United States
Department of
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Forest
Service

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Environmental Assessment

BIG CREEK PROJECT

Nolichucky/Unaka Ranger District
Cherokee National Forest
Cocke County, Tennessee

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Summary

The Cherokee National Forest proposes to implement activities to achieve desired conditions in the Big Creek Watershed. The project area is located in Compartments 234, 237, 241-244, 249-252, 256, and 257 in the Gulf Fork and Big Creek area of the Nolichucky/Unaka Ranger District, Cherokee National Forest, Tennessee. The action is needed because early successional habitat is lacking and age-class diversity of forest trees in the action areas is low. Mast-producing trees and seedlings are being out-competed by more aggressive tree species, such as red maple. Native plants are being displaced by more aggressive non-native invasive species. Wildlife habitat, especially early successional, is lacking and in need of maintenance. The action area contains unneeded and unauthorized roads.

The proposed action would improve habitat for species that utilize early successional stages. Soil and water resource conditions may be affected in the short term, but would be improved in the long term. Forest health would be improved by increasing resilience to environmental calamities. Human health and safety would not be affected. Temporary reductions in habitat may be expected for some plants and animals; positive effects or no effects may be expected for others. Scenery objectives would be met. Recreation opportunities may be increased. Cultural resources would not be affected. There would be positive economic benefits.

In addition to the Proposed Action, the Forest Service also evaluated a No-Action Alternative, and an Alternative that creates additional early successional habitat.

Based upon the effects of the alternatives, the responsible official will decide whether to implement the proposed action or an alternative to the proposed action, a combination of actions, or to continue with current management.

Document Structure

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

- Chapter 1: Purpose and Need - The section includes information on the history of the project proposal, the purpose of and need for the project and the agency's proposal for addressing the purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

- Chapter 2: Alternatives considered, including the Proposed Action - This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose and need. The alternatives were developed based on significant issues raised by the public, other agencies and Forest Service personnel. Finally, Chapter 2 provides a summary table of each alternative's proposed actions.

- Chapter 3: Affected Environment and Environmental Consequences - This section examines the existing conditions in the project area and provides a professional analysis of the potential impacts of implementing the alternatives as described in Chapter 2. The analyses are organized by Resource Area. Within each analysis, the effects of the No-Action Alternative are discussed first to provide a baseline for evaluation and comparison with the other alternatives that follow. The following resources are analyzed in Chapter 3: Wildlife, Vegetation, Timber, Recreation, Fire and Fuels, Non-Native Invasive Species (NNIS), Cultural Resources, Economics & Social Justice.

- Chapter 4: Literature Cited - This section provides a list of those documents specifically cited in the preparation of this assessment.

- Chapter 5: List of Preparers - This section provides a list of individuals who assisted in the development of the environmental assessment.

- Chapter 6: Appendices - The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Nolichucky/Unaka District Office in Greeneville, Tennessee.

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Acronyms and Abbreviations

ac. – Acre
a.e. – Acid Equivalent
Alt. – Alternative
A.T. or AT – Appalachian Trail
ATV – All Terrain Vehicle

BA – Basal Area
BCWA – Big Creek Watershed Assessment
BEE – Butoxyethyl ester (triclopyr formulation): herbicide
BMP – Best Management Practices

CEQ – Council on Environmental Quality
CFR – Code of Federal Regulations
CNF – Cherokee National Forest
$C0_2$ – Carbon dioxide
Cxx/Sxx –Compartment xx, Stand xx

E – Endangered Species
EA – Environmental Assessment
EHWPF – Eastern Hemlock - White pine Forest
EIS – Environmental Impact Statement
EPA – Environmental Protection Agency
ER – Ecosystem Respiration
ESF – Early Successional Forests

FR-62 – Forest Report 62 (see Literature Cited)
FS – Forest Service, synonymous with NFS.
FSR – Forest Service Road, synonymous with NFSR

GIS – Geographic Information System
GPP – Gross Primary Productivity

HWA –Hemlock Wooly Adelgid
HESH – High Elevation Shrubby Habitat

I-40 – Interstate 40

JLB – Adjuvant Brand name; mix with herbicides

lb. – Pound
LSF – Late Successional Forest
LSOG – Late-successional and Old Growth
LWD – Large Woody Debris

MCF – Thousand Cubic Feet
MDF – Mesic Deciduous Forests
MIS – Management Indicator Species
MSF – Mid-successional Forests

NEPA – National Environmental Policy Act
NC – North Carolina
NCT – No Conclusive Trend
NEP – Net Ecosystem Productivity
NFS – National Forest Service, synonymous with FS.
NFSR – National Forest Service Road
NNIS – Nonnative Invasive Species

OOPF – Oak and Oak-Pine Forests
OR x – "Old" Road number x; unauthorized road.
OUT x – "Outlaw" Road number x; unauthorized road.

PNV – Present Net Value
pH –Measure of Acidity
PO – Permanent Openings

RAP – Roads Analysis Process
RF – Riparian
RLRMP – Revised Land and Resource Management Plan
RX– Prescription

S – Sensitive Species
SARA – Superfund Amendments and Reauthorization Act
SDDW – Snags, dens, downed wood
SERA – Syracuse Environmental Research Associates
Sq ft. - Square Feet
SIO – Scenic Integrity Objectives
SMZ – Streamside Management Zone
SPB – Southern Pine Beetle
SPF – Sapling/Pole Forests

TDEC – TN Department of Environment and Conservation
TEA – triethylamine salt (triclopyr formulation): herbicide
TES – Threatened, Endangered and Sensitive species
Tg – Teragrams
TN – Tennessee
TWRA – Tennessee Wildlife Resource Agency

US or U.S. – United States
USDA – United States Department of Agriculture
US 25/70 – United States Highway 25/70, etc.

VC – Viability Concern Species
VMEIS – Vegetation Management EIS
VQO – Visual Quality Objective

WLO – Wildlife Opening

Chapter 1: Purpose and Need for Action

Chapter 1 covers:

Where the proposed activities would occur

What activities we propose to do

How the activities fit into overall Forest management

Why we proposehe activities

What our decision will address

How we involved the public

How we addressed the issues

Introduction

The Big Creek Project is located on National Forest System lands in Cocke County, Tennessee. Treatments are proposed in compartments 234, 237, 241-244; 249-252, 256, and 257, totaling approximately 16,777 acres, which are distributed in the following Prescription Areas (PA):

- 12,941 acres in 7.E.2 (Dispersed Recreation Areas);
- 3,745 acres in 4.A (Appalachian Trail Corridor);
- 43 acres in 7.D (Concentrated Recreation Zone: Round Mountain Recreation Area); and
- < 1.0 acres in 5.B (Designated Communication Electronic Sites).

Within the Prescription Areas are unmapped areas of PA 11(Riparian Corridors). The project is within Management Area 7.

Forestwide goals and objectives, Management Area objectives, Prescription Area goals and objectives, and direction from the Cherokee National Forest (CNF) *Revised Land and Resource Management Plan* (RLRMP) provide the following management direction for the Big Creek Project's proposed actions:

Forestwide Goals and Objectives

Goal 10 Maintain and restore natural communities in amounts, arrangements, and conditions capable of supporting viable populations of existing native and desired non-native plants, fish, and wildlife species within the planning area.

Goal 14 Contribute to conservation and recovery of federally listed threatened and endangered species, and avoid actions that would lead to federal listing of other species under the Endangered Species Act.

Objective 14.02 Provide upland water sources approximately every 0.5 miles, to provide an important habitat element for wildlife, including the endangered Indiana bat. Water sources are comprised of both permanent ponds and ephemeral pools and are often located in openings or near road corridors that allow access by bats.

Goal 15 Minimize adverse effects of invasive non-native species. Control such species where feasible and necessary to protect national forest resources.

Objective 15.02 Control non-native and unwanted native species, where they threaten TES elements, ecological integrity of communities, or habitats created for demand species.

Goal 16 Manage through protection, maintenance, or restoration, a variety of large, medium, and small old growth patches to provide biological and social benefits.

Goal 17 Restore and maintain forest communities to those plant communities predicted as most likely to occur based on the ecological potential of the site potential native vegetation.

Objective 17.01 Over the ten-year period restore at least 5000 acres of diverse native communities appropriate to sites currently occupied by white pine plantations.

Objective 17.02 Over the 10-year period restore oak or oak-pine forests on at least 9,000 acres of appropriate sites currently occupied by pine plantations or other sites with minimal diversity.

Goal 18 Contribute to maintenance or restoration of native tree species whose role in forest ecosystems is threatened by insects and disease. Management activities will reduce the impacts from non-native invasive species.

Objective 18.01 Encourage reintroduction of extirpated or declining native species when technologically feasible. These species include, but are not limited to, American chestnut, butternut, hemlock, dogwood, Fraser fir, and red spruce. Develop partnerships with universities, groups and other agencies to facilitate reintroduction of native species.

Objective 18.02 Promote the health of susceptible forest communities by maintaining a site-specific basal area that promotes tree vigor. Encourage advanced regeneration of oak species.

Goal 19 Where forest management activities are needed and appropriate to achieve the desired composition, structure, function, productivity, public health and safety, and sustainability of forest ecosystems; a result of such activities will also be to provide wood products for local needs.

Objective 19.01 Provide 33,726 MCF of sawtimber per decade.

Objective 19.02 Provide 6,242 MCF of pulpwood per decade.

Goal 40 Conserve, maintain, and enhance the scenic and aesthetic values of the CNF.

Goal 48 Provide a transportation system that supplies safe and efficient access for forest users while protecting forest resources. Emphasize acquisition of rights-of-way or fee-simple titles as appropriate to facilitate maintenance and meet access needs.

Goal 49 Decommission unneeded roads.

Objective 49.01 Decommission unneeded roads that are identified through an interdisciplinary process.

Prescription Area Goals and Objectives

Objective 7.E.2-1.01 Manage forest successional stages to maintain a minimum of 50 percent of forested acres in mid- to late-successional forest, including old growth; a minimum of 20 percent of forested acres in late-successional forest, including old growth; and 4 to 10 percent in early-successional forest.

Goal 11-3 Aquatic habitat conditions are suitable to maintain viable populations of aquatic species native to the planning area, and to support desirable levels of selected species (e.g., species with special habitat needs, TE&S species, species commonly fished, MIS or species of special interest).

After reviews, District personnel found that these Goals and Objectives are not being fully realized in Compartments 234, 237, 241-244, 249-252, 256, and 257.

Purpose and Need

The Cherokee National Forest is proposing the Big Creek Project to work toward the desired condition for the project area as directed in the Cherokee National Forest *Revised Land and Resource Management Plan* (pages 93, 94, 112, 126-128, 130-132, and 160-163).

The purpose of this project is to achieve the desired conditions within the Big Creek Project area as outlined in the Prescription Area directions. The need for management activities in the Big Creek area was determined during the Big Creek Project Area Assessment that began in January 2006. Existing conditions were compared to those that are desired for each prescription area.

Field studies found there are no stands providing early successional habitat conditions in the project area. Many species of wildlife including Chestnut-sided warbler, Black bear, White-tail deer, Ruffed Grouse, and Wild turkey, utilize this habitat and their populations would decline as a result. There is a need to create early successional habitat.

There are white pine stands occupying sites that are appropriate for more diverse native communities, including oak forests. There is a need to begin restoring these stands.

Mast-producing trees are being out-competed in previously regenerated stands. There is a need to release these trees from competition to ensure mast-producing species are a component of the mature stands.

There is a previously harvested shelterwood stand. There is a need to remove the overstory on this stand to release the advanced regeneration.

Dense understories of rhododendron and other competing species are precluding regeneration of mast-producing species. Mast-production would decline in the area as mature trees are lost and not replaced. There is a need to reduce midstory competition in these stands to encourage regeneration.

- Establishment of non-native invasive species (NNIS) would displace native vegetation. There is a need to control NNIS as and where they occur.

Wildlife forage opportunities are lacking or in need of maintenance in the project area. There is a need to maintain existing wildlife forage. Adequate watering holes for wildlife are lacking in the analysis area. Wildlife habitat structures are limited. There is a need to provide nest boxes and bat houses.

Stream productivity in the tributaries to Big Creek is generally low. There is a need to improve stream habitat in these tributaries.

There are 5.8 miles of unauthorized road. These roads need decommissioned if not needed for resource management, or converted to system roads.

There are 3.4 miles of system roads in the area that are not needed for resource management. These roads are not needed for resource management and need to be decommissioned.

Commercial timber harvest may be used to accomplish management objectives in Prescription Area 7.E.2. Within Compartments 342-344, and 349, there are 6,065 total acres in this prescription, and

3,774 of these are suitable for timber management (See Forest Resource for more discussion of suitable acres).

The Need for Action responds to the goals and objectives outlined in the Revised Cherokee National Forest Plan, and helps move the project area towards desired conditions described in that plan (RLRMP 2004).

Proposed Action

This is a summary of the modified proposed action. The modified proposed action is described in detail in the Alternatives section.

The actions proposed by the Forest Service to meet the purpose and need are:

1. Provide 268 acres (11 stands) of early successional habitat in Prescription Area 7.E.2.
2. Clear-cut a 28-acre white pine stand, regenerate to hardwoods, and provide early successional habitat in Prescription Area 7.E.2.
3. Overstory removal on a 28-acre stand proposed as shelterwood.
4. All stands in items 1, 2 and 3 would require site preparation and release treatments.
5. Begin restoration of 36 acres (2 stands) of white pine plantations by release thinning favoring mast-producing trees.
6. Release mast-producing trees from competition on 176 acres in 6 stands.
7. Daylight 12.6 miles of roads maintained as wildlife openings.
8. Maintain approximately 15.0 miles of prehaul road, and construct 0.3 miles of temporary road in support of items 1, 2, 3, and 7.
9. Reduce midstory competition on 474 acres (19 stands) using herbicides to encourage oak and other mast-producing species regeneration.
10. Control non-native invasive plant species within all treatment areas, along roads, and in wildlife openings using herbicides.
11. Improve wildlife habitat.
12. Decommission approximately 2.6 miles of unauthorized roads.
13. Decommission 3.4 miles of authorized road.
14. Authorize 3.3 miles of existing roadways.

Decision Framework

The decision to be made by the Deciding Official is whether to implement the Proposed Action, an alternative action, or a combination of actions to meet the Purpose and Need; or to continue with existing management under the No-Action Alternative.

Public Involvement

During the Big Creek Project Area Assessment a public call for preliminary information gathering was made in June of 2008. One hundred forty one letters were sent out, flyers were posted in several public places in the Big Creek area, and news releases were sent to the *Greeneville Sun* and *Newport Plain Talk* newspapers. Seven comments were received.

The proposed action was provided to the public and other agencies for comment during scoping February 26th through April 3rd, 2009. The proposal has been published in the Schedule of Proposed Actions since April 1, 2008. Twenty letters and e-mails were received. Using comments from the public and other agencies, the interdisciplinary team developed a list of issues to address.

Issues

The Forest Service separated the issues into two groups: significant and non-significant issues. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "*…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…*" Significant issues were defined as those directly or indirectly caused by implementing the proposed action.

Ninety-seven comments were derived from the twenty responses. Sixty-six comments fell into the following categories: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) not relevant to the decision to be made, 4) conjectural and not supported by scientific or factual evidence 5) general comment, suggestions, opinion, or position statement; or 6) other agency or partners consultation, review, advice, recommendations, etc., or 7) already considered in the proposed action or is standard procedure. All 66 comments were considered non-significant issues.

The remaining 31 comments were specific to the project, with 14 issues developed from the comments.

Discussion of Issue Significance

BC 7. Lack of early successional habitat.

Prescription area 7.E.2 has an early successional objective of from 4% to 10%. On the suitable acreage where regeneration is proposed (compartments 242, 243, 244, and 249), the proposed action results in about 7.8% early successional habitat. This proposal at this time regenerates stands qualifying for regeneration by commercial harvest, after considering all other resource constraints. Further creation of early successional habitat by non-commercial means is beyond the scope of the proposed action.

This issue is significant to this project.

BC 8. Maintain Basal Area below 20.

A minimum of 15 basal area (BA) must be left in any regeneration treatment over 10 acres (Forestwide Standard 34). This will be the prescribed BA in all regenerated areas unless greater BA is needed for scenery mitigation. The BA may be clumped and variable, allowing some areas without overstory.

This issue is non-significant to the project.

BC 9. Create early successional edge around wildlife openings.

Most of the wildlife openings in this project area are linear openings; roads maintained as open area wildlife foraging areas. Although 12.64 miles of these are proposed for daylighting to improve sunlight

into these openings, linear openings do not lend themselves well to purposely creating early successional habitat in strips along them. The daylighting would to some extent encourage sprouting and provide an early successional habitat component. Other open areas are within the Appalachian Trail corridor and subject to visual constraints.

This issue is non-significant to this project.

BC 10. Use herbicide instead of chainsaw in mast-tree thinning.

This suggestion is an attempt to retain vertical cover for grouse for a little longer by leaving treated stems standing instead of cutting them off. Treating competing stems with herbicide may result in deadened stems standing 2-3 years longer. Cut stems seldom fall completely, instead are held up on surrounding vegetation at varying angles, so some vertical cover is retained. Sprouting of cut stumps actually prolongs the early successional cover for a few years, and this benefit would be lost if these stems were treated with herbicide. Herbicide treatments are also more expensive. Use of chainsaws is an effective means to accomplish the objective of releasing mast-producing species from immediate competition for light.

This issue is non-significant to this project.

BC 11. Clear-cut instead of shelterwood.

See discussion under BC 8. Clumping the required leave basal area would allow some areas to regenerate without overstory, providing maximum stem density.

This issue is non-significant to this project.

BC 12. Limit rhododendron thinning to roadsides and streams adjacent to regeneration areas.

The rhododendron thinning proposed might be more accurately described as "trimming". The objective is not to eradicate rhododendron, but to trim it back enough to increase the amount of light onto streams to improve the fisheries through insect production.

This issue is non-significant to this project.

BC 13. Limit herbicide use in midstory treatments to rhododendron, laurel, and red maple. Do not treat sugar maple or ash.

Sugar maple, ash, basswood, oaks, walnut, butternut, hickories, black cherry, dogwoods, and hemlock are excluded from treatment now.

This issue is non-significant to this project.

BC 14. Oppose C242/S30 midstory treatment.

The proposed action will be modified to drop this stand from midstory treatment.

This issue is non-significant to this project.

BC 15. Oppose creating wildlife openings.

No new wildlife openings are created in this proposal. The planting of mast-producing shrubs in skid trails and landings on 32 acres within the harvested areas are proposed to enhance wildlife forage as the stands regenerate. These areas would not be maintained as open area.

This issue is non-significant to this project.

BC 16. Oppose adding road OR-9 to the system.

Opposition to this road seems to be because of some confusion about its role in illegal ATV traffic, and why an adjacent poplar stand suggested during pre-scoping could not be commercially thinned because of the ATV use.

Old Roads (OR) 11 and 12; and Outlaw (OUT) 12 are the roads that are receiving the majority of the illegal ATV use in this area and these roads are proposed for decommissioning (Item 12). OR-9 was determined during the Roads Analysis Process to be needed for long-term resource management needs; OR-11, OR-12, and OUT-12 were not.

The poplar stand in question was not proposed for commercial thinning because thinning poplar usually results in damage to the residual stems and epicormic sprouting of the residual so it is not usually silviculturally desirable. It is doubtful there would be a market for the young poplar at this time, making commercial thinning unfeasible. Midstory treatments could accomplish the objectives of moving this stand towards more diversity, until the stand matures and could be commercially regenerated in 10-20+ years and this stand is proposed for midstory treatments.

This issue is non-significant to this project.

BC 17. Already considered in the proposed action or is standard procedure.

Several comments suggested projects that were already part of the Proposed Action; or suggested that we conduct surveys or analysis that are already routinely accomplished.

This issue is non-significant to this project.

BC 18. Replace fescue and orchard grass with warm season grasses.

Fescue and orchard grass are being phased out. Not all sites are appropriate for warm season grasses. Native species and non-invasive species are used during seeding.

This issue is non-significant to this project.

BC 19. No ground disturbance in mesic areas and interior forests to prevent non-native invasive species spread.

Restricting activities in mesic areas would prevent accomplishing the Desired Conditions for this area as directed by the Revised Land and Resource Management Plan. Nonnative invasive species treatments are planned to ameliorate invasive species introduction resulting from activities planned to carry out Plan direction.

This issue is non-significant to this project.

BC 20. Effects of project on climate change/carbon sequestration.

Climate change can affect the resources in the project area and the proposed project can affect climate change through altering the carbon cycle. Climate models are continuing to be developed and refined. The impacts of global carbon sequestration and atmospheric concentrations of CO_2 of this project are miniscule.

The forests of the United States significantly reduce atmospheric concentrations of CO_2 resulting from fossil fuel emissions. The forest and wood products of the United States currently sequester approximately 200 teragrams 200 teragrams, or Tg, equals 196,841,306 US tons. of carbon per year (Heath and Smith, 2004). This rate of carbon sequestration offsets approximately 10% of CO_2 emissions from burning fossil fuels (Birdsey et al., 2006).

U.S. Forests currently contain 66,600 teragrams of carbon. The short-term reduction in carbon stocks and sequestration rates resulting from the proposed project are imperceptibly small on global and national scales, as are the potential long-term benefits in terms of carbon storage.

This issue is non-significant to this project.

BC 21. Skeptical of the ecological benefits of planting non-native shrubs.

Nonnative invasive shrubs such as autumn olive and oriental bittersweet are not planted. Apples are the only nonnative mast-producing species commonly planted. Plantings of mast-producing shrubs for wildlife forage are done to supplement what may or may not naturally regenerate. Enhancing wildlife habitat is a driving force for vegetation management on the Cherokee National Forest.

This issue is non-significant to this project.

Significant Issues

Of the 14 issues discussed above, one is directly or indirectly caused by implementing the proposed action, and is a significant issue for this project:

1. Early Successional Habitat is lacking.

Content Analysis of the scoping comments, issue development, and determination of significant issues is in Appendix B. Original letters are located in the project file.

Chapter Two: Comparison of the Alternatives

This chapter describes and compares the alternatives considered for the Big Creek project. It includes a description of each action alternative considered. This section also presents the alternatives in comparative form. This section provides a clear basis for choice among options by the Deciding Official and the public. Maps for each action alternative are in Appendix A.

Chapter 2 covers:

How the alternatives were developed

Alternatives eliminated from detailed study

A description of the alternatives studied in detail

A comparison of the alternatives

Units of Measure

Acreages, mileages, and volumes are based on best information available (Geographical Information Systems (GIS), Stand Maps, etc.). Quantities would be determined during on-the-ground project layout. Stated percentages may vary slightly due to rounding. Stand ages are as of year 2009, unless otherwise stated, based on the preponderate age of the dominant and co-dominant trees.

Alternative A (No Action)

This is the "No-Action" alternative. The proposed action would not be implemented in this alternative. Current management would continue, for example: monitoring and maintenance activities, road maintenance, mowing wildlife openings, etc. This alternative provides a baseline from which to compare the other alternatives, and is considered the "Existing Condition".

Alternative B (Modified Proposed Action)

This alternative drops midstory treatment with herbicide on Stand 30 in Compartment 242 in response to public comment. Percentages of early successional habitat created with this proposal have been revised based on more current information of the amount of suitable acreage. Mileages of prehaul maintenance have been reduced from 17.3 in the original proposal to 14.59 based on more current information. (See *Alternatives Considered But Not Developed* for further explanations of modifications to the original Proposed Action.)

Details of Alternative B

1. Provide early successional habitat on up to 10% of the suitable acreage in Prescription Area 7.E.2 utilizing commercial timber harvest by regenerating eleven stands (Table A1) with the Shelterwood Method (Objective 7.E.2-1.01, Goal 19, Objectives 19.01 and 19.02).

Table A1. Stands to Regenerate

Compartment	Stand	Acres	Year of Origin [1]	Forest Type
242	20	40	1930	White Oak/Northern Red Oak/ Hickory
242	22	40	1913	Yellow Poplar/White Oak/Red Oak
242	51	12	1914	Chestnut Oak
242	52	27	1904	Yellow Poplar/White Oak/Red Oak

Compartment	Stand	Acres	Year of Origin [1]	Forest Type
242	73	40	1913	Yellow Poplar/White Oak/Red Oak
244	10	34	1911	Yellow Poplar/White Oak/Red Oak
244	13	23	1911	Yellow Poplar/White Oak/Red Oak
244	16	15	1910	Cove Hardwoods/White Pine/Hemlock
244	39	7	1927	Yellow Poplar/White Oak/Red Oak
244	57	16	1923	White Oak/Northern Red Oak/ Hickory
244	70	14	1919	Chestnut Oak
Total acres		**268**		

[1] Year of origin (YOO) reflects the age of the stand; e.g. YOO for C244/S10 = 1911 = 99 years old.

2. Clear-cut white pine stands (Table A2), regenerate to hardwoods by planting mast-producing hardwood seedlings after harvest, and provide early successional habitat on up to 10% of the suitable acreage in PA 7.E.2 (Objective 7.E.2-1.01; Goals 17 and 19; Objectives 17.01, 17.02, 19.01 and 19.02).

Table A2: Stands to Clear-cut

Compartment	Stand	Acres	YOO	Forest Type
243	10	10	1970	White Pine
244	9	18	1969	White Pine
Total acres		**28**		

NOTE: In the Prescription Area 7.E.2 for the Big Creek Project, a total of 3,774 acres are suitable for commercial timber harvest. Actions 1 and 2 combined total 296 acres, which equals 7.8 % of the suitable acres.

3. Overstory in compartment 242, stand 32 (28 acres) (Table A3) reduced to a basal area of 15 ft^2 to release advanced regeneration from previous shelterwood harvest (Goals 10, 18 and 19; Objectives 18.02, 19.01 and 19.02).

Table A3: Overstory Removal

Compartment	Stand	Acres	YOLT [2]	Forest Type
242	32	28	1996	White Oak/Northern Red Oak/ Hickory
Total acres		**28**		

[2] Year of Last Treatment, e.g. C242/S32 was last treated, via a shelterwood cut in 1996.

4. All stands in action items 1-3 would require the following pre-harvest site preparation and post-harvest release treatments (Goals 10 and 18):

   - Prior to harvest, midstory species would be controlled with herbicide (Triclopyr and Imazapyr) to reduce post-harvest sprouting of overly-competitive species.
   - American chestnut seedlings from American Chestnut Foundation may be planted in regenerated areas to test blight resistance.

- Site preparation with chainsaw slashdown and/or herbicide treatment (Triclopyr) after harvest, and approximately two years after harvest, to reduce overly-competitive sprouts. Use chainsaw to release mast-producing trees at about age 10.

5. Start restoration of white pine plantations by thinning plantation to release mast-producing trees (Table A4). Release approximately 100 trees per acre from direct competition using chainsaw slashdown. Treat non-native invasive plant species as found with Triclopyr, Imazapyr, or Glyphosate (Goal 17, Objectives 17.01 and 17.02).

Table A4: Release Thinning

Compartment	Stand	Acres	YOO	Forest Type
249	11	22	1997	White Pine
251	18	14	1997	White Pine
Total acres		**36**		

6. Release approximately 100 mast-producing trees per acre from direct competition using chainsaw slashdown (Table A5). Treat non-native invasive plant species as found with Triclopyr, Imazapyr, or Glyphosate (Goal 10; Objective 18.02).

Table A5: Mast-Tree Release

Compartment	Stand	Acres	YOO	Forest Type
249	43	40	1997	Yellow Poplar/White Oak/Red Oak
250	14	5	1997	White Oak/Northern Red Oak/ Hickory
250	16	12	1997	White Oak/Northern Red Oak/ Hickory
250	24	32	1997	White Oak/Northern Red Oak/ Hickory
250	26	36	1997	White Oak/Northern Red Oak/ Hickory
251	22	51	1997	Upland Hardwoods/White Pine
Total acres		**176**		

7. Daylight selected roads used as wildlife openings (Table A6). Commercially thin by primarily removing non-mast bearing trees in an area approximately 50 feet on either side of the centerline of the road. This would increase forage production in the wildlife openings and create and/or maintain forest edge habitat **(**Goals 10 and 14; Objective 14.02).

Table A6: Roads to Daylight

Road No.	Miles
22421	1.6
22440	1.6
22441	1.6
22442	0.8
22491	1.7
3243	1.5
3243A	0.5
3249	3.3
Total miles	**12.6**

8. Conduct prehaul maintenance on approximately 17.3 miles, and construct approximately 0.3 miles of temporary road (Table A7) in support of timber and wildlife activities (Goal 48).

Table A7: Road maintenance and construction

Road No.	Action	Miles
22421	Prehaul Maintenance	1.6
22440	Prehaul Maintenance	1.6
22441	Prehaul Maintenance	1.6
22442	Prehaul Maintenance	0.8
22491	Prehaul Maintenance	1.7
3242	Prehaul Maintenance	3.0
3243	Prehaul Maintenance	1.5
3243A	Prehaul Maintenance	0.5
3249	Prehaul Maintenance	3.3
96	Prehaul Maintenance	1.7
Total miles of prehaul maintenance		**17.3**
Temp Road	Temporary Construction	0.3
Total miles of temp rd construction		**0.3**

9. Promote the development of mast-producing species regeneration (19 stands; Table A8) by reducing competition of the understory and midstory by about 25% using herbicides (Triclopyr and Imazapyr) (Objective 18.02).

Table A8: Midstory Treatment

Compartment	Stand	Acres	YOO	Forest Type
242	24	23	1928	White oak-Northern red oak- Hickory
242	25	29	1909	Yellow poplar-White oak-Red oak
242	26	19	1913	Yellow poplar-White oak-Red oak
242	28	38	1920	Yellow poplar-White oak-Red oak
242	64	21	1913	Yellow poplar-White oak-Red oak
243	8	15	1921	White pine-Upland hardwood
244	3	18	1910	Yellow poplar-White oak-Red oak
244	15	30	1926	White pine-Upland hardwood
244	20	6	1928	Yellow poplar-White oak-Red oak
244	38	11	1928	Yellow poplar-White oak-Red oak
244	53	11	1911	Yellow poplar-White oak-Red oak
244	61	5	1911	White pine
244	65	16	1928	Yellow poplar-White oak-Red oak
244	71	6	1926	White pine-Upland hardwood
249	24	12	1928	Yellow poplar-White oak-Red oak
249	34	33	1928	Yellow poplar-White oak-Red oak
249	37	20	1928	Cove hardwoods-White pine-Hemlock
249	45	12	1923	Cove hardwoods-White pine-Hemlock
249	48	149	1923	Yellow poplar-White oak-Red oak
Total acres		**474**		

10. Control non-native invasive plant species within all treatment areas, roads, and wildlife openings (Goal 15 and Objective 15.02). The areas would only be treated if non-natives were found. Treatment of occurrences would be with herbicides (Glyphosate, Triclopyr, or Imazapyr) using the foliar spray, hack-and-squirt, streamline, or cut-surface treatment.

11. Wildlife and Fisheries Habitat Improvement Activities (Goals 10 and 14, Objective 14.02).

Wildlife Habitat Activity Descriptions (Table A9)

- **Rehab** – disc, fertilize, lime, and re-seed wildlife openings, Year 1
- **NNIS** – control non-native invasive species in wildlife openings and old field, Years 4-5
- **Water** – construct waterholes, vernal ponds, or wetland (25'x 25'), Years 2-3
- **Boxes** – place bat roosting boxes and bird/small mammal nesting boxes, Years 2-3
- **Logs** – place grouse drumming logs, Years 3-4
- **Top-dress** – fertilize and lime wildlife openings, Year 3
- **Brushing** – cut brush along WLO edges, Years 5 and slash brush in old field, Years 4-5
- **Gate** – replace (R) gate, Year 1; Maintain (M) gate, Years 2 and 5
- **Plant** – plant mast-producing shrubs in skid trails and landings, Years 2-3.

Table A9: Wildlife Activities

Location	Rehab (acres)	NNIS (acres)	Water	Boxes	Logs	Top-dress	Brushing (acres)	Gate	Plant (acres)
All Harvested Areas									32
Mitchell Loop WLO (C242)	5	5.0	2	6		5 ac.	5	1 M	
Boomer Den WLO (C249)	15	15.0	2	6	5	15 ac.	15	1 M	
Pheasant Gap WLO (C244)	2	2.0	1	3	-	2 ac.	2	1 M	
Hunter Crk/Fork Ridge WLO (C244)	4	4.0	2	6	5	4 ac.	4	1 R	
Round Mtn, Lookout Rd (C242)		0.3	1					1 M	
Hurricane Branch Old Field* (C242)		2.0					2		
Totals	**26**	**28.3**	**8**	**21**	**10**	**26 ac.**	**28**	**4 M/1 R**	**32**

* Activities at Hurricane Branch would restore the native plant community and be maintained as old field habitat.

Fisheries Habitat Activity Descriptions (Table A10)

- **Habitat Structures** – place logs in stream for overhead cover and pool development
- **Rhododendron Thinning** – trim rhododendron on stream banks to increase light and productivity
- **Brook Trout Restoration** – remove non-native rainbow trout by electro-shocking and stock native brook trout

Table A10: Fisheries Activities

Stream	Habitat Structures	Rhododendron Thinning (miles)	Brook Trout Restoration (miles)
Trail Fork Big Creek	15	1.7	1.7
Tom Creek	6	0.6	-
Hunter Creek	5	0.5	-
Totals	**26**	**2.8**	**1.7**

12. Decommission 2.6 miles of unauthorized roads (Outlaw Road (OUT) 12, Old Road (OR) 4, OR5, OR6, OR7, OR10, OR11 and OR12) (Goal 49, Objective 49.01).

13. Decommission 3.4 miles of authorized road: 1.3 miles of (Forest Service Road) FSR 225201A (0.4 miles to remain authorized) and 2.1 miles of FSR 5145 (0.10 to remain authorized) (Goal 49, Objective 49.01).

14. Authorize 3.28 miles of existing roadways (Table A11) (Goal 48). The roads would be gated and closed to all but administrative use. Old Roads 01- 03 are powerline access roads under Special Use Permit.

Table A11: Roads to be Authorized

Roads Analysis Inventory[1]	Road Name	RMO[2]	Length (miles)	Disposition
OR01	Davenport Gap 1	D2*	0.6	New FSR #225701
OR02	Davenport Gap 2	D2	0.4	New FSR #225702
OR03	Green Corner Utilities	D2	0.2	New FSR #225203
OR09	Hoot owl Ridge Spur A	D2	0.9	New FSR #225203
WL01	Hurricane Gap	D2	0.2	Add to FSR #3243
WL02	Hurricane Gap	D2	0.5	Add to FSR #3243
WL03	Hurricane Gap Spur	D2	0.5	New FSR #3243A
Total miles			**3.3**	

[1] OR (Old Road); WL (Wildlife Road)
[2] Road Management Objectives

* See Roads Analysis Plan (RAP) for definition of D2 Road Management Objective.

Alternative C

Alternative C is a modification of Alternative B based on issues identified during the scoping process. In summary, Alternative C would increase (31 acres) the amount of early successional habitat created, and reduce (12 acres) the amount of midstory treated for mast-producing species regeneration. Action items 2 through 8, and 10 through 14 would be the same as those proposed in Alternative B. Only changes specific to Alternative C are provided below (see Alternative B for actions retained in Alternative C).

1. Provide early successional habitat on up to 10% of the suitable acreage in Prescription Area 7.E.2 utilizing commercial timber harvest by regenerating 299 acres (13 stands; Table A12) with the Shelterwood Method (Objective 7.E.2-1.01, Goal 19, Objectives 19.01 and 19.02). Two stands in Compartment 249 – stand 22 (19 acres) and 24 (12 acres) – were added under Alternative C.

Table A12: Stands to Regenerate

Compartment	Stand	Acres	YOO*	Forest Type
242	20	40	1930	White oak-Northern red oak-Hickory
242	22	40	1913	Yellow poplar-White oak-Red oak
242	51	12	1914	Chestnut oak
242	52	27	1904	Yellow poplar-White oak-Red oak
242	73	40	1913	Yellow poplar-White oak-Red oak
244	10	34	1911	Yellow poplar-White oak-Red oak
244	13	23	1911	Yellow poplar-White oak-Red oak
244	16	15	1910	Cove hardwoods-White pine-Hemlock
244	39	7	1927	Yellow poplar-White oak-Red oak
244	57	16	1923	White oak-Northern red oak-Hickory
244	70	14	1919	Chestnut oak
249	22	19	1928	White oak-Northern red oak-Hickory
249	24	12	1928	Yellow poplar-White oak-Red oak
Total acres		**299**		

*YOO (Year of Origin)

9. Promote the development of mast-producing species regeneration (18 stands; Table A13) by reducing competition of the understory and midstory by about 25% using herbicides (Triclopyr and Imazapyr) (Objective 18.02). One stand - Compartment 249, Stand 24 (12 acres) - was dropped under Alternative C.

Table A13: Midstory Treatment

Compartment	Stand	Acres	YOO	Forest Type
242	24	23	1928	White oak-Northern red oak-Hickory
242	25	29	1909	Yellow poplar-White oak-Red oak
242	26	19	1913	Yellow poplar-White oak-Red oak
242	28	38	1920	Yellow poplar-White oak-Red oak
242	64	21	1913	Yellow poplar-White oak-Red oak
243	8	15	1921	White pine-Upland hardwood
244	3	18	1910	Yellow poplar-White oak-Red oak
244	15	30	1926	White pine-Upland hardwood
244	20	6	1928	Yellow poplar-White oak-Red oak
244	38	11	1928	Yellow poplar-White oak-Red oak
244	53	11	1911	Yellow poplar-White oak-Red oak
244	61	5	1911	White pine

Compartment	Stand	Acres	YOO	Forest Type
244	65	16	1928	Yellow poplar-White oak-Red oak
244	71	6	1926	White pine-Upland hardwood
249	34	33	1928	Yellow poplar-White oak-Red oak
249	37	20	1928	Cove hardwoods-White pine-Hemlock
249	45	12	1923	Cove hardwoods-White pine-Hemlock
249	48	149	1923	Yellow poplar-White oak-Red oak
Total acres		**462**		

Mitigation Measures

Specific measures may be incorporated into the project design during the development of alternatives based on resource concerns and issues raised during scoping and analysis. Mitigation measures are intended to lessen or eliminate potential impacts from proposed activities. These measures that may or may not be included in RLMRP's Standards and Guidelines.

The mitigation measures 62-66, 68-79, 81-86, and 88-93, from the Record of Decision for the *Vegetation Management in the Appalachian Mountains Environmental Impact Statement* (VMEIS) for Herbicide Use would apply to Alternatives B and C. The VMEIS mitigations are incorporated as Standards in the RLRMP as well.

Mitigation Common to All Action Alternatives:

- Build the fewest skid trails, logging roads, and log landings as feasible.
- Use broad-based dips or water bars on all access ways on non-level slopes.
- Use a soil scientist to assist in the location of ephemeral pools.
- Mixing-water for herbicide use would be brought to the site by work crews and not obtained from streams or other bodies of water.

Scenery Design Features are in Appendix G.

Alternatives Considered but Not Developed

The original Proposed Action was modified and analyzed as Alternative B (Modified Proposed Action).

- The original Proposed Action sent out for scoping included midstory herbicide treatment on Stand 30 in Compartment 242. This stand was dropped in response to public comment that this stand did not require this treatment.

- The original Proposed Action stated that the proposal would result in creation of 3.4 % early successional habitat based on 8,694 suitable acres. Further analysis has determined that there are only 3,774 acres in Compartments 242, 243, 244, and 249 within Prescription area 7.E.2 that are suitable for commercial timber harvest. The modified Proposed Action reflects this change.

The original Proposed Action (unmodified) was not developed or analyzed further.

An alternative that would have created the maximum of 10% early successional habitat was not feasible. Virtually all stands qualifying for regeneration utilizing commercial timber harvest and considering other resource constraints are included in Alternative C. Further creation of early successional habitat with non-commercial means is beyond the scope of this project.

Three letters from scoping called for more roads to be decommissioned and expressed opposition to adding existing unauthorized roads to the road system. An alternative that would have added fewer roads to the system and decommissioned more roads was considered but not developed. Roads inventoried during Roads Analysis must be added to the road system or decommissioned to comply with Title 36 of the Code of Federal regulations §212.5. Roads to decommission are those that are not needed for long-term resource management. The Modified Proposed Action adopts the recommendations from the Big Creek Roads Analysis Plan (RAP). The roads to be added to the system were determined during the Interdisciplinary RAP process to be needed for long-term resource management. Those proposed for decommissioning in the Modified Proposed Action are not needed for resource management.

Three letters suggested further restoration of white pine and yellow poplar-dominated stands, specifically Stands 3, 8, and 50 in Compartment 243; and Stands 15, 41, and 61 in Compartment 244. Stands in the Gulf Tract were also advocated as in need of restoration.

Following are the reasons that these suggestions for alternatives were not developed further:

- The white pine stands submitted are mostly too small in diameter to commercially harvest at this time. In about 10 years these stands would be commercial size and could be thinned with commercial timber harvest.
- Thinning of young yellow poplar is usually not silviculturally desirable because of residual stand damage and epicormic sprouting of remaining stems that decreased the future value of the stand. It is also marginal economically; there is usually a weak market for small diameter yellow poplar. Again, in about 10-20 years these stands can be economically regenerated with commercial timber harvest.
- Stand 8 in Compartment 243, and Stands 15 and 61 in Compartment 244 are included in the proposed action for midstory completion treatment to promote the development of mast-producing species and begin the conversion process.
- Stands in the Gulf Tract are generally too old to benefit from Mast Tree Release treatments, and too young to be commercially thinned or regenerated.

Comparison of Alternatives

Table A14 and A15 provide a comparison of the activities and a summary of the effects of implementing each alternative. Information in the tabled is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table A14: Comparison of Alternatives

Proposed Activities	Units	Alt B	Alt C
Habitat Diversity			
Shelterwood Regeneration	acres	268	299
Clear-cut Regeneration	acres	28	28
Overstory Removal	acres	28	28
Site preparation and release	acres	268	299
Release thinning in white pine stands	acres	36	36
Release mast-producing trees from competition	acres	176	176

Proposed Activities	Units	Alt B	Alt C
Midstory treatment for oak regeneration	acres	474	462
Control non-native invasive species (plants)	acres	1108	1127
Wildlife and Fisheries Habitat Improvement			
Daylight roads maintained as wildlife openings	miles	12.64	12.64
Disc, fertilize, lime, and reseed wildlife openings	acres	26	26
Construct, maintain, and monitor waterholes.	each	8	8
Construct, install, and monitor wildlife boxes	each	21	21
Install and monitor Grouse Drumming logs	each	10	10
Fertilize and lime wildlife openings	acres	26	26
Brush wildlife openings and old field	acres	28	28
Install gate	each	1	1
Maintain gates	each	4	4
Plant and maintain mast trees and fruiting shrubs	each	32	32
Install and monitor fish structures	each	26	26
Thin Rhododendron	miles	2.8	2.8
Restore Brook Trout	miles	1.7	1.7
Transportation			
Prehaul maintenance	miles	17.3	17.3
Temporary road construction	miles	0.3	0.3
Decommission unauthorized roads	miles	2.55	2.55
Decommission system roads	miles	3.43	3.43
Convert unauthorized roads to system roads	miles	3.28	3.28

Table A15: Comparison of Effects of Alternatives

Item	Alt A	Alt B	Alt C
Soil and Water			
Water Yield	No Change	Little effect	Little effect
Water Chemistry: Nitrogen, Calcium, and Magnesium	No Change	Small, short-term increase in nutrient levels	Small, short-term increase; more than Alternative B
Temperature	No Change	No Change	No Change
pH	No Change	No Change	No Change
Herbicide	No Risks	Negligible	Negligible

Item	Alt A	Alt B	Alt C
Soil erosion, and sediment	No Change	Small, short-term increase; long-term improvements from rehabilitation	Small, short-term increase, more than Alternative B; long-term improvements from rehabilitation
Forest Resource			
All Forested Acres in RX 7.e.2 (age class in 2013) 0-10 11-40 41-80 81+	 0 903 1268 3958	 296 903 1239 3689	 327 903 1239 3658
Suitable Acres in RX 7.E.2 (age class in 2013) 0-10 11-40 41-80 81-110 111+	 0 870 995 1898 11	 296 870 967 1629 11	 327 870 967 1598 11
Health and Safety			
Human health	No risk	Little Risk	Little Risk
Biological Resource (Management Indicator Species)			
Acadian flycatcher	No conclusive trend	No negative influences	Same as Alternative B
Chestnut-sided warbler	No conclusive trend	Local increase	Local increase > Alt. B
Hooded warbler	Decline	No negative influences	No negative influences
Ovenbird	Increase	Continue increase	Continue increase
Pileated woodpecker	Increase	Continue increase	Same as Alternative B
Prairie warbler	No conclusive trend	Local increase	Local increase > Alt. B
Scarlet tanager	No conclusive trend	No Negative influences	No negative influences
Recreation			
Meet Scenery Integrity Objectives	Meets	Meets	Meets
Recreation Opportunities	No Change	Mixed, No significant net effects	Mixed, No significant net effects
Cultural Resources			
Cultural and Heritage Resources	No effect	No effect	No effect

Item	Alt A	Alt B	Alt C
Economics			
Present Net Value	0	$19,632.13	$21,067.80

Chapter 3: Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of the alternatives presented in Table A16.

Chapter 3 describes:

The existing condition and environmental consequences of the alternatives for the following resources:

- Soils and Water
- Forest
- Health and Safety
- Biological
- Scenery
- Recreation
- Climate Change
- Cultural
- Economics

Soil and Water Resource

Affected Environment: Big Creek Assessment Area

The Big Creek Assessment Area is located approximately six miles south of Del Rio, Tennessee in the Blue Ridge Mountains. The assessment area is a portion of the Big Creek Watershed.

The physical character of the project area is greatly influenced by the geology associated with the Blue Ridge physiographic province. The project area is located in the Southern Sedimentary Ridges Eco-region. Rocks in the eco-region are primarily Cambrian-age sedimentary (shale, slate, sandstone, siltstone, quartzite and conglomerate). The diverse parent material along with other factors such as aspect, topography, climate and vegetation has resulted in a wide range of soil types within the project area.

Elevation in the area ranges from about 4000 feet on Chestnut Ridge Mountain to about 1600 feet in along the Trail Fork of Big Creek.

The area has an average annual temperature of 55 degrees Fahrenheit (F^o). January is usually the coldest month with an average temperature of 34 degrees Fahrenheit, while July is usually the hottest month with an average temperature of 74 degrees Fahrenheit. The area averages about 50 inches of precipitation annually, which is distributed fairly evenly throughout the year. July is usually the wettest month with an average of 5.8 inches of precipitation, while October is usually the driest with an average of 2.0 inches of precipitation. The length of the growing season is approximately 180 days per year. Prevailing winds in eastern Tennessee are predominantly from the southwest.

Water

Affected Environment

Drainages within the assessment area include Trail Fork Big Creek, Gulf Fork Big Creek, Tom Creek, Hurricane Branch, Double Branch, and several other, small composite streams. Approximately 40 percent of the Big Creek Watershed is in public (national forest) ownership. The majority of the ownership is in the upper portions or headwaters of the watershed.

Valley types within this assessment area exhibit moderate relief, are generally stable, and have moderate side slope gradients. The upper reaches of streams can be described as A3 types by the use of the classification system developed by Rosgen (Rosgen, 1994). Stream gradients are generally steep in the

upper reaches of the watershed (10% +) with low stream sinuosity. Channel materials are predominantly cobbled with a mixture of bedrock, boulders, gravel, and sand. Larger streams generally have a decrease in gradient, and stream types change from an A3 to B or C channels. Each of these stream types is generally stable.

Stream flow varies seasonally with rainfall and the effects of evapotranspiration. Higher discharges generally occur in the winter and spring months while low flows generally occur in the late summer and fall. Streams within the assessment areas have not been gauged in the past to determine an average annual discharge.

The water quality of streams within the watershed can generally be characterized as low in conductivity, low in alkalinity, slightly acidic, low in nutrients, and generally free from excessive sediment. The water quality of streams within the assessment area has been found to meet their use classifications.

The Tennessee Eco-region Project has completed an initial effort to establish reference conditions for water quality by eco-region (TDEC, 2000). A summary of selected water quality statistics for the Blue Ridge Eco-region represented in the assessment area is displayed in Table 1 in Appendix F. The data values and statistics shown represent sites within the entire eco-region, and provide a first approximation of reference water quality.

Stream channels in the analysis area are generally in good physical condition. Erosion from the existing road system, trails, dispersed recreation sites, and other areas results in some sediment deposition into streams.

A proper functioning condition assessment has not been completed on forest riparian areas. Most riparian areas on NFS lands are believed to be functioning at or near their proper capability and potential. Where roads exist in riparian areas, proper functioning condition could be at-risk or non-functioning. Sufficient quantities of large woody debris, for example, may be absent in some streams due to these facilities and/or past land use practices.

It is quite likely that small wetland areas are associated with springs and seeps within the analysis area. If so, these would be identified and protected during project implementation. To identify jurisdictional wetlands subject to Clean Water Act regulations requires field delineation and identification. Field delineation would be required prior to any ground disturbing management actions near wetland areas.

Scope of Analysis

In general the entire Big Creek Watershed was considered during assessment. However, four subwatersheds were specifically analyzed to determine effects from the proposed activities. These four subwatersheds were chosen because a higher percentage of ground disturbing activities were occurring in these subwatersheds than in others. The size of this area is about 2.5 square miles. The time-period considers the past ten years and future actions that could occur within five years of implementation.

Effects Analyses of the Alternatives

Direct, Indirect and Cumulative effects of the Alternatives on the Water Resource are provided below.

Alternative A (No Action)

Direct and Indirect Effects

On the National Forest, prescribed fire use on landscape areas, road management, and natural events are expected to continue. Minimal, geologic erosion would continue from undisturbed forest lands. Other than geologic erosion, accelerated erosion would primarily continue from existing roads and trails.

Road surfaces are impervious for the most part and add to permanent water yield increases unless reforested. Surface and subsurface flows are also intercepted by the road when water is moving down adjacent hill slopes. Water can be concentrated either on the road surface or in adjacent ditches, and in places, is rerouted from pathways it would otherwise take if the road were not present. By intercepting surface and subsurface water flow, and diverting it into ditches and channels, roads effectively increase the density of streams on the landscape. As a result, water infiltration decreases, the timing of flood flow is quickened, and the peak of flood flow is increased. Water yield increases are occasionally moderate to high relative to road drainage inputs to small channels on site. Frequent drainage structures reduce the amount of concentrated flow that is diverted into forest filter strips at any one point. Drainage structures also divert water flow directly to channels which increases the potential for sediment to reach streams.

Road maintenance operations such as blading the road surface and cleaning ditch lines can lead to increases in soil erosion and increases in sediment production. However, these operations in combination with structural improvements, hardened surfaces, and vegetation establishment would reduce soil erosion and sediment production from these roads over the long term.

Under this alternative 2.55 miles of unauthorized roads and 3.43 miles of authorized roads would not be decommissioned.

Cumulative Effects

The Affected Environment describes conditions that would be associated with Alternative A. Past, present, and reasonably foreseeable future activities on NFS lands and/or private lands in conjunction with Alternative A may continue to have effects on the water resource. (See past and future projects list in Project File W-1)

Past vegetation management on federal lands in the area has consisted of timber harvesting activities, periodic prescribed burning, and wildlife opening maintenance. Timber harvesting activities occurred more regularly from the 1970's to the 90's. No commercial timber sales have occurred since then. Some mast tree release contracts were award in this area in 2006. Two prescribed burns were implemented in this area; one in 1998, the other in 2004 totaling 1,039 acres. Effects from these activities should be minimal considering Forest plan standards and guidelines have been followed. When properly implemented, BMPs have been effective at protecting water quality and associated resources (Adams and Hook, 1993, Adams, 1994). Twenty-two wildfires have occurred during a twenty year period from 1981-2001. Activities in the reasonably foreseeable future include 1,991 acres of prescribed burning proposed for 2010 and 326 acres in 2011. Other activities include road maintenance on Forest Service Roads (FSRs).

FSRs are generally aggregate surfaced and are generally on side-slope and ridge-top locations. The roads are, however, the main source of erosion and sediment yields from National Forest Service (NFS) lands within this analysis area. Better drainage and additional road hardening with gravel would improve the condition of these roads and reduce road-related erosion.

Approximately 60% of the Big Creek watershed is comprised of private lands. Past and present land use types and activities such as, agricultural crop and animal production, home construction, land clearing, road construction and maintenance, and timber harvesting. The nature of the disturbance that is associated with some of these land uses is known to create the potential for greatly accelerated erosion

and sediment rates. It is likely that this condition exists, and influences the quality of some surface waters within the project area. Effects from similar activities in the reasonably foreseeable future would continue to occur.

The loss of hemlock in the Southern Appalachians may also result in hydrolic changes. Evapo-transpiration will decrease with the declining number of mature hemlocks. Four hydrolic consequences are predicted: (1) increased soil moisture, (2) increased discharge, (3) decreased diurnal amplitude of streamflow, and (4) increased width of the variable source area (Ford and Vose 2007). Hemlocks have been treated with Merit Insecticides in Spicewood and predator beetles have been released along Dry Creek. Effects in these areas may be to a lesser degree than in other areas depending on the success of the treatments.

Alternative A would not result in any new ground disturbance or other effects, but it also would not implement any improvements to roads within the affected watersheds. Road improvements through reconstruction and maintenance would improve the condition of the roads, reduce erosion, and road-related sediment over time.

Alternative B (Modified Proposed Action)

Direct and Indirect Effects

Timber Harvesting

Perennial and intermittent streams are close to, adjacent or within stands where harvesting is proposed. Streamside management zones (riparian corridors and filter zones) would be established around these streams as specified in the RLRMP. Filter zones would be established along scoured ephemeral streams. Temporary roads and skid trails would be located mostly on ridge top and side slope locations, where most of the erosion that does occur would filter out in the undisturbed forest floor before reaching stream channels. Roads, log landings, and primary skid trails would be constructed outside of stream management zones.

Mitigation measures that are employed during and after timber harvest activities to reduce erosion and sediment yield potential are an important consideration. Extensive research and effectiveness monitoring have proven the value of properly applied mitigation measures in greatly reducing erosion and sediment yield potential (Patric 1994; Curtis et al. 1990).

Changes in water yield would occur in response to timber harvest, skid trail development, and silvicultural activities such as mechanical slashdown of vegetation. These activities would increase water yield by decreasing the interception of precipitation by trees and the loss of soil water due to transpiration. Research indicates that achieving a measurable increase in streamflow requires at least a 20% decrease in basal area (Douglas and Swank 1972; Patric 1994). As basal area reduction increases to 100%, greater increases in streamflow take place. Any basal area left on harvested areas would tend to reduce the water yield increase.

Stream flow increases do not last long in the southeastern U.S. due to the rapid regeneration of dense new stands on cut areas. Although increased yields are possible from five to 10 years after harvest, almost all of the increase is over after five years for clear-cuts and within one to three years when less than 50% of the basal area is removed (Swank, Vose and Elliot 2001).

Timber harvesting increases stormflows in relation to the amount of basal area removed, the number of acres of a given watershed treated, inherent watershed hydrologic response factors (such as soil depth), and the magnitude and frequency of storms following treatment. Research at Coweeta Hydrologic Lab indicate that timber harvest (clear-cutting) with minimal forest floor disturbance and a low density of

carefully located and designed roads produce only small and acceptable (about 15 %) increases in mean stormflow volumes and peak flow rates (Swank, Swift and Douglas 1988).

The percentage of harvest acres to watershed acres is low; therefore, little, if any, effect to water yield would occur in these watersheds. Any augmented flows from the streams in the analysis area would merge imperceptibly into Big Creek. Periodic high flows also act as a flushing mechanism to move sediments downstream through a channel system. Table SW1 displays the acres of commercial timber harvesting by treatment within each sub-watershed and percentage of harvest activity.

Table SW1: Timber Harvest in Watersheds by Treatment

Watershed	Watershed Size (acres) [1]	Clear-cut (acres) [1]	Regeneration (acres) [1]	% Watershed with Harvest Activity
Spicewood Branch	620	28	21	7.9%
Hurricane Branch	416	--	93	22.3%
Unnamed tributary of Hunter Creek	128	--	29	22.6%
Double Branch	406	--	39	9.6%
Totals	1570	28	182	62.4%

[1] GIS calculated

The chemistry of water flowing through forests changes as water passes through the canopy, forest floor, and soil. Forest harvesting reduces interception losses, allowing more water to reach the soil, thereby diluting nutrient concentrations (all else equal). The removal of mature trees would result in a temporary decrease in the demand for nutrients therefore; more nutrients are available and are potentially free to move off site. Nutrients can be dissolved in precipitation and infiltrate into underlying mineral soil. Subsequent drainage through the soil can carry some nutrients such as Nitrogen, Calcium and Magnesium to nearby streams. The duration of this possible effect is generally considered to be less than five years. After this time period, sprouts, seedlings and other vegetative growth reestablish the cut area and effectively tie up available nutrients.

Long term measurements of chemical changes in water quality at Coweeta Hydrologic Lab are summarized as follows:

- Based on observations beginning in 1972, none of the harvested areas or other disturbances at Coweeta produced nutrient concentrations that would have an adverse impact on water quality for municipalities or downstream fisheries.

- Compared to other forested regions of the U.S. increases in nutrient concentrations of streams at Coweeta were small, even for the most drastic vegetative disturbances.

- Nitrate-N is a sensitive indicator of forest disturbance and although concentrations are quite low (<0.2 mg/1), elevated levels in streams draining clear-cuts appear to persist for 20 years after cutting. However the increase is substantially diminished by the fifth year after cutting and appears to approach pre-logging levels (Swank 1988).

Implementation of forest Best Management Practices (BMP's) such as Streamside Management Zones (SMZ's) would greatly reduce the amount of nutrients reaching the stream. Vegetation within the buffer zone would quickly absorb any available nutrients. Any chemical changes that might occur from the

project should be examined in the context of the streams natural or background chemical composition. Streams draining the affected area are low in dissolved solids and fertility. Any small infusion of fertility into these streams that are nutrient poor would have benign or possibly positive effects in terms of aquatic habitat.

Stream temperature would not be affected by the proposed action. SMZ's would be left beside perennial and intermittent streams in any stand affected by timber harvest. These corridors would provide shade strips where trees would be left uncut and soil disturbance would be kept to a minimum (see mitigation section of this EA).

Available research indicates that pH is not sensitive to most forest management activities. There is no evidence that acid-bearing rock is present in the affected area. If any were to be encountered during project implementation, appropriate steps (project cessation and/or mitigation) would be taken immediately to address the hazard.

Herbicides

Chemical treatments would be used for midstory control, site-preparation, and to control non-native invasive plants. Specific herbicides that could be used include triclopyr, and glyphosate, imazapyr. A variety of ground application methods could be used, but each method would directly apply chemical to the targeted plants.

Triclopyr is not highly mobile in the soil, and is not a leaching problem under normal conditions since it binds to clay and organic matter in the soil. It may leach from sandy soils if rainfall is heavy after application. The herbicide is broken down by soil microorganisms and ultraviolet light, and persists for 30 to 90 days (46 day average) in the soil depending on soil type and weather (Extoxnet Fact Sheet 1996). Triclopyr BEE (butoxyethyl ester) is much more toxic to aquatic species than triclopyr TEA (triethylamine salt), the projected levels of exposure are much less even for acute scenarios because of the rapid hydrolysis of triclopyr BEE to TEA, as well as, the lesser runoff of triclopyr BEE because of its lower water solubility and higher affinity for soils (SERA 2003a). Nonetheless, triclopyr BEE is projected to be somewhat more hazardous when used near bodies of water where runoff to open water may occur (SERA 2003a).

JLB Oil is used as an adjuvant with triclopyr formulations (BEE). This is a mineral oil and Limonene or vegetable oil and Limonene mixture used as a carrier. This product has been reviewed according to the EPA hazard categories under section 311 and 312 of SARA Title III, 1986 and does not contain hazardous components that require reporting.

The binding of Imazapyr to soil is very complex depending on soil texture, pH, the presence of iron oxides, organic carbon, aeration, soil depth, and soil moisture. The most influential factor in the persistence of Imazapyr in soil, however, appears to be microbial activity (SERA 1999). Imazapyr is chemically stable in soil, and microbial breakdown along with dispersal by mechanisms such as percolation and runoff, would be the primary ways that Imazapyr decreases in soil over time. Due to the strong adsorption of Imazapyr to the soil, it is usually found in only the top few inches of the profile and has a low potential for leaching into ground water. Most movement of Imazapyr to surface waters is by storm runoff. Undisturbed streamside management zones can significantly reduce movement of Imazapyr to surface waters. The half-life of Imazapyr in water is about 4 days.

Glyphosate is inactivated when it comes into contact with soil since it is strongly adsorbed onto soil particles. It is readily metabolized by soil bacteria and many species of soil micro-organisms can use Glyphosate as a carbon source. Because of its adsorption to soil, Glyphosate is not easily leached and is not likely to contaminate ground water. Glyphosate remains unchanged in the soil for varying lengths of time depending on soil texture, organic matter content and environmental conditions (SERA 2003b).

In general, herbicides can enter surface waters via three main routes including:

1. Movement or leaching through the soil profile to subsurface water and travel until contact is made with surface systems,
2. Absorption to a soil particle and movement to surface water systems during heavy rains and;
3. Direct contact with surface water during application.

The herbicides that would be used in the analysis area are low-toxicity chemicals. No herbicide would be applied within 30 feet of open water except for selective treatments that use herbicides labeled for aquatic use. Timing the herbicide application to avoid rainfall during and immediately after application reduces the risk of contamination. Methods of herbicide application (generally foliar treatments or direct injection) would minimize herbicide contact with the soil or surface water. Due the little amount of herbicide used in this project effects to the water resource are negligible.

The greatest hazard to surface and ground water quality would result from a possible accident during transportation, storage, mixing and disposal of the chemicals.

The quantity of herbicide to be used, on-site degradation processes, the method of application, the relatively short persistence of the herbicide in the soil, in-stream dilution and degradation, and mitigation measures to be used would result in minimal risk of surface and ground water quality impact. No herbicide would be applied within 30 feet of open water except for selective treatments that use herbicides labeled for aquatic use. This along with careful control over the weather conditions during which the herbicide would be applied would prevent direct contamination of surface water. Many of the herbicide treatments would be applied directly to targeted species and very little herbicide would make ground contact. As a result, infiltration into the soil and movement via soil water (subsurface) would be minimal. The greatest hazard to surface and ground water quality would result from a possible accident during transportation, storage, mixing and disposal of the chemicals.

Roads

Effects of NFS roads on the water resource are disclosed in the No Action alternative. Decommissioning 5.98 miles of authorized and unauthorized roads would allow these roads to grow up in natural vegetation and the effects from these roads would decrease over time.

Approximately 3.28 miles of existing roadways would be authorized. These roads would be gated and closed to all but administrative use. Gating these roads would decrease the amount of traffic and reduce the potential for resource damage that may occur from road use.

Temporary roads constructed on low to moderate slopes away from streams have limited hydrological effects. There would be minimal long term effects as long as road closures prevent continued use by vehicles, and measures to reduce erosion and control water are in place. Some closed temporary or unauthorized roads, wildlife openings and log landings would be disked to maintain quality wildlife food, cover and hunting opportunities with limited risk to water resources. Standards and BMPs address road activities and avoidance or restrictions in road location or practices would be employed when crossing streams or within the riparian corridor. Temporary roads used for harvest operations contribute to erosion and sediment in the short term (up to three years), but the effects to soil and water can be mitigated to a great extent with effective erosion control measures.

Prehaul maintenance operations such as blading the road surface, cleaning ditch lines, improving structures, hardening surfaces, and replacing gravel can lead to increases in soil erosion and increases in sediment production. However, prehaul maintenance would reduce soil erosion and sediment production from these roads over the long term. Prehaul maintenance is needed to prevent road degradation from high trafficking of heavy loaded vehicles.

In general day lighting linear wildlife roads would increase sunlight to the roads increasing vegetative cover on the roads which would lead to a dryer less erosive road. In this case there would be no effect on the water resource. However, in some instances depending on soil type, site preparation, soil compaction, and seeding rates vegetative cover could be limited. In this instance day lighting wildlife roads would lead to an increase in erosion. Effects on the water resource would depend on many factors such as location of the road, number of stream crossings, slope of the road, and drainage structures.

Fisheries Activities/Wildlife Activities

Activities proposed to improve stream habitat would have minimal impacts to the water resources. Large woody debris such as tree boles oriented perpendicular into the stream channel may create minimal stream bank scour below the structure. Large amounts of woody debris in one location could prevent sediment movement and aggregate the stream bed upstream of the debris. Thinning of Rhododendron may increase sunlight to the stream but water temperatures would not increase.

Activities proposed in this alternative as wildlife activities would have minimal effects on the water resource. These areas are generally on upland sites away from surface waters. In general waterholes, vernal ponds, or wetlands are created on uplands sites in openings, skid trails, log landings, and/or in the upper portions of ephemeral drainages. These sites are usually small (25'x25') ephemeral watering areas that hold water for a short period of time after a rain event or during wetter months of the year. Effects from the constructed water sources would be negligible.

Alternative C

Direct and Indirect Effects

In Alternative C all activities are the same with the exception of a 31 acre increase in stand regeneration. These stands are located in the upper portion of two unnamed tributaries that run into the Trail Fork of Big Creek. Implementing this alternative may increase water yield. Water yield changes after timber sales are disclosed in Alterative B. Overall, effects to the water resources from activities proposed in this alternative would be virtually the same as effects from activities proposed in Alternative B.

Alternatives B and C

Cumulative Effects

Alternative B and C's cumulative effects are being analyzed together since the direct and indirect effects of both alternatives would be similar. Note: Cumulative effects that resulted from past and current conditions in the affected watershed are described in Alternative A. Alternative B or C would result in additional disturbance within the watersheds from specified road construction and prehaul maintenance activities associated with timber harvest. Actual ground disturbance on NFS lands would be a very low percentage of a subwatershed within the analysis area and would be dispersed over the landscape.

Prescribed burning should create a mosaic type effect where areas of slash would burn severely, but most of the sites should have creeping ground fires and some areas would not burn at all. There would be limited potential to change runoff or water chemistry as a result from the burning since only a small percentage of the areas would burn severely.

Implementation of Alternative B or C would reduce the amount of sediment entering the tributary steams of the Gulf Fork Big Creek by decommissioning FSR 225201A and in Dry Fork by decommissioning FSR 5145. Prehaul maintenance on 17.3 miles of roads would reduce the road sediment that enters into intersecting steams and drainages for a few years into the future. Duration of benefit would greatly depend on the amount of use the road receives over time and weather. No other Forest Service activity that could affect the hydrologic condition of these watersheds is known or

planned. Effects to stream within the Big Creek Watershed are likely to continue from private land activities.

Implementation of Alternative B or C considered together with past and reasonably foreseeable future activities is not expected to have a cumulative effect on the water resource. Mitigation that would be used during project implementation is a primary factor leading to this determination.

Soils

Affected Environment

Diverse parent material along with other factors such as aspect, topography, and climate has resulted in many different soil types forming across the landscape. Upland soils that are well drained and have moderate permeability most frequently occur within the analysis area. However, the depth to bedrock may vary greatly depending on landscape position and past events such as landslides. Seeps and springs commonly occur in many soil types that are found on benches, foot slopes, toe slopes, colluvial fans, and coves. Soils that exhibit anaerobic conditions are associated with the few isolated wetlands found within the analysis area.

Some soil types due to steep slopes and low strength are subject to slippage and slumping. Other soil types within the stand have a severe risk of erosion mainly due to there textures and slope. Slopes range from 5% to 50% with some areas exceeding 50 %. The topography is moderately dissected by drainages and streams.

Soils within the proposed stand boundaries have undergone intensive management in the past and have remained stable and productive. However, the soil types found within the stand boundaries have limitations that should be considered before ground disturbing activities take place. Soil compaction, rutting, displacement, erosion, and severe burning of surface organics are the key factors that affect soil productivity. The soils found within the proposed stands are slightly to none eroded. The surface textures are silt loam, fine sandy loam, loam, and cobbly, sandy loam in texture and have a moist soil consistence that is very friable to friable. These characteristics allow for good root penetration and nutrient uptake. The subsurface textures are loam, sandy clay loam, cobbly sandy clay loam, and cobbly clay loam with a consistence of friable. Common soil series found within stand boundaries include Ditney, Maymead, Sylco-Cataska complex, and Tusquitee.

Soil series percentage in the proposed stands include Ditney (33%), Sylco-Cataska complex (11%), Maymead (11%), Tusquitee (8%), and Junaluska-Brasstown Complex (6%). Soco, Chestnut, and several other soil series are also found in the treatment area at low percentages, about (30% combined).

Scope of Analysis

In general scope of this analysis includes the entire Big Creek Watershed. Site specific analysis such as acres of soil types is derived only from areas where vegetation management is proposed. The time-period considers the past 10 years and future actions that could occur within five years of implementation.

Effects Analyses of the Alternatives

Direct, Indirect and Cumulative effects of the Alternatives on the Soil Resource are provided below.

Alternative A (No Action)

Direct and Indirect Effects

With the exception of road maintenance there would be no ground disturbing activities. Current rates of soil building and erosion would continue. In general, the area has no severe chronic hill-slope erosion problems.

Road maintenance operations such as blading road surfaces and pulling the ditches can lead to increases in soil erosion and sediment production. During road maintenance activities, soil may be displaced and exposed. Soil movement would occur; however, mitigation measures designed to stabilize the road surface, such as adding aggregate surfacing by armoring the soil or limiting distance and amount of concentrated flow by installing water diversion devices (dips, reverse grades, out-slopes, leadoff ditches, culverts) would reduce adverse effects. The detachment and distance soil particles move would be reduced by limiting water concentration and movement on disturbed surfaces and/or fill materials.

Cumulative Effects

Alternative A does not propose any new ground disturbance. Effects to soils generally occur because of ground disturbing activities. Cumulative effects from past and present activities generally result in a localized loss in soil productivity due to compaction, rutting, and/or soil displacement. However, soil erosion may also occur which may contribute to sedimentation. Activities, on National Forest lands, that are reasonably foreseeable would be implemented under the standards for protecting soils listed in the Revised Land and Resource Management Plan for the Cherokee National Forest (RLRMP); therefore, cumulative effects from these actions are minimal. Activities on private lands would be site specific to those lands and no cumulative effects would occur to the soil resource from those actions.

Alternative B (Modified Proposed Action)

Direct and Indirect Effects

Timber Harvesting

Timber harvesting involves various types and intensities of ground disturbing activities that can potentially affect the soil resource. Erosion hazard and steepness of slope are the primary soil concerns that could limit management activities. Soil concerns associated with logging and other connected actions center around rutting, soil compaction, displacement/erosion, soil exposure and nutrient reduction. Soil disturbance and compaction during timber harvest vary depending upon both the type of soil and harvest method (Swank and others 1989). Timber harvesting can directly affect the physical, chemical, and biological properties of the soil (Swank and others 1989). Effects from this action may include immediate changes in soil and/or organic matter displacement, water infiltration rates, and soil compaction.

Approximately 19% of the soils found within this area consist of Maymead and Tusquitee soil series. These soil types are made of colluvium material which is susceptible to slippage and slumpage when disturbed. Adequate road drainage such as out sloping, cross drains, and/or rolling dips is important when building roads on these soil types. Extra caution should be used when disturbing these soils. Soil descriptions and limitations are listed in the project file.

Loss of organic matter can result in disruption to nutrient recycling in the soil and reduced nutrient availability for trees and other plants. Nutrient removal varies with the intensity of the activities and degree those organic materials that are removed.

Compaction limits root growth and development in soil, decrease tree growth (Swank and others 1989) and increase risk for blow down or tree stress. Water infiltration rates may be reduced due to compacted soils. Soil rutting and erosion can reduce soil productivity, resulting in permanent loss of soil.

Where soil compaction is severe and unmitigated, soil productivity would be reduced due to loss of soil structure. Compaction is most likely to occur on those areas where heavy equipment operates repeatedly, especially when soils are wet. Areas subject to compaction include skid trails, temporary roads, and log landings. While subject to many variables, it is estimated that about 10% of a given area harvested by conventional logging equipment (rubber tired skidders/forwarder) is impacted by skid trails, temporary roads and log landings.

The potential effects of soil erosion, sediment yield, and compaction have a spatial and temporal context. The amount produced depends upon the topographic, soil, and climatic characteristics of the affected area along with the intensity of management practices being implemented. Erosion that results from timber harvest would be greatly modified through time in that disturbance would be temporary and generally a single pulse over a long period of time. Research has repeatedly shown that sediment production during timber harvest may accelerate temporarily to about 0.05 to 0.50 tons per acre per year (Patric 1976 and 1994). Any given area to be disturbed by regeneration harvest would be cut and site prepared within a year's time. After this, it is unlikely the area would be disturbed (barring natural disturbance) for at least 50 to 60 years.

Indirect effects occur with time such as accelerated weathering of the soil, increased erosion, and accumulation of soil in depressional areas, nutrient leaching and alteration of organic matter formation.

With proper mitigation applied, all effects of timber harvest on soil loss, sediment yield and compaction would return to precutting conditions within two to five years. If any areas suffer severe compaction, however, the effects of the compaction could last much longer. Impacts to soils would be reduced by following existing Forest Plan standard and guidelines (RLRMP), and implementing Tennessee BMP's.

Refer to Table 2 in Appendix F: for soil limitations and hazard ratings by soil mapping unit. Refer to Table 3 in Appendix F: for soil mapping unit acres and location by compartment and stand.

Roads

Effects of roads and road maintenance are disclosed in Alternative A.

Some soil types within the Big Creek watershed are better suited for road building. Proper location of roads would reduce the risk of road failure. Following forest plan standards and guidelines (RLRMP) would reduce the effects to the soil resource.

Decommissioning roads allows the soil building process to begin on the road surface. As soils develop vegetative growth enhances. This process allows decommissioned roads to recover to a more natural state over time.

Wildlife Activities

For wildlife openings and linear wildlife strips, annual to periodic disking is common on some areas, and not on others. Disking at regular intervals can cause excessive erosion and productivity losses. These adverse effects are at acceptable levels normally by limiting these activities to slopes less than 10%. Additional measures such as no till, contour farming, or leave strips can be used to further reduce soil exposure or concentrated flow that contributes to erosion.

Some of the soils within the proposed stands are not suited for creating ephemeral pools. Effects from the creation of ephemeral pools on flat ground would be minimal. Great care need be taken to avoid unstable soils on slopes, fill slopes and other areas that could be hydraulically overloaded, resulting in failure. Direct effects would be the removal of the surface soil horizons, and an increase in water retention within the localized area. There would be some soil displacement from the removed soil. Indirect effects may be an eventual change from aerobic to anaerobic conditions of the soil within the wetland. This would depend on how well the depression holds water.

Herbicides

Chemical release treatments would have minimal effects on the soil resources due, in part, to the application methods. Minimal amounts of chemical would come in contact with the soil as most are targeted for application on the leaf surface or directed at the stem. These application methods do not require disturbance to the soil litter or duff layer and therefore, erosion is not a concern.

Many field studies involving microbial activity in soil after Glyphosate exposures note an increase in soil micro-organisms or microbial activity, while other studies noted a transient decrease in soil fungi, bacteria and microbial activity (SERA 2003b). There's very little information suggesting Glyphosate would be harmful to soil microorganisms under field conditions and a substantial body of information indicating that Glyphosate is likely to enhance or have no effect on soil microorganisms (ibid).

There does not appear to be any basis for asserting that Imazapyr is likely to adversely effect microorganisms in soil (SERA, 2004 page 4-26).

Triclopyr would be applied to the base of target trees. The streamline or hack and squirt application method would be used. Only the individual trees or other competing vegetation, requiring treatment, would be targeted. Therefore, contact to soil should be minimal.

Alternative C

Direct and Indirect Effects

In alternative C all activities are the same with the exception of a 31 acre increase in stand regeneration. Soil limitations and hazard ratings by soil mapping unit for timber harvest operations are within those stand boundaries are covered in Tables 2 and 3 in Appendix F.

Alternative B and C

Cumulative Effects

Alternative B and C's cumulative effects are being analyzed together since the direct and indirect effects of both alternatives would be similar. Little timber harvesting has occurred over the last 10 years on federal lands; however, periodic prescribed burns totaling 1,039 acres have been implemented in portions of the analysis area. Cumulative impacts on soil conditions relative to compaction, displacement and subsequent erosion from past prescribed burning and connected actions are considered minimal for the majority of areas. Soil would recover over time depending on burn severity. Severely burned areas loose productivity and are subject to erosion.

Impacts on soils resulting from timber harvests normally recovered before a new cycle of harvesting begins, and as a result, cumulative impacts relative to compaction and displacement from successive harvesting operations would be expected to be minimal for the majority of harvested areas. Areas that

are repeatedly used for logging decks and skid trails in stands that have frequent entries, have the potential to suffer more continuous periods of decreased soil productivity and decreased water infiltration. Although rehabilitation of these sites decreases the duration of the recovery period for soils and lessens the potential for cumulative degradation of soil conditions, the re-opening and use of these areas during successive harvest operations generally results in some decreased soil quality on these sites. These areas are a small fraction of the project area.

Activities in the reasonably foreseeable future include 1,991 acres of prescribed burning proposed for 2010 and 326 acres in 2011. Other activities include road maintenance on FSRs.

Other activities on Federal lands within the proposed treatment areas include a variety of maintenance measures. For roads and rights-of-way, activities are performed to ensure the safety of the public and to prevent degradation of infrastructure and the environment. Road maintenance operations such as blading the road surface and pulling the ditches can lead to increases in soil erosion and increases in sediment production. However, these operations may be combined with structural improvements and improvements to drainage structures which reduce soil erosion and sediment production from the road surfaces over the long term. Disking wildlife openings at regular intervals can cause excessive erosion and productivity loss. Limiting these activities to lesser slopes, vegetating, and fertilizing would keep these adverse effects at acceptable levels.

Implementation of Alternative B and C considered together with past and reasonably foreseeable future activities is not expected to have a cumulative effect on the soil resource. Mitigation that would be used during project implementation is a primary factor leading to this determination.

Forest Resource

Affected Environment

All acreages from Cherokee National Forest Geographical Information System (GIS). There may be some minor discrepancies when comparing total acres and percentages due to rounding.

The Big Creek Assessment Area contains approximately 16,777 acres of National Forest lands. Prescription 4.A (Appalachian Trail) contains 3,793 acres, 5.B-Designated Communication Electronic Sites contains 0.14 acres, and 43 acres are in 7.D-Concentrated Recreation Zone (Round Mountain Campground). All of these prescriptions are unsuitable for timber management. About 12,941 acres are in Prescription Area 7.E.2, a suitable prescription for timber management. Within these prescriptions, there are unmapped areas of Prescription Area 11-Riparian Corridors, also unsuitable for timber management.

The forested acres of the Big Creek Assessment area have a dominant cover made up of deciduous trees with some evergreens. The largest forest type is yellow poplar/white oak/northern red oak occupying 41% of the area. Next largest is White Pine with about 9% of the area. White Oak/Northern Red Oak/Hickory occupies less than 8% of the area, then Chestnut Oak with almost 7% of the area, and then White Pine/Hardwood with just over 5%. Cove Hardwoods/White Pine/Hemlock, Yellow Poplar, Scarlet Oak, and Chestnut Oak/Scarlet Oak each occupy about 4% of the area Pitch Pine/Oak and Sugar Maple/Beech/Yellow Birch each occupy less than 3% of the area. Upland Hardwoods/White Pine and Chestnut Oak/Scarlet Oak/Yellow pine each have under 2% of the area. Hemlock/Hardwood occupies just over 1% of the area. White Pine/Hemlock, Virginia Pine/Oak, Shortleaf Pine, Pitch Pine, and Sweetgum/Yellow Poplar each have less than 1% of the area.

Table FR1: Age class distribution - All Forested Lands

Big Creek Assessment Area- base year 2009					
Age	0-10	11-40	41-80	81-110	111+
Acres	6	3171	7248	6246	38
Percent	<1%	19%	43%	37%	<1%

The majority (80%) of the forested land is occupied by stands between 41-110 years old, dating back to extensive logging beginning about the 1900's, prior to Federal ownership. Nineteen percent is in the younger age classes of 11-40 years old, from timber sales in the 1970's, 80's and '90's. Less than 1% is older than 111 years old. There is less than one percent in the 0-10 year age class.

Within the 12,941 total acres of the 7.E.2 prescription area there are 4,203 acres of stands that are unsuitable because of inaccessibility, steep slopes, other resource priorities, are non-forested etc; leaving 8,738 suitable acres, where commercial timber harvest may be used to accomplish management objectives. This is only about 52% of the total assessment area. There are also unmapped riparian corridors, also unsuitable for timber management (Prescription Area 11).

The proposed activities that affect age class distribution would only take place in Compartments 242, 243, 244, and 249. These compartments contain 6,065 total acres in Prescription Areas 7.E.2. There are about 2,292 acres of stands that are unsuitable because of inaccessibility, steep slopes, other resource priorities, are non-forested etc; leaving 3,773 suitable acres, where commercial timber harvest may be used to accomplish management objectives, only about 62% of the total acreage in these compartments. The suitable acreage in this analysis (3,773 acres) is less than 22% of the total 16,777 acres originally considered in the Big Creeks Assessment Area. The age class distribution on these suitable lands is shown in Table FR2.

Table FR2: Age class distribution - All Suitable Lands in Prescription 7.E.2, Compartments 242-244, and 249

Big Creek Assessment Area - base year 2009					
Age	0-10	11-40	41-80	81-110	111+
Acres	0	1170	1153	1450	0
Percent	0%	31%	31%	38%	0%

The suitable forested land in 7.E.2 is fairly well distributed in the 11-40, 41-80, and 81-110 age classes. There is no acreage in the 0-10 or the 111+ year age class.

Starting about 2001 Southern Pine Beetle (SPB) activity was detected in the area. SPB caused pockets of mortality in yellow pine and white pine and reduced the amount of pine stocking in general throughout the assessment area.

Hemlock Wooly Adelgid (HWA) is widespread through the entire Big Creek drainage. HWA has been treated with systemic insecticide in 2007 and 2009 at Spicewood in Compartment 243, and in 2008 at Round Mountain Campground. Predator beetles were released at a site near Round Mountain

Campground in 2007. These sites are Hemlock Conservation Areas from the Conservation of Native Hemlock EA (CNH 2005).

Almost 26% of the area is in forest types dominated by oak species that are primary hosts for Gypsy Moth. Another 47% have forest types with a strong component of oak species in combination with species less preferred by Gypsy Moth

Scope of Analysis

The scope of analysis for all effects to the Forest Resource is the 7.E.2 Prescription area in Compartments 242, 243, 244, and 249. The time frame is approximately 10 years before implementation to 10 years after. Planning for major management activities that would significantly affect the age class distribution generally follow a 10-year planning cycle. The last major regeneration activity in this project area happened over 10 years ago and the next planning cycle for this area would not likely happen for another 10 years.

Assuming that the project would begin implementation in 2011, a mid-point year of 2013 would be used for age class distributions for the action alternatives.

The proposed activities that directly affect the forest resource are all within the combined 3,774 suitable acres of Prescription Area 7.E.2 within Compartments 242, 243, 244, and 249. The effects of these proposed activities, particularly the creation of early successional habitat, to the age classes within the suitable acres are shown in Tables FR3, FR5, and FR7. Effects to successsional stages, including old growth, on all forested acres, are shown in Tables FR4, FR6, and FR8.

Effects Analyses of the Alternatives

Age Class distribution and structure is a means to measure many attributes of the forest resource. A forest with a diversity of age classes is more resilient to insects and disease outbreaks and natural disasters, such as wildfire, ice storms and wind events. A mixture of successional stages (groupings of age classes) provides differing habitats for wildlife, both animal and plant. This is reflected in the Desired Conditions and Objectives for Prescription areas 7.E.2 that give desirable percentages of early-, mid- and late- successional forest. Successional stages, by definition, are not static. A forested stand regenerated now would provide early-successional habitat for a period of time and then mid-successional habitat. In the absence of additional disturbances, eventually this stand would provide late-successional habitat. Regenerating stands and creating early-successional habitat is the only means to affect age class distribution. Management activities cannot directly create other successional stages such as mid-and late-successional habitat.

Alternative A (No Action)

Direct and Indirect Effects

None of the proposed actions would take place in this alternative; therefore, no immediate changes to the existing vegetation would occur. The forests would continue to grow and age, resulting in an older, more uniform forest where species composition, age class distribution, and understory vegetation continue to change relatively slowly by processes of natural succession. Any new age class diversity would depend on the occurrence of widespread natural processes (fire, ice storms, insect infestations, etc.). Plant communities associated with older stands would remain fairly static and communities associated with younger stands would decline. Shade tolerant species would gradually dominate shade intolerant species.

As the trees grow older, there would be increased vulnerability to such agents as oak decline, gypsy moth, SPB, and HWA because of reduced health and vigor associated with advanced age. Shade

tolerant, less susceptible species growing in the understory would replace dying trees. Species diversity would decrease as the area ages toward a prevalance of late-successional forest.

Table FR3: Age class distribution - All Suitable Lands in Prescription 7.E.2, Compartments 242-244, and 249

Alternative A: Big Creek Project Area - base year 2013					
Age	0-10	11-40	41-80	81-110	111+
Acres	0	870	995	1898	11
Percent	0%	23%	26%	50%	<1%

The acreage of suitable forested land in 7.E.2 between 81-110 years old would be increased 38% to 50% (Table FR3). The acreage in the 11-40 year age class has dropped from 31% to 23%, and the 41-80 year age class has dropped from 31% to 26%. Eleven acres has aged into the 111+ age class. There would be no acreage in the 0-10 for forage and hiding cover for wildlife, to provide diversity of age classes, or for the eventual transition to mid-successional forest.

Successional Stages and Old Growth

Early-successional forest is from 0 to 10 years of age. Mid-successional forest has an age of 41-80 years. Late successional would be greater than 80 years of age. Old Growth as defined in "*Guidance for Conserving and Restoring Old Growth Forest Communities on National Forests in the Southern Region"* (FR-62) must meet four criteria, one of which would be a minimum age that varies by Forest Type. This miminum age varies from 100 to 140 years.

OBJECTIVE 7.E.2-1.01: Manage forest successional stages to maintain a minimum of 50 percent of forested acres in mid- to late-successional forest, including old growth; a minimum of 20 percent of forested acres in late-successional forest, including old growth; and 4 to 10 percent in early-successional forest.

Table FR4: Age class distribution - All Suitable Lands in Prescription 7.E.2, Compartments 242-244, and 249

Alternative A: Big Creek Project Area - base year 2013					
Age	0-10	11-40	41-80	81-110	111+
Acres	0	903	1268	3958	0
Percent	0%	15%	21%	65%	0%

There would be 65% of the Prescription Area in late-successional forest (Table FR4). This fully meets the Objective minimum for mid- to late successional forest (50 percent) and minimum for late-successional forest (20 percent). There would be no early successional forest in year 2013 for forage and hiding cover for wildlife, to provide diversity of age classes, or for the eventual transition to mid-successional forest.

About 105 acres in Stands 42 and 43 in Compartment 242 are designated as existing Old Growth.

The conditions discussed under the affected environment for Old Growth would continue under this alternative with all stands continuing to age in the absence of a major disturbance, such as an insect and disease outbreak, ice storm, wind event, or catastrophic wildfire.

Forest Health and Diversity

As shown in Table F4, 65% of Prescription Area 7.E.2 is in mature forest over 81 years old and remains susceptible to oak decline, gypsy moth, Southern Pine Beetle, Hemlock Wooly Adelgid, and natural disasters such as wildfire, ice storms and wind events. Thirty-six percent is under 80 years old and there is no regenerating forest (0-10 year age class). No Release thinnings would occur to improve the general stand health by reducing competition for sunlight and nutrients.

Cumulative Effects for Alternative A

The overall effect of the no-action alternative would be an older, more uniform forest. By 2013, acreages in all age classes would have advanced into the next older age class and there would be no stands younger than 10 years old. Regeneration from timber sales prior to 10 years ago are reflected in the age class distribution and the current stand conditions.

Mast tree release has occurred on 92 acres about 2006 on stands regenerated in the 1990's. These activities should improve the stand health, but would not change the age class or forest type of the stands. Hemlock dying from Hemlock Wooly adelgid may be planned for salvage in the Big Creek area. Only dying hemlock would be removed. The trees will die whether they are salvaged or not and this is considered under the direct effects, so the salvage activity has no cumulative effect to the forest resource. Prescribed burns would continue, and these are not expected to change age classes or forest types significantly within the next 10 years.

Maintenance and monitoring activities would continue under Alternative A.

There are no other foreseen projects in this area for the next 10 years that would change age or forest types. No cumulative effects to the forest resource are expected.

Alternative B (Modified Proposed Action)

Direct and Indirect Effects

This alternative regenerates 296 acres in 13 stands utilizing commercial timber harvest. All stands harvested are 81-110 years old so this age class would be reduced to 43%. There would now be almost 8% (7.84%) of the suitable acreage in the 0-10 age class. Twenty-three percent would still be in the younger age classes of 11-40 years old and 26% in the 41-80 year age class. Percentage in stands older than 111 years old would remain at less than 1%.

Table FR5: Age class distribution - All Suitable Lands in Prescription 7.E.2, Compartments 242-244, and 249

Alternative B: Big Creek Project Area - base year 2013					
Age	0-10	11-40	41-80	81-110	111+
Acres	296	870	967	1629	11
Percent	8%	23%	26%	43%	<1%

The shelterwood method would leave about 15-20 square feet of Basal Area in residual trees. Basal area retained would be greater in some individual stands due to mitigation for scenery (See Mitigation Section, and Scenery Effects Section). All den trees would be selected first as leave trees, followed by oaks, hickories and other hardwoods in that order. These trees would remain through the next rotation. This method would create a two-aged stand with an open overstory of mature hardwoods. Regeneration would be from seeds and sprouting.

With shelterwood harvesting, some residual trees would be damaged during the felling and skidding operations. Most damage would not be severe and most trees would recover quickly from these mechanical injuries. Open wounds are an entry point for insects and disease, thus some trees may die as a result, creating snags.

Prior to harvest, midstory species would be controlled by herbicide (Triclopyr and Imazapyr) to reduce post-harvest sprouting of overly-competitive species, and nonnative species would be treated. After the merchantable timber is removed, the remaining standing stems not being retained as the shelterwood component would be slashed down. This allows the rootstocks to resprout into straight, vigorous, competitive stems. If needed, an application of Triclopyr and JBL oil would be applied to stems of over-competitive species to favor mast-producing trees. Approximately two-three years following these site preparation activities overly competitive sprouts are once again treated with Triclopyr and JBL oil. This step may be done with chainsaw slashdown again if herbicide is not needed.

Midstory treatments with Triclopyr and Imazapyr are proposed for 19 stands totaling 474 acres. This treatment reduces the existing competition allowing mast trees such as oaks to regenerate under the existing overstory. If these stands are harvested in 10 years, this advanced oak regeneration is available to resprout and become a component of the future stand. If these stands are not harvested in the future, the advance oak regeneration is still available to replace trees lost to natural causes. If available, American Chestnut seedling may be planted on some regenerated areas to begin restoring this species to it's former range. Invasive species that may have been introduced by the harvesting activities would be treated at every entry.

These activities assure that the harvested stands would be restocked with indigenous species. The relative abundance of species may vary from the previous stands but no forest type changes are expected with these methods, except in the regenerated former white pine dominated stands. These stands would be encouraged to regenerate to native hardwoods. Post-sale release treatments are planned to ensure that the stands would have a strong component of mast-producing species to provide forage for wildlife. Without these treatments, light-seeded species such as yellow-poplar and red maple would increase in relative abundance at the expense of cherry, oaks, and hickories.

Successional Stages and Old Growth

Early-successional forest is from 0 to 10 years of age. Mid-successional forest has an age of 41-80 years. Late successional would be greater than 80 years of age. Old Growth as defined in "Guidance for Conserving and Restoring Old Growth Forest Communities on National Forests in the Southern Region" (FR-62) must meet four criteria, one of which would be a minimum age that varies by Forest Type. This miminum age varies from 100 to 140 years.

OBJECTIVE 7.E.2-1.01 Manage forest successional stages to maintain a minimum of 50 percent of forested acres in mid- to late-successional forest, including old growth; a minimum of 20 percent of

forested acres in late-successional forest, including old growth; and 4 to 10 percent in early-successional forest. (RLRMP)

Table FR6: Age class distribution - All Suitable Lands in Prescription 7.E.2, Compartments 242-244, and 249

Alternative B: Big Creek Project Area - base year 2013					
Age	0-10	11-40	41-80	81-110	111+
Acres	296	903	1239	3689	0
Percent	5%	15%	20%	60%	0%

There would be 60% of the Prescription Area in late-successional forest. This fully meets the Objective minimum for mid- to late successional forest (50 percent) and minimum for late-successional forest (20 percent). There would be now be 5% in early successional forest in year 2013. This meets the Objective minimum.

About 105 acres in Stands 42 and 43 in Compartment 242 are designated as existing Old Growth.

Forest Health and Diversity

In Table FR6, forested stands > 81 years-old have been reduced to 60% of the analysis area and remain susceptible to oak decline, gypsy moth, Southern Pine Beetle, Hemlock Wooly Adelgid, and natural disasters such as wildfire, ice storms and wind events. An age class of regenerating forest has been introduced, 5% for 7.E.2, which would begin the age class diversity needed for a more resilient forest. Release thinnings would occur on 212 acres. These thinnings would improve the general stand health in these stands by reducing competition for sunlight and nutrients.

Alternative C

Direct and Indirect Effects

This alternative regenerates 327 acres in fifteen stands utilizing commercial timber harvest. All stands harvested are 81-110 years old so this age class would be reduced to 42%. There would now be almost 9% (8.66%) of the suitable acreage in the 0-10 age class. Twenty-three percent would still be in the younger age classes of 11-40 years old and 26% in the 41-80 year age class. Percentage in stands older than 111 years old would remain at less than 1%.

Table FR7: Age class distribution-All Suitable Lands in Prescription 7.E.2, Compartments 242-244, and 249

Alternative C: Big Creek Project Area- Base year 2013					
Age	0-10	11-40	41-80	81-110	111+
Acres	327	870	967	1598	11
Percent	9%	23%	26%	42%	<1%

Harvest methods and site-preparation would be the same as Alternative B on 31 additional acres.

Midstory treatments with Triclopyr and Imazapyr to encourage mast-producing species regeneration are proposed for 18 stands totaling 462 acres, 12 acres less than Alternative B. One stand proposed in Alternative B for Midstory treatment is regenerated under Alternative C (Stand 24 in Compartment 249)

Invasive species that may have been introduced by the harvesting activities would be treated with Triclopyr, Imazapyr, and/or Glyphosate at every entry.

Successional Stages and Old Growth

Early-successional forest is from 0 to 10 years of age. Mid-successional forest has an age of 41-80 years. Late successional would be greater than 80 years of age. Old Growth as defined in "Guidance for Conserving and Restoring Old Growth Forest Communities on National Forests in the Southern Region" (FR-62) must meet four criteria, one of which would be a minimum age that varies by Forest Type. This miminum age varies from 100 to 140 years.

OBJECTIVE 7.E.2-1.01 Manage forest successional stages to maintain a minimum of 50 percent of forested acres in mid- to late-successional forest, including old growth; a minimum of 20 percent of forested acres in late-successional forest, including old growth; and 4 to 10 percent in early-successional forest. (RLRMP)

Table FR8: Successional Stages-All Forested Lands in Prescription 7.E.2, Compartments 242-244, and 249

Alternative C: Big Creek Project Area- Base year 2013					
Age	0-10	11-40	41-80	81-110	111+
Acres	327	903	1239	3658	0
Percent	5%	15%	20%	60%	0%

There would be 60% of the Prescription Area in late-successional forest. This fully meets the Objective minimum for mid- to late successional forest (50 percent) and minimum for late-successional forest (20 percent). There would be now be 5% in early successional forest in year 2013. This meets the Objective minimum.

About 105 acres in Stands 42 and 43 in Compartment 242 are designated as existing Old Growth.

Forest Health and Diversity

In Table FR8, forested stands > 81 years old have been reduced to 60% of the analysis area and remain susceptible to oak decline, gypsy moth, Southern Pine Beetle, Hemlock Wooly Adelgid, and natural disasters such as wildfire, ice storms and wind events. An age class of regenerating forest has been introduced, 5% for 7.E.2, which would begin the age class diversity needed for a more resilient forest.

Release thinnings would occur on 212 acres, the same as in Alternative B. These thinnings would improve the general stand health in these stands by reducing competition for sunlight and nutrients.

Alternative B and C

Cumulative Effects

Alternative B and C's cumulative effects are being analyzed together since the direct and indirect effects of both alternatives would be similar. Note: past activities in the forested stands of the Big Creek Project Area as discussed under Alternative A, including past timber sales, prescribed burns, mast tree releases, and Hemlock Wooly Adelgid treatments have resulted in the present conditions as discussed in the Affected Environment section above. The effects of time to the forest resource would occur independent of the proposed activities except where proposed active vegetation manipulation to regenerate stands and improve forest health are implemented and these effects are discussed in the Direct Effects section.

The activities discussed in Alternative A would also occur under Alternative B or C. Maintenance and monitoring activities would continue the same as under Alternative A.

There are no other foreseen projects in this area for the next 10 years that would change age or forest types. The activities proposed combined with past and future activities would not result in cumulative effects to the forested resource.

Mid- to Late- Successional and Old Growth

There are no foreseen future projects in this area for the next 10 years that would significantly change mid- to late successional habitat. Direct effects to these conditions have already been discussed and displayed in Tables FR4, FR6, and FR8.

Since there are no direct effects to Old Growth of implementing Alternatives B and C, and there are no foreseen future projects that would affect Old Growth in the next 10 years, there are no cumulative effects to Old Growth.

Health and Safety

Affected Environment

This section specifically discusses the effect of herbicide use on the health and safety of forest users and workers. Effects of herbicide use on other resources are discussed under the respective resource heading. Forest users and Forest workers occasionally visit the project areas. The proposed stands are not high-use recreation areas and no designated trails pass through these stands. Hunters are most likely to visit these areas. Forest Service workers visit these areas while performing administrative and maintenance duties.

Scope of Analysis

The scope of analysis is the individual boundaries of the areas in Items #1-11, listed under the respective alternatives. The time frame is generally from when the first project area is treated to less than one year beyond the time when the last project area in this analysis is treated, about 10 years from present.

Effects Analysis of the Alternatives

Direct, Indirect and Cumulative effects of the alternatives on Health and Safety are provided below.

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

Under the no-action alternative, current management would continue. There would be no increased health hazard to forest users or workers beyond those hazards associated with recreating and working in a wildland environment. There would be no cumulative effects to human health with the no-action alternative.

Alternative B (Modified Proposed Action)

Direct and Indirect Effects

Under the modified proposed action, the use of three herbicides are proposed for site preparation and release treatments, to develop advance oak regeneration, and treat non-native invasive plant species. The chemicals are known to be effective for situations encountered with this project, with minimal environmental impacts. Three different chemicals were chosen because one is more effective on particular vegetation or in a particular situation than another. The uses for each chemical and application methods are discussed in the alternatives under the proposed action. What chemical to use would depend on the plants to be controlled, the plants to release and maintain, and the overall objectives.

Unless otherwise referenced, information presented is from Risk Assessments prepared for the Forest Service by Syracuse Environmental Research Associates, Inc. (SERA),. SERA Risk Assessments for individual herbicides may be found at: http://www.fs.fed.us/foresthealth/pesticide/risk.shtml

The three herbicides proposed and their typical use rates are:

- Glyphosate formulations without surfactants. Typical Forest Service (FS) usage rate is two lbs. of acid equivalent (a.e.) per acre.

- Triclopyr. Typical FS usage rate is 1.0 lb a.e./acre.

- Imazapyr. Typical FS usage rate is 0.15 lb. a.e/acre.

Herbicide would be used within an area of up to 1,096 acres in this alternative, but not all of the area would be treated due to the selective nature of the applications (See herbicide use assumptions in Appendix C). Approximately 46.38 lbs a.e. of Triclopyr, 7.63 lbs a.e. of Imazapyr and 6.00 lbs a.e. of Glyphosate, for a total of 60.01 lbs a.e. of chemical would be used on the project area. This use is, on average, about .05 lbs a.e./acre.

The mitigation measures that are a part of the proposed action are designed to minimize human health risks. Following all handling, application and safety instructions further reduce risks. Forest users may come into contact with herbicide treated areas as they visit the forest. Signage during treatment would discourage use. Forest workers actually applying the herbicides are exposed for longer periods and to more volume of herbicide than a casual forest visitor. At the typical Forest Service use levels the SERA Risk Assessments for all three chemicals state that there is little potential risk to the health of workers and the general public.

Glyphosate, Imazapyr, and Triclopyr are all rated low in toxicity to mammals (SERA). For comparison, caffeine has a moderate toxicity (VMEIS). There is no evidence of carcinogenic effect for Glyphosate and Imazapyr; and marginal evidence with Triclopyr.

Glyphosate is classified as non-irritating or only slightly irritating to the skin and eyes. Triclopyr is classified as only slightly irritating. Imazapyr can cause irritation to the skin and eyes.

For Glyphosate and Imazapyr, birth defects have not been observed in test animals. With Triclopyr, no birth defects were observed below the levels that Triclopyr is toxic, and Triclopyr has low toxicity. This means that extremely high levels of chemical, above what would kill the test subject, are required to cause birth defects.

All of the chemicals are rapidly eliminated from the body and are not persistent, thereby reducing the posssibility of effects.

JLB Oil

JLB Oil is used as an adjuvant to mix with the formulation of Triclopyr sold under such brand names as Garlon 4. JLB is a mineral oil. Mineral oils are classified as very slightly toxic, are slight skin irritants, but not eye irritants. There is no evidence for carcinogenicity (VMEIS).

Marker Dyes

Hi-light™ blue dye is typically used if application is done by contractors. The Material Safety Data sheet for Hi-light™ reports, "No reportable quantities of toxic chemicals subject to the reporting requirements of Section 313 of SARA Title III and of 40 CFR 372 are present."

Alternative C

Direct and Indirect Effects

The chemicals used, treatments, and effects are similar to Alternative B, but the mix of treatments varies resulting in slightly more herbicide use than Alt. B because more acreage is treated.

Herbicide is used within an area of up to 1,115 acres in this alternative, but not all of this area is treated due to the selective nature of the applications (See Herbicide use assumptions in Appendix C). Approximately 48.81 lbs a.e. of Triclopyr, 7.80 lbs a.e. of Imazapyr and 6.00 lbs a.e. of Glyphosate, for a total of 62.61 lbs a.e. of chemical would be used on the project area. This use is, on average, less than 0.06 lbs a.e./acre.

Mitigation measures are the same as for Alternative B. At the typical Forest Service use levels the SERA Risk Assessments and worksheets for all three chemicals show Hazard Quotients well below the concern level for human health.

Usage and effects of JLB Oil and Marker Dyes are the same as with Alternative B.

Alternative B and C

Cumulative Effects

Alternative B and C's cumulative effects are being analyzed together since the direct and indirect effects of both alternatives would be similar. Only those herbicide treatments analyzed in the direct and indirect effects are planned on these project areas during the scope of this analysis. With expected mitigation measures and application, no herbicide is expected to leave the project area boundaries, and none is expected to enter these project areas from other projects. Due to the dispersed nature of these

project areas and the time frames when they may be treated, it is unlikely that any one forest user would visit multiple treated areas during the time that exposure to chemicals might occur. Even forest workers would not work on multiple project areas within a time frame that would cause cumulative effects, because the rapid elimination and lack of persistence of these chemicals in the body would preclude accumulation to the point of having cumulative effect. Also the SERA Risk Assessment states that repeated exposures below a toxic threshold should not be associated with cumulative toxic effects.

Cumulative effects are not expected with any alternative.

Biological Resources

Affected Environment

Analysis of effects to biological resources loosely follows the habitat framework used in the RLRMP to ensure comprehensive consideration of project effects. Threatened, Endangered, and Sensitive Species are addressed in detail in the *Big Creek Biological Evaluation* (Carter 2010)(Appendix E). Based on current information, the following habitats, communities, and species occur in the treated areas and/or would have the potential to be impacted by the alternatives. Other habitats, communities, and species identified in the RLRMP that do not occur or would not be impacted are not discussed further.

Terrestrial Resources

Forest Communities

Mesic deciduous forests (MDF) include northern hardwood, mixed mesophytic hardwood, bottomland hardwood, and dry (xeric) to moist (mesic) oak forest communities. They cover a major percentage of the CNF (USDA Forest Service 2004.)

Eastern hemlock and white pine forests (HWPF) include conifer-northern hardwood communities. These forests typically occur over acidic soils in moist areas, but sometimes occur on dry slopes. Many of the white pine forests are old plantations. HWPF cover a small portion of the CNF (USDA Forest Service 2004.) The amount of eastern hemlock on the CNF is dropping by the infestation of hemlock wooly adelgid (HWA).

Oak and oak-pine forests (OOPF) occur in dry to moist conditions. These forests cover a large part of the CNF (USDA Forest Service 2004). Mast production is greatest in mid to late-successional oak forests. Hard mast production fluctuates from year to year due to climatic and other factors. Most oaks begin to produce acorns from 40 years of age, although production decreases in later years (USDA Forest Service 2004).

Pine and pine-oak forests (PPOF) include all southern yellow pines with hardwoods as minor components. Historically, these forests mainly occurred on ridges and south-facing slopes where they were subject to natural fire regimes, but expanded due to past land uses. PPOF are well distributed across the CNF, but have been severely impacted by southern pine beetle (USDA Forest Service 2004).

Early-successional forests (ESF) are regenerating forests from zero to ten years old, not including permanent openings. These forests are short-lived and dominated by relatively dense, young trees where an overstory is absent or sparse. The amount of ESF on the CNF (1%) has been and continues to be

very low. The abundance of these forests is sporadic and declining on National Forests in the Southern Appalachians and the eastern U.S. (USDA Forest Service 2004).

Sapling/pole forests (SPF) are between 11 and 40 years old. Although timber harvesting has declined drastically in the last 20 years, a moderate amount of this habitat is available on the CNF (14%).

Mid-successional forests (MSF) are between 41 and 80 years old. A large amount of the CNF is in the mid-successional stage (31%). These forests begin to develop a more diverse canopy structure, functioning like late-successional forests.

Late-successional forests (LSF) are 81 years or older. They provide habitats and food sources for a group of habitat specialists as well as habitat generalists. They dominant the Southern Appalachians and the CNF and continue to increase (USDA Forest Service 2004).

Permanent openings are composed of a variety of grasses, broadleaf non-woody plants, seedlings, saplings, and shrubs. They include frequently maintained openings, old fields, utility right-of ways, and improved pastures. Permanent openings comprise less than one percent of the CNF landscape (USDA Forest Service 2004). Over one-third of these permanent openings are powerline corridors, and the remaining acres are wildlife openings and mountain balds.

High elevation shrubby habitats include woodland complexes, old fields, and regenerating forests 0-10 years old. These habitats overlap with permanent opening habitats (old fields). High elevation shrubby habitats have been declining as a result of succession of old fields, fire suppression, and reduced management activities, and this has put associated species at risk (USDA Forest Service 2004). Open, shrubby habitats represent four percent of the CNF high elevation acreage.

Riparian habitats include the transition between aquatic systems and terrestrial systems. These areas often provide rich, moist environments, serve as corridors for animal movement, and connect habitats and populations. Input of plant material, particularly large woody debris (LWD), from riparian habitats is one of the most important processes for stream ecosystems. Riparian forests make up almost a quarter of the CNF (USDA Forest Service 2004).

Snags, dens, and downed wood are important components to both aquatic and terrestrial habitats. They are typically most abundant in late-successional forests. Availability of snags, dens, and downed wood is currently not considered a limiting factor on the CNF. It has increased due to SPB outbreaks and will continue because of HWA infestation over the next ten or more years (USDA Forest Service 2004).

Table BR1: Terrestrial Habitats in the Big Creek Watershed.

Major Forest Communities	Acres	Percent of Watershed
Mesic deciduous (MDF)	10,376	61.8%
Eastern hemlock & white pine (EHWPF)	1,497	8.9%
Oak & oak-pine (OOPF)	8,188	48.8%
Successional Habitats	**Acres**	**Percent of Watershed**
Early successional (ESF)	6	< 0.01%
Sapling/pole (SPF)	3,171	18.9%
Mid-successional (MSF)	7,248	43.2%

Late-successional & old growth (LSOG)	6,284	37.5%
Other Terrestrial Habitats	**Acres**	**Percent of Watershed**
Permanent openings (PO)	98	0.6%
High elevation shrubby habitats (HESH)	6	0.0%
Riparian (RF)	2,635	16%
Snags, dens, downed wood (SDDW)	13,532	80.7%

Management Indicator Species

Management Indicator Species (MIS) that occur in the affected areas of the watershed are listed in Table BR2. MIS bird species migrate over long distances and spend only the breeding season in the CNF. Many factors outside of CNF management influence their population trends. A variety of factors (observer bias, weather, timing, species abundance, number of points in habitat, etc.) also influence trend estimates, resulting in confidence intervals that are often not conclusive. The estimated trend for the Acadian flycatcher population on the CNF shows a slight decline, a measurable decline for the chestnut-sided warbler, a measurable increase for prairie warbler, and a slight population increase for the scarlet tanager. However, the results are too varied to draw accurate conclusions from the data. Local reports in Northeast Tennessee indicate these birds to be at least fairly common (Knight 2008). However, USGS breeding bird data indicate a population decline (-2.3% 1980-2007) of Acadian flycatcher in the Blue Ridge region (Sauer et.al. 2008), and Forest Service data indicate negative trends for the prairie warbler (-7.5%) in the Southern Blue Ridge region (La Sorte et.al 2006). Data for the scarlet tanager from all available sources is not conclusive.

Acadian flycatcher (*Empidonax virescens***)** breeds in most of the eastern half of U.S. and winters in South America (NatureServe 2007). Requires deciduous forests near streams for breeding, and prefers forests with a high, dense canopy and few shrubs at elevations < 3500 feet in elevation (Nicholson 1997). The species was selected as a MIS to represent mid- and late-successional riparian forest habitat.

Chestnut-sided warbler (*Dendroica pensylvanica*) breeds in most of the eastern half of the U.S. and winters in Mexico, South America, and the Carribean Islands (NatureServe 2007). It is common above 3,000 feet in elevation in forests with an open canopy and dense shrub layer. These birds prefer deciduous brush and young growth in abandoned farms, orchards, and pastures, cutover forests, roadsides, thickets, and clearings (Dunn and Garrett 1997). The chestnut-sided warbler was selected as a MIS to represent high elevation early successional forests (shrubby habitats).

Hooded warbler (*Wilsonia citrina*) breeds in most of the eastern half of the U.S. and winters in Mexico, Central America, and the Carribean Islands (NatureServe 2007). It is found in moist deciduous forests with fairly dense understories (Hamel 1992). Hooded warbler was selected as a MIS for mid-late successional MDF with canopy gaps and structurally diverse understories (USDA Forest Service 2004).

Ovenbird (*Seiurus aurocapillus***)** breeds in most of northern and eastern U.S. and winters in Mexico, Central America, and the Carribean Islands (NatureServe 2007). It typically nests in older closed-canopied deciduous and mixed deciduous-coniferous forest with deep litter layer and limited understory. Large, contiguous forested tracts are needed to support successful breeding and long-term population viability (USDA Forest Service 2004). This species was selected as a MIS because of its association with mature deciduous forest interiors.

Pileated woodpecker (*Dryocopus pileatus*) is a permanent resident across most of the eastern U.S., portions of the northwest and across Canada (NatureServe 2007). It requires large cavity trees for nesting and forages on dead trees and downed logs across a variety of community types. The occurrence of this species may be correlated with forested habitats with abundant large dead trees and fallen logs (USDA Forest Service 2004). Pileated woodpecker was selected as an MIS because it requires large snags for nesting and feeding. It was also selected to help indicate the effects of management activities on the availability of forests with desired abundance of snags.

Prairie warbler (*Dendroica discolor*) breeds in the Eastern United States stretching from Main to Texas. It is a permanent resident in Florida and winters in the Caribbean. Brushy second growth, dry scrub, low pine-juniper, mangroves, pine barrens, burned-over areas, and sprout lands are ideal breeding habitats for prairie warblers. Typically their terrestrial habitat consists of old field, shrub land/ chaparral, and woodland-conifer forests (NatureServe 2009). The prairie warbler was selected as a MIS to represent low-elevation early successional forests.

Scarlet tanager (*Piranga olivacea*) breeds in most of the eastern half of the U.S. and winters in South America (NatureServe 2007). Primary habitat includes mature deciduous forests, especially in uplands; they also breed in bottomlands (Hamel 1992). The scarlet tanager was selected as a MIS to represent oak and oak/pine forests.

Table BR2: MIS of the Big Creek Watershed.

Management Indicator Species	Representative Habitat	Acres of Habitat	Percent of Watershed	CNF Population Trend
Acadian flycatcher	Mid-late successional riparian	2,286	13.6%	NCT * (-0.3%)
Chestnut-sided warbler	High elevation early successional	6	0.0%	NCT* (-2.4%)
Hooded warbler	Mid-late successional MDF	8,782	52.3%	Decline (-1.8%)
Ovenbird	Mature deciduous forest interiors	12,312	73.4%	Increase (1.4%)
Pileated woodpecker	Abundance of snags	13,532	80.7%	Increase (2.1%)
Prairie warbler	ESF (low elevation)	0	0	NCT* (4.1%)
Scarlet tanager	Mid-late successional OOPF	6,486	38.7%	NCT* (0.5%)

* NCT – No conclusive trend based on data; 90% confidence interval does not indicate reliable results

Demand Species

Demand Species in the affected areas of the watershed are listed in Table BR3. Black bear is both a MIS and demand species, but is discussed in the Demand Species section.

Table BR3: Demand Species of the Big Creek Watershed

Demand Species	Key Habitat Available - Acres (%)	Population Trend - CNF
Black bear	Denning - 6,284 (37%); foraging - 6,590 (39%)	Increase
Ruffed grouse	Nesting - 3,171 (19%); brood rearing - 6 (<1%)	Decline
White-tailed deer	Winter - 6,492 (39%); spring/summer - 104 (1%); cover - 4,772 (29%)	Increase*
Wild turkey	Winter - 6,584 (39%); spring/summer - 104 (1%)	Increase

*TWRA reports a limited amount of quality habitat in the mountains of Cocke County

Black bear (*Ursus americanus***)** uses a wide variety of habitats in the Southern Appalachians. Important habitat elements include remoteness and diversity, hard mast, den sites, and large home ranges (USDA

Forest Service 2004, Whitaker and Hamilton 1998). Black bear was selected as a MIS to help indicate management effects on meeting hunting demand for this species.

Ruffed grouse (*Bonasa umbellus*) utilize a variety of forest habitats and successional stages. Grouse generally nest in pole timber (or larger) hardwood stands. Dense and diverse herbaceous vegetation, offering low overhead cover and easy movement, provides high quality brood habitat. Adults use cover in young forests (6-15 year-old) or shrubby habitats, but also use older stands with dense cover. Close proximity of nesting habitat to secure adult cover and brood habitat is critical. Grassy areas are important brood habitat and bugging areas for young. Linear openings, especially those associated with young regenerating forests provide optimal brood habitat (USDA Forest Service 2004).

White-tailed deer (*Odocoileus virginianus*) use a variety of forest types and successional stages to meet their year-round needs. In the Southern Appalachians, regeneration areas and older forests provide complimentary benefits to deer. Older forests are most important in fall and winter providing acorns, the dominant food item. In spring and summer, regeneration areas provide an abundance of food (woody browse, herbs, fungi, soft mast), which is limited in older forests. Wildlife openings, especially those containing a clover-grass mixture, are used most extensively in early spring. They are also an important source of nutritious forage in winter, especially when acorns are in short supply (USDA Forest Service 2004).

Wild turkey (*Meleagris gallopavo***)** is present throughout the Southern Appalachians and occupies a wide range of habitats. This includes mature mast-producing stands during fall and winter, shrub-dominated stands for nesting, and herb-dominated communities, including clearings for brood rearing. High population densities are associated with greater amounts of oak forest and cropland, and lesser amounts of developed and coniferous forestland. Forest openings also are a key habitat component for wild turkeys throughout the year. Permanent openings provide nutritious green forage in winter and early spring and seeds in late summer and fall. They are especially important brood rearing habitat for young turkeys because of the abundance of insects and herbaceous plants (USDA Forest Service 2004).

Non-Native Invasive Species

Many non-native invasive species (NNIS) occur in the watershed, although the abundance is relatively low when compared to many other areas across the CNF. Eight of the invasive plant species found are identified and tracked by the RLRMP. NNIS found in the watershed are listed in Table BR4.

Table BR4. NNIS of the Big Creek Watershed

Scientific Name	Common Name	Tracked in RLRMP
Ailanthus altissima	Tree-of-heaven	Yes
Barberis thunbergii	Japanese barberry	No
Celastrus orbiculatus	Oriental bittersweet	No
Coronilla varia	Crown vetch	No
Dioscorea batatas	Cinnamon vine	No
Pueraria montana var. lobata	Kudzu	Yes
Lespedeza cuneata	Sericea lespadeza	Yes
Ligustrum sinense	Chinese privet	Yes

Scientific Name	Common Name	Tracked in RLRMP
Lonicera japonica	Japanese honeysuckle	Yes
Microstegium vimineum	Nepal grass	Yes
Miscanthus sinensis	Chinese silvergrass	No
Paulownia tomentosa	Princess tree	Yes
Spiraea japonica	Japanese spiraea	No
Rosa multiflora	Multiflora rose	Yes
Vinca minor	Common periwinkle	No
Tussilago farfara	Coltsfoot	No

Rare Communities and Species

Fifty-four species on the CNF Species Viability List (USDA Forest Service 2004a) have been detected within areas proposed for treatment, and are listed in Table BR5, along with their status and habitats. Three rare communities, ***Table Mountain - Pitch pine woodland, rich montane seep (high elevation),*** and ***rich montane cove forest*****,** occur in or ajacent to areas proposed for treatment.

Table BR5: Viability Concern Species and Associated Habitats of the Big Creek Watershed

Scientific Name	Common Name	Status*	Canopy Gaps	Dry Forests	Mesic Forests	Riparian/ Wetland	Cliffs Rocks
Fish/ Reptiles/Amphibians							
Crotalus horridus	Timber rattlesnake	VC	Habitat	Habitat	Habitat	Not Habitat	Not Habitat
Desmognathus caroninensis	Car. Mtn. Dusky Salamander	S					
Plethodon teyahalee	So. Appalachian Salamander	VC					
Mammals							
Corynorhinus rafinesquii	Rafinesque's big-eared bat	S					
Myotis grisescens	Gray bat	E					
Myotis leibii	Eastern small-footed bat	S					
Myotis sodalis	Indiana bat	E					
Napaeozapus insignis	Woodland jumping mouse	VC					
Neotoma floridana haematoreia	So. Appalachian woodrat	VC					
Sorex cinereus	Masked shrew	VC					
Spilogale putorius	Spotted skunk	VC					
Zapus hudsonius	Meadow jumping mouse	VC					
Birds							
Caprimulgus carolinensis	Chuck-wills-widow	VC					
Caprimulgus vociferous	Whip-poor-will	VC					
Certhia americana	Brown creeper	VC					
Corvus corax	Common raven	VC					
Dendroica fusca	Blackburnian warbler	VC					
Scolopax minor	American woodcock	VC					

Scientific Name	Common Name	Status*	Canopy Gaps	Dry Forests	Mesic Forests	Riparian/ Wetland	Cliffs Rocks
Invertebrates							
Mesodon andrewsae	Balsam globe	VC					
Mesomphix andrewsae	Mountain button	VC					
Mesomphix latior	Broad button	VC					
Mesomphix rugeli	Wrinkled button	VC					
Mesomphix subplanus	Flat button	VC					
Speyeria diana	Diana fritillary	S					
Ventridens lawae	Rounded dome	VC					
Vertigo bollesiana	Delicate vertigo	S					
Plants							
Arnoglossum muehlenbergii	Great Indian plantain	VC					
Carex aestivalis	Summer sedge	VC					
Carex appalachica	Appalachian sedge	VC					
Carex ruthii	Ruth's sedge	VC					
Carex scabrata	Rough sedge	VC					
Castanea dentata	American chestnut	VC					
Chelone lyonii	Pink turtlehead	VC					
Chrysoplenium americanum	Golden saxifrage	VC					
Diphylleia cymosa	Umbrella leaf	VC					
Disporum maculatum	Spotted mandarin	VC					
Dryopteris goldiana	Goldie's woodfern	VC					
Eupatorium steelei	Steele's Joe-pye-weed	VC					
Isotria verticillata	Large whorled pagonia	VC					
Juglans cinerea	Butternut	S					
Liparis liliifolia	Large twayblade	VC					
Listera smallii	Kidney-leaf twayblade	VC					
Lycopodium clavatum	Ground pine	VC					
Lygodium palmatum	Climbing fern	VC					
Melanthium latifolium	Broadleaf bunchflower	VC					
Penstemon smallii	Small's beardtongue	S					
Prenanthes roanensis	Roan Mtn. Rattlesnake root	S					
Silene ovata	Blue Ridge catchfly	S					
Trillium undulatum	Painted trillium	VC					
Triphora trianthophora	Nodding pogonia	VC					
Vaccinium erythrocarpon	Bear berry	VC					

* Status: E-Endangered; S-Sensitive; VC-Viability Concern

Aquatic Resources

Aquatic habitats in the Big Creek watershed include 17 miles of perennial streams and scattered wet weather waterholes. The habitat includes a sufficient amount of large woody debris (LWD) with an average of 750 pieces/mile, a considerable amount of sand (14%), relatively low silt (3%), and a

suboptimal amount of pools (41%). Headwater streams are choked with rhododendron along their banks and across the channels. ***Demand Species - Wild trout*** including rainbow, brown, and brook trout, can be found in 17 miles of the coldwater streams. ***Brook trout***, the only trout native to Tennessee, occupy roughly 3.5 miles of the streams in the watershed. The amount of habitat occupied by brook trout is likely reduced to approximately 20% from possible historical occupied habitat in the watershed. This reduction is a result of historical land uses over the last 200 years, particularly around the turn of the last century in East Tennessee. Weather events such as floods and droughts have major impacts on wild trout populations in the southern Appalachians (Strange and Habera 1995). Populations fluctuate from year to year, but their overall trends are stable (USDA Forest Service 2004). No rare aquatic species occur within affected areas. Detailed discussion of aquatic resources can be found in the *Aquatic Habitats of the Big Creek Watershed* report (Carter 2008a).

Scope of Analysis

The scope of analysis for direct and indirect effects on biological resources includes the 16,777 acres of Forest Service lands in the Big Creek watershed. For viablity concerns and cumulative effects, the scope of the analysis includes the entire CNF to address Goal 10 in the RLRMP to maintain viable populations of all native species across the CNF. The period of time used in this analysis is up to 20 years after completion of the work, and 20 years before present time for cumulative effects. Conditions would continue to change within individual treatment areas for a much longer period of time, but conditions at the project level after 20 years would resemble conditions present today. For aquatic species, the scope of analysis includes tributaries of Big Creek adjacent to and downstream of proposed activities.

Effects Analyses of the Alternatives

Direct, Indirect and Cumulative effects of the alternatives on Biological Resources are provided below.

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

Forest Communities

Mesic deciduous forests, Eastern hemlock and white pine forests, and oak and oak/pine forests would continue to mature and be affected by natural processes, but would mainly provide late successional habitat for a variety of dependent wildlife such as black bear and Blackburnian warbler. Alternative A would have no cumulative effects on the amount of mesic deciduous forest, Eastern hemlock and white pine forests, and oak and oak pine forests in the watershed or the CNF.

Successional Habitats

The diversity of age structure would be greatly reduced over the next 10 to 20 years. Forests would continue to mature, except where natural processes create canopy gaps. Existing early successional forest (ESF) (six acres) would disappear, moving into the sapling/pole forest in the next 10 years. Local wildlife populations depending on ESF would decline as they move to other areas seeking ESF habitat. Sapling/pole forest (SPF) would decline by 72% (2,284 acres) in the next 20 years as ESF mature into this stage and a portion of the current SPF moves into mid-successional stage. Mid-successional forest (MSF) would have a net decrease of 4,702 acres (65%) as SPF mature into this stage, and some current MSF move into late-successional stage, increasing late-successional forest (LSF) by 6,992 acres.

This alternative would contribute measurably to the limited and rapidly declining ESF in the watershed and across the CNF. As current ESF mature, the loss would only be offset by small patches created by natural disturbances and controlled burning. Sapling/pole forest would continue to mature into mid-successional forests with no future recruitment. As a result, SPF would seriously decline in the next 20 years in the watershed and across the CNF. This alternative would not contribute any cumulative effects to the amount of mid successional forest and late successional forest in the watershed and the CNF.

Other Terrestrial Habitats

Permanent openings would remain the same with regular maintenance. The minimal existing high elevation shrubby habitat (HESH) would remain in six acres of powerlines. Small pockets of HESH would be created in the future by natural events such as wind, ice, and insect infestations. Riparian habitats would continue to improve as forests mature and LWD increases, but the riparian acres would stay the same. Hard mast production would continue to increase as 2,284 acres of young forests become mature in the next 20 years, providing additional food sources for many wildlife species such as bear, turkey, deer, and squirrels. Snags, dens and downed wood abundance are expected to increase over time as forests continue to age and older trees become more susceptible to stress. The abundance of dead trees is expected to greatly increase from insects and disease, particularly from HWA.

Alternative A would have no cumulative effects on permanent openings, old growth, riparian forests, or snags, dens, and downed wood. This alternative would contribute measurably to the limited and rapidly declining high elevation shrubby habitats (HESH) in the watershed and across the CNF. As current HESH mature, the loss would only be offset by small patches created by natural disturbances and controlled burning. Because of aging forests, oak decline and prolonged drought, this alternative would contribute to the decline of mast production in the watershed.

Management Indicator Species

Under Alternative A, habitat and populations for Acadian flycatcher, chestnut-sided warbler, hooded warbler, ovenbird, pileated woodpecker, prairie warbler and scarlet tanager would continue on their current population trends listed in Table BR2.

Alternative A would have no cumulative effects on Acadian flycatcher, hooded warbler, ovenbird, pileated woodpecker, or scarlet tanager. This alternative would contribute measurably to the limited and rapidly declining habitat of chestnut-sided warbler. Lack of habitat would contribute to the negative population trend of chestnut-sided warbler across the CNF (Carter 2009). Alternative A would contribute to the decline of habitat for prairie warbler. However, combined with past harvesting, natural occurrences such as pine beetle kills, and stand replacement fires, habitat is likely to remain on the CNF and population trends would continue to be positive.

Demand Species

Black bear habitat elements including hard mast and den sites would increase by 1,253 acres and 2,284 acres respectively over the next 20 years as sapling/pole forests become mature and late successional forests increase. Spring and summer foraging habitat would continue to be limited on CNF lands. Habitat diversity would continue to decline as young forests mature and disappear, and the landscape is further dominated by late successional forests. The bear population would continue on its present positive trend.

Ruffed grouse habitats would decline in the next 20 years as young forests mature. About 1,616 acres of early successional forests and sapling/pole forests (nesting and adult cover habitats essential to ruffed grouse) would be lost in the next 20 years due to succession, leaving only natural disturbances to provide small pockets of habitat. As a result of habitat loss, ruffed grouse populations would continue to decline in the watershed.

Wild turkey and white-tailed deer winter habitat would increase over the next 20 years as 1,253 acres of sapling/pole forests matured and began to produce mast. The amount of open area would remain the same, providing habitat year-round. Spring and summer habitat on CNF lands would remain extremely low. Turkey and deer would continue to rely on open areas, particularly on private land for much of their habitat needs. In the watershed, turkey and deer populations would continue their positive trends.

Alternative A would not contribute to improved habitat diversity for black bear, wild turkey, and white-tailed deer in the watershed and across the CNF. Instead it would be a major contributor to a decline in habitat diversity, only offset by opening management, controlled burning, and natural disturbances. Past timber harvest and wildlife management activities would continue to provide diversity for the next 10 years, although ESF for these species would disappear from the landscape in less time. Populations of black bear and wild turkey would remain stable or continue to increase. White-tailed deer would continue to increase on private land, but likely to decline on FS lands. This alternative would contribute measurably to the limited and rapidly declining ruffed grouse brood and cover habitat, further limit local populations, and to the already declining populations of ruffed grouse in the CNF (Carter 2009).

Non-Native Invasive Species

NNIS would continue to increase, displacing native plants. Most of the spread would occur along stream banks, forest edges, and other disturbed areas. NNIS spread would degrade diversity and wildlife habitat, displacing more nutritious native foods, and decreasing productivity (Miller 2003).

Minimal efforts have been made in the past to control NNIS in the watershed, and efforts in the future would likely be limited. This alternative would contribute to the current expansion of NNIS in the watershed and across the CNF. Expansion of NNIS would further displace native plant populations and degrade wildlife habitat.

Rare Communities and Species

Whip-poor-will and American woodcock habitat and populations would continue to be scarce in the watershed. Timber rattlesnake, woodland and meadow jumping mouse, Southern Appalachian woodrat, masked shrew, spotted skunk, Chuck-wills-widow, common raven, and Diana fritillary habitat diversity would continue to decline over the next 20 years as forests mature into the later age classes, leaving only natural disturbances to provide future diversity. Steele's Joe-pye-weed and Roan Mountain rattlesnake root may decline in the next 20 years as the canopy closes in on existing open areas. Some suitable habitat would continue through natural disturbances, controlled burning, roads, powerlines, and managed open areas. Alternative A would not impact the remaining viability species, including the two federally endangered species – gray bat and Indiana bat - or the rare communities.

Alternative A would contribute to the decline of whip-poor-will, American woodcock, Appalachian sedge, Steele's Joe-pye-weed, ground pine, broadleaf bunchflower, and Roan Mountain rattlesnake root habitat in the watershed when combined with past and future management. Alternative A would have no cumulative effects on the remaining viability species or the rare communities.

Aquatic Resources

Aquatic species, including wild trout including brook trout, would continue to be limited based on low food production and limited habitat. As LWD in the streams increases naturally over the next 10 years (an increase of approximately 184 additional pieces per mile), productivity of aquatic invertebrates and wild trout may increase. However, low light conditions over rhododendron-choked streams would continue to limit insect production, an important food source for trout, which is already low (Carter 2008a), resulting in low trout productivity.

Continued use of unauthorized roads and trails that are not maintained may increase sediment in the streams, potentially impacting aquatic resources and trout habitat. Sedimentation could cause a decrease in fish populations by smothering eggs, trapping young fish in the gravel, or preventing adult fish from escaping into the gravel during periods of high water flow and low water temperatures. Increased turbidity could cause a decrease in growth rates of site feeders. Sediment carried downstream could scour algae and other tiny organisms from the rocks and streambed material, which would temporarily impact an important link in the food chain of the stream community (Filipek 1993).

Wet weather waterholes in drier, upland areas would remain scarce. These waterholes provide breeding habitat for a variety of amphibians and invertebrates and are important water sources for a wide array of other wildlife, including many amphibians and bats.

Cumulative Effects

Past management activities (wildlife, fisheries, and recreation management, timber harvest, silvicultural treatments, and prescribed burning), human interactions (hunting, fishing, recreation, wildfires, and illegal uses), and environmental processes (flooding, drought, ice, wind, pests, and diseases) are responsible for the habitat conditions and species compositions that are present in the watershed. Natural processes and ongoing activities (road maintenance, recreation activities, illegal uses, wildlife opening maintenance, stream habitat improvements, fuel reduction burning, and wildfires) would continue, but minimal timber harvesting is expected in the next 10 years. Insect and disease outbreaks and catastrophic weather events may cause unpredictable effects.

The forest management activities in this alternative would have minimal contribution to cumulative effects on aquatic resources in conjunction with past and future activities and natural events.

Alternative B (Modified Proposed Action)

Direct and Indirect Effects

Only those activities that might impact a habitat or species are discussed in each section. If no effects are expected from an activity, it will not be mentioned. The timeframe for effects analysis would begin with project implementation.

Forest Communities

The amount of mesic deciduous forest (MDF) and oak and oak pine forest (OOPF) would not change under Alternative B, because no stands would be converted from one habitat type to another, but the structural diversity of these forests would change (Table BR6).

Table BR6: Forest Communities Altered in Alternative B.

Habitat	Early Successional (acres)	Hard Mast Improvement (acres)	Overstory Removal (acres)	Total Acres (Percent) Altered
MDF	242	543	28	813 (8%)
EHWP	28	0	0	28 (<1%)
OOPF	82	159	28	269 (3%)

Successional Habitats

Early successional forest would be created on 296 harvested acres, covering les than 2% of the watershed. This would ensure the continuation of many ESF dependant species for the next 10 years. Though 296 acres of sapling/pole forest would be added in the next 10 years, 2,284 acres of current SPF would move into the next successional stage, leading to a net decrease of 1,988 acres in the next 20 years. Mast tree release, thinning, and overstory removal would improve 240 acres of SPF. Mid successional forest would be reduced by 4,742 acres, due to 40 acres harvested and the rest moving into late successional forest. Even though 228 acres (4%) of late successional forest (LSF) would be reduced by harvesting, an additional 6,992 acres of current MSF would mature into LSF in the next 20 years, resulting in a net increase of 6,764 acres of LSF. Species dependent on LSF, such as black bear, would continue to have abundant habitat with increased diversity across the landscape.

Other Terrestrial Habitats

Twenty-seven percent of the permanent openings (26 acres) in the watershed would be improved by rehabilitation (fertilizing, liming, seeding), daylighting (thinning), and brushing the edges. These improvements would increase the amount and quality of forage for many wildlife species, including a variety of birds, small mammals, and most game animals. The linear openings along road corridors would also disperse available forage throughout a large area, impacting more animals per acre than spot openings (Harper 2008). Wildlife nest boxes and bat roost structures (21) would also be installed in many of the openings, providing habitat for small mammals and birds.

High elevation shrubby habitat (HESH) would be created on approximately 86 acres adding to the existing six acres in powerlines for a total of 92 acres. However, this increase only brings the amount of HESH up to 0.5% of the watershed. A variety of wildlife species, including birds such as chestnut-sided warblers and Canada warblers would benefit from the increased availability of this habitat. These actions would ensure the continued existence of HESH and associated species in the watershed.

Riparian habitats would be protected under the RLRMP standards and avoided during harvest. Rhododendron thinning and felling of trees for LWD would improve up to 6 acres of riparian habitat by allowing more sunlight in, and increasing understory diversity, and stream productivity. Harvesting of white pine plantations on 28 acres would also increase the diversity in those riparian forests. LWD left on the ground from stream improvements and timber harvest would provide cover and feeding areas for rodents, salamanders, snails, and other invertebrates in riparian forests.

Hard mast production would be reduced in 82 acres where late successional oak forests are harvested. Hard mast is a lesser component in 171 acres of stands proposed for harvest. Mast production in these stands would also be reduced, but on a smaller scale. Mast-producers would be favored as leave trees in all harvested areas, ensuring continued availability of hard mast in harvested areas. Ten years after

harvest, young mast-producers would be released from competing vegetation. Planting blight resistant chestnut trees would increase the diversity of future hard mast in some harvested areas, if successful. Removal of mature mast producing overstory trees in a previously harvested stand would further reduce mast production on 28 acres. Mast tree release (midstory treatments) in late successional forests would improve future mast production on 474 acres. An additional 1,253 acres of mid successional forests would move into the late stage in the next 20 years, resulting in a net increase of 1,143 acres of forests dominated by mast producing trees. A white pine plantation would be harvested and planting with mast producing trees, increasing future hard mast production. These actions in combination would benefit black bear, white-tailed deer, ruffed grouse, wild turkey, grey squirrel, chipmunks, and wood rats that utilize hard mast as an important food source.

Snags, dens, and downed wood (SDDW) would be altered on 1016 acres. RLRMP standards require retention of most snags and den trees during harvest. Damage to some remaining trees in harvest areas (296 acres) would offset losses of cavities and snags by creating new ones. Stumps, root wads, limbs, and smaller downed trees would increase within harvest and midstory treatment areas, providing food, cover, and habitat for small mammals, salamanders, reptiles, and snails. A small amount of existing SDDW might be lost as a result of log landing and road related activities. Wildlife improvement activities would create additional habitat for species dependent on downed wood. Logs (10) would be placed in appropriate areas to provide grouse, salamander, and snail habitat, and logs would be felled to add LWD to riparian and stream habitats. The overall increasing trend of snags, dens, and downed wood would continue as forests age and insect infestations and diseases progress.

Management Indicator Species

Herbicides used in treatments are not likely to come directly in contact with MIS, but may be on food sources that are ingested (plants and insects). However, the herbicides used are of low toxicity to birds (Tu et al 2001). This alternative would allow for herbicides across 1,108 acres (7%) of the watershed, but only a portion of this would be directly impacted (See Appendix C). The very small amounts used, the direct methods of applications, timing to avoid rainfall, minimizes the risk of direct contamination.

Acadian flycatcher habitat would be protected by RLRMP standards for riparian zones, except in the area where white pine plantation restoration would occur. This activity would reduce habitat by 28 acres. Felling of trees for fish habitat improvement structures may disrupt up to six acres of habitat, but the impacts would be extremely small scale; habitat would remain. Activities would negatively impact reproduction of Acadian flycatchers if implementation occurs in the breeding season. Direct impacts would include disruption of nesting behavior and mortality of young in the nest. These impacts would be extremely minor and would occur within the year of implementation, but would not continue into the following year. This alternative would not negatively influence the population trends in the watershed.

Chestnut-sided warbler habitat would increase by the addition of 86 acres of high elevation shrubby habitat in the watershed. Harvest in these areas would ensure the continued existence of habitat and possible population increases in the watershed. Because activities would not occur in existing habitat, no direct impacts would occur to chestnut-sided warblers. A local population increase would likely occur from this alternative.

Hooded warbler habitat would be reduced by 242 acres (3%) in the watershed. These birds would move to adjacent areas with suitable habitat. The dense understory that hooded warblers require for breeding would return to harvested areas in five to 10 years. Although habitat would be reduced, 1,111 acres of MDF would mature in the next 20 years, providing a net increase of 869 acres of habitat. Harvesting

during breeding season would disrupt nesting behavior and could cause mortality of young if in the nest. Because these activities would occur over a long period, and not all at once, the impacts would be short-term and minor in context of the surrounding landscape. Midstory treatments may lessen habitat suitability by reducing the density of the midstory and understory on 418 acres (5%) of habitat. Thinning rhododendron along streams would occur in the dense shrub habitat this species prefers, but impacts would be minor to non-existent because only those branches hanging over the stream would be cut. Impacts from this alternative would not negatively influence the population trends in the watershed.

Ovenbird habitat would be temporarily lost in 268 acres (2%) through harvest. These birds would move to adjacent areas with suitable habitat. Midstory treatments would not reduce suitability of habitat (418 acres). Although ovenbird habitat would be reduced in the watershed, 1,482 acres of deciduous forests would mature in the next 20 years, providing a net increase of 1,214 acres of habitat. Harvesting activities during breeding season would disrupt nesting behavior and cause mortality of young if in the nest. Because harvesting would occur over a long period, and not all at once, these impacts would be short-term and minor in context of the surrounding landscape. Population trends in the watershed would be expected to continue on a positive trend.

Pileated woodpecker habitat would be protected in harvest areas (296 acres) by RLRMP standards regarding snag retention. Additional small snags would be created on 474 acres by midstory treatments. Standing snags would provide suitable foraging areas, drumming sites, and potential nest sites. An additional 2,284 acres of mid successional forests would move into the late successional stage in the next 20 years increasing habitat along with an increase in snags created by insect infestations and disease. Harvesting activities during breeding season would disrupt nesting behavior and cause mortality of young if in the nest. Because harvesting would occur over a long period, and not all at once, these impacts would be short-term and minor in context of the surrounding landscape. Population trends in the watershed would be expected to continue on a positive trend.

Prairie warbler habitat is not currently available in the watershed, with the exception of small patches where natural disturbances or stand replacement fires have occurred. Habitat would become more widely available by the addition of 296 acres of early successional forest. Harvest in these areas would ensure the continued existence of habitat in the watershed. Because activities would not occur in existing habitat, no direct impacts would occur to prairie warblers. A local population increase would likely occur from this alternative.

Scarlet tanager habitat would be reduced in suitability by harvesting on 82 acres (1%) of habitat. However, these birds would continue to use the edges of the harvested areas. Midstory treatments (23 acres) would not reduce habitat suitability. Although scarlet tanager habitat would be reduced in the watershed, 1,253 acres of oak and oak pine forests would mature in the next 20 years, resulting in a net increase of 1,171 acres of habitat. Harvesting activities during breeding season would disrupt nesting behavior and cause mortality of young if in the nest. Because harvesting would occur over a long period, and not all at once, these impacts would be short-term and minor in context of the surrounding landscape. This alternative would not negatively influence the population trends in the watershed.

Demand Species (terrestrial)

Herbicides used in treatments are not likely to come directly in contact with demand species, but may be on food sources that are ingested (plants and insects). However, the herbicides used are no more than slightly toxic for mammals and of low toxicity to birds (Tu et al 2001). This alternative would allow for herbicides across 1,108 acres (7%) of the watershed, but only a portion of this would be directly

impacted due to the direct application methods often used (See Appendix C). The very small amounts used direct methods of applications, and timing to avoid rainfall minimize the risk of contamination.

Black bear habitat would be altered on 228 acres by harvesting late successional forests (4%). Hard mast production in these areas would be greatly reduced, but soft mast production and cover would be increased providing areas for feeding and loafing. Potential den trees would be protected according to RLRMP Standards, so impacts to denning habitat should be minor. Bears may also den in brush piles created from logging slash. Midstory treatments, mast tree release, and overstory removal (622 acres) would promote future hard mast production to improve winter foraging habitat. Also 32 acres of planting mast producing trees and shrubs would increase forage year round. Permanent opening rehabilitation (26 acres), old field improvements (two acres), and daylighting linear openings (153 acres) would increase productivity of available forage such as blackberries.

Activity and movement patterns may be altered during implementation in order to avoid humans, but bears would continue to utilize the areas during and after implementation. Habitat remoteness would be impacted during temporary road construction (0.3 miles), but the road would be closed after use, so impacts would not last beyond implementation. Decommissioning of over eight miles of roads would add to habitat remoteness. Installation of eight waterholes would provide water sources in drier areas. Because of the increase in food sources and diversity of habitat on 1,038 acres, spring and summer bear activity may increase within the watershed. These activities would in turn improve hunting and wildlife viewing opportunities for the public. The black bear population trend would continue to be positive as a result of this alternative.

Ruffed grouse brooding, roosting, and feeding habitat would increase by 296 acres due to harvesting. Increased insect production from open conditions and cover under dense vegetations would provide ideal conditions for ruffed grouse. Overstory removal and release treatments in sapling/pole forests (240 acres) would improve forage production (seeds, plants, and insects) while still maintaining nesting habitat. Permanent opening rehabilitation (26 acres), old field improvements (two acres), and daylighting linear openings (153 acres) would also improve forage production and brood habitat. The majority (72%) of the current nesting habitat (3,171 acres) would be lost in the next 20 years to succession, but the proposed harvesting would reduce the overall loss to 2,875 acres. Drumming logs (10) would be installed to provide an important component of breeding habitat. Improvements on 564 acres would ensure the continuation of ruffed grouse hunting and viewing opportunities.

Harvesting activities during breeding season would disrupt nesting behavior and cause mortality of eggs. Because harvesting would occur over a long period, and not all at once, these impacts would be short-term and minor in context of the surrounding landscape. These minor impacts would be offset by the improvements of habitat across the watershed and would likely contribute to a local population increase.

Wild turkey and white-tailed deer are habitat generalists and utilize the same types of habitats. Habitat diversity across the watershed would increase with the creation of 296 acres of early successional forests. Mast tree release, midstory treatments, thinning, and overstory removal on 714 acres would also provide benefits by improving mast production in the future. Permanent opening rehabilitation (26 acres), old field improvements (two acres) and daylighting linear openings (153 acres) would provide important forage (seeds, plants, and insects) during late winter and early spring when little other food is available (Harper 2008). Installation of 8 new waterholes would provide water sources in drier areas.

The 1,038 acres of management proposed in this alternative would increase the structural diversity in the area, as well as the variety of food sources and nesting/roosting habitat. This would provide better year-round conditions because individuals would have less distance to travel and more areas available to them to obtain their seasonal requirements. Improved habitat conditions would likely result in small population increases, increasing hunting and viewing opportunities for wild turkey and white-tailed deer.

Harvesting activities during breeding season would cause disruptions and mortality of newborn fawns or turkey eggs if present. Because harvesting would occur over a long period, and not all at once, these impacts would be short-term and minor in context of the surrounding landscape. These minor impacts would be offset by the improvements of habitat across the watershed and would likely contribute to local population increases.

Non-Native Invasive Species

Ground disturbance such as temporary road construction (0.3 miles) and timber harvesting (296 acres) would result in opportunities for further NNIS establishment. The eight species mentioned previously that cause the most impacts would be controlled with herbicides, along with other invasive species present in the treatment areas. Measures would be implemented within all treatment areas and along roads and wildlife openings to reduce the spread of NNIS on up to 1,108 acres of the watershed. Control and reduction of NNIS would increase the amount of native plant habitats and wildlife foraging available in the watershed, and in turn, increasing wildlife and native plant productivity.

Rare Communities and Species

Table Mountain pitch pine woodlands occur in two stands proposed for harvesting and one stand with midstory treatment. Pine would not be targeted in harvest areas or midstory treatment, and any direct impacts (incidental damage) would be minimal. Both harvesting and midstory treatments would be beneficial to this community by promoting growth of young pines.

Rich montane seeps (high elevation type) were found in two stands proposed for harvesting and two untreated stands. These communities would be protected by the RLRMP standards for riparian habitats and would not be impacted.

Rich montane cove forests that fit the rare community criteria were found in three stands in the project area. Two are proposed for harvesting, and one is untreated. These communities would be protected by the RLRMP standards for rare communities, excluded from harvest, and would not be impacted by harvesting activities. Treatment of NNIS would benefit these forests.

Activities would not jeopardize the viability of rare species on the CNF. A more detailed discussion of effects to Endangered, Threatened and Sensitive species can be found in the Big Creek Biological Evaluation (Carter 2010) (Appendix E).

Wildlife

Herbicides used in treatments are not likely to come directly in contact with animals, but may be on food sources that are ingested (plants and insects). However, the herbicides used are no more than slightly toxic for mammals (Tu et al 2001) and present low risk to aquatic species (SERA). The impacts of herbicides on amphibians and reptiles are not known. This alternative would allow for herbicides across 1,108 acres (7%) of the watershed, but only a portion of this would be directly impacted due to the direct

application methods often used. The very small amounts used, direct methods of applications, timing to avoid rainfall, use of approved herbicides near aquatic habitats, and streamside buffer zones minimize the risk of contamination.

Individual Carolina Mountain dusky and Southern Appalachian salamanders may be damaged or destroyed during harvest activities, particularly during temporary road construction. However, these salamanders are nocturnal and would be underground when activities are taking place, and by and large would be protected. Habitat is scattered throughout the watershed, and the majority of the populations would not be impacted. No more than 268 acres (2%) of potential habitat would be impacted. Shelterwood cutting would increase sunlight to the forest floor causing leaf litter dry-out and increased surface temperatures. This may cause salamanders to relocate to more moist conditions in adjacent stands. Salamanders are known to recolonize a clear-cut over 4-15 years and reach pre-harvest levels in up to 20 years (Ash 1997). Protection within harvested areas would be provided by riparian zones, leave areas, logging slash, and remaining LWD. Over time, canopy cover would increase to more suitable conditions again.

These salamanders have frequently been observed using tunnels in road cuts on the CNF, so new temporary road construction would provide additional habitat. Midstory treatment would still allow shaded conditions, not affecting habitat to any degree. The addition of grouse drumming logs (10) and the creation of eight waterholes in the project area would improve habitat conditions in the future.

Rafinesque's big-eared bat, Eastern small-footed bat and Indiana bat may be directly impacted if temporary road construction and harvesting were conducted during the summer, and if bats were roosting in trees that were felled or pushed over. However, Indiana bats have not been found on the North-end of the CNF in bat surveys conducted annually since 1998, and therefore, are not likely to occur in the proposed treatment areas. Most of the potential roosting trees would be protected by RLRMP standards for riparian areas and snag retention, and new roost trees would be created by project activities. Forage production (insects) would increase in harvested stands. Additional waterholes (8) would provide important water and feeding sources across the watershed. Installation of bat boxes would provide additional roosting habitat. Maternity colony habitat (rock outcrops, cliffs, bridges) would be excluded from management activities and protected from potential impacts.

Gray bat would not be directly impacted by any activities. Riparian zones would protect habitat from any changes. Changes to habitat would be minimal, but additional sunlight in these small patches would increase productivity of the insects for mammalian prey.

In a letter dated April 29th, 2010, the US Fish and Wildlife Service in response to informal consultation for the Gray and Indiana bat stated: "… *due to the lack of known presence of these two species and no known bat hibernacula or maternity caves [in the Big Creek Project area], the likelihood that proposed project action would result in impacts to either species is low. Additionally, some of the proposed actions would benefit the Indiana bat by creating new roosting habitat and benefit both species by increasing forage production (insects) and foraging sources. Therefore, we concur with your 'not likely to adversely affect' determination for these two species*" (USDI Fish and Wildlife Service 2010).

Timber rattlesnake, woodland and meadow jumping mouse, Southern Appalachian woodrat, masked shrew, spotted skunk, Chuck-wills-widow, common raven and Diana fritillary may be directly impacted by this alternative. Individuals may be disturbed, damaged or destroyed during harvest activities and temporary road construction. Most individuals, except Diana caterpillars, would likely move from the

area of disturbance. Diana fritillary caterpillar habitat would decline by 242 acres (3%) of the potential habitat in the watershed. Over the next 10-20 years, habitat diversity would improve with the addition of 296 acres of early successional forests and eight new waterholes. Open conditions, increased diversity, and improved hard mast would increase foraging productivity.

Brown creeper and Blackburnian warbler may be directly impacted by this alternative. Harvesting and road construction may disturb or damage nesting birds if activities are conducted during the breeding season. Because harvesting would occur over a long period, and not all at once, these impacts would be short-term and minor in context of the surrounding landscape. No more than 86 acres of brown creeper and Blackburnian warbler habitat would be lost.

Harvesting would increase Whip-poor-will and American woodcock habitat by 296 and 242 acres, respectively. Increased insect production from open conditions and cover under dense vegetations would provide ideal conditions for these birds. Overstory removal and release treatments in sapling/pole forests (240 acres) would improve forage production (seeds, plants, and insects) while still maintaining habitat. Harvesting activities during breeding season would disrupt nesting behavior and cause mortality of young. Because harvesting would occur over a long period, and not all at once, these impacts would be short-term and minor in context of the surrounding landscape. These minor impacts would be offset by the habitat improvements across the watershed, likely contributing to a local population increase.

Balsam globe, mountain button, broad button, wrinkled button, flat button, rounded dome, and delicate vertigo would be affected by 268 acres of harvest and temporary road construction under Alternative B. Impacts would be restricted to about two percent of their habitat. These activities would lead to leaf litter dry-out and increased surface temperatures in some areas. Snails are able to survive dry periods by sealing their openings with mucous to prevent moisture loss, and may be able to remain this way for years (Burch and Pearce 1990). Refuge would remain in harvested areas in the form of underground retreats, standing trees, slash piles, and other LWD. Additional LWD would be added in the vicinity of harvested areas (10 logs). This refuge is the most important limiting factor for these animals, protecting them from dry conditions and predators (Burch and Pearce 1990). Riparian zones and protection areas for other rare species would also protect individuals in treated stands. Equipment used for timber harvesting and temporary road construction may crush some snails. However, gravel used in temporary road construction and maintenance would provide an additional source of calcium needed for shell production (Burch and Pearce 1990).

Plants

American chestnut sprouts are common throughout the watershed, including areas proposed for treatments. These sprouts may be damaged or destroyed during harvesting, midstory treatments, or road activities. Stump sprouts occur by the millions across their range, but mature trees are very rare (NatureServe 2008). They seldom reach maturity due to the chestnut blight. Mature trees were only found in three stands and would not be cut during harvest. They would be protected by leave areas. Open conditions would allow for additional sprouting in harvested stands. Planting of blight resistant seedlings would increase chances of recovery for this species.

Butternut occurs in at least two locations in the watershed, one in a harvest area. Butternut canker disease has severely depleted populations and the species is considered to be in severe decline. Butternut trees would be protected during all harvest activities and other treatments, so they should suffer no negative direct effects. Because this tree is shade-intolerant and grows best in full sunlight, harvest

would create conditions favorable for its continuation. Young trees do not withstand overhead shading (NatureServe 2008).

Appalachian sedge, Steele's Joe-pye-weed, ground pine, broadleaf bunchflower, and Roan Mountain rattlesnake root are likely to suffer loss of individual plants from road construction, harvest, and other treatments but these losses would not be detrimental to their populations. Occurrences would not be impacted in riparian corridors, leave tree clumps, and planned exclusions.

Habitat conditions following implementation would be very favorable for recovery, expansion of existing populations, and colonization of new sites. Harvested areas, the new road, and obliterated roads would provide suitable habitat for the short-term, but suitability would slowly decrease as trees grow and slowly shade out these areas. Existing roads and wildlife openings would continue to provide habitat for the long-term. Midstory treatments, post-harvest treatments, road daylighting, rhododendron thinning, and tree felling along streams may pose a slight risk from herbicides and crushing, but habitat conditions would be improved for a few years following treatment. Obliterating roads and invasive species control may provide opportunities for future establishment or expansion within the watershed.

Table BR7. Number of Documented Rare Plant Locations in the Big Creek Watershed

Species	Road	Overstory Removal	Midstory	Harvest	Road Thinning	Total Impacted	*No Impacts
Great Indian plantain				2		2	3
Summer sedge				1		1	2
Appalachian sedge		1		1		2	1
Ruth's sedge					1X	0	1
Rough sedge		1X		2X	3X	0	7
American chestnut		1			1	2	
Pink turtlehead				4	4	8	5
Golden saxifrage				2X		0	4
Umbrella leaf				1		1	3
Spotted mandarin			1	4	1	6	
Goldie's woodfern				1X		1X	
Steele's Joe-pye weed	6	1	1		5	13	5
Large whorled pagonia					3X	0	4
Butternut	1X	1				1	1
Large twayblade				1	2	3	2
Kidney-leaf twayblade			1	2	3	6	2
Ground pine					1	1	
Climbing fern					1	1	
Broadleaf bunchflower				1		1	
Small's beardtongue					1	1	
Roan Mtn. Rattlesnake Root				2		2	2
Blue Ridge catchfly	1X					0	1
Painted trillium				2	4	6	3
Nodding pogonia					1	1	1
Bear berry				2		2	

X – Locations in riparian or other exclusions
* Includes known occurrences outside impact areas

Great Indian plantain, pink turtlehead, and Small's beardtongue would be directly and indirectly impacted by this alternative. Harvest, road daylighting, and temporary road construction may result in the loss of some individuals. Individuals would not be impacted in riparian corridors, leave tree clumps, and planned exclusions. Following implementation, habitat conditions would not be optimal until canopy closure takes place in 20 or more years, but these species are often found in more open conditions. Population size may decline in harvested areas during the first few years following treatment, but habitat along edges and in leave areas would continue to be suitable. Populations would continue to fluctuate, but conditions would improve as the stands mature. Midstory, release, and overstory removal treatments are not expected to have negative effects and may be beneficial by increasing light conditions. Herbicide use may pose a slight risk to some individuals, but control of invasive species may provide opportunities for future establishment or expansion within the watershed.

Summer sedge, Ruth's sedge, umbrella leaf, spotted mandarin, large twayblade, kidney-leaf twayblade, painted trillium, nodding pagonia, and bear berry would be directly and indirectly impacted by this alternative. Harvest, road daylighting, and temporary road construction may result in the loss of some individuals. Occurrences would not be impacted in riparian corridors, leave tree clumps, and planned exclusions. Following implementation, habitat conditions would not be suitable until canopy closure takes place in 20 or more years. Populations would decline in harvested areas, but individuals are likely to persist in leave areas and surrounding stands. Post harvest activities and midstory treatments are not expected to have long–term negative effects. Herbicide use may pose a slight risk to some individuals, but control of invasive species may provide opportunities for future establishment or expansion within the watershed.

Rough sedge, golden saxifrage, Goldie's woodfern, climbing fern, and large whorled pagonia are associated with streams or wetlands that are protected by riparian corridors. Blue Ridge catchfly is found adjacent to an area proposed for road work. Road construction, harvesting, and other forest treatments would not impact these species. Some minor impacts could occur as a result of LWD felling along streams and road/wildlife opening activities for individuals that occur in close proximity (<25 feet). Populations are expected to recover from any impacts that occur following treatment.

Aquatic Resources

The effects to water quality from project activities are addressed in detail the *Soil and Water* effects section. Activities are proposed in the following drainages: Laurel Branch, Gulf Branch, Double Branch, Trail Fork Big Creek, Spicewood Branch, Tom Creek, Hunter Branch, Middle Prong Gulf Creek, Brown Gap Creek, and Deep Gap Creek. Aquatic habitats are within riparian zones and are protected under the RLRMP standards. These standards provide for shade strips that protect the streams from excessive fluctuations in water temperature (Sedell 1981). However, a white pine plantation would be harvested in the riparian area along Spicewood Branch. Trees would remain along the stream banks, but the rest would be removed. Some shade would remain, and impacts would be minimal.

Stream reaches in the drainages adjacent to or downstream from roads, skid trails, and landings may experience temporary increases in suspended sediment loading during tree removal activities (Filipek 1993). However, compliance with RLRMP standards including the stream filter zones would protect fish, salamanders, and aquatic invertebrates from negative impacts due to excessive sedimentation (CNF 2004b). Decommissioning of 8.1 miles of road and maintenance to 17 miles of roads would help reduce sedimentation in the streams. The proposed temporary road would not be connected to any streams and would not cause further impacts.

Alternative B proposes to use three different herbicides. For Triclopyr TEA, acute and chronic risks to aquatic plants and animals are low. Triclopyr BEE is somewhat more hazardous when used near bodies of water where runoff may occur. However, the risk of chronic exposure of is essentially the same as Triclopyr TEA since it rapidly hydrolyzes to Triclopyr acid. JLB Oil used with Triclopyr does not contain hazardous components. Imazapyr appears to have a very low potential to cause any adverse effects in aquatic animals. Glyphosate has minimal effects to fish and invertebrates (SERA). This alternative would allow for herbicides across 1,108 acres, only 7% of the watershed. The very small amounts used, direct methods of applications, timing to avoid rainfall, and streamside buffer zones minimize the risk of stream contamination.

Habitat improvement structures and rhododendron thinning along 2.8 miles of stream would improve the diversity and quality of aquatic habitats. Ephemeral wetland and pond habitats would be created by the construction of eight vernal ponds and waterholes throughout the watershed. This fish free habitat is important in the life cycle of amphibians, crustaceans, and insects. Bats also use this habitat type as a water source and to forage for insects (Biebighauser 2003).

Demand Species (aquatic)

Wild Trout populations occur in eight of the ten streams in the affected areas, and only two of these streams include brook trout. Impacts to these populations would be minimal. Addition of LWD and installation of habitat improvement structures would provide more structural diversity to aquatic habitats, creating pools and cover for trout. These habitats are especially critical during periods of drought. Rhododendron thinning would open streams to more sunlight and increase food production. Aquatic habitat improvements would enhance fish populations and increase angling opportunities. Rhododendron thinning on 2.8 miles of stream would improve fishing access. Upon completion of restoration in the Trail Fork Big Creek, 6.4 miles of stream in the watershed would be occupied by brook trout. This increase would result in 38% of the total 17 miles of coldwater streams supporting native brook trout.

Sedimentation from roads and associated activities may increase sedimentation, but RLRMP standards would minimize these impacts (CNF 2004b). Riparian corridors and streamside filter zones would protect water quality from temperature increases and herbicide contamination and in turn, would protect wild trout (CNF 2004c). This alternative would benefit wild trout by providing key components to their habitat and improving conditions that influence their productivity.

Alternative C

Direct and Indirect Effects

The type of effects to species and habitat would be the same as in Alternative B; only the amounts of affected area or individuals that differ are discussed.

Forest Communities

The amount of Mesic deciduous forest and oak and oak pine forests would not change under Alternative C, but the structural diversity of these forests would change (Table BR8). Impacts to Eastern hemlock and white pine forests would be the same as Alternative B.

Table BR8: Forest communities altered in Alternative C

Habitat	Early Successional (acres)	Hard Mast Improvement (acres)	Overstory Removal (acres)	Total Acres (Percent) Altered
MDF	273	543	28	813 (8%)
OOPF	101	159	28	269 (3%)

Successional Habitats

Early successional forest would be created on approximately 327 harvested acres, covering less than two percent of the watershed. Even though 327 acres of Sapling/pole forest would be added in the next 10 years, 2,284 acres of current SPF would move into mid-successional forest, leading to a net decrease of 1,957 acres in the next 20 years. The effects to MSF would be the same as Alternative B. Late successional forest would be reduced by 327 acres (3%), but an additional 4,702 acres of current MSF would mature into the LSF stage in the next 20 years. This would result in a net increase of 4,375 acres.

Other Terrestrial Habitats

Effects to permanent openings, riparian habitats would be would be the same as in Alternative B. High elevation shrubby habitat would be created on approximately 117 acres adding to the existing six acres in powerlines for a total of 209 acres. The increase would bring the amount of HESH up to one percent of the watershed. Effects to snags, dens, and downed wood would be the same as Alternative B.

Hard mast production would be reduced in 101 acres where late successional oak forests are harvested. Removal of mature mast producing overstory trees in a previously harvested stand would further reduce mast production on 28 acres. An additional 1,253 acres of mid successional forests would move into the late stage in the next 20 years, resulting in a net increase of 1,124 acres of forests dominated by mast producing trees. Other effects would be the same as Alternative B.

Management Indicator Species

This alternative would allow for herbicides across 1,136 acres (7%) of the watershed, but only a portion of this would be directly impacted due to direct application methods often used (See Appendix C). Effects to Acadian flycatcher and pileated woodpecker would be the same as Alternative B. Chestnut-sided warbler habitat would increase by the addition of 117 acres of high elevation shrubby habitats. Prairie warbler habitat would increase by the addition of 327 acres of early successional habitat.

Hooded warbler habitat would be reduced on 254 acres (3%) of habitat. Although habitat would be reduced, 1,111 acres of MDF would mature in the next 20 years, providing a net increase of 857 acres of habitat. Ovenbird habitat would be temporarily lost in 299 acres (2%) through harvest. Although habitat would be reduced in the watershed, an additional 1,482 acres of deciduous forests would become mature in the next 20 years, resulting in a net increase of 1,183 acres. Scarlet tanager habitat would be reduced in suitability on 101 acres (2%). Although habitat would be reduced in the watershed, an additional 1,253 acres of oak and oak pine forests would mature in the next 20 years, resulting in a net increase of 1,152 acres.

Demand Species (terrestrial)

This alternative would allow for herbicides across 1,136 acres (7%) of the watershed, but only a portion of this would be directly impacted due to the direct application methods often used (See Appendix C). Black bear habitat would be altered by harvesting 259 acres (4%) of late successional forests. Because of the increase in food sources and diversity of habitat on 1,069 acres, spring and summer bear activity may increase within the watershed. Ruffed grouse brooding, roosting and feeding habitat would be increased on 327 acres by harvesting. The majority (72%) of the current nesting habitat (3,171 acres) would be lost in the next 20 years to succession, but the proposed harvesting would reduce the overall loss to 2,844 acres. Improvements on 595 acres would ensure the continuation of ruffed grouse hunting and viewing opportunities. Wild turkey and white-tailed deer habitat would improve with the creation of 327 acres of early successional forests. The 1,069 acres of management proposed in this alternative would improve the structural diversity in the area, as well as increase the variety of food sources, cover and nesting/roosting habitat.

Non-Native Invasive Species

Disturbance from timber harvesting (327 acres) would result in opportunities for NNIS establishment. Effects from other activities would be the same as in Alternative B. Measures would be implemented within all treatment areas and along roads to reduce the spread of NNIS on over 1,136 acres of the watershed.

Rare Communities and Species

This alternative would not jeopardize the viability of species listed in BR5. Effects to rare communities would be the same as in Alternative B.

Wildlife

This alternative would allow for herbicides across 1,136 acres (7%) of the watershed, but only a portion of this would be directly impacted due to the direct application methods often used (See Appendix C). Impacts to all rare animals would be the same as discussed in Alternative B, except that the amount of harvested acres and associated effects would increase.

Habitat for Rafinesque's big-eared bat, Eastern small-footed bat, and Indiana bat, would be altered on 327 acres, but would remain in harvested areas. Timber rattlesnake, woodland and meadow jumping mouse, Southern Appalachian woodrat, masked shrew, spotted skunk, Chuck-wills-widow, and common raven habitat would be altered on 327 acres, but overall diversity across the landscape would improve. Effects to Diana fritillary adult habitat would be similar, improving foraging habitat on 327 acres, but caterpillar habitat would decline by 254 acres (3%). Harvesting would increase Whip-poor-will and American woodcock habitat by 327 and 273 acres, respectively.

No more than 299 acres (2%) of potential Carolina Mountain dusky and Southern Appalachian salamander habitat would be temporarily lost. Brown creeper and Blackburnian warbler habitat would be lost on no more than 117 acres. Balsam globe, mountain button, broad button, wrinkled button, flat button, rounded dome, and delicate vertigo habitat would be altered on 327 acres. Habitat would be less suitable, but would remain inhabitable.

Plants

Impacts to all rare plants would be the same as discussed in Alternative B, except that the amount of harvested acres and associated effects would increase.

Aquatic Resources

Effects to aquatic resources would be the same as in Alternative B, except for an increase of herbicide use. This alternative would allow for herbicides across 1,136 acres (7%) of the watershed, but only a portion of this would be directly impacted due to the direct application methods often used (See Appendix C).

Alternatives B and C

Cumulative Effects

The direct and indirect effects of Alternatives B and C are similar, and therefore both alternatives will be analyzed together for cumulative effects.

Forest Communities

The alternatives contribute measurably to the structural and age class diversity of mesic deciduous forests (MDF) and oak and oak-pine forests (OOPF) across the watershed, particularly when combined with harvesting that has taken place in the last 30 years. However, controlled burning has contributed much more to the diversity than all the timber sales combined. Future burning, insects, and disease would have the biggest effects in the future. When combined with forest management across the CNF as a whole, these alternatives contribute to the health and diversity of MDF and OOPF. These alternatives do not contribute measurably to any effects on Eastern hemlock and white pine forests when combined with past management in the watershed and across the CNF. When compared to the future effects of hemlock wooly adelgid on this forest community, they do not contribute measurably.

Successional Habitats

These alternatives would contribute extensively to the amount of early successional forest, providing much more than has been available in the last 10 years. However, ESF would continue to be in limited supply in the watershed and across the CNF. Combined with past harvesting in the last 30 years, these alternatives would continue to maintain the presence of sapling/pole forest, but this habitat would continue to decline. When combining these alternatives with activities in the last 30 years, harvesting would cover less than 10 percent of the watershed, having little cumulative impacts on the amount of mid successional forest and late successional forest in the watershed and the CNF.

Other Terrestrial Habitats

These alternatives would not have any cumulative effects on permanent openings. Cumulative effects on high elevation shrubby habitats would be the same as those on early successional habitats. Because the majority of the watershed would remain in late successional forests and riparian forests would be protected, these alternatives would not contribute to cumulative effects on riparian forests. Because impacts to snags, dens, and downed wood would be minor, these alternatives along with past timber harvesting do not have major cumulative effects and are offset by controlled burning and natural events.

These alternatives combined with past forest management would have beneficial cumulative effects on mast production in the watershed when looking to the future.

Management Indicator Species

These alternatives would have no cumulative effects on Acadian flycatcher. When combining these alternatives with activities in the last 30 years, harvesting would cover less than 10 percent of the watershed, having little cumulative impacts on hooded warbler, ovenbird, pileated woodpecker, and scarlet tanager. Because local population trends would not be negatively impacted, the alternatives would not contribute negatively to population trends (Table BR2) of these species across the CNF.

These alternatives would contribute extensively to the amount of chestnut-sided warbler and prairie warbler habitat, providing much more than has been available in the watershed for the last 10 years. Combined with past and future timber management and controlled burning, these alternatives would offset negative population trends of chestnut-sided warbler and add to the positive trend of prairie warbler in the watershed. This would help to ensure the viability across the CNF.

Demand Species (terrestrial)

Black bear populations have been increasing under past management, and when combined with these alternatives and future management, notable changes in black bear habitat and population trends are not expected. Past, planned and future activities are consistent with management directions for wild turkey and white-tailed deer, which should provide stable to increasing populations within the watershed and across the CNF. These alternatives, combined with past and future timber harvests, would contribute extensively to the amount of ruffed grouse habitat, providing much or more than has been available in the last 10 years. Combined with past and future timber management and controlled burning, these alternatives would ensure the viability and offset negative population trends of this species in the watershed and across the CNF.

Non-Native Invasive Species

Minimal efforts have been made in the past to control NNIS in the watershed, and efforts in the future beyond those implemented with this project would likely be limited. These alternatives would help control past and future introductions, and would be the major contributor of effects. NNIS would not be eliminated from the project area or CNF, but these actions would control and reduce the spread and would ultimately benefit the natural communities.

Rare Communities and Species

These alternatives would not threaten the viability of any rare species on the CNF. They would not contribute measurably to cumulative effects on Rafinesque's big-eared bat, gray bat, Eastern small-footed bat, Indiana bat, Ruth's sedge, rough sedge, golden saxifrage, Goldie's woodfern, large whorled pogonia, climbing fern, and Blue Ridge catchfly when combined with past and future management in the watershed.

These alternatives would contribute measurably to the diversity and overall quality of Timber rattlesnake, woodland and meadow jumping mouse, Southern Appalachian woodrat, masked shrew, spotted skunk, Chuck-wills-widow, common raven and Diana fritillary habitat across the watershed.

Combined with past and future timber management and controlled burning, these alternatives would ensure the viability and possible expansion of these species in the watershed and in the CNF.

These alternatives would contribute extensively to the amount of whip-poor-will, American woodcock, Appalachian sedge, American chestnut, Steele's Joe-pye-weed, Butternut, broadleaf bunchflower, and Roan Mountain rattlesnake root habitat available in the watershed. Combined with past and future timber management and controlled burning, these alternatives would ensure the viability and possible expansion of these species in the watershed and in the CNF.

Although these alternatives may have negative impacts to Carolina Mountain dusky and Southern Appalachian salamanders, Brown creeper, Blackburnian warbler, balsam globe, mountain button, broad button, wrinkled button, flat button, rounded dome, delicate vertigo, great Indian plantain, Summer sedge, pink turtlehead, umbrella leaf, spotted mandarin, large twayblade, kidney-leaf twayblade, ground pine, Small's beardtongue, painted trillium, nodding pagonia, and bear berry they would not cause a considerable decline in populations or habitat when combined with past and future forest management and controlled burning. Effects from these alternatives would contribute modestly to negative effects when compared to controlled burning and are minimal when considered in the context of the entire watershed.

Aquatic Resources

The forest management activities in these alternatives would have minimal contribution to cumulative effects on aquatic resources in conjunction with past and future activities and natural events. Stream improvements would contribute to the quality of aquatic habitats and wild trout populations (including brook trout) across the watershed, particularly when combined with past stream improvements and additional LWD expected from future hemlock mortality. However, weather events such as floods and droughts would continue to be the major factor affecting trout populations (Carter 2008a). Restoration of brook trout would be the major contributor of population increases of this species in the watershed.

Scenery Resources

Affected Environment

National Forest visitors choose the area's mountain settings to engage in a variety of popular recreation activities including, but not limited to hiking, backpacking, hunting, fishing, sightseeing (wildlife and scenery) and driving for pleasure. The Appalachian National Scenic Trail (A.T.), traversing Snowbird Mountain in the project area from I-40 near Davenport Gap and Waterville, NC to Hot Springs, NC, attracts local, national and international visitors. With low road densities, most of the public lands on this portion of the Bald Mountain range provide backcountry experiences. National forest lands are predominately natural-appearing, while local communities/private lands can be characterized as pastoral/agricultural and/or rural/forested landscapes. Highways, trails, a developed recreation area, and county and forest roads provide short and long-range views of the Big Creek landscape.

On these national forest-managed lands, there is evidence of past timber management that predates the current Forest Plan (RLRMP). Lands known as the "Gulf Tract" and "Martha Sundquist State Forest" were owned by a private timber management company until early in this decade. Over time, most harvested areas have regenerated into a predominately natural-appearing landscape with canopy cover, color and texture similar to the adjacent forest.

Landscape visibility is a function of many interconnected considerations including (1) context of viewers, (2) duration of view, (3) degree of discernible detail, (4) seasonal variations, and (5) number of viewers (*Landscape Aesthetics*, Chapter 4, page two). Three major travel-ways provide foreground and middleground views into the Big Creek area:

- The Appalachian National Scenic Trail forms most of the southern and eastern boundaries for the project area. An internationally renowned, nationally-designated foot trail, the A.T. is used by approximately 1,200 thru-hikers, many more day users, each year. This segment, easily accessible from I-40 near Waterville, NC, acts as portal into Cherokee National Forest, just north of Great Smoky Mountain National Park, linking Davenport Gap with Hot Springs, North Carolina. Max Patch is a scenic destination; Max Patch to Lemon Gap is a popular day hike.
- County Road 107 in Tennessee and its state counterpart, Max Patch Road, in North Carolina, connects US 25/70 in the vicinity of Del Rio, Tennessee, with Road Mountain Campground, popular A.T. trailheads and destinations (Lemon Gap and Max patch), recreation areas in Harmon Den in Pisgah National Forest and to I-40 (Exit 7) via Cold Springs Road.
- County Road 209 (Spicewood Rd) is a loop road through the Tom Town/Pheasant Gap area.

Other travel-ways that provide viewing platforms into the project area include:

- I-40, with a limited long-range view into the project area,
- Forest roads in the Gulf Tract, presenting long- and short-distance views into various parts of the project area,
- Forest roads in the Toms Creek/Spicewood Road portion of Cocke County, presenting long- and short-distance views into various parts of the project area.

The quality of scenery viewed from these travel-ways directly contributes to the quality of a visitor's recreation experience. Based on management prescription, viewing distance and user interest within the project area, the 2004 Revised Forest Plan (RLRMP) provides objectives to attain low to high levels of scenic integrity; these are expressed as Scenic Integrity Objectives (SIOs).

Project-level analysis was conducted in two ways: field reconnaissance from identified travel-ways and terrain modeling using GIS applications. A spatial analysis helped determine the areas in affected compartments that are potentially visible from identified viewing platforms. This analysis is based on terrain only, but, with field verification at project level, vegetative screening is considered as a dynamic component of the landscape.

Scope of Analysis

The projects discussed in this document are scattered in the Big Creek watershed between the crest of Snowbird Mountain, the Tennessee-North Carolina state line and the French Broad River in part of the area known as Pigeon River Recreation Zone. The time frame addressed in this discussion ranges from the time harvesting activities take place to approximately 15 years beyond that point. This reference was selected as the approximate time needed for harvested acreage to regain tree crown cover.

Effects Analyses of the Alternatives

Direct, Indirect and Cumulative effects of the alternatives on Scenery Resources are provided below.

Alternative A (No Action)

Direct and Indirect Effects

Under this alternative, the proposed action would not be implemented. The overall effect of the no-action alternative would be no change to the existing natural-appearing landscape and no significant negative effects to scenery and recreation resources. Prior to 1998, Visual Quality Objectives (VQOs) were generally met; however, VQOs for this area were lower than current SIOs. Lands previously held by private timber companies were not subject to the USDA Forest Service scenery standards. Forest lands were inventoried in the late 1990s based on guidance from *Landscape Aesthetics*, taking into account an increased interest in scenery by Forest users. The Scenery Management System was formally adopted with the revised Forest Land and Resource Management Plan in 2004. In this area, VQOs/SIOs have been generally maintained with past management activities during the past ten years.
By implementing this Alternative, SIOs in the project area would continue to be met. Over time, most of the tree diameters would increase in size, a positive effect along travel corridors. However, there would be no enhancements or restorations to improve scenery or create visual diversity, either short- or long-term, which could affect both scenery and recreation resources. Emergency forest health and safety projects may be implemented, but projects to improve the overall health of the forest may not be implemented. Road rehabilitation, authorizing existing roads, decommissioning authorized and unauthorized roads, rehabilitation of existing wildlife openings and other proposed wildlife and fisheries habitat projects would not occur, potentially adversely affecting forest access for hunting, fishing, wildlife viewing and general driving for pleasure. Prescribed burning has been used periodically in the Big Creek watershed to reduce fuels that could contribute to wildfire, and to promote forest health and provide wildlife benefits by renewing the mid- and understory vegetation. It is anticipated that this practice would continue. Its short-term effects to scenery are scorched vegetation, usually lasting only a few weeks. Effects over a longer period of time (immediately to a few years) are a reduction of downed woody debris and a more open forest, changes that benefit both scenery and recreation for those users who enjoy hunting, wildlife viewing and longer views into the natural-appearing woodland.

General Discussion Relative to Alternatives B and C

Proposed timber management activities utilize mostly two-age harvest techniques; two stands are proposed for clear-cutting. For all action alternatives**,** the table in Appendix G identifies stand number, Management Prescription, assigned SIO, associated proposed treatment type and visibility from analyzed viewing platforms and travel-ways. As indicated in the "Viewing Platform" column, stands may be seen from more than one viewing platform; this combined effect is considered during analysis.

Scenery design features that are common to all stands include feathering unit boundaries to avoid straight edges; retaining natural-appearing groups of trees; minimizing soil disturbance so constructed features like roads and skid trails blend and remain subordinate to the landscape; screening log landings from view, with restoration of the area as close to the original landscape as practical. When the desired landscape character is "natural appearing," the appearance of a continuous forested canopy would be achieved by retaining trees at intervals throughout the stand, based on the prescribed basal area (BA) and refined in the field prior to implementation.

Leaving a higher tree density in areas closest to the viewer and especially along ridgelines reduces textural and color contrasts between treated areas and adjacent forest. Also, retaining several vertical feet of vegetation along skyline ridges maintains the continuous effect of a natural-appearing forest.

Edge-feathering reduces or eliminates shadow-lines along unit boundaries. These and other design features effectively soften visual impacts of timber harvesting and allow assigned SIOs to be met.

When viewed as Middleground (1/2 to 4 miles from the viewing platform), two-age harvest areas may appear to be more sparsely vegetated or have fewer trees than adjacent un-cut stands, but do not create a distinct opening as with clear-cut harvests. To the average viewer, a two-age treatment of 15-20 sq ft ba/ac may be noticeable for ten or less years after harvest, while a 30+ sq ft ba/ac treatment may be noticeable for a shorter time. An area with a higher reserve basal area, with a denser canopy cover and a greater number of remaining tree stems would be less noticeable when over-viewing the forested canopy. In leaf-on season, Middleground views of two-age treatments may allow varying degrees of visible ground beneath the remaining overstory trees or individual stems may be more distinct. In certain lighting conditions, shadows beneath residual trees may make the stand appear darker and have a more coarse texture than the adjacent forest. Within two or three growing seasons, crowns of residual overstory trees expand to create a denser canopy, and understory vegetation grows to obscure views of ground exposed during harvest. In leaf-off, two-age treatments appear more like adjacent un-cut stands, except for the tree density. However, roads, log landings and logging debris may be more noticeable.

In general, visitors walking or driving in the remote parts of the forest where these activities are proposed could notice the following effects of harvesting: decreased canopy cover; increased sunlight; increased visibility into the forest; damaged living vegetation from logging activities; and visible debris, stumps and root wads on the ground. The height of remaining slash (debris, stumps and root wads) would range four feet or less in height, depending on the area's SIO and visibility from noted travel-ways. After a harvest, forest visitors could notice the effects of manual site preparation, chemicals and prescribed burning, techniques used to eliminate undesirable species and promote desired tree species. These activities could produce additional downed woody debris, scorched vegetation from burning and a more open forest.

Post harvest evaluation by specialists would determine visibility of road and skid trail banks and beds within the middleground viewing distance of the Appalachian National Scenic Trail. If necessary, additional treatments would be used to reduce harvest-related alterations of established form, line, color and texture.

Alternative B (Modified Proposed Action)

Direct and Indirect Effects

Proposed creation of early successional habitat in 11 stands (268 acres) is by shelterwood methods with 15 sq ft ba/ac. An additional two stands (28 acres) are proposed to be clear-cut to create early successional habitat. Overstory removal is proposed for one stand of 28 acres, while thinning are proposed for two stands (36 acres) and release is proposed for six stands (176 acres). Converting existing forested areas to the desired early successional vegetation stage would create the most noticeable impacts to existing forest scenery. To the average viewer, a clear-cut unit may be noticeable for up to 20 years, depending on edge treatment and regenerating species. A two-age treatment with 15-20 square feet of basal area per acre (sq ft ba/ac) may be noticeable for ten or less years after harvest. A 30+ sq ft ba/ac treatment may be noticeable for a shorter time. Most of the proposed commercially harvested units would be logged by conventional methods. Necessitating construction of few to no roads, overstory removal, thinning and release may be noticeable for a much shorter timeframe, generally noticeable only in the immediate foreground of the average viewer and only for the amount of

time for slash and brown foliage to degenerate. In addition 17.3 miles of prehaul maintenance and 0.3 miles of temporary road reconstruction would be constructed.

The Moderate SIO applies to middleground views from the Appalachian National Scenic Trail. The current continuous covering of trees creates a natural-appearing landscape. In higher elevation areas and along ridgelines, seen from identified travel-ways and viewing platforms, removing most of the canopy cover would be a deviation from the desired landscape character. In some stands viewed as middleground, increasing the proposed basal area leave would maintain a denser tree canopy and keep changes to the landscape subordinate to surrounding scenery. With implementation of proposed design features, effects of timber harvesting would meet the assigned SIO. Where two-age treatments are visible, the tree canopy would likely appear thinner than the surrounding forest for one or more growing seasons, depending on the basal area.

In addition, this alternative proposes to reduce midstory vegetation in 19 stands; control nonnative invasive species in all treatment areas, roads and wildlife openings; conduct a number of wildlife and stream habitat improvement activities; and decommission and/or authorize existing roads.

Midstory removal: The process of reducing the mid-story could have a positive effect on the scenery in the area by increasing the depth of views into the forest. In the short term, unseasonable leaf drop would have the most noticeable effect on the scenic resource, particularly in the immediate foreground of travel-ways. Brown leaves and dead stems that result from treating the midstory would be evident for a growing season or less, but the opening of the stands could have positive long-term effects on the scenery, wildlife viewing and hunting. Established SIOs would only be affected in the short-term (one growing season or less) after application.

Controlling nonnative invasive species could have a positive long-term effect on the scenery resources of this area by maintaining native Appalachian mountain flora and treating nonnative competitors. Established SIOs would only be affected in the short-term (one growing season or less) after application due to an unseasonable leaf drop.

Wildlife and stream habitat improvement activities: This alternative proposed to create, maintain and/or enhance grassy wildlife openings, which would have a positive long-term effect on recreation and scenery resources of this area. Rehabilitating and maintaining existing wildlife openings would replicate the agricultural/pastoral farmland appearance and local and regional associations with historic grazed-field patterns common to the southern Appalachian Mountains. Recreationists use grassy woodland openings for picnicking, camping, hunting and wildlife viewing. Constructing and maintaining fish structures, vernal ponds, wildlife watering holes, wildlife boxes and adding woody debris to streams would draw wildlife and fish species to these constructed features, with a positive long-term effect on recreation opportunities for fishing, hunting and wildlife viewing. Other proposed wildlife habitat activities should have little or no effects to recreation and scenery resources. Established SIOs would only be affected in the short-term (one growing season or less) after application.

Roads/Trails: Scenic resources may be negatively affected by proposed 0.3 miles of temporary road construction, as well as 17.3 miles of prehaul maintenance. Even with obliteration and seeding, temporary roads are distinguishable as corridors because of residual cut banks, lost canopy and flattened roadbed. Prehaul maintenance of existing roads could expose previously undisturbed areas of mineral soil, increasing viewshed visibility of those roads. To protect area SIOs of Moderate, road maintenance and temporary construction should be designed to minimize their visibility from affected viewing

platforms and travel-ways. These are not newly-cut roads, and there would be little new effect on Scenery resources except for a very short-term disturbance to the beds and banks when maintenance is performed. Decommissioning of 2.55 miles of unauthorized roads and 3.43 miles of authorized road would have a long-term positive effect on Scenery; generally, decommissioning a road and letting it continue to revegetate over time increases the canopy cover and contributes to the area's natural-appearing landscape. Authorizing 3.28 miles of existing roadways would have little effect on the scenery resource; all of these roads would be gated and closed to all but administrative use.

Alternative C

Direct and Indirect Effects

Converting existing forested areas to the desired early successional vegetation stage would create the most noticeable impacts to existing forest scenery. Effects on scenic resources are similar to those described for Alternative B, but on a slightly larger scale due to the increased number of treated acres proposed in this alternative. Proposed creation of early successional habitat in 13 stands (299 acres) is by shelterwood methods with 15 sq ft ba/ac. The number of clear-cut acres is the same as Alternative B, as are the other vegetation treatment proposals. Approximately the same number of miles of prehaul road maintenance and new temporary road would be required. To meet Moderate SIOs, scenery design features, as well as proposed recommendations for higher elevations and ridgelines, are the same as Alternative B in the treated stands.

All the other proposed activities (midstory treatment, controlling nonnative invasive species, conducting wildlife and stream habitat restoration projects, decommissioning and/or authorizing forest roads, etc.) have the same effects as described in Alternative B.

Cumulative Effects Common to Scenery Resources

In the past 10 - 15 years, the following vegetation management activities have taken place in the proposed project area:

- Government-contracted timber harvests (1990s and before)
- Private timber companies' timber harvests (2006 and before)
- Mast tree release with chainsaws
- Treatments to control Hemlock Wooly Adelgid infestations
- Chemical treatments of invasive vegetative species
- Prescribed burn over 1,040 acres (1998, 2004)
- Numerous wildfires over a 20-year period.

Portions of the Appalachian National Scenic Trail along Snowbird Mountain have been relocated. Structures have been removed from property purchased to help buffer the A.T. corridor. Champion Paper Company transferred 6,800 acres to the state of Tennessee and Cherokee National Forest; the State maintains its 2,000 acre portion of the tract as Martha Sundquist State Forest. The Forest continues to administer and monitor treatments against the Hemlock Wooly Adelgid in selected areas; stream structures have been installed, wildlife openings have been maintained and area roads have been improved and maintained.

In the foreseeable future, over the next 10 years or so, other projects in this area could include additional prescribed burns, wildlife habitat improvements, continuing trail rehabilitation and relocations, as needed and continuing road maintenance. Illegal ATV and other off-road motorized uses threaten resources in the general forest environment. Monitoring, damage repair and prevention (including education) would continue to be required.

Cordell notes that "…Americans' interest in nature and nature-based recreation, though changing is not declining; rather, it is strong and growing." Activities including viewing, photographing and other ways of observing elements of nature have grown more than 60% in the past seven years (H. Ken Cordell, "The Latest on Trends in Nature-based Outdoor Recreation," Forest History Today, Spring 2008, pp 4 – 10). Recreational forest use is not expected to exceed carrying capacity in the foreseeable future.

Past timber harvests, clearings, roads, structures and other landscape modifications are visible on private and NFS lands from the designated viewing platforms and travel-ways. The degree to which these modifications impact scenic quality varies by type, scale and contrast with the surrounding natural landscape. Potential future scenery impacts in the Big Creek area include increased residential development and gradual loss of the pastoral/agricultural and rural/forested landscape character.

Alternative A

Cumulative Effects

The overall effect of implementing Alternative A would be an older forest, but with no enhancements or restorations to improve scenery or create visual diversity. Emergency projects in response to forest health and safety may be implemented, but no projects to improve the overall health or populations of the forest would be implemented. No cumulative effects for either Scenery or Recreation, other than direct and indirect effects previously discussed, are anticipated.

Alternatives B and C

Cumulative Effects

No additional vegetation projects are planned within the next 10 years that would affect the Scenery resource, except those previously described. Management-influenced SIOs would continue to be met. No cumulative effects to either Scenery or Recreation are anticipated, other than direct and indirect effects previously discussed.

Recreation Resources

Affected Environment

Two Cherokee National Forest RLRMP recreation-related prescriptions are in the project area. A narrow corridor of Appalachian National Scenic Trail and up to ½ mile seen area viewshed makes up Prescription 4.A. All remaining acreage is classified as 7.E.2, Dispersed Recreation Areas with Vegetation Management.

The section of Appalachian National Scenic Trail (A.T.) from Waterville (I-40, Exit 451) to Lemon Gap across the Snowbird Mountain forms the southern boundary of this zone. The 7-mile segment of the A.T. between Lemon Gap and Max Patch is known for its spring floral displays. Trails in the Big Creek

Area of Great Smoky Mountain National Park and Harmon Den Area of Pisgah National Forest are nearby.

Anglers fish for trout in Gulf Fork and Brown Gap Creek; nature watchers view prairie warblers and yellow breasted chats along the area's dry piney ridges, or catch a glimpse of turkey, grouse, deer and black bear. Hunters also use the area to pursue game species.

In the Gulf Area, dispersed camping is concentrated on the relatively level lands in Martha Sundquist State Forest. Forest Service-managed lands are steep with little opportunity for recreation development except trails, fishing and hunting.

Scope of Analysis

The scope of analysis for Recreation Resource is the entire Big Creek Analysis Area, approximately 16,777 acres in the Big Creek Drainage (See Introduction, page ii). The time frame is from the present to approximately 15 years in the future.

Effects Analyses of the Alternatives

Direct, Indirect and Cumulative effects of the alternatives on Recreation Resources are provided below.

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

Under this alternative the proposed action would not be implemented. The overall effect would be no change to the recreation resources. Few or no improvements to increase or enhance populations of existing wildlife species could result in less opportunity for hunting, fishing and wildlife viewing. There would be no cumulative effects to the Recreation Resource under the No Action alternative.

Alternative B (Modified Proposed Action)

Direct and Indirect Effects

Proposed creation of early successional habitat of 268 acres using the shelterwood method along with a 28 acre White Pine clear-cut and 12.64 acres of road daylighting would create and/or enhance grassy wildlife openings. Recreationists use these grassy woodland openings for picnicking, camping, hunting and wildlife viewing. In addition the construction and maintenance of fish structures, vernal ponds, wildlife boxes and grouse drumming logs would draw wildlife and fish species to these constructed features, providing a positive long-term effect on recreation opportunities such as fishing, hunting and wildlife viewing. Decommissioning six miles of authorized and unauthorized roads would allow the roads to revegetate and could have a long-term negative effect for recreationists who prefer established road beds to access the forest.

Alternative C

Direct and Indirect Effects

In this alternative an additional 31 acres is being treated. The effects on recreation resources for this additional acreage are minimal and therefore similar to those described for Alternative B.

Alternatives B and C

Cumulative Effects

There are no other foreseen projects in this area for the next 10 years that would significantly affect the Recreation Resource. The activities proposed combined with past and future activities would not result in cumulative effects to the Recreation Resource.

Climate Change

Affected Environment

Climate change can affect the resources in the project area and the proposed project can affect climate change through altering the carbon cycle. Climate models are continuing to be developed and refined, but the two principal models found to best simulate future climate changed conditions for the various regions across the country are the Hadley Centre model and the Canadian Climate Centre model (Climate Change Impacts on the United States 2001). Both models indicate warming in the southern region of the United States. However, the models differ in that one predicts little change in precipitation until 2030 followed by much drier conditions over the next 70 years. The other predicts a slight decrease in precipitation during the next 30 years followed by increased precipitation. These changes could affect forest productivity, forest pest activity, vegetation types, major weather disturbances (droughts, hurricanes), and streamflow. These effects would likely be seen across the Forest; although some sensitive areas (such as high elevation communities) may be affected sooner. The proposed treatment area does have sensitive areas, which contain high elevation communities.

Scope of Analysis

The scope of this analysis for direct, indirect, and cumulative effects on climate change includes the 16, 694 acres of Forest Service lands in Compartments 234, 237, 241-244, 249-252, 256-27. The time frame used in this analysis is up to ten years after completion of the activities.

Effects Analyses of the Alternatives

Direct, Indirect and Cumulative effects of the alternatives on Climate Change are provided below.

Alternative A (No Action)

Direct and Indirect Effects

In general terms, Alternative A (No Action) would result in no change to the current trend for carbon storage or release. Forested stands are expected to be less resilient to possible climate change impacts, such as changes in productivity or insect and disease.

Alternatives B (Modified Proposed Action) and C

Direct and Indirect Effects

It is not expected that the action alternatives (B and C) would substantially alter the effects of climate change in the project area. The regeneration in the areas to be harvested would provide more structural diversity to the area, and establish a young, vigorous stand of timber that may be more resilient to the changes in climate. The action alternatives (B and C) would alter the carbon cycle in that it affects the

carbon stock in any one of the pools. Each of the action alternatives (B and C) would remove biomass as a result of timber harvest. This would reduce the amount of carbon stored in the treated stands. A portion of the carbon removed would remain stored for a period of time in wood products.

Regeneration harvests would reduce existing carbon stocks at the harvest sites. The harvest of live trees, combined with the likely increase in down, dead wood would temporarily convert stands from a carbon sink that removes more carbon from the atmosphere than it emits, to a carbon source that emits more carbon through respiration than it absorbs. These stands would remain a source of carbon to the atmosphere until carbon uptake by new trees and other vegetation exceeds the emissions from decomposing dead organic material. The stands would likely remain a carbon source for several years, and perhaps for more than a decade, depending on the amount of dead biomass left on site, the length of time before new trees become reestablished, and their rate of growth once reestablished. As the stands continue to develop, the strength of the carbon sink would increase until peaking at an intermediate age and then gradually decline but remain positive. Similarly, once new trees are established, carbon stocks would accumulate rapidly for several decades. The rate of accumulation would slow as the stands age. Carbon stocks would continue to accumulate, although at a declining rate, until impacted by future disturbances.

Recent scientific literature confirms this general pattern of changes in net ecosystem productivity (NEP)[1] and carbon stocks over the period of forest stand development. Most mature and old stands remained a net sink of carbon. Pregitzer and Euskirchen (2004) synthesized results from 120 separate studies of carbon stocks and carbon fluxes for boreal, temperate, and tropical biomes. They found that in temperate forests NEP is lowest, and most variable, in young stands (0-30 years), highest in stands 31-70 years, and declines thereafter as stands age. These studies also reveal a general pattern of total carbon stocks declining after disturbance and then increasing, rapidly during intermediate years and then at a declining rate, over time until another significant disturbance (timber harvest or tree mortality resulting from drought, fire, insects, disease or other causes) kills large numbers of trees and again converts the stands to a carbon source where carbon emissions from decay of dead biomass exceeds that amount of carbon removed from the atmosphere by photosynthesis within the stand.

The impacts of the action alternatives on global carbon sequestration and atmospheric concentrations of CO_2 are miniscule. However, the forests of the United States significantly reduce atmospheric concentrations of CO_2 resulting from fossil fuel emissions. The forest and wood products of the United States currently sequester approximately 200 teragrams[2] of carbon per year (Heath and Smith, 2004). This rate of carbon sequestration offsets approximately 10% of CO_2 emissions from burning fossil fuels (Birdsey et al., 2006). U.S. Forests currently contain 66,600 teragrams of carbon. The short-term reduction in carbon stocks and sequestration rates resulting from the proposed project are imperceptibly small on global and national scales, as are the potential long-term benefits in terms of carbon storage.

The currently large carbon sink in US forests is a result of past land use changes, including the re-growth of forests on large areas of the eastern U.S. harvest in the 19th century, and 20th century fire suppression in the western U.S. (Birdsey et al. 2006). The continuation of this large carbon sink is

[1] Net ecosystem productivity, or NEP, is defined as gross primary productivity (GPP) minus ecosystem respiration (ER) (Chapin et al. 2006). It reflects the balance between (1) absorbing CO_2 from the atmosphere through photosynthesis (GPP) and (2) the release of carbon into the atmosphere through respiration by live plants, decomposition of dead organic matter, and burning of biomass (ER). When NEP is positive, carbon accumulates in biomass. Ecosystems with a positive NEP are referred to as a carbon sink. When NEP is negative, ecosystems emit more carbon than they absorb. Ecosystems with a negative NEP are referred to as a carbon source.

[2] 200 teragrams, or Tg, equals 196,841,306 US tons.

uncertain because some of the processes promoting the current sink are likely to decline and projected increases in disturbance rates such as fire and large-scale insect mortality may release a significant fraction of existing carbon stocks (Pacala et al. 2008; Canadell et al. 2007). Management actions – such as those proposed – that improve the resilience of forest to climate-induced increases in frequency, and utilize harvested trees for long-lived forest products and renewable energy sources may help sustain the current strength of the carbon sink in US forests (Birdsey et al. 2007).

Cumulative Effects

For all alternatives, the release of stored carbon may be an obvious concern; the contribution of the proposed project areas to the carbon cycle is extremely small. When combined, the carbon from these projects has minimal cumulative effect not only at the local level, but at the larger level. When implemented, the risk and rate of additional carbon release through regeneration is minimal for the reasonably foreseeable future.

Cultural Resources

Affected Environment

The project area has been subjected to both records research and an archaeological field survey designed to identify and evaluate all significant cultural resources within the proposed impact areas.

Scope of Analysis

The scope of analysis is the individual boundaries of the areas identified in items 1-14 of the alternatives. The analysis would be performed prior to project implementation.

Effects Analyses of the Alternatives

Direct, Indirect and Cumulative effects of the alternatives on Cultural Resources are provided below.

Alternative A (No Action)

This alternative would have no direct or indirect effects on cultural resources.

Alternatives B (Modified Proposed Action) and C

There would be no direct or indirect effects to significant cultural resources in the areas of impact proposed in Alternatives B and C.

Alternatives A, B and C

There are no known cumulative effects.

Economics

Affected Environment

Several local industries and sawmills utilize timber from the Watauga Ranger District. Forest workers and contractors contribute to local economies. Many local residents heat their homes with firewood, while others supplement their income by gathering other forest products such as ginseng, galax and rhododendron. Hunters and recreationists bring revenues into the area.

Scope of Analysis

The scope of analysis is generally the communities within about one hundred miles of the project area. The time frame is generally from when the project is first implemented to less than one year from when the final work is complete. Only the net present value of the commercial timber sale is discussed here.

Effects Analyses of the Alternatives

Direct, Indirect and Cumulative effects of the alternatives on Economics are provided below.

Alternative A (No Action)

Alternative A would not provide any additional economic benefits to help provide employment and generate revenues in this portion of eastern Tennessee, beyond what is occurring now. There are no revenues or associated costs of a commercial timber sale with Alternative A.

Alternative B (Modified Proposed Action)

Forest Service Manual 2432.22c requires a financial analysis of any timber sale of $100,000 or more, to inform how well expected revenues would cover costs. This analysis is included as Appendix D. The discounted cash flow analysis shows a Positive Present Net Value of $19,632.13 for Alternative B.

Alternative C

The discounted cash flow analysis shows a Positive Present Net Value of $21,067.80 for Alternative C.

Alternatives A, B and C

Cumulative Effects

The beneficial effects of previous timber sales on the local economy would have generally been exhausted by the time of implementation, and no additional sales are expected from this area in the near future. There would be no cumulative effects with implementation of these alternatives.

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Chapter 6: Appendices

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