prescribed Burning: would not directly affect northern long-eared and Eastern small-footed bats in the winter because there are no hibernacula's in the project area. Fire from prescribed burning could directly affect both bat species by burning up roost or maternity trees if occurring during the active bat seasons, but would be unlikely because the majority of burns occur in the dormant growing season and there are no known roost trees or maternity trees in the project area. Indirect effects of prescribed burns would be to possibly reduce the amount of understory vegetation that inhibits free bat movement and foraging activity by maintaining uncluttered foraging pathways and easier access to roost trees and disturbance from smoke may also cause bats to temporarily abandon treatment sites but actions would not likely exclude bats from foraging. Proposed burns would occur over the majority of the project area and would be burned in sections during the next 10-year period and beyond. The variety of fire intensities that would

occur due to environmental conditions would provide a habitat mosaic with varying degrees of midstory vegetation removal and occasional overstory tree mortality. Prescribed fire would help maintain and create habitat for this bat species.

Roads and Firelines: Road/Fireline construction, reconstruction and maintenance treatments can have the potential to both positively and negatively affect both bat species within the project area. Road and fireline clearing, could directly affect roosting bat and /or maternity sites, resulting in damaged or removal of trees. If a maternity tree is felled, young non-volant pups could be killed. Disturbance within road/fireline construction, reconstruction and maintenance areas may also cause bats to temporarily abandon sites but, actions would not likely exclude bats from foraging in road corridor areas. No direct or indirect effects would occur to wintering northern long-eared bats because there are no known hibernacula in the road corridor. The closest hibernaculum is 2.9 miles from the project area and no suitable mine habitat is within the project area. Direct effects to small-footed bats would be highly unlikely since this bat species tend to prefer mesic old growth forest, rocky ridges, and outcrops, for roosting and maternity sites. However, direct effects are expected to be minimal because there are no known roost trees or maternity trees in the project area. Indirect benefits would be likely since proposed actions would provide linear flight corridors and linear foraging habitats for bats.

Pond Improvements: Wildlife ponds often support hydrophytic (water dependent plant species) vegetation not found in riparian systems which in turn supports a whole host of aquatic insect species also not found in streams and river systems. This diversity of vegetation and associated insect populations would provide foraging habitats for bats. The direct and indirect effects of pond improvements the existing ponds would be similar to those for timber management and chemical treatments and to provide reliable water sources for the bats throughout the watershed.

Wildlife Opening Construction/Improvement/Maintenance: Wildlife openings play an important role in the foraging ecology of woodland bat species. Many bat species take advantage of wildlife openings since they support a high concentration of insects and a rich diversity of insect populations. The uncluttered flying space provided by openings allows bats to freely maneuver, find and catch insect prey and expend less energy than they normally would in a more heavily forested habitat dodging trees. The direct and indirect effects of wildlife opening construction/improvement to the existing openings and new openings would be similar to those for timber harvest and non-native invasive treatments and to provide open foraging areas throughout the watershed.

Nest Box Installation: Boxes would be placed along ridges, flood plains and mid-slopes to provide summer roosting habitat and possible maternity roosting sites for tree roosting bat species. No direct impacts are anticipated for northern long-eared and Eastern small-footed bat from the placement of bat boxes. Currently there are nine North American bat species known to use bat houses seven of which occur in Arkansas. Northern long-eared bats along with other bat species (little brown bat, free-tailed bat, big brown bat, evening bat) that occur in the area would likely benefit from their placement.

Watershed Erosion Control: Proposed watershed restoration treatments would be used to protect wildlife, soil, and water resources. No direct effects to northern long-eared bats are anticipated since actions would be to close currently open and closed roads/trails and rehabilitate impacted areas. Indirect benefits would be likely since proposed actions would provide linear flight corridors and linear foraging areas for bats.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the negative impacts on individuals, and beneficial habitat effects of these ongoing activities.

Plants Preferring Moderate Disturbance: Waterfall's sedge and Ozark chinquapin

Alternative A: No Action

Proposed management activities would be deferred; there would be no effects on these species.

Alternative B: Proposed Action

Timber Management: Waterfall's sedge has responded well to moderate levels of disturbance. Although it is likely that vegetative portions of individual plants might be directly impacted by felling timber and timber removal, this disturbance should not pose a significant risk to local populations. Regeneration cuts would directly impact this species by being out competed in an open canopy. Thinning of timber stands often indirectly improves habitat conditions for Waterfall's sedge by allowing more sunlight to reach the forest floor (increasing growth potential and seed production) and by providing areas of disturbed soil for dispersal of seeds and development of new growth. Individual plants may be damaged or even uprooted during timber harvest and planting but overall habitat conditions should improve for Waterfall's sedge as a result of the proposed actions.

Timber management actions are proposed for upland shortleaf pine, pine/hardwood and hardwood stands that may support habitats conducive to Ozark chinquapin. Field surveys found no new locations of Ozark chinquapin and known and any newly found locations will be flagged and protected from any proposed timber management treatment in that area. The proposed timber management actions may have direct and indirect effects on Ozark chinquapin from damaging or uprooting trees.

Chemical: Target areas for most herbicide application will occur in areas that are suffocated with invasive plants and along roadsides, it is possible that these treatments can occur in MA 6. Individual *Carex latebracteata* plants could be impacted if prescribed burning and or heavy

equipment was used as a control treatment during growing season. Herbicide application methods, including direct application to target foliage or to freshly cut stumps/surfaces, would minimize the possibility of direct contamination to non-target species. Effects to sensitive plants will be further minimized because; the use of herbicides is prohibited when weather conditions exceed the threshold for use that could cause drift LRMP (HU015, Table 3.8, pp. 88-89) and locations of these sensitive plants within the project area are documented. The greatest threat to glade species like waterfall's sedge is habitat loss due to the encroachment of woody and non-native invasive herbaceous species into open glade areas. The herbicide application to invasive vegetative species and the removal of wood species will improve habitat quality by increasing light to the forest floor decreasing competition.

Direct effects to Ozark chinquapin are unlikely due to no new locations and occurrence in areas where most applications of herbicide will occur. This tree's physical form is easily recognized allowing avoidance in know location planned for invasive species control by mechanical and herbicide application. The forest plant 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. Chinquapins respond well to an increased level of light and a reduction in competition for water, space, and nutrients when competing vegetation is reduced by herbicide.

Prescribed Burning: Vegetative portion of plants and some seed loss would likely occur depending on intensity and duration of burn events. Some individual Ozark chinquapins may be set back by being burned but they would be expected to re-sprout from their stumps. It is likely that Waterfall's sedge would benefit indirectly from burning due to reduced competition and their ability to tolerate moderate soil disturbance. Loss of the natural fire regime has led to successional change that has negatively affected regeneration and growth in chinquapin (NatureServe 2015). Prescribed burning would help reduce understory competition providing long-term opportunities for individual plants to grow and would attempt to restore the fire regime.

Roads and Firelines: Road/fireline construction/ reconstruction and maintenance may be detrimental to both species by uprooting individual plants. Uprooting of Ozark chinquapin and *Carex latebracteata* would result in the permanent loss of that individual plant. However, given that the Waterfall's sedge occurs in diverse habitats it could recolonize areas of temporary roads and firelines the disturbed area therefore any direct effects should not be permanent. Habitat on open roads would be eliminated into the future. Any soil disturbance from construction/ reconstruction should be temporary.

Pond Improvements: The proposed activities would occur outside of habitats preferred by these plants species, no direct or indirect impact are anticipated.

Wildlife Opening Construction/Improvement/Maintenance: At the future proposed sites for wildlife openings no occurrence of these two sensitive plant species were found. Therefore no direct or indirect impacts are anticipated for these plant species.

Nest Box Installation: The proposed activities would occur outside of habitats preferred by these plants species, no direct or indirect impact are anticipated.

Watershed Erosion Control: Proposed watershed restoration treatments would be used to protect wildlife, soil and water resources. No direct impacts are anticipated since the majority of sites do not contain suitable habitat due to impacts of over use. It is possible that Waterfall's sedge would receive some indirect benefits from restoration activities since Waterfall's sedge can reestablish itself in areas with some soil disturbance.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the negative impacts on individuals, and beneficial habitat effects of these ongoing activities.

Plants of Streamside Management Areas: Southern lady's slipper and Browne's waterleaf

Alternative A: No Action

Proposed management activities would be deferred; there would be no effects on these species.

Alternative B: Proposed Action

Timber Management: Timber management treatments are proposed for upland shortleaf pine, pine/hardwood and hardwood stands, these treatment areas only support habitat conditions for these sensitive species within streamside management areas and wetland communities such as seeps and springs, which are protected by the standards in the LRMP. The proposed timber management actions would have no direct or indirect impact on these sensitive plant species. Chemical Treatments (chemical site preparation, chemical timber stand improvement and non-native invasive control)

Chemical: Target areas for most herbicide application will occur in areas that are suffocated with invasive plants and along roadsides, it is possible that these treatments can occur in MA 9. Individual plants could be impacted if prescribed burning and or heavy equipment was used as a control treatment during growing season. Herbicide application methods, including direct application to target foliage or to freshly cut stumps/surfaces, would minimize the possibility of direct contamination to non-target species. Effects to sensitive plants will be further minimized

because; the use of herbicides is prohibited when weather conditions exceed the threshold for use that could cause drift LRMP (HU015, Table 3.8, pp. 88-89) and locations of these sensitive plants within the project area are documented.

The riparian areas are being affected by invasive plants encroachment that could affect Southern lady's slipper and Browne's waterleaf. The herbicide application to invasive species and the removal of wood species will improve habitat quality by decreasing competition though some individual southern lady's slipper and Browne's waterleaf plants could be damaged or killed during the herbicide treatment.

Prescribed Burning: Prescribed burns would occur over the majority of the project area. Effects would vary due to fire intensity, aspect, and slope and it would be expected that some degree of the forest floor cover would be removed. Overall prescribed fire is not likely to directly impact these species due to the wet habitat conditions in which they normally occur and prescribed burning occurring during the plants dormancy. Indirectly, plants may benefit post burn due to reduced competition.

Roads and Firelines: Fire lines used for prescribed burning would take advantage of existing natural barriers such as existing roadways and streams and utilizing hand lines within streamside management areas limiting the amount of disturbance in preferred habitats. Reconstruction of system roads would occur in previously disturbed areas generally unsuitable to these sensitive plant species due to soil compaction. Direct or indirect effects are not anticipated because of the limited amount of disturbance to preferred habitats. Roads or firelines if constructed in riparian areas seeps and/or spring heads the habitat could be altered and become unsuitable for these species.

Under the proposed activities, management actions would protect overall forest health and provide long-term, mesic, closed-canopy habitat in streamside management areas and seeps/springs preferred by these plants. Soil disturbance, heavy equipment operation, prescribed fire, creation/maintenance of early successional habitat, and sedimentation within the project area would largely occur outside of this species; preferred habitat; therefore, any negative effects would be minimal.

Pond Improvements: No direct or indirect impacts are anticipated for these sensitive plant species.

Wildlife Opening Construction/Improvement/Maintenance: Examination of proposed future sites for wildlife openings found no occurrence of these sensitive plant species. Therefore no direct or indirect impacts are anticipated for these plant species.

Nest Box Installation: The proposed activities would occur outside of habitats preferred by these plants species, no direct or indirect impact are anticipated.

Watershed Restoration

Watershed Erosion Control: Proposed soil stabilization and restoration would be used to protect wildlife, soil and water resources. No direct effects would occur to these sensitive plant species since botanical surveys found, no occurrences, nor sites that support habitat conditions conducive to these sensitive plant species. The restoration sites do not contain suitable habitat for these sensitive plant species due to impacts of over use. Indirect effects anticipated from rehabilitation of these sensitive plant species habitats are reduced stream siltation, soil compaction and sedimentation.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the negative impacts on individuals, and beneficial habitat effects of these ongoing activities.

Diana fritillary

Alternative A: No Action

Proposed management activities would be deferred; there would be no effects on these species.

Alternative B: Proposed Action

Timber Management: Adult butterflies are highly mobile and it is unlikely that they would be directly affected by timber management actions. However, there is the possibility of harm to eggs and larvae if trees are felled or equipment impacts eggs and larva in the leaf litter. Although timber management activities may directly affect eggs and larvae of butterflies these same actions (including TSI and WSI) would also allow for increases in new herbaceous plant growth which may contain high quality nectar producers and violets for egg deposition beneficial for this butterfly species.

All treatment actions would create some disturbance to the understory vegetation and could result in the temporary loss of some woody shrubs, and annual, and perennial broadleaf herbaceous plant species that provide shelter and food sources for this butterfly species. While some butterfly habitats may be impacted by the treatment activities, maintaining or expanding suitable habitat would be beneficial for this species in the long-term.

Chemical: Given the great diversity of species of terrestrial invertebrates, the use of data from a single species (*Bee-Apis mellifera*) for the risk characterization obviously leads to uncertainty in the risk assessment. However, given the preponderance of scientific studies available this information is applicable and represents the best science resource to date.

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, annual, and perennial broadleaf herbaceous plant species that provide shelter and food sources for this butterfly species. While some butterfly habitats may be impacted by the treatment activities, maintaining or expanding suitable habitat would be beneficial for the species in the long-term. The table below lists the toxicity risk to insects.

SUMMARY OF LD₅₀ VALUES FOR BEE (TABLE 3.11)

Active Ingredient	LD ₅₀ *	Toxicity Risk to Bee – <i>Apis mellifera</i>	Risk Assessment
Glyphosate	>100 µg/bee	Relatively Nontoxic	Syracuse Environmental Research Associates, Inc. 2011a
Imazapic	No LD50 stated		Syracuse Environmental Research Associates, Inc. 2004a
Imazapyr	>100 µg/bee	Relatively Nontoxic	Syracuse Environmental Research Associates, Inc. 2011b
Picloram	>100 µg a.i./bee	Relatively Nontoxic	Syracuse Environmental Research Associates, Inc. 2011c
Triclopyr	>72 µg/bee	Nontoxic	Syracuse Environmental Research Associates, Inc. 2011d

LD50*- lethal dose for 50% of population tested

Prescribed Burning: Adult Diana fritillary butterflies are naturally adept at avoiding natural and prescribed fires, therefore no direct impacts are anticipated. There is the possibility that prescribed burning may directly kill eggs and larvae over-wintering in the leaf litter. However, prescribed burning benefits should far outweigh the onetime loss of eggs and larvae by enhancing and expanding the acres of suitable foraging and egg laying habitat throughout the watershed. Indirect effects of proposed burning would enhance and increase in acres of suitable foraging and egg laying habitat.

Roads and Firelines: Since adult butterflies are highly mobile it is extremely unlikely that they would be directly affected by road/fireline construction, reconstruction and maintenance treatments. However, there is the possibility of crushing eggs and larvae with heavy equipment. Although proposed activities may have direct negative effects on eggs and larvae of butterflies, these same actions would also allow for increases in new herbaceous plant growth which may contain high quality nectar producers and violets for egg deposition beneficial for this butterfly species.

All proposed actions would create some disturbance to the understory vegetation and could result in the temporary loss of some woody shrubs, annual and perennial broadleaf herbaceous plants species that provide shelter and food sources for this butterfly species. While some butterfly habitats may be negatively impacted by the treatment activities, maintaining or expanding suitable habitat would be “beneficial” for the species in the long-term.

Pond Improvements: No direct are anticipated as a result of improving ponds in the project area. Indirect effects may include herbaceous vegetation around the pond being disturbed during restoration which could cause a small temporary interruption in the butterflies' habitat.

Wildlife Opening Construction/Improvement/Maintenance: Wildlife opening construction/improvements would not impact the Diana fritillary directly, since they are highly mobile. However, the possibility of construction/improvements may directly impact eggs and larvae if in leaf litter. Indirect effects would provide habitat for plant species that is used by this butterfly and should outweigh the loss of eggs and larvae by enhancing suitable foraging and egg laying habitat.

Nest Box Installation: No direct or indirect impacts are anticipated as a result of placing roosting or nest boxes within that project area. Placement would require minimal ground disturbance if any and would not result in the loss of vegetation upon which Diana fritillary is dependent.

Watershed Erosion Control: Watershed restoration would be used to protect wildlife, soil and water resources. No direct impacts to Diana fritillary are anticipated since action would be close to open roads, reassign designation of existing roads and improve impacted areas. However, there is the possibility of harm to eggs and larvae if equipment impacts eggs and larva in the leaf litter. It is likely the proposed actions would indirectly benefit butterflies by allowing the areas to revegetate thus providing potential foraging habitat.

Alternative C: No Herbicide Use

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

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the negative impacts on individuals, and beneficial habitat effects of these ongoing activities.

Local Economy & Financial Efficiency

Present Conditions

The majority of the Bonnerdale Project area falls in Garland and Montgomery counties. As of 2013, the population of these counties was 97,173 and 9,226; respectively. These counties' economic base is made up of tourism, agriculture, mining and timber. For Garland County, national forest lands occupy fifty-seven percent of the area, while for Montgomery County the number is sixty-five percent. Based on these percentages, the local timber industries depend on National Forest land for a source of raw material. In 2013, the average earnings per job were \$35,535 for Garland County; while Montgomery County was \$23,804.

Alternative A: No Action

Direct, Indirect and Cumulative Effects

There would be no effects on the local economies from not implementing the proposed actions. Ongoing Forest Service contracts located within Garland and Montgomery counties would continue to provide jobs and revenue to local communities and businesses.

Alternatives B and C: Proposed Action and No Herbicide

Direct, Indirect and Cumulative Effects

Many management actions are performed by contractors (site preparation, stand improvement, timber sale layout etc.). These activities would provide jobs to the local community and create a stream of revenue to local businesses. These effects would be additive to ongoing Forest Service contracts located within Garland and Montgomery counties.

Project Financial Efficiency

Under Alternative B and Alternative C there would be both costs and revenues associated with the sale of timber. Costs include activities that are directly associated with timber management (site preparation, timber sale administration, road maintenance, etc.). Revenues are generated from the sale of timber. A computer program called Quick Silver version 7.0 was used to evaluate the financial efficiency of each alternative; these results are displayed in the table below. The detailed costs, revenues, and the complete Quick Silver analysis report are in the project file.

COMPARISON BY FINANCIAL EFFICIENCY (TABLE 3.12)

Financial Indicator	Alternative A No Action \$	Alternative B Proposed Action \$	Alternative C No Herbicide \$
Present Value of Revenues ¹	0	2,140,445.81	2,140,445.81
Present Value of Costs ²	0	(2,004,644.31)	(2,033,692.86)
Present Net Value ³	0	135,801.49	106,752.95
Revenue/Cost Ratio ⁴	N/A	1.07	1.05

1- Present Value of Revenues – The sum of all revenues discounted at some interest rate.

2- Present Value of Costs – The sum of all costs discounted at some interest rate.

3- Net Present Value – The sum of the present value of the revenues minus the sum of the present value of the costs.

4- Revenue/Cost Ratio – Present value of revenues divided by the present value of costs.

The Revenue/Cost Ratio is highest for Alternative B. Costs for manual activities are higher than the use of herbicides under Alternative C.

Public Health & Safety

Present Conditions

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

Alternative A: No Action

Direct and Indirect Effects

The prescribed burning and the application of herbicides prescribed in Alternative B would not take place under Alternative A. Therefore, there would be no direct effect to public health and safety specific to these activities under Alternative A.

Under the No Action alternative, controlled fuel reductions burns would continue to take place under the Bonnerdale Pre-Mark Burn CE. This could pose a risk to public health and safety in the form of an increase in the likelihood of smoke exposure, but only for a short amount of time. Under the No Action Alternative there would be no application of herbicides; therefore, there would be no indirect effects to public health and safety in regards to the application of herbicides.

Cumulative effects

There are no actions proposed under this alternative, so there would be no cumulative effects on this resource.

Alternative B: Proposed Action

Direct and Indirect Effects

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 (Forest Service Manual 2109 Chapter 30) 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 significant threat to human health or aquatic organisms.

Syracuse Environmental Research Associates Incorporated (SERA) Human Health and Ecological Risk Assessments were used to analyze the risks associated with the six herbicides proposed under this Alternative. Project specific SERA worksheets were completed for glyphosate, imazapyr, imazapic, triclopyr-A, triclopyr-E and picloram.

Project specific SERA worksheets (version 6.0) 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, and consuming contaminated vegetation for an adult female at upper level applications.

Project specific SERA worksheets (version 6.0) 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 10 gallons per acre, and upper application volume is 20 gallons per acre. All Hazard Quotients are at acceptable levels (less than 1) for all worker exposure scenarios and all general public exposure scenarios.

Active ingredient imazapic may be used at a rate of 0.10 pounds/acre under this analysis. It would generally be applied as a foliar application to the non-native invasive species. Typical exposures to imazapic do not lead to estimated doses that exceed a level of concern. For workers, no exposure scenarios, acute or chronic, generate a level of concern even at the upper ranges of estimated doses. For members of the general public, the upper limits for hazard quotients are below a level of concern except for the accidental spill of a large amount (> 200 gallons) of imazapic into a very small pond. Immediate consumption of water from this pond would reach a level of concern (SERA 2004, pgs 3-22 to 3-24.). Measures are taken to help ensure that these accidental spills do not happen and that the general public does not come in contact with herbicides. For example, by establishing buffer zones of non-treatment around private property, and streams; carefully transporting only enough herbicide for one days 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.

Project specific SERA worksheets (version 6.0) were completed for triclopyr-amine 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 21.5 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 a whole child at upper level applications; the direct spray of an adult female's feet and lower legs at central and upper level applications; vegetation contact by an adult female wearing shorts and t-shirt at central and 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 lower, central and upper level applications; and water consumption from an accidental spill by a child at upper level applications; Chronic (longer term) exposures for the consumption of contaminated vegetation by an adult female at central and upper level applications.

Project specific SERA worksheets (version 6.0) were also completed for triclopyr-ester formulation at the maximum prescribed rate of 0.76 pounds per acre. The lower application volume is 5 gallons per acre, central application volume is 21 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: accidental/incidental exposure of workers to contaminated gloves for 1 hour, 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 central and upper level applications; vegetation contact by an adult female wearing shorts and t-shirt at central and 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 lower, central and upper level applications; and water consumption from an accidental spill by a child at upper level applications; Chronic (longer term) exposures for the consumption of contaminated vegetation by an adult female at central and upper level applications.

Project specific SERA worksheets (version 6.0) were also completed for picloram formulation at the maximum prescribed rate of 1 pound per acre. The lower application volume is 5 gallons per acre, central application volume is 30 gallons per acre, and upper application volume is 100 gallons per acre. Hazard Quotients are at acceptable levels (less than 1) for all exposure scenarios except for the following: chronic (longer term) exposures for the consumption of contaminated vegetation by an adult female at upper level applications.

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.

Alternative C: No Herbicide Use

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.

Recreation, Scenic Resource, Wild & Scenic Rivers

Present Conditions

Possible mixes or combinations of activities, settings, and probable experience opportunities are arranged along a spectrum, or continuum. This continuum is called the Recreation Opportunity Spectrum (ROS) and is divided into six classes. Each class is defined in terms of the degree to which it satisfies certain recreation experience needs. The following ROS class is present in the project area:

Roaded Natural - Area characterized by a predominantly natural or natural appearing environment with a low probability of experiencing isolation from the sights and sounds of man. Interaction between users may be low to moderate, but with evidence of other users prevalent. Conventional motorized use is provided for in construction standards and design of facilities. Opportunities for both motorized and non-motorized forms of recreation may be provided.

The primary recreational activities occurring within the project area are off highway vehicle (OHV) use, camping at dispersed campsites, hunting (deer, turkey, squirrel, etc.), hiking along old roads and trails, wildlife viewing and driving for pleasure.

Scenic Integrity Objectives (SIOs) are desired levels of excellence based on physical and sociological characteristics of an area. They refer to the degree of acceptable alterations to the landscape character. SIOs range from very high to low. The SIOs occurring within the project area are moderate and low. These SIOs are defined as follows:

Moderate - Landscapes appear slightly altered. Noticeable human-created deviations must remain visually subordinate to the landscape character being viewed.

Low - Landscapes appear moderately altered. Human-created deviations begin to dominate the valued landscape character being viewed but borrow from valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed.

The project area is bounded to the south by the Caddo River, an eligible river for consideration as a component of the National System of Wild and Scenic Rivers. The closest wilderness (Caney Creek) and the nearest Roadless area (Brush Heap) are both located approximately 30 miles west of the project area.

Alternative A: No Action

Direct and Indirect Effects

In the short term, by not implementing the proposed activities, this Alternative would not alter scenic integrity. Changes in the landscape would continue to appear natural to the observer. In the long term, scenic quality may be compromised by not implementing harvest activities in this area. Densely stocked stands result in reduced vigor or health, which increases an area's susceptibility to insects and disease. Infestations could result in tree death, negatively impacting visual quality.

In the event of a wildfire or crown fires, those that sweep through the canopy, there would be a visible change to the landscape. Snags would appear as black, brown, and gray "skeletons". Other trees would show burn scars. Burn scars on tree trunks or "torched trees" remain visible for a long time. Understory vegetation would quickly green up, however the standing burned vegetation would remain.

Cumulative effects

There would be no cumulative effects; no management actions are proposed; no additive effect would occur.

Alternative B: Proposed Action

Direct and Indirect Effects

Immediate effects to the recreation resource would include a disturbance in the recreation experience by the sights, sounds, and smells of management activities such as logging operations and prescribed burning. Noise from logging and road construction, as well as increased dust, would be a temporary disturbance while management activities are being performed. Regeneration harvests and thinning operations could result in increased wildlife viewing and hunting opportunities.

Proposed modified seed tree regeneration harvests would reduce the stand basal area and create a visible linear edge along the surrounding forest. The number of trees removed from a typical thinning usually creates a minimal change in the forest form. Few, if any, linear edges occur. Pine needles in slash turn a distinctive red-orange color and the wood becomes gray. Hardwood slash does not change color, but tends to be noticeable in early spring and in late fall. Understory vegetation helps screen slash from view.

Proposed site preparation would result in a loss of midstory and understory vegetative screening, and produce slash on the forest floor. Because these activities target hardwoods, a loss of spring and fall colors would be evident. Although the application of herbicides may coincide with the seasonal browning of leaves in autumn, standing dead vegetation may be evident for two or three years after application.

Changes in color and texture would result from exposed soil in roads, skid trails, and firelines. Prescribed fires that burn along the ground tends to create short-term color changes. Prescribed burning would temporarily reduce the amount of understory vegetation, allowing for greater viewing depth into the forest. Burning would create a charred appearance on tree trunks and the forest floor. These effects would diminish in three to six months due to regrowth of vegetation on the forest floor, as well as natural leaf shedding. The landscape would regenerate within 1 to 2 years following the disturbance, allowing greening-up and limiting far distant views into the landscape.

By implementing the proposed harvest activities, thus increasing the vigor or health of the trees, may reduce the negative impacts to visual quality that could result from insects and disease. By implementing the prescribed burning blocks, the detrimental effects to visual quality resulting from catastrophic fire are diminished. Namely, the chance of a crown fire is diminished that could result in dead overstory trees and large burn scars on remaining live trees.

There would be no effects on roadless areas or wilderness due to their distant location from management actions.

Cumulative effects

Approximately 3,500 acres of prescribed burning is scheduled to be implemented within the project area in 2016. The prescribed burning proposed in this project would be additive to the beneficial habitat effects, as well as the detrimental effects to individuals, of these ongoing activities.

Alternative C: No Herbicide Use

The effects of Alternative C would be the same as those listed under Alternative B above except the listed effects from herbicide would not occur.

Climate Change

Effects of proposed actions on climate change

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 CO₂ from the atmosphere in the process of photosynthesis and releasing carbon into the atmosphere through live plant respiration, decomposition of dead organic matter, and burning of biomass (Krankina and Harmon, 2006).

Through the process of photosynthesis, carbon is removed from the atmospheric pool. About half the carbon absorbed through photosynthesis is later released by plants through respiration as they use their own energy to grow. The rest is either stored in the plant, transferred to the soil where it 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 CO₂ 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 CO₂. 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 (CO₂) 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, et al.).

Alternative A: No Action

Direct and Indirect Effects

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 are included (Malmsheimer, Heffernan, Brink, et al.). In the absence of prescribed fire, fuel loadings would continue to increase and accumulate on the forest floor. In the event of a wildfire, fuel loading would be higher, increasing the risks of catastrophic damage to natural resources. This would result in a large release of GHG and carbon into the atmosphere. By deferring timber harvest activities, the forests would continue to

increase in density. Over time this could pose a risk to density dependent mortality, insects, and disease. This could result both in a release of carbon from tree mortality and decomposition as well as hinder the 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.

Alternatives B and C: Proposed Action and No Herbicide

Direct and Indirect Effects

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 CO₂ emissions from wood products are delayed (Malsheimer, Heffernan, Brink, et al.). Prescribed burning activities, although a carbon neutral process, would release CO₂, 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.

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 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, for this project, no direct, indirect, or cumulative effects from climate change on the proposal are anticipated.

Chapter 4

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Chapter 5

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Chapter 6

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Appendices

(A) Activities List by Compartment and Stand

(B) Project Maps

- 1. Project Area and Compartments**
- 2. Management Areas**
- 3. Harvest and Road Activities**
- 4. Silvicultural Activities**
- 5. Prescribed Burning Activities**
- 6. Wildlife Activities**

Appendix A – Activities by Compartment and Stand (Proposed Action)

Compartment	Stand	Activity	Acres	Miles	Number
12	3	Release (Chem/Manual) & PCT	58		
12	5	Commercial Thin	62		
12	6	Commercial Thin	29		
12	7	Release (Chem/Manual) & PCT	29		
12	8	Release (Chem/Manual) & PCT	50		
12	9	Commercial Thin	10		
12	10	Seedtree	26		
12	10	Site Prep Burn	26		
12	10	Site Prep (Chem/Mechanical)	26		
12	10	Release (Chem/Manual)	26		
12	10	Pre-commercial Thin	26		
12	10	Chop/Rip/Hand Plant S.L. Seedlings	26		
12	11	Commercial Thin	29		
12	12	Commercial Thin	38		
12	13	Commercial Thin	13		
12	14	Seedtree	66		
12	14	Site Prep Burn	66		
12	14	Site Prep (Chem/Mechanical)	66		
12	14	Release (Chem/Manual)	66		
12	14	Pre-commercial Thin	66		
12	14	Chop/Rip/Hand Plant S.L. Seedlings	66		
12	14	Wildlife Opening Construction	6		
12	15	Pre-commercial Thin	31		
12		Nest Box Installation			8
12		Pond Improvement			4
12		New Fireline Construction		2	
12		Fireline Maintenance		2.3	
12		Road Reconstruction		2.3	
12		Road Construction (Temporary)		1.3	
16	2	Commercial Thin	10		
16	4	Release (Chem/Manual)	47		
16	5	Commercial Thin	51		
16	6	Commercial Thin	36		
16	7	Commercial Thin	10		
16	8	Old Growth Restoration	347		
16	10	Commercial Thin	12		
16	11	Release (Chem/Manual) & PCT	45		

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Compartment	Stand	Activity	Acres	Miles	Number
16	13	Release (Chem/Manual)	43		
16	14	Commercial Thin	41		
16	17	Commercial Thin	15		
16	18	Commercial Thin	6		
16	19	Old Growth Restoration	42		
16	20	Old Growth Restoration	32		
16	21	Release (Chem/Manual) & PCT	25		
16	31	Release (Chem/Manual) & PCT	41		
16	47	Commercial Thin	34		
16	47	Wildlife Opening Improvement	1		
16		Nest Box Installation			3
16		New Fireline Construction		2.2	
16		Fireline Maintenance		0.7	
16		New Road Construction		0.4	
16		Road Reconstruction		2.8	
16		Road Construction (Temporary)		2.6	
21	1	Seedtree	37		
21	1	Site Prep Burn	37		
21	1	Site Prep (Chem/Mechanical)	37		
21	1	Release (Chem/Manual)	37		
21	1	Pre-commercial Thin	37		
21	1	Chop/Rip/Hand Plant S.L. Seedlings	37		
21	2	Commercial Thin	54		
21	3	Commercial Thin	78		
21	4	Commercial Thin	73		
21	5	Commercial Thin	49		
21	6	Commercial Thin	59		
21	7	Release (Chem/Manual) & PCT	30		
21	9	Site Prep Burn	53		
21	9	Site Prep Burn	36		
21	9	Site Prep (Chem/Mechanical)	53		
21	9	Site Prep (Chem/Mechanical)	36		
21	9	Release (Chem/Manual)	53		
21	9	Release (Chem/Manual)	36		
21	9	Pre-commercial Thin	53		
21	9	Pre-commercial Thin	36		
21	9	Chop/Rip/Hand Plant S.L. Seedlings	53		
21	9	Chop/Rip/Hand Plant S.L. Seedlings	36		
21	9	Release (Chem/Manual) & PCT	42		
21	10	Commercial Thin	65		

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Compartment	Stand	Activity	Acres	Miles	Number
21	11	Commercial Thin	38		
21	11	Seedtree	18		
21	11	Site Prep Burn	18		
21	11	Site Prep (Chem/Mechanical)	18		
21	11	Release (Chem/Manual)	18		
21	11	Pre-commercial Thin	18		
21	11	Chop/Rip/Hand Plant S.L. Seedlings	18		
21	12	Woodland Stand Development	61		
21	13	Woodland Stand Development	36		
21	14	Commercial Thin	38		
21	14	Seedtree	51		
21	14	Site Prep Burn	51		
21	14	Site Prep (Chem/Mechanical)	51		
21	14	Release (Chem/Manual)	51		
21	14	Pre-commercial Thin	51		
21	14	Chop/Rip/Hand Plant S.L. Seedlings	51		
21	14	Wildlife Opening Improvement	1		
21	17	Seedtree	53		
21	19	Seedtree	36		
21	20	Woodland Stand Development	46		
21	22	Woodland Stand Development	17		
21		Nest Box Installation			7
21		Pond Improvement			5
21		New Fireline Construction		11.5	
21		New Road Construction		0.3	
21		Road Reconstruction		0.6	
21		Road Construction (Temporary)		2.5	
22	2	Commercial Thin	70		
22	3	Old Growth Restoration	124		
22	4	Pre-commercial Thin	39		
22	5	Commercial Thin	40		
22	6	Commercial Thin	51		
22	7	Old Growth Restoration	55		
22	9	Release (Chem/Manual) & PCT	68		
22	10	Old Growth Restoration	70		
22	11	Old Growth Restoration	64		
22	12	Old Growth Restoration	18		
22	13	Release (Chem/Manual) & PCT	18		
22	14	Commercial Thin	30		
22	15	Commercial Thin	14		

Bonnerdale Project

Compartment	Stand	Activity	Acres	Miles	Number
22	16	Commercial Thin	26		
22	17	Old Growth Restoration	15		
22		Pond Improvement			3
22		New Fireline Construction		3.6	
22		Fireline Maintenance		0.5	
22		Road Maintenance (Pre-haul)		2.5	
22		Road Construction (Temporary)		2.6	
23	1	Release (Chem/Manual) & PCT	84		
23	2	Commercial Thin	70		
23	4	Prescribe Burn	48		
23	5	Seedtree	46		
23	5	Site Prep Burn	46		
23	5	Site Prep (Chem/Mechanical)	46		
23	5	Release (Chem/Manual)	46		
23	5	Pre-commercial Thin	46		
23	5	Chop/Rip/Hand Plant S.L. Seedlings	46		
23	6	Commercial Thin	73		
23	7	Commercial Thin	91		
23	8	Woodland Stand Development	66		
23	8	Woodland Stand Development	52		
23	9	Woodland Stand Development	50		
23	11	Woodland Stand Development	36		
23	12	Woodland Stand Development	56		
23	13	Commercial Thin	56		
23	17	Pre-commercial Thin	40		
23	18	Pre-commercial Thin	93		
23	20	Commercial Thin	30		
23	22	Prescribe Burn	64		
23	24	Woodland Stand Development	35		
23	24	Wildlife Opening Improvement	1		
23	27	Wildlife Stand Improvement	14		
23	30	Woodland Stand Development	58		
23	31	Commercial Thin	13		
23	42	Woodland Stand Development	63		
23	45	Release (Chem/Manual) & PCT	40		
23	46	Release (Chem/Manual)	79		
23	49	Woodland Stand Development	10		
23	52	Release (Chem/Manual) & PCT	23		
23		Nest Box Installation			4
23		Pond Improvement			4

Bonnerdale Project

Compartment	Stand	Activity	Acres	Miles	Number
23		New Fireline Construction		5.6	
23		Fireline Maintenance		1.4	
23		Road Reconstruction		3.5	
23		Road Maintenance (Pre-haul)		2.5	
23		Road Construction (Temporary)		3.1	
24	1	Commercial Thin	90		
24	2	Commercial Thin	89		
24	3	Commercial Thin	48		
24	5	Woodland Stand Development	34		
24	6	Woodland Stand Development	21		
24	7	Woodland Stand Development	26		
24	7	Wildlife Stand Improvement	26		
24	8	Woodland Stand Development	20		
24	9	Commercial Thin	59		
24	10	Woodland Stand Development	15		
24	11	Woodland Stand Development	17		
24	12	Release (Chem/Manual) & PCT	13		
24	13	Release (Chem/Manual) & PCT	36		
24	17	Woodland Stand Development	50		
24	18	Release (Chem/Manual) & PCT	39		
24	20	Woodland Stand Development	66		
24	31	Pre-commercial Thin	49		
24	32	Pre-commercial Thin	33		
24		Nest Box Installation			2
24		Pond Improvement			2
24		New Fireline Construction		2.5	
24		Fireline Maintenance		1.9	
24		Road Reconstruction		2.2	
24		Road Maintenance (Pre-haul)		0.6	
24		Road Construction (Temporary)		1.8	
26	1	Woodland Stand Development	74		
26	2	Commercial Thin	63		
26	3	Woodland Stand Development	105		
26	4	Woodland Stand Development	43		
26	5	Commercial Thin	81		
26	6	Commercial Thin	60		
26	6	Wildlife Opening Improvement	1		
26	11	Release (Chem/Manual) & PCT	5		
26	24	Wildlife Stand Improvement	2		
26	30	Wildlife Stand Improvement	34		

Bonnerdale Project

Compartment	Stand	Activity	Acres	Miles	Number
26	33	Seedtree	69		
26	33	Site Prep Burn	69		
26	33	Site Prep (Chem/Mechanical)	69		
26	33	Release (Chem/Manual)	69		
26	33	Pre-commercial Thin	69		
26	33	Chop/Rip/Hand Plant S.L. Seedlings	69		
26		Nest Box Installation			3
26		Pond Improvement			4
26		New Fireline Construction		2.8	
26		Road Reconstruction		0.9	
26		Road Maintenance (Pre-haul)		0.6	
26		Road Construction (Temporary)		1.6	
27	6	Seedtree	25		
27	6	Site Prep Burn	25		
27	6	Site Prep (Chem/Mechanical)	25		
27	6	Release (Chem/Manual)	25		
27	6	Pre-commercial Thin	25		
27	6	Chop/Rip/Hand Plant S.L. Seedlings	25		
27	7	Commercial Thin	216		
27	8	Commercial Thin	70		
27	9	Release (Chem/Manual) & PCT	46		
27	10	Commercial Thin	29		
27	11	Commercial Thin	58		
27	12	Commercial Thin	77		
27	13	Commercial Thin	29		
27	14	Pre-commercial Thin	29		
27	18	Release (Chem/Manual) & PCT	31		
27	19	Pre-commercial Thin	21		
27	20	Seedtree	15		
27	20	Site Prep Burn	15		
27	20	Site Prep (Chem/Mechanical)	15		
27	20	Release (Chem/Manual)	15		
27	20	Pre-commercial Thin	15		
27	20	Chop/Rip/Hand Plant S.L. Seedlings	15		
27	21	Seedtree	12		
27	21	Site Prep Burn	12		
27	21	Site Prep (Chem/Mechanical)	12		
27	21	Release (Chem/Manual)	12		
27	21	Pre-commercial Thin	12		
27	21	Chop/Rip/Hand Plant S.L. Seedlings	12		

Bonnerdale Project

Compartment	Stand	Activity	Acres	Miles	Number
27	25	Commercial Thin	9		
27	26	Commercial Thin	22		
27		Nest Box Installation			3
27		Pond Improvement			5
27		New Fireline Construction		1.1	
27		Fireline Maintenance		3.8	
27		Road Maintenance (Pre-haul)		0.5	
27		Road Construction (Temporary)		2.6	
28	2	Seedtree	45		
28	2	Site Prep Burn	45		
28	2	Site Prep (Chem/Mechanical)	45		
28	2	Release (Chem/Manual)	45		
28	2	Pre-commercial Thin	45		
28	2	Chop/Rip/Hand Plant S.L. Seedlings	45		
28		New Fireline Construction		1.4	
28		Fireline Maintenance		1.1	
29	4	Seedtree	29		
29	4	Site Prep Burn	29		
29	4	Site Prep (Chem/Mechanical)	29		
29	4	Release (Chem/Manual)	29		
29	4	Pre-commercial Thin	29		
29	4	Chop/Rip/Hand Plant S.L. Seedlings	29		
29	5	Release (Chem/Manual) & PCT	26		
29	11	Commercial Thin	16		
29	11	Timber Stand Improvement			
Throughout Project Area		Non-native invasive plant treatment			
Throughout Project Area		Landscape burn			
Throughout Project Area		Watershed Restoration			

Appendix B - Project Maps











