Environmental Assessment

Reedy Project (Timber Sale)

Long Cane Ranger District, Sumter National Forest
McCormick and Greenwood Counties, South Carolina

United States
Department of
Agriculture

Forest
Service

July 30, 2013

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Summary

The Sumter National Forest proposes vegetation management projects in the form of timber sales within the Reedy Project Area (RPA) of the Long Cane Ranger District in McCormick County, South Carolina. The RPA is located within the Lower Long Cane Creek analysis area approximately six miles northwest of the town of McCormick, South Carolina between Mt. Carmel and Troy. The RPA is distributed within 13 management compartments that contain 23 stands ranging from approximately 26 to 80 acres. The project area is bound by State highways 177, 10, 28, 44, and 30 to the East, State highway 43 to the South, State highway 38 to the North and U.S. highway 28 to the West.

The RPA is situated within Management Area (MA) 4. Included in this MA are all national forest system lands outside of the Turkey Creek and Upper Stevens Creek watersheds. Two management prescriptions are included in this project area: 10.B.-high quality forest products and management prescription 11-riparian corridors. Management prescription 11 is embedded in adjoining prescriptions.

Interdisciplinary team review of the data collected during stand exams conducted in compartments 222, 226, 227, 234, 235, 236, 238, 240, 241, 254 and 256 indicate that silvicultural treatments were needed to manage vegetative conditions as directed in the *Revised Sumter Land and Resource Management Plan*, *Sumter National Forest*, 2004 (Forest Plan)

Vegetative management treatments are proposed on approximately 1,275 acres within the eleven compartments.

These silvicultural treatments would take place in stands in which loblolly pine (*Pinus taeda*) is the majority species. Proposed actions would implement seed-tree regeneration harvests. These silvicultural treatments would be accomplished through a commercial timber sale in which trees would be sold, harvested and transported to processing plants.

Hardwood inclusions and riparian corridors containing hard and soft mast hardwoods such as oak, hickory, dogwood, black gum, black cherry and persimmon would be protected during harvest operations. Trees of these species outside inclusions and riparian corridors six inches to ten inches in diameter would be harvested in order to encourage sprouting. Healthy shortleaf pines with full crowns, free of little leaf disease would be retained in order to maintain future restoration opportunities.

Chapter 1 – Purpose and Need for Action

1.1 Introduction

The Forest Service prepared this environmental assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the direct, indirect and cumulative environmental impacts that would result from the implementation of the proposed action, connected actions and alternatives.

The EA is organized into four parts:

- Chapter 1: This section includes information on the purpose of and need for the project and the Agency's Proposed Action. This section also details how the Forest Service informed the public of the proposal and developed key issues.
- Chapter 2: This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues. This discussion also includes design criteria. In addition, this section includes alternatives considered but not fully developed. Finally, this section provides a comparison of the alternatives.
- Chapter 3: This section describes the environmental effects of implementing the proposed action and other alternatives. The analysis is organized into three environmental topic areas: physical; biological; and social. Within each section, the affected environment is described first, followed by the comparison of the other alternatives that follow.
- Chapter 4: This section provides a list of people who worked on the interdisciplinary team (IDT) and EA. It also lists those who responded during the scoping/30-day notice and comment request period.

Additional documentation, including more detailed analyses of project-area resources may be found in the project planning record located at the Long Cane Ranger District in Edgefield, South Carolina.

1.2 Background

The Forest Service is responsible for forest management on the National Forests. The *Revised Land and Resource Management Plan Sumter National* Forest (Forest Plan) provides standards for resource management activities. The Record of Decision *Final Environmental Impact Statement Revised Land and Resource Management Plan Sumter National Forest* was signed on 1/15/2004. This proposal is consistent with the Forest Plan.

This EA tiers to the Region 8 *Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle* (SPB EIS), Southern Region.

1.3 Purpose and Need

The Reedy Environmental Assessment documents the potential impacts of actions proposed by the United States Department of Agriculture (USDA), United States Forest Service (USFS) to improve vegetative conditions in the RPA.

The purpose of vegetation management activities are to: promote better distribution of early successional stage/age classes to benefit wildlife habitat and improve vegetative diversity. Replacing some of the older mature stands that are high risk to mortality from insects and disease with younger more thrifty stands would reduce the potential build-up and spread of SPB. Currently, many stands in the project area are both dense and mature. Dense, mature (older) loblolly pine stands exhibit slow growth rates resulting in decreased vigor and a higher than normal susceptibility to Southern pine beetle (*Dendroctonous frontalis*).

Part of the desired condition in management prescription 10.B. is a mix of forest successional stages, including 10-17% age 0-10 forest (Forest Plan, page 3-38). On Long Cane Ranger District age 0-10 forest is currently 5% of the forested acres in this management prescription.

Forest Goal 18 is to provide a sustainable supply of wood products. Objective 10.B-OBJ-1 is likewise to provide local economies with wood products.

The IDT review of existing conditions identified the need for silvicultural treatments in this project area to reduce the risk of insect and disease outbreaks, improve the health and vigor of stands, and provide more early successional forest habitat. Treatments in the form of regeneration and other canopy opening treatments would increase the amount of early successional habitat benefiting wildlife through increased varieties of stand structure, function and composition.

Cultural and silvicultural treatments (consisting of commercial timber sales) would lower overall insect and disease susceptibility; increase the variety of understory forbs, grasses, shrubs and other native and desired non-native plants beneficial to a variety of wildlife species.

1.4 Proposed Action

Under the proposed action, approximately 1,275 acres of predominantly loblolly pine would be regenerated by the seed tree method – leaving 10-12 trees/acre as a seed source. Desirable hard/soft mast species, wildlife den trees, bird peck trees and some snags would be retained where possible during silvicultural treatments. Conventional ground-based logging systems would be used during harvest operations. Seed trees would be removed after the initial treatment (approximately three to five years) once the understory is fully stocked with desirable tree regeneration. Herbicide would be used to release tree seedlings from competing vegetation so they can form the new forest stand.

1.5 Forest Plan Consistency

The proposal is consistent with the Forest Plan, Forest Health, pages 2-11 through 2-14 and management prescriptions as listed below.

- 10.B. – High Quality Forest Products – pages 3-38 through 3-39.
- 11. – Riparian Corridors – pages 3-39 through 3-44.

1.6 Decision to be Made

The Responsible Official, (District Ranger) will decide:

1. Whether to proceed with the proposed action or the "No-Action" alternative.
2. Whether the alternative that is selected would have a significant impact on the quality of the human environment or not.

If a determination is made that the impact is not significant then a "Finding of No Significant Impact" (FONSI) would be prepared. Significant impacts on the quality of the human environment would require the preparation of an Environmental Impact Statement [NEPA, 1501.4(C) and (e)].

The Decision of the District Ranger would be documented in a Decision Notice (FSH, 1909.15, 43.2).

1.7 Public Involvement

The proposal is listed in the Planning, Appeals and Litigation (PALS) data base as project number 37241. A scoping letter requesting comments was mailed to individuals that made up the district mailing list on September 29, 2011. The scoping period ended October 17, 2011. One comment was received during scoping.

The 30 day notice and comment period began on February 9, 2013 and ended March 11, 2013. One commenter responded during this time period. The comments received and the Forest Service response to those comments is contained in the project record.

1.8 Issues

The Forest Service has identified key and non-key issues.

Key issues have a cause-effect relating actions under consideration to the effects if the proposed action is implemented.

Non-key issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. There are no non-key issues.

The Forest Service (IDT) identified the following key issue:

1. **Comment:** Timber harvest can harm wildlife habitat. Please take measures to assure that wildlife will be protected.

   Response: The effects to wildlife are disclosed in Chapter 3 of the EA. Design criteria would reduce impacts to wildlife.

Chapter 2 - Alternatives

This Chapter describes and compares the alternatives considered for the RPA. It includes a description of each alternative considered. This section also presents the alternatives in how their environmental impacts differ.

Other alternatives were considered to meet the purpose and need but were not fully developed.

2.1 Alternative 1: No Action

Current management activities would continue in the project area under the no-action alternative. Ongoing management actions involves: road maintenance, SPB suppression activities, non-native invasive plant species control, herbicide treatments to reduce vegetation competition to tree seedlings, pre-commercial thinning, prescribed burning and wildlife opening maintenance.

Vegetation management activities including regeneration harvests would not be implemented to improve vegetative diversity in the project area. Mature stands would remain at high risk for SPB attack. Wildlife habitat diversity would not be improved in the project area.

2.2 Alternative 2: Proposed Action

The following details the proposed action which uses a number of vegetation management practices to meet the Purpose and Need.

Seed Tree Regeneration – This silvicultural method leaves 10 to 12 predominantly loblolly pine trees/acre as a seed source to regenerate the stand. Desirable hardwoods would be retained where possible. Approximately 1,275 acres would be regenerated by this method. The seed trees would be removed in approximately three to five years once the understory is fully stocked with desirable tree seedlings.

Roller Drum Chopping of the Seed tree Units – This treatment would be performed after the removal of the merchantable trees except for the 10 to 12 seed trees/acre and hard/soft mast producers ten inches and greater in diameter. Drum chopping decreases the amount of competition from early pioneering species, exposes a limited amount of soil surface area for seed germination and helps decomposition and nutrient cycling of recent cut stems in the seed tree units.

Herbicide Treatment of Seed Tree Regeneration Areas - Chemical release of desired seedlings would occur in the first and third year after harvest. A foliar spray mixture containing 1/2 ounce of imazapyr herbicide; one ounce of water soluble dye spray pattern indicator and 1/2 ounce of limonene adjuvant or equivalent per gallon of water would be used. The mixture would be selectively applied by hand application methods to target vegetation by speckling the leaf surfaces during the period of mid-June through September of the second or third growing season. Estimated application rates would be 10 gallons of mix, including 5

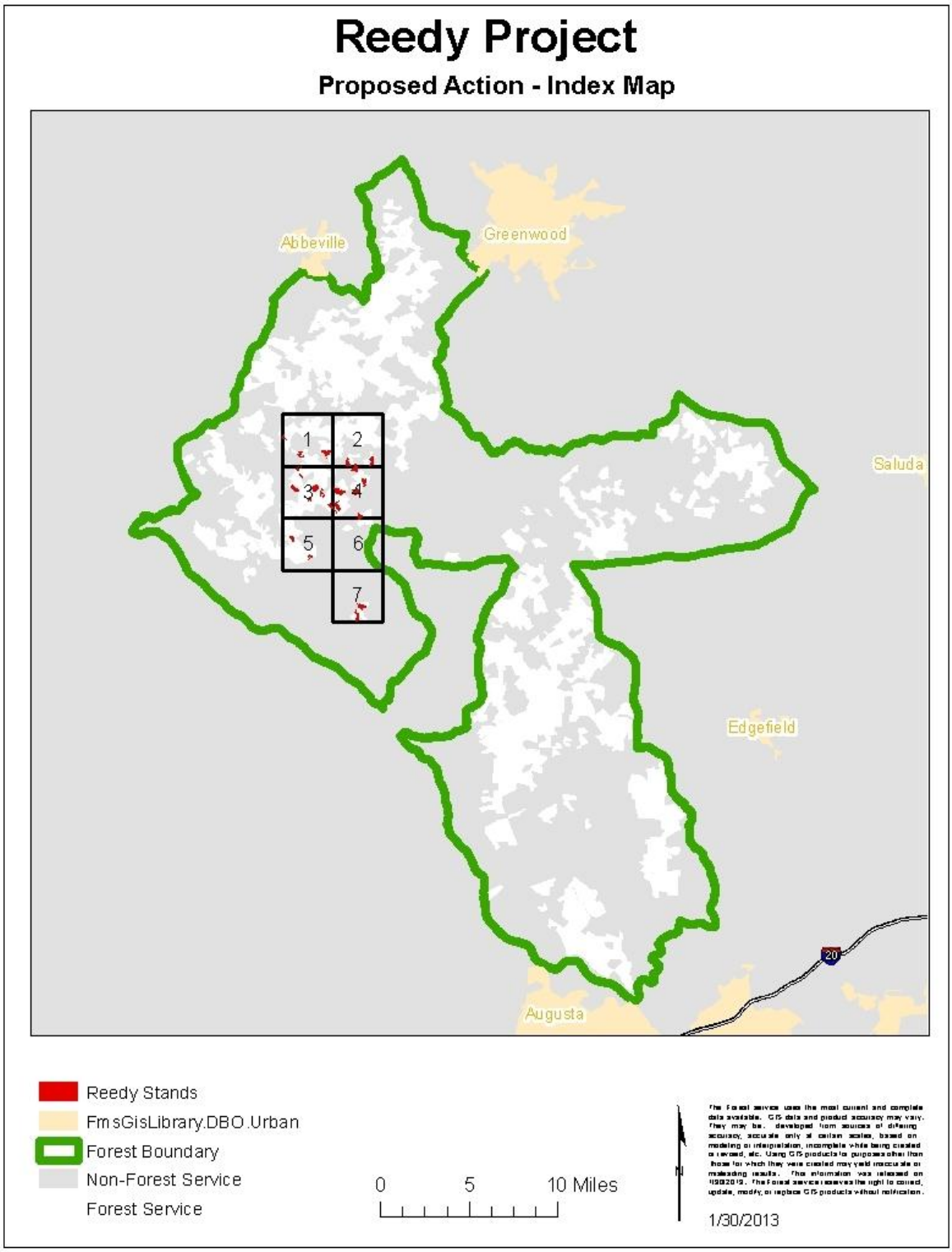
ounces of Arsenal AC or equivalent (0.16 pounds of imazapyr per acre). There would be no broadcast application of herbicides.

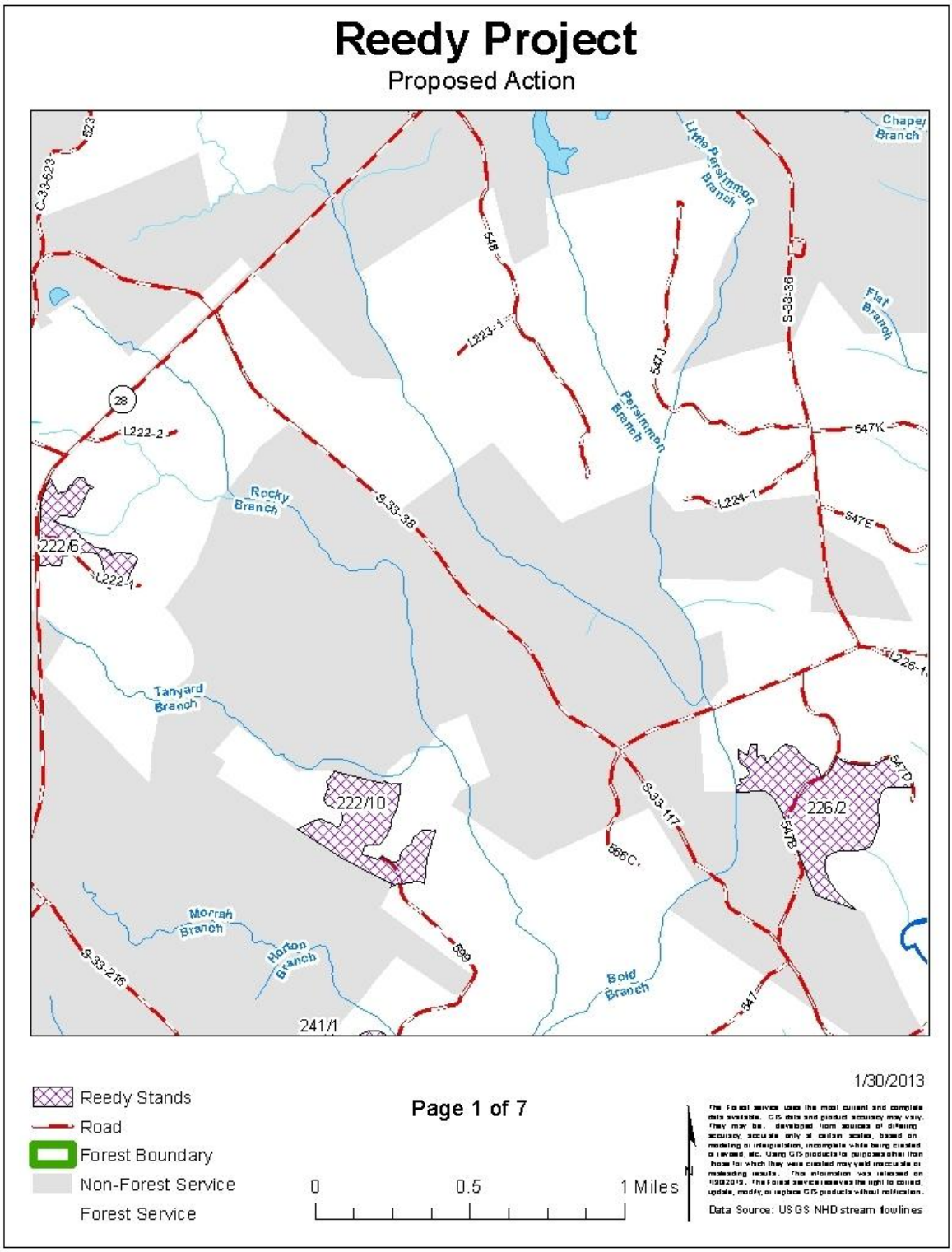
The hack- and- squirt method would be used to treat targeted vegetation (greater than six feet tall) using imazapyr (Arsenal AC or equivalent) and triclopyr (Garlon 3A or equivalent) herbicide that is sprayed/injected into cuts made into the cambium layer with a manual cutting tool (such as an axe or sandvik). The herbicide mixture used would be 50 percent triclopyr, 50 percent water, plus 6 ounces of Arsenal AC per gallon of water. All treated areas would be monitored for further follow-up treatments after the initial treatment. All treated vegetation would be left on-site to decompose.

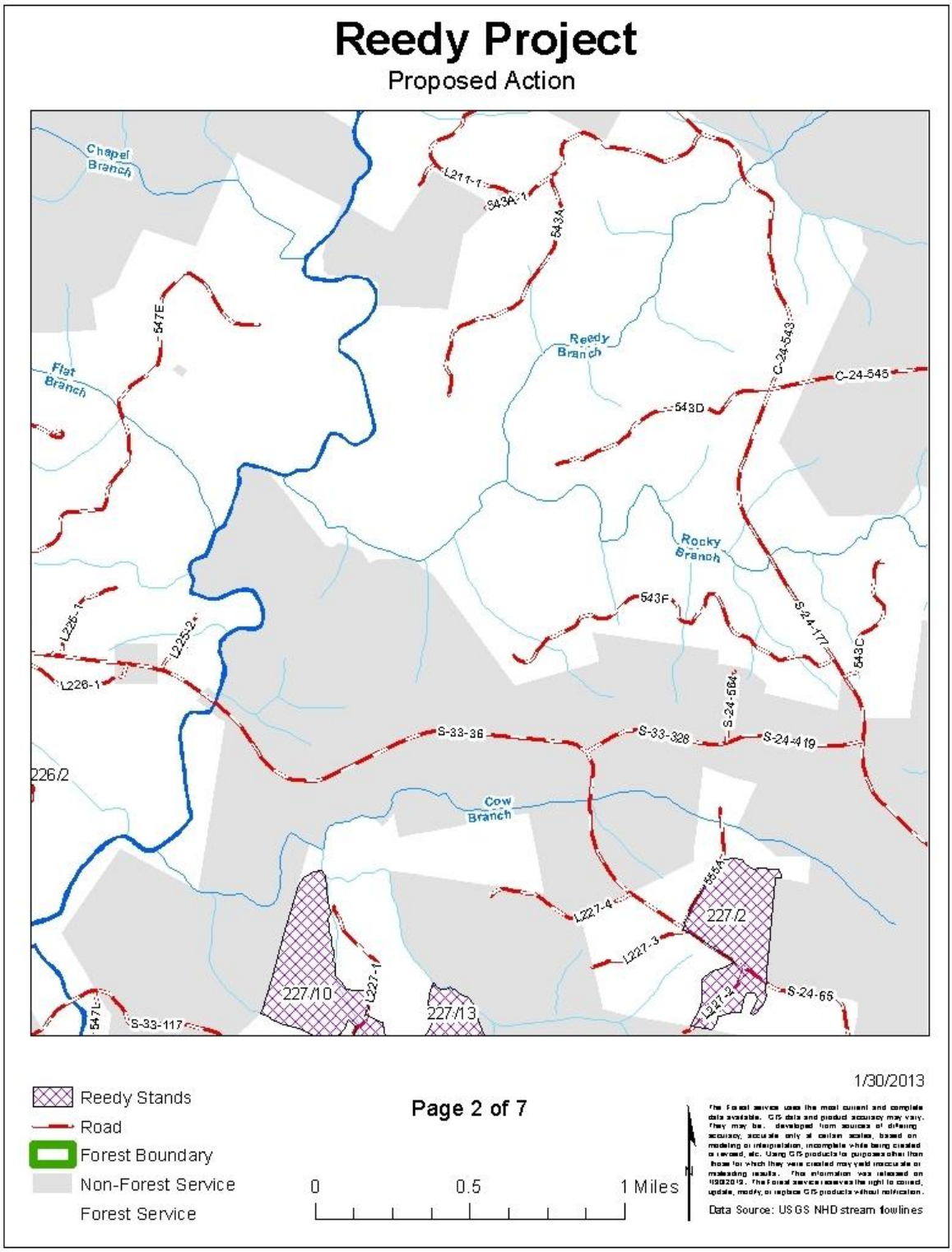
***NOTE:** Commercial herbicides/adjuvant/dyes (Garlon 3A, Arsenal AC, Cidekick, and Bullseye) represent those formulations that are commonly used for the proposed forestry treatments. However, other equivalent formulations may be used for implementation of the proposed treatments. Equivalent formulations would include any other brand name herbicides that have an equivalent proportion of the specified active ingredients.

Table 2.2-1 Compartment/Stand Summary for the Proposed Action

Compt/Stand	Acres	Treatment	Prescription
222/06	26	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
222/10	48	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
226/02	80	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
227/02	66	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
227/10	68	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
227/13	72	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
234/09	57	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
235/04	54	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
235/08	74	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
236/04	49	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
236/07	71	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
238/01	54	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
238/05	52	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
238/08	42	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
240/01	73	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
240/07	35	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
241/01	41	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
241/09	25	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
241/17	70	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
254/05	44	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
254/12	35	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
256/01	75	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
256/09	62	Seed tree	Leave 10-12 seed trees/acre. Drum chop. Herbicide selected crop tree release. Seed tree removal.
Total	**1,275**		


Reedy Project
Proposed Action - Index Map
Abbeville
Greenwood
Saluda
Edgefield
Augusta
20
1
2
3
4
5
6
7
Reedy Stands
FmsGisLibrary.DBO.Urban
Forest Boundary
Non-Forest Service
Forest Service
0
5
10 Miles
N
1/30/2013


Reedy Project
Proposed Action
Chapel Branch
Little Persimmon Branch
Flat Branch
Persimmon Branch
Rocky Branch
Tanyard Branch
Morrah Branch
Horton Branch
Bold Branch
222/6
222/10
226/2
241/1
L222-1
L222-2
L223-1
L224-1
L226-1
547K
547E
547D
547B
547J
548
549
566C
S-33-38
S-33-117
S-33-216
C-33-623
28
1/30/2013
Reedy Stands
Road
Forest Boundary
Non-Forest Service
Forest Service
Page 1 of 7
0
0.5
1 Miles
Data Source: USGS NHD stream flowlines


Reedy Project
Proposed Action
Chapel Branch
Flat Branch
Reedy Branch
Rocky Branch
Cow Branch
L211-1
543A-1
543A
547E
C-24-543
C-24-545
543D
543F
S-24-177
543C
L225-1
L225-2
L226-1
S-24-564
S-33-36
S-33-328
S-24-419
226/2
L227-4
L227-3
L227-2
L227-1
665A
227/2
227/10
227/13
S-24-65
547L
S-33-117
1/30/2013
Reedy Stands
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Non-Forest Service
Forest Service
Page 2 of 7
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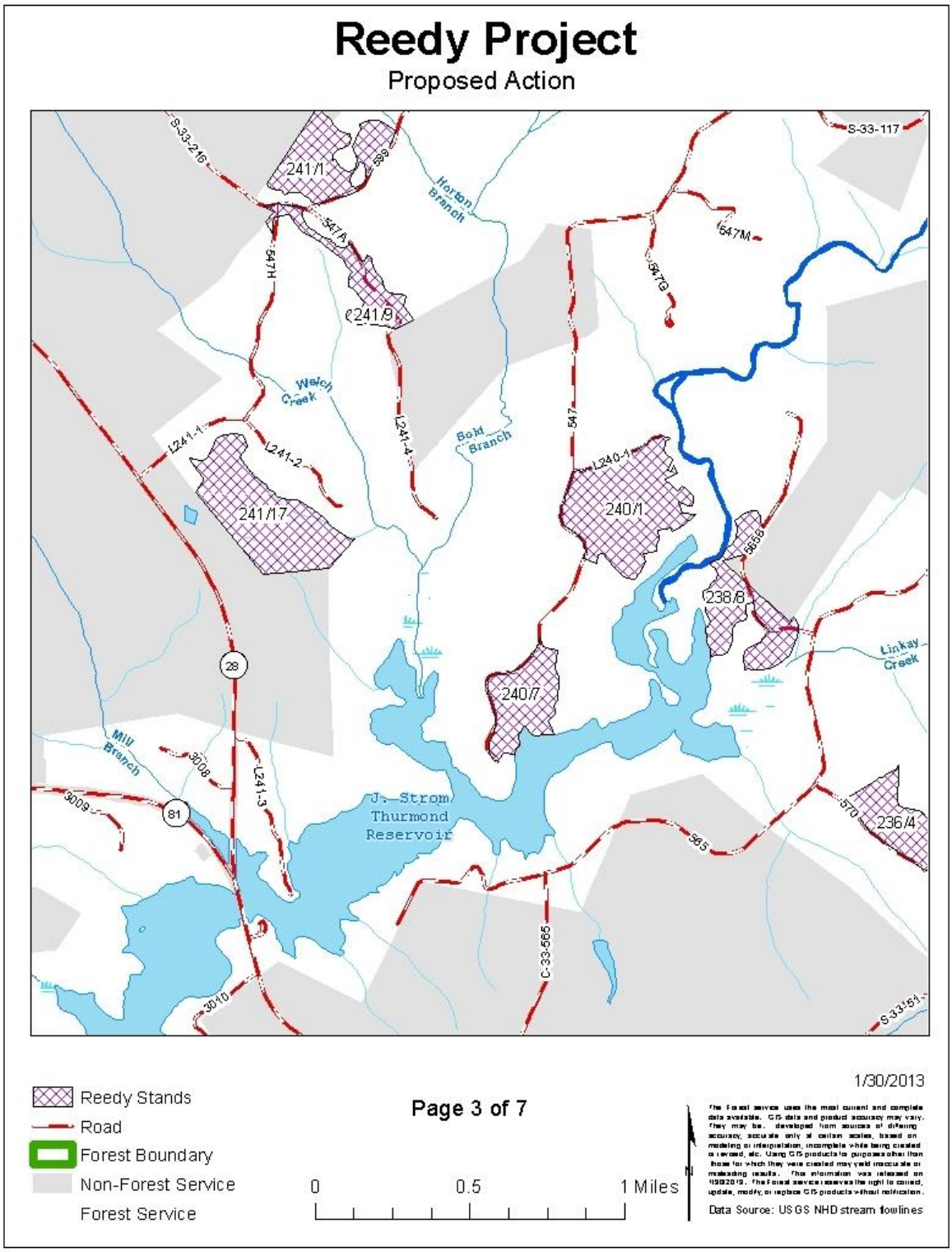
Reedy Project
Proposed Action
S-33-216
S-33-117
241/1
599
Horton Branch
547A
547H
547M
547G
241/9
Welch Creek
L241-1
L241-2
L241-4
Bold Branch
547
L240-1
241/17
240/1
5856
238/8
Linkay Creek
28
240/7
Mill Branch
3008
3009
81
L241-3
J. Strom Thurmond Reservoir
570
236/4
565
C-33-565
3010
S-33-51
1/30/2013
Reedy Stands
Road
Forest Boundary
Non-Forest Service
Forest Service
Page 3 of 7
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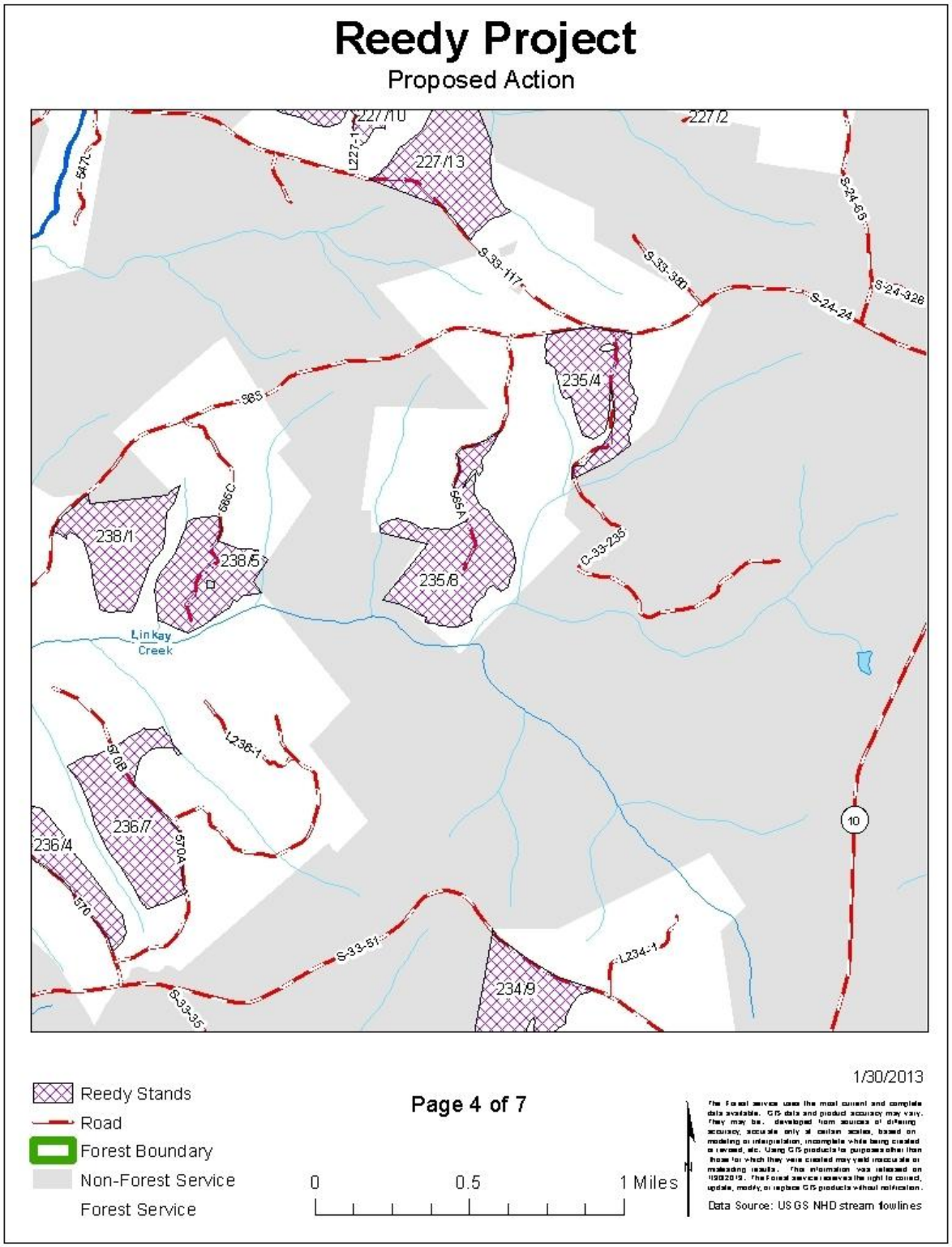
1 Miles
N
Data Source: USGS NHD stream flowlines


Reedy Project
Proposed Action
227/10
227/12
227/13
L227-12
S-24-325
S-33-117
S-33-330
S-24-328
S-24-24
235/4
985
685C
685A
238/1
238/5
235/8
C-33-235
Linkay Creek
L236-1
570B
236/7
236/4
570A
570
10
S-33-51
L234-1
234/9
S-33-35
1/30/2013
Reedy Stands
Road
Forest Boundary
Non-Forest Service
Forest Service
Page 4 of 7
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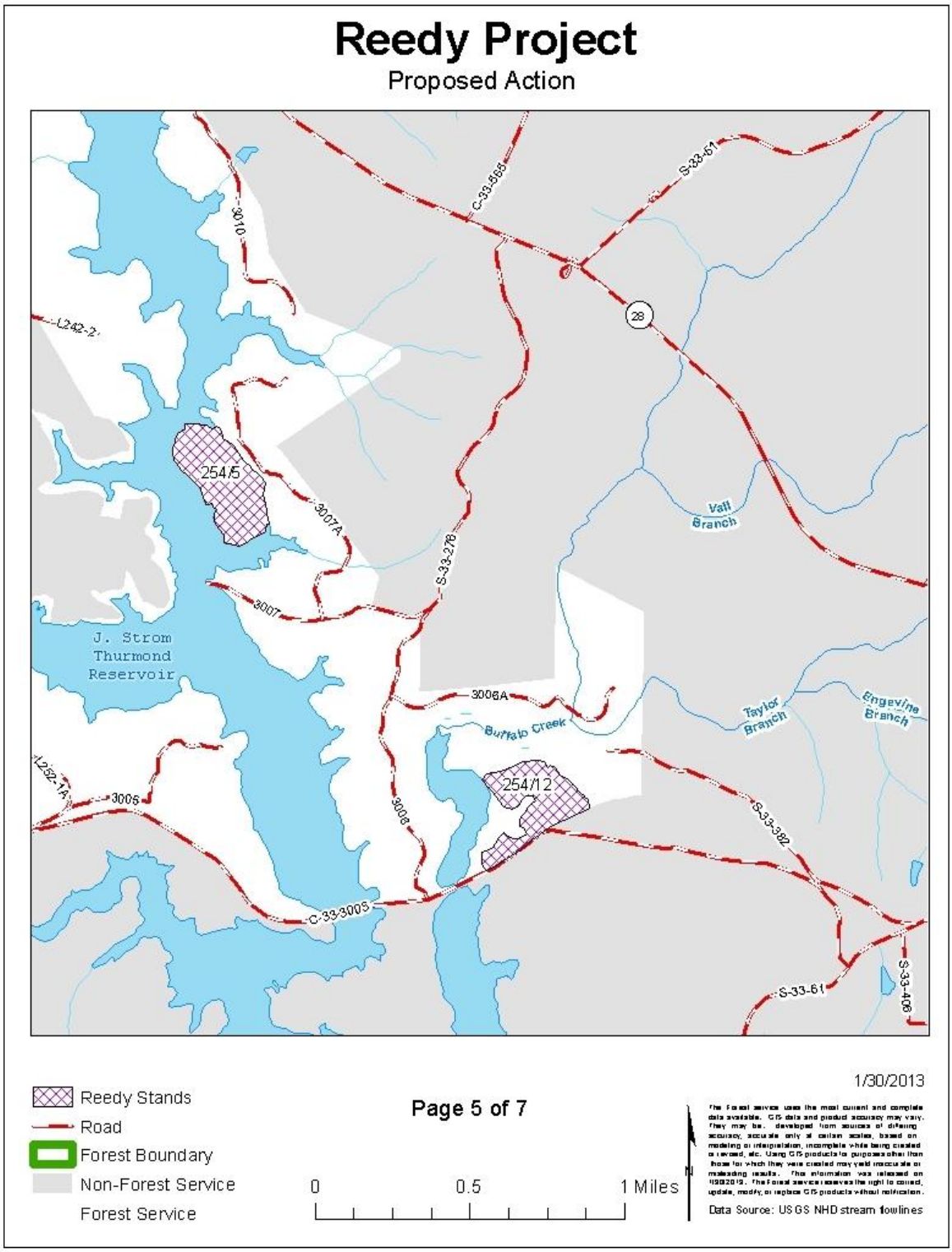
1 Miles
Data Source: USGS NHD stream flowlines


Reedy Project
Proposed Action
C-33-565
S-33-61
3010
28
L242-2
254/5
3007A
S-33-276
Vail Branch
3007
J. Strom Thurmond Reservoir
3006A
Buffalo Creek
Taylor Branch
Engevine Branch
L232-1A
3005
254/12
3006
S-33-382
C-33-3005
S-33-61
S-33-406
1/30/2013
Reedy Stands
Road
Forest Boundary
Non-Forest Service
Forest Service
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0
0.5
1 Miles
N
The Forest service uses the most current and complete data available. GIS data and product accuracy may vary. They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpolation, incomplete while being created or revised, etc. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. This information was released on 1/30/2013. The Forest service reserves the right to correct, update, modify, or replace GIS products without notification.
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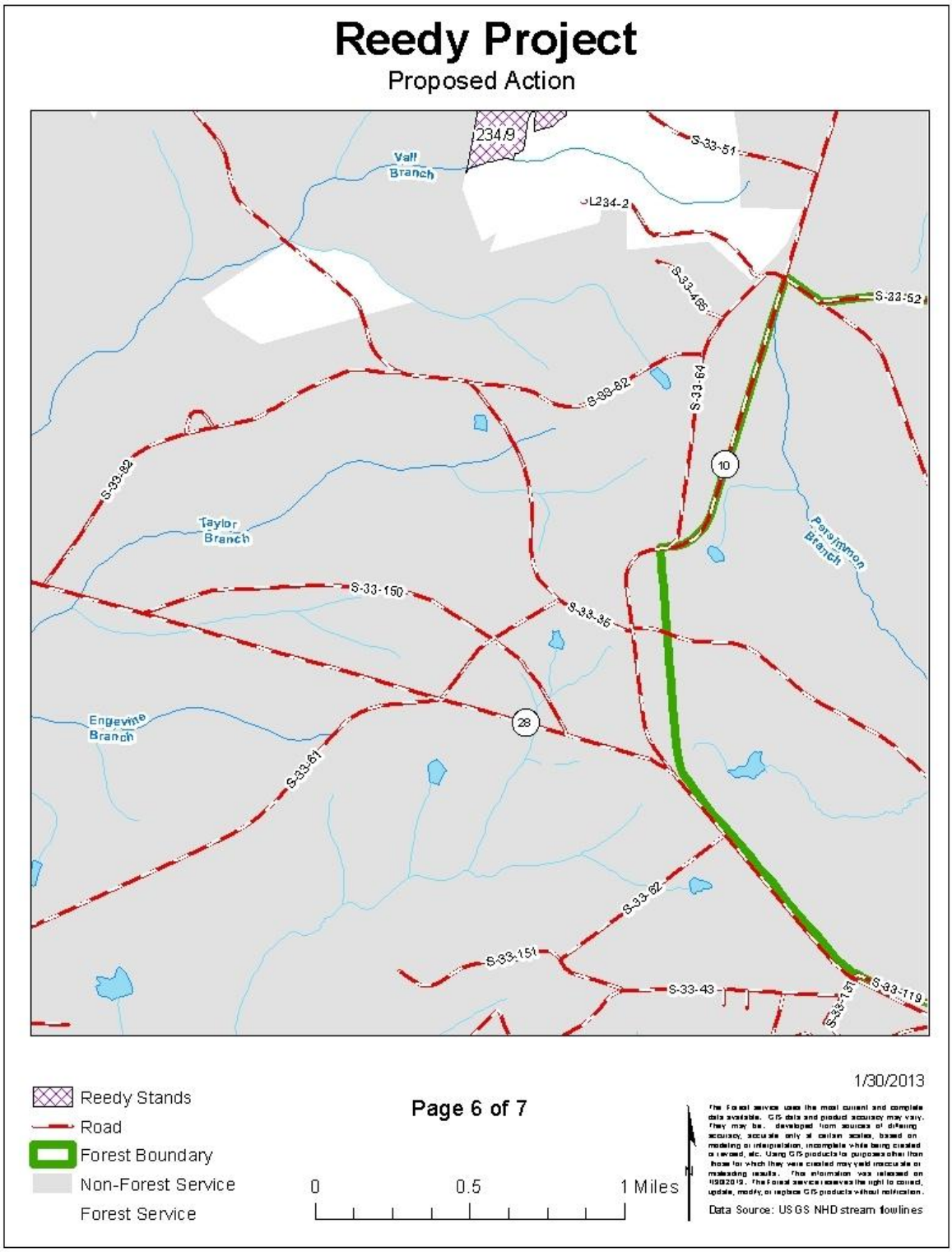
Reedy Project
Proposed Action
234/9
Vall Branch
S-33-51
L234-2
S-33-48
S-33-52
S-33-82
S-33-64
10
S-33-82
Taylor Branch
Persimmon Branch
S-33-150
S-33-36
28
Engevine Branch
S-33-61
S-33-62
S-33-151
S-33-43
S-33-151
S-33-119
1/30/2013
Reedy Stands
Road
Forest Boundary
Non-Forest Service
Forest Service
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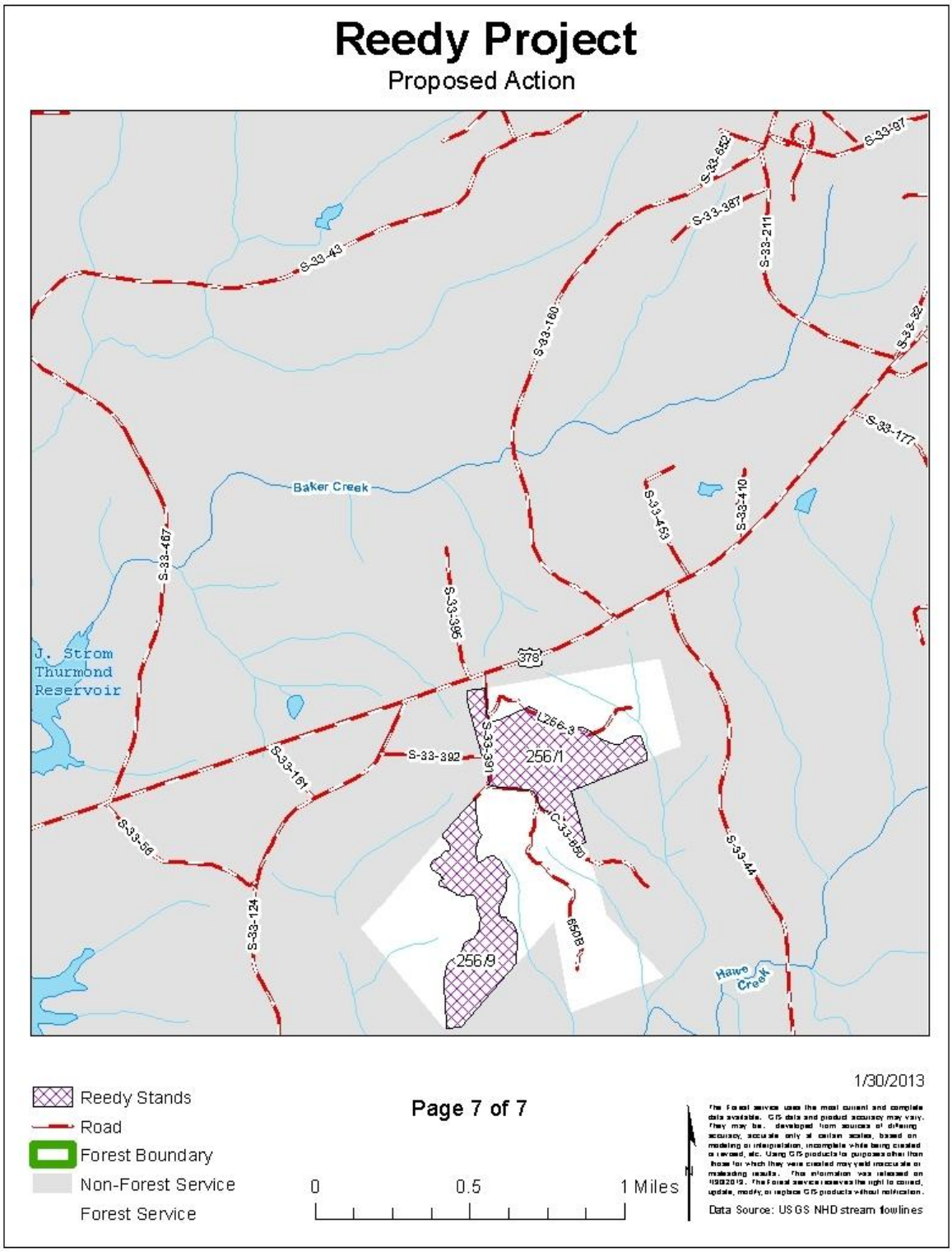
Reedy Project
Proposed Action
S-33-43
S-33-160
S-33-387
S-33-211
S-33-177
S-33-410
S-33-453
S-33-467
S-33-396
Baker Creek
J. Strom Thurmond Reservoir
378
S-33-392
256/1
256/9
S-33-161
S-33-58
S-33-124
S-33-44
650B
Hawe Creek
1/30/2013
Reedy Stands
Road
Forest Boundary
Non-Forest Service
Forest Service
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0.5
1 Miles
Data Source: USGS NHD stream flowlines

Connected Actions

Skidding, Decking and Hauling of Logs

Harvested trees would be skidded with heavy equipment to landings where they would be loaded onto log trucks then transported to processing plants. Existing skid trails and landings from previous timber harvest activities would be used during skidding and loading operations. Site-specific design criteria along with Forest Plan standards and guidelines would be used to limit soil impacts and protect streams from sedimentation. Typically, skid trails and landings are water-barred and re-vegetated to reduce soil erosion.

Seed Tree Removal (1,275 acres)

Seed trees would be harvested after stands are fully stocked with desirable tree regeneration. This normally occurs about three to five years after the initial timber harvest but would only be done when the area has been satisfactorily restocked with trees.

Road Maintenance

System road maintenance activities such as but not limited to grading, spot surfacing with crushed stone, replacement of damaged and non-functional culverts and brush removal to enhance visibility may be necessary to ensure safety and prevent environmental degradation during vegetation management activities. Approximately 22 miles of national forest system roads would be maintained during timber harvest operations and 0.3 miles of temporary roads would be used.

Erosion Control Measures

Design criteria would be used to reduce or prevent erosion during timber harvest operations. Surface drainage structures such as dips, water-bars and water lead-outs, seed/fertilizer and would be utilized as needed to minimize erosion and delivery of sediment to stream channels from skid trails, temporary roads and log landings.

2.3 Alternatives Considered But Not Developed

Two other action alternatives were considered but not developed.

(1.) Another alternative considered would use the alternate seed tree method (4-6 seed trees/acre) to regenerate stands in the project area. Drum chopping followed by a prescribed burn would be performed to prepare the seed bed. No release work would be performed. This alternative was dismissed from further consideration because there are not enough preferred advanced hard/soft mast hardwood rootstock to adequately restock the regeneration areas. In addition, this alternative would favor low timber value and non-wildlife preferred early pioneering species such as sweet gum and red maple.

(2.) This alternative would use prescribed burning exclusively on a 3-4 year burn regime to increase understory grasses and forbs for wildlife. This alternative was dropped because

understory vegetation such as grasses would not be stimulated satisfactorily by prescribed burning because of a lack of sunlight and soil moisture which are considered limiting factors. The overstory canopy would not be open enough to stimulate growth of understory species. The pine stands would remain at high risk to southern pine beetle.

2.4 Design Criteria

Forest wide standards, goals and objectives in the Forest Plan; *South Carolina's Best Management Practices for Forestry* (BMPs) (SCFC, 2003); and *Soil and Water Conservation Practices Guide,* Southern Region, (U.S. Department of Agriculture 2002) will be followed in implementation of this project. In addition, the following site-specific design criteria would be included with the action alternative in order to reduce adverse resource impacts.

1. Project activities would avoid effects to known historic properties and unevaluated archeological sites. The eight unevaluated sites (38MC2398, 38MC2399, 38MC2423, 38MC2433, 38MC2438, 38MC2446, 38MC2515, 38MC2505) and two historic period cemeteries (38MC1261, 38MC1700) would be marked with painted boundaries to be protected from ground disturbance.
2. Identified PETS species location would be avoided during site disturbing activities associated with logging and follow-up cultural treatments.
3. Temporary roads and skid trails would be located in such a manner to roll with the terrain to avoid unnecessary water concentrations. Drainage dips and lead outs would be incorporated in construction of temporary roads to ensure that erosion from concentrated flow is minimized and does not reach streams.
4. Gully crossings would be avoided and surface drainage would be designed to avoid discharging directly into gullies.
5. Areas of exposed soil, such as skid trails and log decks, would be seeded, fertilized and mulched after operations are completed. Where practical, seed mixtures would include native grasses and legumes or other desired non-native species beneficial to wildlife.
6. Trees would not be harvested within gullies or on steep slopes adjacent to gullies unless needed to promote stabilization or recovery efforts.
7. Perennial and intermittent streams that could be affected by logging operations would be identified on sale area maps and protective measures would be specified in the timber sale contract.
8. Herbicide mix water would be carried to the site by contractors or workers.
9. Trucks containing herbicide or tank mixed herbicide would not be allowed to park within 200 feet of a stream or pond.

10. Hardwood inclusions to be protected within and adjacent to harvest units would be identified on the ground and on the sale area map of the timber sale contract.
11. To prevent damage to residual trees, do not operate drum choppers closer than five feet of seed trees and residual mast producers.
12. Do not operate drum choppers during saturated soil conditions.
13. Disturbed road cut and fill slopes would be re-vegetated to the extent possible to reduce adverse visual impacts.
14. Flowering and other visually attractive trees would be left in harvest units where possible.
15. Logging operations would not take place during the weekend during the peak use summer recreation season for compartment 238 stand 8, compartment 240 stands 1 and 7 and compartment 254 stand 5.

2.5 Comparison of Alternatives

This section compares aspects of the alternatives to one another. Analysis of the effects can be found in the next section, Environmental Consequences.

Table 2.5. Alternative Comparison

	Alternative 1- "No Action"	Alternative 2- "Proposed Action"
PHYSICAL ENVIRONMENT		
Soils	-Cumulative impacts from other projects within the same watersheds on private and Forest Service managed lands.	-Temporary localized adverse impacts from increased erosion in harvest units. -Soil compaction at log landings, temporary roads and skid trails.
Water Resources	-Cumulative impacts from other projects within the same watersheds on private and Forest Service managed lands.	-Short-term impacts from increased water yields. -Short-term impact from increased sediment. -Negligible impacts from herbicide runoff.
Air Quality	-Cumulative temporary impacts from prescribed burning.	-Temporary cumulative impacts from logging and other connected activities occurring on national forest system lands and private lands. -Temporary localized impacts from dust and vehicle exhaust from logging equipment.
BIOLOGICAL ENVIRONMENT		
Forest Vegetation	-Impacts from other management activities. -Cumulative impacts from the action	-Logging damage to residual trees. -Temporary impacts from seed tree removal.

	alternatives. -Highly susceptible to SPB. -Less distribution of age classes.	-Treatment of unwanted vegetation with herbicide. -Risk to SPB is reduced with establishment of new stand of young thrifty growing trees. -Greater distribution of age classes. -Increase in biodiversity – younger stands, increase understory growth of grasses, forbs and shrubs. -Increase in amount of early successional forest habitat.
MIS	-Does not create early successional habitat. -Benefits species requiring older, dense forests.	-Could adversely impact nesting birds. -Creates early successional habitat. -Adversely impact species requiring dense forest habitat. -Altered patterns of animal use.
Aquatic Community	- Temporary increase in erosion and sediment from other mgmt. activities.	-Temporary increase in runoff, sedimentation and water yield. -Negligible impact from herbicide.
SOCIAL ENVIRONMENT		
Visuals and Recreation	-Browning of some trees after some prescribe burns. -Browning of herbicide treated invasive species. – -Temporary entry restrictions. -Higher susceptibility to SPB leading to dead pocket of trees that could increease safety hazards.	-Temporary impact to hikers, hunters, and other forest visitors during logging. -Increased vegetation variety in viewshed in the long-term. -Browning of herbicide treated vegetation from understory treatments. With imazapyr, little browning is noticeable. -Increase in open area habitat and increase in hunt-able wildlife likely. -Increase in motorized traffic
Economics (B/C)	0	3.11
Environmental Justice	-No impact	-No impact
Human Health and Safety	-Temporary impact from other management actions.	-Temporary potential for adverse impacts from heavy equipment use. -Negligible impacts from herbicide use.

Chapter 3 - Environmental Consequences

Introduction

This chapter discloses the direct, indirect and cumulative effects on the physical, biological and social environment in the project area from the alternatives. This chapter provides the scientific and analytical basis to compare the alternatives. (40 CFR 1508.9(b))

3.1 Physical Environment

3.1.1 Water (Including Riparian Areas and Wetlands)

Affected Environment

Area/Weather

The Long Cane Ranger District is within the piedmont (Gulf Atlantic Rolling Plain physiographic province) of South Carolina. Historically, the piedmont region of South Carolina supported mixed forests that were dominated by mature hardwoods, loblolly pine and short leaf pine. Disturbances in this dynamic system included fire (both wild and man caused), insects, diseases, storms, droughts and floods. Past farming practices in the Piedmont Region resulted in severe gullying and loss of topsoil.

The sensitivities in the land do not preclude management, but they require maintaining soil cover on eroded areas. Some of the past impacts have been reduced with sustained efforts within the National Forest to restore the land, water and biological resources. The low to moderate slopes of the project area make it a good choice for the proposed treatments.

Storms and storm sequences in the southeastern United States can be severe. From 5 to 8 inches or more rain can be generated from a severe tropical storm event. It is likely that the area would be exposed to one or more of these during any treatment or recovery period. In addition, thunderstorms and frontal events are more frequent across the landscape, though typically not as severe.

Generally, precipitation averages 45 inches per year for the piedmont of the Sumter National Forest. Water yield averages about 13-15 inches, so about 30-32 inches is typically utilized by plants in transpiration, or evaporates. The highest potential for precipitation and associated runoff and flooding occurs in the winter and early spring when groundwater levels are higher and soils are moister. Winter rains are usually widespread and prolonged while much of the summer rains are localized thunderstorms of short duration.

Stream flow behavior is described as “flashy” in headwater streams, meaning that the channels and their contributing stream networks are capable of rapidly delivering a high volume of water in response to sustained heavy precipitation events. Many of the channels are entrenched into the landscape due to gully development or resultant deposition and degradation due to recovery, down-cutting and entrenching. The headwaters do not typically have a floodplain where flood flows are partially detained and/or retained. The extensive networks of gully channels develop to be efficient for the delivery of flow and sediment. Partially because of this delivery efficiency of surface flow, base flow (or ground water contribution to surface flow) can be a minimal component of stream flow. As the watershed

recovers, soils are able to absorb and maintain base flow. Recovery of area gullies are in part due to better riparian management, conversion of agriculture back to forest, better watershed management and attention to BMP's. The current pine dominated forest uses more water than hardwood and grasslands, so this along with the gullies contribute to why many of the small channels are typically devoid of surface flow during the hot summer months (July through September).

Several of the proposed units contain streams or channels of various types that will be protected with the riparian corridor guidance for perennial and intermittent streams or plan guidance for scoured ephemeral channels. Any ephemeral channel with active erosion, gullies or scouring will be managed as a scoured ephemeral. The corridor guidance includes direction to implement BMPs, in addition to other guidance. Many stands border Long Cane Creek and the lower reaches of streams affected by flooding and water level changes associated with J. Strom Thurmond Lake. The Lake would be buffered from timber harvesting by at least 200 feet. Riparian guidance would also apply where appropriate. See Tables 3.1.1-3 and 3.1.1-4 for stands with perennial, intermittent, lake and wetland area near or within the stand.

Watershed

J. Strom Thurmond Reservoir or Thurmond Lake is the most prominent feature on the landscape. The dam was built and the reservoir filled from 1946 to 1954, as a flood control, hydropower, and navigation project. Today's purposes include recreation, water quality, water supply, and fish and wildlife management. The lake is a major influence of area ground water level. Thurmond Lake is located on the South Carolina and Georgia border north of Augusta and just west of the RPA. With the establishment of the reservoirs, the Little River portion of the lake extended 17 miles into South Carolina. Thurmond Lake is now one of the most visited recreational U.S. Army Corps lakes in the U.S.

The project area is in the Piedmont Ecoregion in the hydrologic boundaries of the Upper-Savannah River Basin, HUC 03060103; with smaller basins of Lower Long Cane Creek, Bold Branch, Long Cane Creek Fork of Thurmond Lake, Lower Little River Fork of Thurmond Lake, and Lower Thurmond Lake outlining the RPA. Of these five watersheds about 19 percent of the 118,072 acres is managed by the Forest Service with the majority of private land being forested (Table 3.1-1).

Elevations of the RPA range from 330 to 510 above mean sea level (330 AMSL is normal pool for Thurmond Lake). Many small perennial, intermittent and ephemeral streams exist throughout the PRA. Named streams that may be affected within the RPA follow; Horton Branch flows into Morrah Branch. Tanyard Branch flows into Rocky Branch. Morrah Branch and Rocky Branch flows into Bold Branch. Cow Branch flows into Long Cane Creek prior to the Thurmond Lake and Bold Branch and Linkay Creek flows into Long Cane Creek Fork of Thurmond Lake. Vall Branch flows into Buffalo Creek. Buffalo Creek flows into Thurmond Lake. The units east-southeast of Barker Creek State park, units 256/01 and 256/09, have dissecting and adjacent unnamed streams that flow into Hawe Creek which flows into Lower Thurmond Lake. All the streams within the RPA are tributaries to Thurmond Lake, and all except Hawe Creek are tributaries to the Little River portion of Thurmond Lake. All streams within the RPA watersheds are classified "freshwaters" (FW). Most of these freshwaters are suitable for primary and secondary recreation, as source of drinking water, fishing, survival

and propagation of a balanced indigenous community as well as industrial and agricultural uses.

Riparian Areas

The riparian areas, lakes, wetlands, perennial, intermittent, ephemeral drainages, and most bottomland hardwood forest managed by the US Forest Service are included in Management Prescription 11 – Riparian Corridors of the *Revised Land and Resource Management Plan for Sumter National Forest* (2004). Riparian corridor includes floodplain, wetlands, springs, seeps, perennial and intermittent streams. Plan standards FW-1 and FW-2 indicate that BMPs including Streamside Management Zones (SMZs) would be employed for forest management activities (USDA 2004). When properly implemented, BMPs have been effective at protecting water quality and associated resources (Adams and Hook, 1993; Adams, 1994, 1998; and Jones, 2000). The riparian corridor prescription in the forest plan maximizes protection of the streams and creeks and is not specifically mapped as other management areas. The riparian corridor prescription is imbedded into mapped management prescriptions to ensure good water quality and aquatic and riparian habitat throughout the forest. The management prescription that is most protective, state BMP or Riparian Corridor, will be applied to ensure resources are conserved and protected as needed.

Table 3.1-1 Land Use/Land Cover in the Reedy Project Watersheds

Watershed	Land Cover Type/Land Cover Usage						
	Forested	Grassland	Barren	Herbaceous Wetland	Urban	Water	Seed Tree*
Lower Long Cane Creek	89.5	7.8	0.1	<0.1	<0.1	0.2	1.3
Bold Branch	84.6	12.5	<0.1	0.0	<0.1	<0.1	2.5
Long Cane Creek Fork of Thurmond Lake	76.5	13.0	0.5	0.0	<0.1	7.0	6.4
Lower Little River Fork of Thurmond Lake	63.2	21.8	0.5	<0.1	0.8	9.1	0.5
Lower Thurmond Lake	47.3	15.4	0.8	<0.1	0.5	33.2	0.2

Source: SCDNR, 2001. *Seed tree is part of the overall Forested area, this calculation is Seed Tree acres/Total watershed acres as a percentage.

As shown in Table 3.1-1, the dominant land use/land cover of the area including national forest and private land in these watersheds is forested, followed by grassland. Forested land is characterized by a mix of deciduous and evergreen trees, including forested wetlands. Barren land is characterized by a non-vegetated condition of land, both natural (rock, non-vegetated flats) and human induced (clearcut forest) (SCDHEC, 2003).

Federal and State laws regulate the quality of surface waters in South Carolina, including the Federal Clean Water Act (CWA) South Carolina Pollution Control Act (48-1-10, et seq., S.C. Code of Laws, 1976). South Carolina water quality standards provide for the protection and maintenance of the existing and classified uses of the waters of the State. Waters in South Carolina are classified for a variety of designated uses, which include: aquatic life, recreation, drinking water and agriculture. A watershed quality assessment of the Savannah River Basin

was prepared in 2010 by the South Carolina Department of Health and Environmental Control (SCDHEC) and presents a general assessment of the water quality conditions and water pollution control programs in South Carolina. There is one water quality monitoring site just downstream of the majority of the RPA sites of the Little River arm of Lake Thurmond. There is also one monitoring station downstream of the treatment area within Savannah River portion of Lake Thurmond (RL-06423) and aquatic life and recreational uses are fully supported at both sites. In 2008, just above the RPA, Long Cane Creek was put on the 303(d) list for fecal coliform; no additional or updated reports were located.

Wetlands are seldom found along most of the streams because soils are well to moderately-drained. Wetlands found in the Sumter Forest are typically associated with higher order streams and are found in areas throughout the RPA. Digital National Wetland Inventory (NWI) maps from the United States Fish and Wildlife Service are available for the entire RPA. Mapped wetlands are found in or near units 235-8, 238-1, 238-5, 238-8, 240-1, 254-12, and near unit 241-17. However, some wetland areas are possible within the RPA (Table 3.1-2). When wetlands are found they are to be treated as a lake and the measurement would start at the ordinary high water mark and go around the perimeter.

There are no surveys available that address springs or recharge areas within the boundaries of any of the proposed treatment units. The riparian corridors are measured in on-the-ground surface feet perpendicular from the edge of the channel, bank, or highest point of noticeable scour and extend out from each side of the stream. To simplify implementation in the field during layout of the units, the following definitions would apply for riparian corridor widths:

- Corridor widths for perennial streams and lakes would be 100 feet, 125 feet and 150 feet corresponding to the following slope breaks 0-30%, 31-45% and 46% plus, respectively.
- Corridor widths for intermittent streams would be 50 feet, 75 feet and 100 feet corresponding to the following slope breaks 0-30%, 31-45% and 46% plus, respectively.
- Channeled ephemeral streams that have a defined channel of flow where surface water converges with enough energy to remove soil, organic matter and leaf litter. Corridor width is 50 feet wide (25 feet on either side of the channel).

There are no areas within the RPA with slopes greater than 30%, therefore all corridor widths for perennial streams will be 100 feet and 50 feet for intermittent. The Forest Plan also addresses standards for scoured ephemeral stream channels with a 25 foot low impact zone with infrequent crossings.

Table 3.1-2 Possible Wetland areas in the Reedy Project Watersheds		
Compartment	**Stand**	**Wetland area**
234	9	Possibly on southern boundary
235	4	Possibly on southern boundary and in the interior
235	8	Possibly all along the southern boundary.
238	8	Southern Boundary
240	1	Southeastern
254	12	Northern Boundary

Roads

Roads managed by private landowners or entities, Forest Service, state, county and other federal agencies are the most prominent feature on the landscape. On private land, roads are mostly native surface and are designed for periodic to permanent use in such activities as logging, farming, ranching, recreation and access to home sites. State, county and U.S. roads are mostly paved, whereas roads managed by the Forest Service are mostly graveled with some native and paved surfaces depending on the distance from streams and maintenance level designation. Roads can affect water quality and aquatic habitats by causing chronic soil erosion, resulting in sedimentation into streams.

The vegetation management activities proposed for the RPA can have a variety of effects on water resources. Most of the effects are temporary to short term. These effects are generally described below. The following table presents the acreage and percentage of the seed tree treatment proposed within each watershed. Roller drum chopping would be the approximate acreage of the seed tree treatment.

Table 3.1-3 Approximate Watershed and Seed Tree Acres in the Reedy Project Watersheds			
Watershed	Watershed acres	Seed Tree Acres	Percent
Lower Long Cane Creek	20,231.0	255.2	1.3
Bold Branch	8,773.0	218.3	2.5
Long Cane Creek Fork of Thurmond Lake	8,924.0	570.5	6.4
Lower Little River Fork of Thurmond Lake	19,476.0	92.0	0.5
Lower Thurmond Lake	60,666.0	137.0	0.2
Total	118,070.0	1,273.0*	1.1

*Slight rounding differences

Direct and Indirect Effects of Alternative 1

Impacts on water resources under alternative 1 would be limited to the effects of periodic prescribed burning under already existing project decisions, routine road maintenance, invasive species control, southern pine beetle control efforts, management activities on private lands and climate change. Some road maintenance issues that would be repaired or improved with the action alternatives would not be fixed. No other impacts are anticipated under this alternative.

Cumulative Effects of Alternative 1

Existing levels of erosion-based sediment were approximated from land use activities and delivered to small streams (methods summarized by Hansen et. al, 1994, Roehl, 1962). Estimates of erosion and sediment from these practices have been made by using the land use estimates and average erosion coefficients for these practices (Hansen et. al., 1994). The summary of erosion and sediment calculations are in the process records automated in GIS by Geoff Holden, Forest GIS Coordinator. Over 80% of the sediment was linked to private sources. These types of erosion include channel, gully and other forms of erosion that are difficult to predict. Normal geological and legacy erosion and sedimentation would continue related to current conditions.

No substantial impacts to riparian areas, perennial, intermittent or ephemeral streams would occur under this alternative since BMPs apply to private land forestry practices as well. Soil loss and sediment yields would be associated with existing roads and ongoing land management activities. Some of the barren lands were adjacent to the lake and to some extent a part of lake level management that periodically floods areas with vegetation mortality, and sediment accumulations. Other pollutants to streams or water bodies may occur associated with activities in the subwatersheds including oil or petroleum based leaks along motorized areas including roads, parking lots; herbicide and pesticide uses associated with undesired plants, insects, disease; litter and garbage dumping or recycling; pets and farm animals; septic tanks, waste treatment facilities, etc. Portions of some watersheds include areas flooded by Thurmond Lake as managed by the Corps of Engineers. Erosion and sediment associated with wind, waves, boat wakes, etc. occur around the lake shore and other potential sources of sediment or other pollutants were not assessed as part of this analysis. On private land,

sediment and water quality (including fecal) impacts are primarily associated with communities, roads and timber harvesting.

Direct and Indirect Effects of Alternative 2

The potential for water resource impacts is primarily temporary in duration and minor to moderate on site, with elevated sediment concentrations for two to three years within the RPA sub-watersheds. With the concentration of the seed tree treatment, increase in sediment would primarily be within the Long Cane Creek Fork of Thurmond Lake. Seed-tree regeneration would reduce normal water infiltration and accelerate soil and nutrient loss through sheet and rill erosion within the project area over the short-term.

The removal of vegetation through seed-tree regeneration can degrade stream water quality by increasing sediment and nutrient runoff input to streams. Seed-tree regeneration would cause some soil displacement and reduce ground cover; however, the sediment production should be minimal due to the extent of the activity and roller drum chopping, which will roughen the surface. Ursic (1986) concluded from data across the south that timber harvesting did not significantly increase sediment levels within any of the South's physiological regions. He observed that any increase in sediment normalized the first year after treatment operations were completed. The development and use of skid trails would likely increase stream sediment during use and for a short term after. Proper implantation of BMPs would help mitigate soil loss from skid trails.

Impacts on water resources from moderate increases in runoff, sediment, and nutrients would be minimal based on forest-wide standards and guidelines and BMP's implemented during timber harvest operations. Changes in water yields would occur in response to activities that regenerate trees within the watershed or natural processes such as storms or fires that may create canopy openings. Water yields would increase following harvesting gradually returning to normal levels after a period of 5-10 years. Skidder trails/landings and temporary roads decrease water infiltration and can increase surface water flow. This can increase water volume/velocity and soil erosion. The concentrated water, if left uncontrolled can result in stream sedimentation. Other erosion and sediment preventative or reduction measures would include the installation of water diversion practices along roads and skid trails.

Other impacts from tree seed harvests include a reduction in normal water infiltration and increased soil and nutrient loss through sheet and rill erosion in the treatment areas. Increase ground surface roughness from drum roller chopping would help to mitigate rill erosion except in unusually wet conditions. If rill erosions should occur, these impacts are typically temporary over the short term. Timber harvest activities have the potential to impair the water quality of streams within the vicinity of harvested areas through vegetation clearing, soil disturbance, and soil compaction from the use of heavy equipment. Vegetation provides water infiltration and uptake, which reduces runoff and subsurface flow to streams. Sediment and nutrient delivery to streams often increases substantially after timber harvest operations and is proportional to the area disturbed and maintained free of vegetation (Gucinski et al., 2001). As the density of the forest stand decreases, intercepted rainfall and transpiration decreases, increasing the amount of surface water runoff and subsurface interflow from the area (Schultz, 1997; USFS, 1985). Increased surface water runoff can increase stream flow and storm flow, which can lead to stream channel scouring, stream bank erosion, increased sedimentation and nutrients, and flooding, all of which can impact aquatic organisms (Fulton and West, 2002;

USEPA, 2001; Miller, 1987). Increased flow can also wash away logs and other woody debris in streams, which provide habitat and nutrients for aquatic organisms (USFS, 1989b; Miller, 1987; USEPA, 2001).

The increase in stormflow from harvested watersheds during the growing season is particularly evident because of the lack of water uptake from vegetation, leaving higher ground water tables and/or moisture in the soil. The lack of vegetation can reduce the organic component that helps retain and enhance absorption of water into the soil. Exposed soil may lead to the sealing of macropores with fine particles, soil saturation and subsequently greater volumes of runoff with potential for entering the streams. The development of understory vegetation after harvest and to a lesser extent thinning would reduce the amount of stormflow caused by overstory tree removal.

Surface water runoff and erosion impacts during timber harvests are typically short-term, reducing as vegetation in the affected area reestablishes. Nutrients, including nitrogen and phosphorous can enter water bodies attached to sediment, dissolved in water runoff, or through the air. Nutrient losses from a site and into a waterbody tend to increase proportionately with sediment movement (Schultz, 1997). Increased nutrient runoff to streams can have either adverse effects (Lemly, 2000) or beneficial effects, depending on the level of nutrient runoff, and the current nutrient content of the streams (Tank and Webster, 1998). Many aquatic systems are nutrient poor, and therefore, small increases in nutrients can improve their productivity (USFS, 1989b).

The potential increase in sediment yields to the RPA watersheds would be negligible overall but may have temporary effects in the headwater streams; impacts that would diminish significantly further downstream into larger, mid-order streams and into Thurmond Lake. No thinning would occur in wet riparian corridors. No soil disturbance is expected to occur in wetland communities since no timber harvests would occur in these areas. Effects to water resources from potential increases in water, sediment and nutrient yields from seed-tree regeneration would be minimized by design criteria that reduce erosion and sediment (SCFC, 2007). Implementing the BMPs would ensure compliance with the Clean Water Act. Skidder trails and log landings would be seeded with native grasses and legumes along with other approved desired seed mixtures following harvest activities to stabilize and rehabilitate exposed soils. Compacted soils on skid trails and log landings would be ripped, tilled, disked, or roller drum chopped before seeding. Surface drainage structures in the form of dips or water bars would be used to limit concentrated flow, erosion and sediment sources.

After the seed tree treatment, roller drum chopping would crush the remaining vegetation except those designated as seed trees. The roller drum chopping crushes trees and brush while the blades chop them, increasing ground surface roughness (Zachman 2003). Crushing the remaining woody debris greatly improves water retention and availability on the effected site (Sorensen 1997). Litter and soil surface roughness increase, which would increase infiltration and decrease soil erosion compared to other common site preparation treatments. The litter cover and increased roughness would help impede overland flow and soil erosion. Water previously taken up by the harvested trees would be readily available for regeneration (Sorensen 1997). An increase in bulk density slows water infiltration, roller drum chopping does not compact soil; therefore does not significantly increase bulk density (McNab et. al. 1990).

Herbicide treatments include a limited potential for water quality (surface and ground water) contamination from low volume foliar spray from backpack sprayers and from the hack and squirt method. No aerial or broadcast applications of herbicide are being proposed. Foliar application generally involves a greater hazard because herbicides are spread through the air. They can move around by aerial drift, washed off plant leaf surfaces, volatilization, plant uptake, leaching and surface runoff. Drift is the movement of herbicides in air as suspended droplets or dust. Rainfall can cause foliar and stem wash off after application, removing herbicide residue from plant surfaces and transporting them into the soil. Volatilization occurs while herbicides are still exposed to sunlight and air and involves chemical movement in the vapor form through the air.

Plant uptake, removes and absorbs herbicide from foliage and bark surfaces or from the soil and temporarily or permanently depending on the herbicide, removes them from transport. Leaching moves herbicides through litter, soil and out of the plant rooting zone. Surface runoff rapidly transports residues off site either in solution or adsorbed to sediment. Subsurface flow of water removes herbicides in solution from the treatment site in slower ground flow. Processes that break down herbicide chemical structures include photodecomposition, microbial and plant metabolism, thermal degradation and hydrolysis. These processes along with those that transport herbicides, determine the degree to which herbicides persists in the environment.

Imazapyr is a broad spectrum herbicide which controls most grasses, broadleaf weeds and woody species. It is absorbed by both foliage and roots, is translocated through the plant and is accumulated in the growing tissues and root system. Lateral and vertical movement in the soil is limited. Field studies show that movement is restricted primarily to the top three inches of the soil profile. The major route of degradation is photolysis; also broken down by soil microbes. Generally, imazapyr persists in the soil for three months and this depends on the concentration used and soil moisture.

Triclopyr is a selective systemic herbicide used to control woody and herbaceous broadleaf plants. There are two basic formulations of triclopyr (triethyamine salt and butoxyethyl ester).Offsite movement through surface or subsurface runoff is a possibility with triclopyr acid as it is relatively persistent and has only moderate rates of adsorption to soil particles. The salt formulation is water-soluble and with sunlight it may degrade in several hours. The ester is not water-soluble and can take longer to degrade. The ester binds to organic particles in the water column and precipitates to the sediment layer. Bound ester molecules degrade through hydrolysis or photolysis to triclopyr acid which moves back into the water column and continues to degrade.

The potential for surface or ground water contamination from an application of imazapyr or triclopyr is very slight. Foliar hand applications offer very little potential for drift. The hack and squirt method would have a lower potential for contamination since the herbicide is applied directly to the cambium of the treated vegetation via a squirt or spray bottle. The herbicide is then readily taken up by the plant. Herbicide applications would be performed to meet BMP standards and design criteria. The dispersed nature of herbicide application in combination with the low frequency and low application rates would present a low risk of pollution to groundwater. The half-life of imazapyr in water is about 4 days. The half-life of triclopyr in water ranges from 1 to 10 days depending on water conditions.

Streams would be protected from herbicide translocation by limiting herbicide application distances to streams, riparian and aquatic zones. Riparian corridors would reduce the amount of offsite movement of imazapyr in stormflow.

Stream side management zones would absorb any limited movement without noticeable effect on land or aquatic vegetation. Placement of an untreated SMZ parallel to the channel greatly reduces the potential for direct contamination of water resources and these no treatment zones absorbs any movement without noticeable effect on aquatic vegetation.

Road maintenance and brush control can adversely affect water quality through removal of vegetation and litter cover; compaction, exposure and disturbance of soils. Road maintenance benefits nearby water resources by minimizing soil movement, ensuring that drainage culverts are functioning properly and that road banks maintain adequate vegetative cover. Although maintaining roads would contribute to sediment movement because it involves disturbing the soil, mitigation measures would minimize any negative impacts. Long term benefits such as reduction of erosion, sediment and concentrated flow occur when roads get proper and regular maintenance.

No road construction or reconstruction is proposed with the project. Approximately 22 miles of system road maintenance and 0.3 miles of temporary road construction would produce sediment through grading and ditching. Adverse water quality impacts from temporary road construction and use for timber harvest activities are typically short-lived, occurring at the highest levels during and for a few years after construction. Temporary roads are closed after harvest and impacts decrease in intensity as the road surface and cut-fill slopes stabilize, and roads revegetate following completion of activities (Fulton and West, 2002; Gucinski et al., 2002). Maintenance of roads and culverts would benefit hydrology and stream water quality by ensuring that drainage culverts function properly and that the road bank maintains an adequate vegetative cover.

The natural variation in water yields and short-term changes in water quality would occur in response to storm, fire, and beetle activity to the same or similar extent as the no-action alternative. In addition, harvesting outlined in these proposals could potentially affect water quality, water quantity, channel morphology and downstream beneficial uses temporarily, in the short run. These effects are minor to miniscule at watershed scales. Short term changes in water and sediment yields would return to normal as sites are re-vegetated.

Erosion, sediment and sediment concentration estimates were made on the combination of proposed treatment activities including the opening of closed roads and closing them after use. Approximately 1,275 acres of activities occurred; usually more than one activity occurred on one acre, resulting in double counting of acres in this amount. The amount of estimated erosion over a decade for the proposed actions was 1,760 tons, sediment delivered was 598 tons, and mean sediment concentration increase of 0.35 ppm over the decade for the 1,275 acres treated. Sediment increases associated with activities would be relatively temporary to short term. As drainage areas increase below activities, the increases would also decline with both dilution and sediment being deposited on floodplains as sediment delivery ratio declines as watersheds get larger.

The Long Cane Creek Fork of Thurmond Lake would have a temporary to short term sediment increase of about 2%, while the other four sub-watersheds have increases of less than 1 percent. Much of this sediment increase would occur during severe events that occur

infrequently, so sediment increases would be difficult to detect in normal day-to-day observations or monitoring. Sediment values reported that reach the perennial streams are going to be substantially reduced before reaching their outlets or Thurmond Lake.

Cumulative Effects of Alternative 2

Other past, present and foreseeable future activities within the project area watersheds mentioned in Alternative 1 that also have a potential to interact cumulatively to affect water resources include herbicide release, SPB suppression and control activities, invasive exotic plant control, system, county, state and special use road maintenance, temporary road construction and maintenance, timber sale activities, prescribed burning, gully restoration/rehabilitation, various types of land uses associated with forestry, agriculture, rural and urban development, golf courses and lake management.

Timber harvest would also be conducted as part of SPB suppression, and control. SPB control efforts occurring before the timber sale could result in the harvest of trees that would ordinarily be harvested during the RPA timber sale. SPB control efforts occurring after the timber sale could result in the loss of potential seed-trees in regeneration areas or openings created in overstocked stands where intermediate and first thinning are proposed. Temporary road construction to access SPB outbreaks and routine road maintenance would result in more soil disturbance and the potential for increased erosion and sediment yields.

Prescribed burning following re-vegetation by understory species would increase potential runoff and higher water yields. A low intensity burn would minimize this. Generally, during low intensity surface burns, woody vegetation recovers quickly along with warm season grasses. Prescribed burning would not be conducted in the regeneration areas in the short term.

Some past and current projects within the affected project area watersheds involve the use of herbicides for selective release and non-native invasive plant control. Herbicide would be applied by on-the-ground, foliar and cut surface application methods. These methods would reduce the potential for drift or accidental contamination of non-target areas. Herbicides used would degrade in the environment after application, leaving a limited window for cumulative adverse effects from other herbicide use projects.

Soil loss is the amount of soil movement off site. Only a small portion is typically transported into streams for each of the activities. The length of time for site recovery was adjusted from normal timber sale activities that typically have a greater duration (Dissmeyer and Stump, 1978). The recovery time should be less than indicated because BMPs and Forest Plan standards and guidelines would be followed. The erosive effect of water is reduced by quickly re-establishing vegetation on highly impacted areas such as skid trails and log landings.

The composite sediment concentration for the five sub-watersheds increased 0.35 ppm over the decade from implementing the proposed actions. At the sub-watershed scale, this change is negligible. The concentrations indicated are those associated with small perennial streams, and do not take into account the reduction in sediment delivery from about 34% to 13-17% expected as drainage size increases from 3rd to 4th order drainages (typically hundreds of acres in size) to sub-watershed scale (sixth level HUCs or 6th-7th order drainages that are 10,000 acres or more in size).

Activities on Private Lands

The majority of the RPA watersheds, including interspersed private lands, consist of closed canopy evergreen forest/woodland. Timber harvest activities on private lands are expected to contribute to both short-term and long-term adverse impacts to water resources in the RPA watersheds and would interact cumulatively with the proposed vegetation management activities. Overall, these adverse impacts are not expected to be significant since the majority of the watershed is forested, providing protective buffers along streams and wetlands. The implementation of BMP is relatively well accepted as a standard practice on private land and aids in the protection of water quality. Loggers are often trained in BMP implementation. The potential for timber harvesting under Alternative 2 to cumulatively contribute to adverse impacts on water resources would be minimal over the short-term.

Table 3.1-4. Stream and Road Notes in the Reedy Project Watersheds

Compartment	Stand	Stream comments	Additional road affect
222	6	Intermittent stream dissects unit in and along eastern boundary, maintain a 50 ft. buffer on both sides from edge of scour until stream scour is not located.	Reopening rd. will produce minimal additional sediment, be sure to keep vegetation on the drainage to the north, effects should be minimal and short term., revegetate road after closure. Drainage problems need to be addressed.
222	10	Tanyard Branch outside northern boundary of unit, maintain 100 ft. buffer from edge of scour.	Crossing Horton Branch, no additional effect,
226	2	Intermittent stream dissects the southern border; maintain a 50 ft. buffer on both sides of stream scour until stream scour is not located.	No additional effect.
227	2	No stream observed	No additional effect
227	10	Intermittent stream dissects unit in and running along eastern boundary, starting at the stand boundary and Rd. L227-1; maintain a 50 ft. buffer on both sides from edge of stream scour.	L-227-1 runs parallel with small drainage. If temp road is constructed on NW side, proper BMPs apply to stream crossing.
227	13	Intermittent stream dissects unit and running along the eastern boundary. Maintain a 50 ft. buffer from edge of stream scour. Probable ephemeral drainage on west side of stand	Needs access point, and may need temp road, avoid western boundary of stand, minimal effects.

234	9	Perennial stream, Vall Branch, on southern stand boundary and possible wetland area on southern and southeastern boundary, maintain a 100 ft. buffer for both stream and any wetland area.	No additional effect.
235	4	Intermittent stream outside western boundary, stay within stand boundary.	No additional effect.

Compartment	Stand	Stream comments	Additional road affect
235	8	Intermittent Stream outside western and eastern boundary, stay within stand boundary. Possible wetland area all along southern boundary, if so, maintain 100 ft. boundary from high water mark.	No additional effect.
236	4	Stay within stand boundary.	No additional effect.
236	7	Intermittent stream outside western and eastern boundary, stay within stand boundary. If stream is on eastern boundary maintain a 50 ft. buffer.	No additional effect.
238	1	Intermittent stream outside western and eastern boundary, stay within stand boundary. Perennial stream outside southern boundary, stay within stand boundary.	Road 565 needs standard maintenance work plus extra work around bridge over Linkay creek.
238	5	Intermittent stream outside or on western and eastern boundary, stay within stand boundary and/or create 50 ft. buffer. Perennial stream outside southern boundary, stay within stand boundary and make sure to have a 100 ft. buffer from high water mark on stream.	No additional effect.
238	8	Intermittent stream outside western boundary, maintain a 50 ft. buffer. That stream flows into a perennial stream on the southern border which also has a wetland area, maintain a 100 ft. buffer on both Linkay Creek and the wetland area. Perennial stream on the northwest border, maintain a 100 foot buffer from the high water mark. Thurmond lake on the southwest border, maintain a 200 ft. buffer from the high water mark.	No additional effect.
240	1	Perennial streams a possible wetland area on the eastern and southern boundary, respectively; maintain a 100 ft. buffer on both areas from the high water mark.	Will produce minimal additional sediment, be sure to keep vegetation on the drainage to the north, revegetate after closure.

Compartment	Stand	Stream comments	Additional road affect
240	7	Thurmond lake on the southern boundary, maintain a 200 ft. buffer from the high water mark. Possible intermittent/ephemeral drainage on the center portion of the southern boundary, maintain a 25 ft. boundary from any scoured stream.	No additional effect
241	9	Intermittent stream outside western boundary, stay inside stand boundary.	No additional effect
241	17	Intermittent stream near western and eastern boundary, maintain a 50 foot buffer from the high scour mark on both sides of channel.	If temporary road is needed, make sure it is a good level site. Address drainage issues.
254	5	Thurmond Lake surrounds all sides except eastern boundary; maintain at least a 100 ft. buffer from high water mark of the lake.	No additional effect
254	12	Small section of western boundary is on Thurmond Lake, maintain a 200 ft. buffer. The Northern boundary is possibly wetland area, maintain a 100 ft. buffer from wetland area.	No additional effect
256	1	Intermittent stream dissects the southern boundary and intermittent stream is outside a small section of the eastern boundary, maintain a 50 ft. boundary on all sides of the streams.	Only open and rework S-33-391 to the extent of the stand. No additional effect
256	9	Intermittent stream outside the eastern boundary, maintain 50 ft. buffer from high scour mark. Topography is somewhat steep (~22%) on/outside the eastern boundary.	Good for temp road through stand. There is an unmapped/unnamed road on southern boundary with three stream crossings, if road is utilized apply all proper BMPs. Rd S33-391 stops at northern edge of stand.

3.1.2 Soils

Introduction

Soil is the unconsolidated mineral or organic material on the immediate surface of the earth that serves as the natural medium for the growth of land plants. A productive soil can sustain biological productivity, maintain environmental quality, and promote plant and animal health. This project is designed to promote better distribution of early successional state/age classes to benefit wildlife habitat and improve vegetative diversity. The purpose and need identifies the replacement of older mature stands that are high risk to mortality from insects and disease, replacing them with young, vigorously growing stands. Treatments would also create opportunities to restore, enhance and protect forest ecosystem components in the project area.

While natural disturbance agents such as wildfires, insects and diseases have the potential to affect soil productivity, the treatments of this project also have the potential to affect soil productivity. The purpose of this section is to investigate and disclose the potential effects of each alternative on soil productivity and to document compliance with the regulatory direction and applicable laws. The primary concerns with regards to the proposed actions are the impacts of erosion, compaction and loss of organic matter.

Regulatory Framework

Laws and regulations provide direction for the management and protection of individual resources. Forest Service manuals and handbooks, forest plans, and BMPs identify the methods and guidelines that individual actions must follow to comply with the laws and regulations. The applicable regulatory framework that provides direction for the protection of soil productivity comes from the following:

- Land and Resource Management Plan, Sumter National Forest, 2004
- Forest Service Manual 2500 (WO Amendment 2500-90-2)
- Multiple-Use Sustained-Yield Act of 1960
- National Forest Management Act of 1976
- Region 8 Soil Quality Standards, FSH 2509.18-2003-1
- South Carolina’s Best Management Practices for Forestry (BMPs), 1994
- Region 8 Soil and Water Conservation Practices (SWCPs) Handbook, 2003

Affected Environment

Soil Characteristics, Potentials, and Limitations to Management

The Reedy Project Proposed Action identifies treatment units on a total of approximately 1,275 acres. The Project area is located within the boundaries of the Long Cane Ranger District, and occurs on forest lands that vary in elevation, aspect, slope, soils, disturbance history, and resilience to disturbance. These lands are typical of the Piedmont area, having a past history of intensive agriculture that created conditions causing accelerated erosion and the

loss of original topsoil. Some reports and studies identified the loss of several inches to several feet of the productive topsoil layer, washing into nearby streams.

Ecologically this area is situated in the Southern Appalachian Piedmont Ecological Section (231A), identified in the Forest Service National Hierarchical Framework of Ecological Units (Cleland et. al. 1993). The Piedmont Section is a lower level of the Subtropical Division (230), marked by high humidity (especially in summer) and the absence of cold winters.

Southern Appalachian Piedmont (231A): irregular plains with smaller areas of high hills and tablelands, elevation range from 330 to 1300 feet; average annual precipitation from 50 to 60 inches; soils are udults, with some areas severely eroded as a result of past intensive agricultural practices. Soils have a thermic temperature regime and a udic soil moisture regime. Dominant soil series on uplands in the Section include Cecil, Davidson, Madison, and Pacolet. Subsoils are typically fine or clayey textured, increasing the potential for erosion or compaction.

Table 3.1.2-1 displays the dominant soil series that have been mapped by soil scientists in the project area stands. The data in Table Soils 3.1.2-1 is based on soil survey data in the Forest GIS soils coverage, surveyed by the Forest Service and Natural Resources Conservation Service.

Table 3.1.2-1 Soil Mapping Units in Proposed Treatment Areas

Soil Series Name Map Unit Symbols	Acres in Project Area	% of Project Area	Slope Percent for Mapping Units	Brief Soil Description (Depth of soil material over bedrock, soil drainage class, surface / subsoil texture)
Cataula 8B2, 8C2	55	4	2 to 6	40-60 inches, well drained, sandy loam / sandy clay loam
Cecil 10B, 11B2, 11C2	800	64	2 to 6, 6 to 10	>60 inches, well drained, sandy loam / clay and clay loam
Davidson 16B	11	1	2 to 6	>60 inches, well drained, loam / clay
Georgeville 26C2, 53D2	110	8	6 to 10	>60 inches, well drained, silt loam /clay
Gundy 52D2	25	2	10 to 15	40-60 inches, well drained, silt loam / clay loam
Hiwassee 32B2	8	1	2 to 6	>60 inches, well drained, sandy loam / clay
Mecklenburg 41B2, 41C2, 41D2	62	4	6 to 10	20-60 inches, well drained, loam / clay
Pacolet 44D2, 44E2	72	5	10 to 15	>60 inches, well drained, sandy loam / clay loam

Rion 47C2, 47D2	3	1	10 to 15	40-60 inches, well drained, loamy sand / sandy clay loam
Toccoa 49	27	2	0 to 2	>60 inches, well and moderately well drained, sandy loam / loam; inclusions of poorly drained soils
Winnsboro 23C2, 23D2	71	5	6 to 10, 10 to 15	40-60 inches, well drained, sandy loam / loam

The project area is located in one soil survey area, Greenwood and McCormick Counties, published in 1980 cooperatively by the USDA Forest Service and USDA Soil Conservation Service (renamed the Natural Resources Conservation Service or NRCS). The mapping data for National Forest lands is available in a Forest GIS data-base and the NRCS Web Soil Survey website.

One soil series is mapped along streams and in riparian areas, the Toccoa series. These delineations typically occur on gently sloping to nearly level valley bottom landscapes along small to medium perennial streams. This landform position is subject to occasional to frequent flooding events of short duration, typically from October to May. Delineations of poorly drained soils that may classify as hydric soils can also occur in small inclusions in the project area, and could potentially be regulated by Section 404 regulations of the federal Clean Water Act, depending on the activity.

Dominant soil series on upland landforms include Cataula, Cecil, Davidson, Georgeville, Hiwassee, Pacolet and Winnsboro, which occur on side slopes and ridges. These series are characterized as having deep to very deep soil material (40 to 60 inches or more to bedrock), well drained, and moderately permeable with clay or clay loam textures in the subsoil. These soils developed in materials weathered from granite and gneiss, low in bases and natural fertility. The hot temperatures and high rainfall leaches out most of the bases, leaving materials high in iron oxides, resulting in the red color common to Piedmont landscapes. These bright red colors are also evidence of soils that are well drained and low in organic matter content, affected by the warm, humid climate. These soils are considered, however, to have high productivity for forest tree species, e.g. loblolly pine rated at 65 to 80 on soil survey site index ratings.

During soil survey mapping, soil scientists traverse the landscape to sample, classify and map soils into survey mapping units. Key soil properties evaluated during survey include slope gradient, soil depth to bedrock, soil texture and structure, soil drainage, landform position, and other physical properties that could influence soil productivity and management. Landform features that may limit use and management are also noted; e.g. gullies and stony areas. These characteristics are generally measured in the field setting, recorded on data sheets, and mapped on a photo imagery base map. Slope gradients on soil mapping units in the project area range from 0 percent (floodplains) to 15 percent (side slopes). The majority of the soil map units are on slopes ranging from 6 to 10 percent.

Environmental Effects

Scope of the Analysis

The geographic boundary used to assess direct effects to soils is the activity areas or locations where treatments such as tree removal, temporary road construction, mechanical site preparation and road maintenance are proposed (refer to maps of Proposed Action for locations). The analysis area for soils encompasses all land within an individual treatment or activity area. In general, soils outside the boundaries of the activity areas are not expected to be directly, indirectly, or cumulatively affected by this proposal. This boundary was chosen because it can be used to determine threshold effects to soil quality from the proposed actions. For instance, the direct effects from a log landing would be the acreage used for the landing because it is the acreage of soil directly impacted by the activity.

The following activities or disturbances could potentially affect soil productivity:

- Harvest operations and associated log loading/landing areas
- Construction, maintenance, and closure of temporary roads
- Maintenance of permanent system roads
- Mechanical site preparation with roller drum chopper
- Removal of residual loblolly pine seed trees 3 to 5 years after initial harvest

These activities have the potential to detrimentally disturb the soil and affect soil productivity through erosion, compaction, rutting, displacement, and loss of organic matter and ground cover.

Based on direction from the applicable laws and regulations this report focuses only on those disturbances that have the potential to affect soil productivity. For example, soil erosion is discussed here only as it relates to soil productivity.

Soil productivity is described as the output of a specified plant or group of plants under a defined set of management practices, or total plant mass that is produced annually per unit area. The most productive part of the soil occurs near the surface at the contact between the forest litter and the mineral soil. This is also the part of the soil that is easiest to disturb during management activities. Therefore, the analysis of activities was limited to this most productive portion of the soil. Evaluation of deeper soil layers and underlying parent material was used only to determine how they influence the productivity of upper soil layers.

As discussed above, the Regional Soil Quality Standards (R8 Supplement 2509.18-2003-1) were designed to be applied at the level of the individual activity areas, or project level. These activity areas serve as the geographic boundaries for this analysis. For harvest operations, the activity areas are described as the actual treatment units and any associated temporary roads and log landings. For these activities, the intent of this analysis was not to assess the existing site conditions and effects to the soil productivity across the entire “project area”. Rather, the

scope of this analysis was narrowed to assess the existing site conditions and effects to soil productivity within the immediate vicinity of the proposed management activities.

The soil quality standards are not applicable to intensively developed sites, e.g. permanent system roads or developed recreation sites. These sites are considered as essential infrastructure, not part of the productive land base and are managed for other purposes. They are not intended to prohibit other resource management practices such as, installing water bars or preparing sites for planting, as long as such practices are consistent with long-term sustainability of the soil resource. Permanent roads do have the potential to affect soil-hydrologic function.

Concerning the temporal boundaries, the temporal scale is dependent on the specific issue being addressed with no one scale being appropriate in all issues. The analysis may need to evaluate the effects of proposed management over all seasons for several days, years, decades, or perhaps centuries. Generally, detrimental effects on soils are not permanent and depend primarily on soil texture, parent material, aspect, and level of compaction. For this project, field assessments detected soil disturbance up to 40 years in the past and the effects of the proposed management activities can be estimated to be about 5-10 years into the future.

The temporal boundary used to assess effects would vary depending on the activity. Short-term effects from: (1) increases in soil moisture from harvesting may last a year or two until new vegetative growth occurs; or (2) disturbance or mixing of the soil organic horizon which may disrupt decomposition processes for a few weeks or months. Long-term effects of five to over 50 plus years may result if the highly productive upper layer of soil is compacted or displaced. For example, soil displacement or soil compaction could result from skid trail development and use. This may remove the organic matter and available nutrients in the upper layer of the skid trails and affect water infiltration. The effect of this may persist from the time of use of the skid trails begins until three to five years when timber harvest activities are completed and soils are ripped and vegetated; or, if compacted soils on the skid trails are not ripped after use, impacts to soil productivity on the skid trails may persist for 40 to 70 years.

Methodology

Field visits by Forest Service personnel, Geographic Information System data, records of past activities, and information from the soil surveys for the Long Cane Ranger District were used to evaluate the impacts of proposed activities. The description of anticipated impacts to the soil resource was based on the sensitivity of the soils in the project area and the amount of soil proposed activities are likely to disturb. Forest Service Handbook FSH 2509.18 Soil Management Handbook R8 Supplement 2 soil quality standard 4.a states “At least 85 percent of an activity area is left in a condition of acceptable potential soil productivity following land management activities (USDA-FS-R8-2509.18, 2003). This is also stated in the Sumter National Forest Land and Resource Management Plan in Forest-wide standard FW-3: “Major soil disturbances that expose the soil surface or substantially alter soil properties such as temporary roads, skid trails, landings, and rutting would not occupy more than 15 percent of

forest vegetation management treatment areas except for chopping, watershed improvements, or other treatments during a rotation designed to reforest to suitable species or correct soil and water problems." To see if this threshold would be exceeded by the proposed Reedy Project activities, acres of soil impacted by soil disturbing activities (skid trails, log landings, and temporary road construction) were estimated using the best available information, and compared to the total acres of the activity areas (harvest units and road corridors).

Environmental Consequences Common to Action Alternatives

Soil Disturbance, Compaction, Productivity and Erosion: Risk of soil disturbance and site degradation exists whenever ground-based equipment is used in forest operations. The severity and areal extent of this disturbance can be managed (Miller 2004). Soil disturbance refers to a change in the natural state of a soil caused by an artificially imposed force (Arnup, 1998). Four basic steps can be analyzed to determine whether a proposed activity would cause adverse impacts to soil productivity:

- Determine what is detrimental disturbance caused by the activity
- Match equipment and best management practices to the site
- Minimize detrimental disturbance
- Ameliorate or rehabilitate detrimental disturbance where needed

In the application of silvicultural or timber management practices, detrimental soil disturbance is commonly recognized in the form of compaction, displacement or erosion, and rutting resulting from the use of ground-based harvesting equipment (Howes, 2006). Soils can be adversely impacted by activities such as building temporary roads and log landings, operating heavy equipment, skidding logs and piling slash. The amount of detrimental disturbance that occurs depends on soil moisture, slope steepness, complexity of topography, and rock content of the soil, depth of slash, season of harvest, skidding design, and type of equipment used, sale administration and the skill of equipment operators. Combinations of these factors affect the magnitude and extent of disturbance.

Disturbance of soils from management practices involving timber harvest, mechanical site preparation and reforestation would result in some form of physical, chemical and biological changes within the sites disturbed. Direct effects to the soils are changes/loss of soil organic matter content, soil erosion, soil compaction, and nutrient leaching and/or displacement. Indirect effects are accelerated weathering, loss of soil as sediment, alteration of organic matter formation, and alteration of soil permeability/water infiltration.

Skidding felled trees along skid trails to a log landing, and the landing/loading operations typically cause most of the soil disturbance in a harvest unit. This disturbance usually includes compaction, mixing of soil layers, and rutting during wet periods. Surface erosion within a harvest unit is typically limited because of the quantity of woody material left on the slope, which disperses overland water flows. Proper and timely installation of water bars and rehabilitating skid trails are best management practices (BMPs) that can reduce accelerated

erosion. These practices are implemented through Forest Service timber sale contract provisions.

Soil Compaction: Compaction increases soil bulk density and decreases porosity as a result of the application of forces such as weight and vibration caused by the operation of heavy equipment common to forest operations. Compaction can detrimentally impact both soil productivity and watershed conditions by causing increased overland flow during storm events and reduced plant growth due to a combination of factors including reduced amounts of water entering the soil and its reduced availability to plant growth, a restricted root zone, and reduced soil aeration. It is generally acknowledged that all soils are susceptible to soil compaction or soil porosity, particularly when wet.

Soil compaction is dependent on soil texture, organic matter, and soil moisture (McKee et al. 1985). Soil compaction causes increased soil density (weight per unit volume) or bulk density. This effect can hamper root growth, reduces soil aeration, and inhibit soil water movement. The lower the bulk density range, the greater the impacts to tree growth from soil compaction. Lighter textured soils (sandy) have a higher range bulk density compared to heavier textured soils (clay). Presence of organic matter and tree limbs and leaves can buffer soil compaction by providing support to equipment. Soil moisture content has a pronounced effect on soil compaction as it influences soil porosity. Identifying soils by surface texture, maintaining surface organic matter, and operating equipment under low soil moisture conditions (BMPs) would reduce the effects of soil compaction within the general forest and on skid trails used for thinning and restoration operations. Temporary roads would be compacted the greatest from multiple traffic use. Harvest technique can also reduce or increase the potential for soil compaction. Use of standard logging equipment (skidders) can compact the soils with as few as three passes over the same ground. Specialized equipment that reduces or disperses equipment weight, such as low-pressure tires, can assist with limiting soil compaction effects.

Within the Reedy Project area there are several soil types rated by soil interpretation standards as having a soil rutting hazard of severe, meaning there are soil properties that allow ruts to form readily. These soils have clay textured surface and subsurface horizons that would form ruts when soil moisture content is at or above field capacity – or saturation. This rating is based on standard NRCS/USFS soil rating criteria established in the National Forestry Manual (NRCS, 1998) and National Soil Survey Handbook (NRCS, 1996). Soil properties rated for compaction include soil texture, depth to water table, and percent rock fragments greater than 75mm in size.

This condition would occur after several days of rain, soils have not dried out and heavy equipment operates over the soils. Soils identified in the Cataula, Cecil, Davidson, Georgeville, and Pacolet soil series are rated as severe, occurring on over 80 percent of the proposed treatment areas. Compaction and rutting can be minimized by locating access routes on well drained terrain and by operating equipment during optimum soil conditions (dry) to minimize the occurrence of rutting (BMPs). Mitigation measures (BMPs) proposed for

Alternative 2 to minimize compaction would be followed in addition to Forest Plan standards and BMPs. The remaining 20 percent of the soils in the project areas have a moderate compaction rating, with a small amount of soils with a slight rating. Soil data identifying compaction hazard are included in the project file information for soils.

Use of special equipment (e.g. low psi) and/or operating under seasonally dry soil conditions, usually March through November, would aid in minimizing soil compaction caused by operations of conventional ground-based harvesting equipment within stands (BMPs). Harvest operations on stands rated as severe need to be conducted under dry conditions that usually occur late summer and early fall. Soil compaction can be expected on temporary roads, skid trails and log landings. Application of mitigating measures would assist in reducing the effects of soil compaction over a three to five year period. Full recovery can take as long as 20 years.

Soil Erosion: Soil erosion is recognized as potentially the most serious form of soil damage. Soil may be permanently lost and soil particles leaving this site may result in sediment in nearby streams which would impact water quality and possibly compromise aquatic habitats. Ground disturbing management practices influence erosion principally because they remove vegetative ground cover and often concentrate and channel runoff water. Research has shown that transportation system and associated impact areas of log decks and primary skid trails are the most common causes of accelerated erosion that occurs in forested watersheds (Gucinski et al., 2000). In addition, erosion rates would tend to remain greater on these areas for several years following their use due to altered soil structure and loss of infiltration.

A soil's susceptibility to erosion varies by soil type and position on the landscape. A slight or moderate erosion hazard indicates that standard erosion control measures such as installing water bars plus seeding and fertilizing roads or skid trails, and not exposing more than 20 to 30 percent of mineral soil in treatment areas, are sufficient to prevent excessive erosion.

Soils within the proposed treatment areas have erosion hazard ratings of slight to moderate for off-road or off-trail uses. This rating indicates that erosion is likely when soils lack ground cover to slow the velocity and concentration of overland water flow. Requiring Best Management Practices including erosion control measures, proper location of access routes, re-vegetation of bare areas and drainage controls would be recommended for ground disturbing activities to minimize the impact and maintain soil productivity and water quality.

Silvicultural practices such as harvesting trees are known to potentially affect the soil resource primarily through nutrient removal. Harvest in the proposed action alternative would involve removal of the mature saw timber trees, site preparation using roller drum chopping and a removal of residual seed trees three to five years later. Proposed seed tree harvest activities would harvest the stem only with tree branches and needles remaining scattered on site. Nutrient removal or restoration where harvesting the stem only, reduces nutrient removal by 50-60% (Pritchett and Fisher, 1979). Nutrient loss from stem removal is believed replaced by soil weathering and natural inputs (Grier et al., 1989, Jorgensen et al, 1971, Wells, 1971, and Pritchett and Fisher, 1979).

All proposed harvest units are expected to meet the Forest Plan standard and regional soil quality guideline of not exceeding 15 percent disturbance because portions of existing trails and roads would be utilized. This is feasible and would be required by the timber sale contract. In addition utilization of existing roadbeds and skid trails would allow for rehabilitation of those areas to be implemented under the timber sale contract.

Temporary roads constructed for access to proposed treatment stands and associated skid trails for thinning and restoration treatments are known to affect the soil resource primarily through nutrient removal, soil compaction and soil erosion. Nutrient loss is greatest on temporary roads since the organic layer and surface soil is removed in the process of construction and/or maintenance. Skid trails under a thinning operation usually do not remove organic or soil surface layers leaving nutrients in place. Primary skid trails (those with multiple passes) can be expected to remove organic layers and expose soils as high as 50 percent. Secondary skid trails, those with surface soils intact, can be expected to have loss of organic surface and soil exposure as high as 25 percent.

Direct and Indirect Effects of Alternative 1

There would be no new ground disturbing activities initiated in the Project Area, resulting in the least amount of direct erosion. Only undisturbed natural erosion would be expected to continue within the project area, however, a significant indirect effect due to the implementation of this alternative would be the effects that a wildfire could have on soil productivity in the area. Under this scenario, the No Action Alternative would represent the most detrimental situation as existing high fuel loadings along with more limited fire suppression equipment access into this area would equate to the most acres that could be affected by wildfires. In the event of a wildfire, the nutrient loss could be the most excessive of the two alternatives.

Cumulative Effects of Alternative 1

Alternative 1 would not implement any new activities that would directly or indirectly disturb soils. Soil erosion may occur as a result of existing conditions or activities, however cumulative effects would be minimal. Activities may occur on adjacent private lands that disturb soils, but effects would be primarily on those lands.

Direct Effects of Alternative 2

For moderately disturbed units, proposed activities in the project area would have long- and short-term direct negative effects on forest soils. Effects include:

- Compaction or rutting
- Erosion and displacement

Past effects from logging are detectable up to 40 or more years. The effect of proposed activities should be relatively short compared to techniques used in the past. If all natural

elements and processes remain intact, one can expect soil impacts to be nearly undetectable within 20 to 40 years.

Alternative 2 proposes to conduct silvicultural treatments on approximately 1,275 acres within the project area treating 23 stands. The proposed silvicultural system for these stands is the seed tree regeneration method, retaining loblolly pine seed trees. Four operations are described under this proposed action:

- Harvest mature, commercial value trees, leaving 10-12 trees per acre as seed trees
- Prepare a seedbed for regeneration between the seed trees using roller drum chopping to decrease competition and expose a limited amount of soil surface for seed germination
- Release desired species seedlings using imazapyr herbicide by hand application of foliar spray to target species leaf surfaces. The hack and squirt application method, using imazapyr and triclopyr herbicides, would be used on targeted vegetation greater than six feet tall.
- Harvest mature, residual loblolly pine seed trees in three to five years when the understory is fully stocked with desirable regeneration.

Ground and soil disturbances in these operations would occur on the harvested area, primary skid trails, log landing and loading areas and temporary haul routes for truck traffic to the landing.

Planning and design analysis has identified 0.3 miles of temporary roads would be needed in the stands to be treated. Less than one acre (@ 2.0 acres/mile disturbed for a 16 foot wide road) would be disturbed from the use of temporary roads. Access routes used in the previous harvest activity exist in most of these stands, and are available for use again if location and condition meet Forest Plan standards and BMPs. An estimated 50 to 60 individual log landings would be needed for loading and processing of logs during operations in these stands, disturbing about 25 acres @ 0.5 acres each. In total this would be about 26 acres of soils that could potentially receive detrimental disturbance within the project area or less than one percent of the total project area. Operations within the stands to remove commercial trees would require skidding to bring the trees into the log landings for loading. Skidding operations generally make two to three passes along skid trails; however they are generally not excavated to open the route. These trails typically have woody debris left on the ground surface to provide cover and minimize erosion caused by overland flow (BMP).

Design Criteria have been developed for Alternative 2 that would mitigate detrimental effects to soil in the treatment stands. These criteria, described in Chapter 2, Section 2.4, include #s 3, 4, 5, 6, and 7. Two common elements in these Design Criteria are the control of concentrated water that can contribute to erosion, and protection of existing areas such as gullies or streams that can be damaged by equipment or erosion.

Mechanical site preparation involves a wide range of activities designed to flatten and break up vegetation and/or loosen the soil. It is frequently used with chemical site preparation to prevent weedy vegetation from competing with newly planted pines. Site preparation must be planned very carefully because poorly planned site preparation not only wastes money but can severely damage wet or highly erodible soils.

To achieve an adequate seed bed for regeneration of pine seedlings, roller drum chopping is the proposed site preparation method for the Reedy Project stands. Chopping is a commonly used method, relatively inexpensive, easy to apply on sites, and requires a minimum amount of equipment. A drum chopper, displayed in the image below, is a large round steel drum with flat blades protruding at ninety degree angles. Its weight can be adjusted by adding water in the drum. It is typically drawn passively behind a rubber tired skidder or crawler tractor across the slopes. The blades sever any slash that the machine rolls over, thus packing the slash and increasing its density. This process breaks up and compresses any leftover slash, often used to facilitate drying for subsequent burning. Roots close to the surface of the soil can also be severed. Chopping retains a large amount of cover and debris on the soil, which can serve as a mulch or be burned to further clear a site for planting.

Impacts to soils from drum chopping include erosion, compaction, rutting, soil exposure to sun increasing temperature, and faster drying due to exposure. Drum chopping can also create numerous shallow indentations in the soil after a pass, creating a tillage effect reducing compaction and small catchments for water, which can be a positive impact.

Drum chopping operations should be avoided when soils are saturated or very wet due to the potential for rutting and compaction (BMP). Mitigation direction to minimize the potential for compaction and/or rutting during the site preparation treatments include design criteria described in Chapter 2, section 2.4. These include # 11 and 12, specifying no operation of choppers during saturated soil conditions.

Photo of Roller Drum Chopping Site Preparation (Photo Credit-USDA Forest Service, Region 2, Bugwood.org)

The last soil disturbing treatment proposed in this alternative is removal of the retained seed trees, planned when regeneration of desirable species is established to acceptable levels, within three to five years. This re-entry into the treatment stands would require use of harvest equipment, use of some skid trails, and operations in log landings, each causing some

additional soil disturbance, although minor when compared to the initial harvest actions. Revegetation of any disturbed areas would complete the activities in the stands under this proposal.

Implementation monitoring of forestry site preparation best management practices (BMPs) is an ongoing activity conducted in South Carolina under the direction of the South Carolina Forestry Commission, along with the USDA Forest Service as a cooperator. Surveys across the state on various practices and ownerships have documented compliance with the BMP direction and the resulting impacts to soil and water resources. Compliance rates of 92.0% were noted for mechanical site preparation methods (Adams, 1998). Sites with lower compliance for site preparation were generally on those with slopes exceeding 11%. The Reedy Project treatment stands are generally on slopes ranging from 6-10%.

Indirect Effects of Alternative 2

Many indirect effects are possible when soil conditions are compromised. Compaction can decrease water infiltration rates, leading to increased overland flow and associated erosion and sediment delivery to streams. Compaction decreases gas exchange (oxygen), which in turn degrades sub-surface biological activity and above ground forest vitality. Rutting and displacement cause the same indirect effects as compaction and also channel water in an inappropriate fashion, increasing erosion potential.

Timber harvest operations remove biomass and site organic matter and thus affect nutrient cycling. Generally, nutrient losses are proportional to the volume of biomass removed from a site. Nutrients are lost during harvesting by removing the stored nutrients in trees, and additional nutrients are lost if the litter layer and woody debris are removed, more common in whole tree harvesting systems. Amounts of nutrient loss from a site would vary with forest types and site conditions (Grier et al, 1989). The amount of nutrients present in the trees would also vary with stand age and development of the humus layer (Grier et al., 1989).

Indirect effects of soil nutrient loss include reduced growth and yield and increased susceptibility to pathogens, such as root disease and insect infestation. Precipitation and weathering of rocks would continue to make additional nutrients available on site. Annual needle, leaf, and twig fall, forbs and shrub mortality would continue to recycle nutrients as well.

To summarize, by maintaining organic matter and ground cover on at least 85 percent of the site, nutrient cycling and availability should not be altered. Site-specific design criteria, forest plan standards that include incorporation of BMPs are prescribed to achieve this desired outcome. Localized losses may occur at log landings or along some temporary roads.

Herbicide Use

Release of desired seedlings is proposed using imazapyr herbicide in hand applied foliar application in the proposed seed tree units (1,275 acres) during the first and third year after

harvest, primarily to release desired seedlings from competition to be free to grow. Herbicide application direction is described in the proposed action in Chapter 2. This treatment would have minimal effect on soils using a selective hand-applied foliar spray method. This application is targeted to the leaf surface or the stem for maximum effect. No soil disturbance would occur. A hack and squirt application, using a mixture of imazapyr and triclopyr, is also proposed for use on target vegetation greater than six feet tall.

Imazapyr is a foliar and soil active herbicide (absorbed by foliage, stems and roots) used to control trees, shrubs, vine, broadleaf and grass weeds. It degrades in soil, with a half-life of 25 to 180 days. Field studies indicate that imazapyr remains in the top 20 inches of soil and do not indicate any potential for imazapyr to move with surface water. Modeling results indicate imazapyr runoff is highest in clay soils, with peaks after the first rainfall. Triclopyr has an average half-life in soil of about 46 days. Warmer temperatures decrease the time to degrade triclopyr. It is weakly adsorbed to soil, though adsorption varies with organic matter and clay content.

Following the recommended application rates, and adhering to the Forest Plan standards for herbicide use and design criteria developed from the herbicide risk assessment, No damage or effect to soil productivity would be expected.

Cumulative Effects of Alternative 2

Effects from previous impacts, expected new impacts from harvesting operations or fuel treatments, and foreseeable future events combine to influence long-term soil productivity. The effects to long-term soil productivity as a consequence of the actions being proposed in the Proposed Action alternative relates to the cumulative effects from erosion, compaction, and displacement as noted above.

Effects of Timber Harvesting

By practicing a “light hand on the land” policy during all soil disturbance activities, by adhering to mitigation measures common to all action alternatives and following Forest Plan direction, long-term soil productivity would be maintained. In addition, fuel loadings throughout most of the analysis area would be reduced from timber harvesting and prescribed fire and the construction of temporary roads would improve overall access for fire suppression needs. These actions would reduce the probability of a future accumulation of fuels and wildfire hazard, which could impair long-term productivity.

Effects of Road Maintenance

All Forest Service system roads built in the past have a lasting effect on soil productivity due to compaction and displacement. There are approximately 23 roads or segments of roads identified for use in the project area, totaling 22.2 miles. Their maintenance for recreation, fire control, and vegetation management requires ongoing use, which results in compaction and displacement throughout the project area. Most of the system roads proposed for use in the

project stands need standard maintenance work, e.g. blading of the roadbed, clean ditches and culverts, add gravel when needed. These activities may increase short-term erosion and sediment movement from road surface runoff initially but should be minimal, especially on road segments that occur at upper slope landscape positions, low in road surface gradient, or at adequate buffer distances from stream channels. Road maintenance includes culvert installation, blading of road surfaces, and brushing along cut or fill slopes, and typically improves drainage and decreases erosion from water channeling down the road surface in the long run.

In summary, the proposed action alternative combined with all past, present, and reasonably foreseeable management activities would affect soil productivity in the project area. Foreseeable activities include timber harvest, National Forest system road management and maintenance, Forest recreation maintenance and management, and fire management. The combined effects of most future activities would cumulatively improve soil productivity, primarily by reducing impacts from roads, and improving forest health of the residual stands.

At the scale of the project area, the contribution of cumulative impacts by the Reedy Project would not be significant on soil productivity or the soil resource. Forest Service activities would meet standards for maintaining soil productivity through proper implementation of management requirements and the prescribed mitigation measures.

3.1.3 Air

Affected Environment

The amendments to the Clean Air Act establish Class I, II and III areas, where emissions of particulate matter and sulfur dioxide are to be restricted. The restrictions are most severe in Class I areas and are progressively more lenient in Class II and III areas. The Reedy project area currently meets Class II air standards per the Clean Air Act.

Direct, Indirect and Cumulative Effects of Alternative 1

No adverse impacts on air quality would be anticipated under this alternative.

Direct and Indirect Effects of Alternatives 2

Dust and emissions from heavy equipment and trucks would occur during the harvesting and transportation process. The amount of dust would be localized and minimal because it would not occur on a persistent basis. No significant impacts to air quality are expected either in the short or long term from logging operations.

Cumulative Effects of Alternative 2

Existing prescribed burning activities would continue on federal land around the project area. Overall, on the Long Cane District, about 8,000-10,000 acres are prescribed burned on an annual basis. Periodic prescribed fires including site preparation burns on private lands within the analysis area would have the potential to create temporary minor impacts to localized air quality.

Reasonably foreseeable vegetation management projects on the District that would utilize prescribed burning as described in the Piedmont Prescribed Burn EA (February, 2008) to manage fuels and vegetation are Curtail analysis area (AA), Watson Hill AA, Little Mountain AA, Lower Little River AA, Lower Long Cane Creek AA, Cuffytown Creek AA, Rocky Creek AA, Goldmine AA, Liberty Hill AA, Upper Turkey Creek AA, Byrd Creek AA, Lower Turkey Creek AA, Upper Stevens Creek AA, Forks AA, Martintown AA and Horn Creek AA. Generally, prescribed burn areas are scattered across the district and when considered together would not significantly affect air quality in any particular area.

Impacts on air quality are most frequent in the general burn area where large quantities of smoke can be produced over a short time period. Forest standards and guidelines allow prescribed burning only if conditions are favorable for smoke dispersal.

The results of air quality monitoring would be contained in the annual air quality monitoring report for the district. Based on Forest Plan monitoring, air quality standards are being met. Additional detailed discussion and analysis of the potential impacts from prescribed fire on air quality are discussed in the Guide to Prescribed Fire in the Southern Forests (U.S. Department Agriculture 1989b).

The carbon dioxide emission factor for prescribed fires ranges from 2,200 to 3,500 pounds per ton of fuel consumed (1098 to 1747 g/kg) (Sandberg and Dost 1990). Logging removes forest fuels from sites and can reduce the amount of carbon dioxide that would be released if the site burned.

The 2011 Monitoring and Evaluation Annual Report Revised Land and Resource Management Plan Sumter National Forest (Sumter Monitoring Report August 2012) summarizes information related to air quality on the Sumter National Forest (pages 42-48). Monitoring results for particulate matter near the Long Cane Ranger District is presented on page 44. Currently, all areas of the Sumter National Forest meet National Ambient Air Quality Standards (NAAQS) for fine particulate matter. Air quality would continue to be monitored on the Forest following current protocols and reporting would be done on a yearly basis. This would provide information on impacts and trends in air quality from management activities and the need for adjustments in the burning program on the District and Forest. The cumulative effects to air quality are not significant.

3.1.4 Climate Change and Carbon Storage

Affected Environment

The affected environment is considered at both the project and global scale. Global climate change may affect the natural resources on the Long Cane Ranger District and interfere with management objectives in the project area. The vegetation management activities proposed may affect carbon storage ability and influence global climate change.

Climate change scenarios predict that for the Southeast Region of the U.S., increases in temperature and drought occurrence could result in increased losses of carbon, possibly exacerbated by increased wildfire activity. The consequences of drought depend on annual and seasonal climate changes and whether the current drought adaptations of trees offer resistance and resilience to changing climatic conditions. The seasonal severity of fire hazard is projected to increase about ten percent over the next century over much of the U.S. with a 20 percent increase in fire hazard for the Southeast Region predicted.

The U.S. Global Changes Research Program published a 2009 report (USGCRP 2009) on climate changes on different regions in the U.S.. Predictions for the Southeast include: air temperature increases; sea level rise; changes in the timing, location and quantity of precipitation; and increased frequency of extreme weather events such as hurricanes, heat waves, droughts and floods. These predicted changes would affect renewable resources, aquatic and terrestrial ecosystems and agriculture, with implications for human health.

The Template for Assessing Climate Change Impacts and Management Options (TACCIMO) was used to assess climate change impacts on meeting desired conditions for the Reedy project area. TACCIMO report (February 2013) summarizes the resulting climate change impacts predicted to take place for the Southern Region of the U.S.. Climate change, especially climate change variability (droughts and floods), may alter hydrologic characteristics of watersheds with implications for wildlife, forest productivity and human use. This climate change variability may manifest itself in long-term and seasonal patterns in temperature that influence ecosystem health and function. These impacts result from both long-term warming and from shorter term fluctuations in seasonal temperature that may interrupt or alter temperature dependent ecosystem processes.

Direct, Indirect and Cumulative Effects of Alternative 1

In the short term, alternative 1 would result in no change to the current trend for carbon storage or release in the project area.

If climate change occurs, studies on longleaf pine (Pederson, Varner and Palik 2007) indicate that drought exacerbates mortality because increased evaporative demand reduces vigor, which predisposes trees to insect and disease. The same results would be expected for loblolly pine and hardwood species in the project area. Potential increases in wildfire activity would also add to this mortality.

Loblolly pine forests exist in areas once dominated by mixtures of hardwoods and shortleaf pine. Declines in agriculture, a result of losses in soil productivity has led to the establishment of loblolly pine across the piedmont. Dense, un-thinned/unmanaged stands of pine could be subject to moisture stress under drier climate conditions. There could be increased risk of Southern pine beetle mortality in project stands.

Past and present projects including periodic prescribed burning, pre-commercial and commercial thinning (pulpwood and intermediate) have reduced hazardous fuels, improved

growing conditions, and increased habitat diversity that includes the development of understory grasses, forbs and shrubs. Keeping already thinned stands at full stocking levels rather than letting them become overstocked and unhealthy would optimize the storage of carbon and reduce drought related mortality.

Potential gains and losses of carbon would be subject to changes in land-use, such as the conversion of forests to agricultural lands. Increased urbanization is occurring on private lands around the forest. However, national forest system lands provide for the long term management of forest areas, which offsets changes in land management and ownership patterns in the piedmont. Large shifts in land use are not expected to occur on private lands in the project area.

Direct, Indirect and Cumulative Effects of Alternative 2

Silvicultural treatments in the project area are aimed at establishing young fast growing loblolly pine stands and fostering desirable hardwoods scattered throughout the upland pine stands. Opening the forest canopy would result in increased growth rates/vigor on residual hardwoods and would lead to a proliferation of understory plant development of grasses, forbs and shrubs.

The rate at which trees take up or sequester carbon is directly related to growth. The total amount of carbon in a tree depends on its' size or total amount of biomass. Third growth forests like these contain less total carbon, but continue to take up and store carbon. Plantations with rotations of 50, 75 and 100 years, tie up 38, 44 and 51%, respectively of the carbon that an old growth forest stores, which is 240 tons per acre.

Typical management activities on both federal and private land such as prescribed fire, thinning and regeneration harvests that maintain a variety of forest ages may increase the overall ability of the forest to sequester carbon. Prescribed burning improves the resilience of forests to climate-induced disturbances such as a catastrophic wildfire which help sustain the current strength of the carbon sequestration ability of forests. Periodic prescribed burning results in less fuel availability for intense wildfires which means that the forest is not totally lost and most likely is able to keep on functioning as a carbon sink.

The action alternative would initially release carbon, leave fewer trees to store carbon, but would also create and maintain a herbaceous layer with a capacity for carbon storage and which may be more resistant to long-term climate change. At a global or national scale, the short-term reduction in carbon stocks and sequestration rates of the proposed project are imperceptibly small as are the potential long-term benefits. Therefore, the project would not significantly add to global climate change.

3.2 Biological Environment

3.2.1 Forest Vegetation

Affected Environment

Currently, ninety-nine percent or 5,141 acres of the total 5,412 forested acres within the project area contain loblolly pine stands with basal areas greater than 80 square feet per acre. High basal areas in loblolly pine stands have resulted in closed canopy conditions and increased susceptibility to southern pine beetle (SPB) attacks. Trees within these stands steadily compete for water and other nutrients. Most beetle infestations originate in stands that are under stress because of poor site conditions, adverse weather, overstocking or over maturity. Stressful conditions brought on by competition for vital resources such as water and other nutrients will continue to provide favorable conditions for future SPB infestations. Normally trees that are vigorously growing can withstand random low intensity attacks by the SPB. Currently approximately sixteen percent of the total Reedy Project Area (RPA) acreage is in the 61-70 age class, twenty-four percent is in the 71-80 age class, fifteen percent is in the 81-90 age class and eight percent is in the 81-90 age class. Loblolly pine is the dominant species in each of the previously mentioned ten year cohorts. Within the overall analysis area, eighty-three percent of the forested acreage is loblolly pine. Forty-four percent of the forested acreage within the 61-90 age categories is loblolly pine. It is anticipated that tree mortality would continue in overstocked and over mature stands within the RPA. Hardwoods can be found as inclusions within the pine stands. Additional hardwood areas of white oak (Quercus alba)-black oak (Q. velutina)-yellow pine (synonymous to loblolly pine) and white oak-red oak (Q. rubra)-hickory (Carya sp.) communities can be found along streams. The composition of these plant communities has been influenced by activities including, farming, timber harvest, insect and disease and both prescribed and wild fires. The shrub sub-canopy commonly consists of dogwood (Cornus florida), blackberry (Rubus sp.), sumac (Rhus sp.), hornbeam (Carpinus caroliniana), sourwood (Oxydendrum arboreum) and blackgum (Nyssa sp.), as well as seedlings and saplings of overstory species, including red maple (Acer rubrum), sweetgum (Liquidamber styraciflua), oak (Quercus spp.), and loblolly and some shortleaf pine (P. echinata). Oak species are usually found in combination with red maple. Releasing desirable oak and other hard and soft mast is a priority when found in competition with other species of trees such as red maple and sweetgum.

Understory vegetation can vary from location to location depending on the conditions present (i.e., soil conditions, amount of light penetration, hydrology, disturbance history). Understory vegetation in these areas may include greenbriar (Smilax sp.), poison ivy (Toxicodendron radicans), honeysuckle (Lonicera sp.), blackberry, and beautyberry (Callicarpa americana), as well as a variety of grasses and legumes.

Current Forest Age Class Distribution

Table 3.2.1-1

Major Age Classes and Acreages of Forest Stands Within the RPA		
Age Class	Acres (FSveg)	Project Area (%)
0-10	0	0
11-20	71	1
21-30	1204	22
31-40	312	6
41-50	405	7
51-60	105	2
61-70	345	6
71-80	1332	24
81-90	846	15
91-100	451	8
101-110	341	1

***This table is based on FSVeg data base analysis.**

Direct and Indirect Effects of Alternative 1

Outbreaks of southern pine beetle would likely continue in the mature and overstocked slow growing loblolly pine stands in the area (those greater than 50 years old). In severe epidemics, mortality would be expected in younger overstocked pine stands and the rate of spread would be faster. Beetle suppression activities approved in previous environmental documents would likely be successful in controlling outbreaks, but they would only be reactionary to beetle attacks.

Health and vigor of pine stands would not be improved with this alternative and desirable hardwood species such as oaks and hickory would be present though in low numbers due to overwhelming competition from early pioneering species. Understory vegetation consisting of shade tolerant red maple, elm, sweet gum and other species would continue to dominate stands in the area. Dense pine stands limits understory vegetation development and lacks variety of composition and structure which limits the value for wildlife. Early successional habitat (less than 10 years old) is also very limited in this area and would decline even more in the long term.

Cumulative Effects of Alternative 1

Past silvicultural treatments in the area have resulted in stands of loblolly pine that are overstocked. Beetle outbreaks are expected in the future as these stands continue to be overstocked and slow-growing. Drought stress along with other factors is a primary contributor to stand susceptibility to beetle attacks. Dead trees from beetle attacks would contribute to an increase in fuel loading and increase the danger of catastrophic wildfires. Suppression of southern pine beetle activity would continue on federal lands in the area in reaction to outbreaks. Salvage harvest operations would be implemented to control beetle infestations but are limited to stands that are accessible to logging equipment. Cut and leave operations may be performed on stands where access is an issue; however, market conditions during outbreaks may trigger cut and leave as a necessary control method in stands where access is not an issue.

Once a buildup of southern pine beetle occurs, adjacent well-managed stands may also be attacked. In the long term, there would be increasing risk to insect and disease activity as overall forest health declines. Natural development of early successional habitat would be limited mainly to catastrophic events such as insect outbreaks, wildfire and weather. Prescribed burning would control further understory development relative to the prescribed burn areas. Other areas that are not prescribed burned would continue to develop dense stand conditions. The quality of the habitat developed would be low since many understories and some midstories are dominated by shade tolerant species of red maple and sweet gum. These species would dominate for a long period of time with overstory mortality and would be costly to manipulate in order to develop desirable species of hardwoods and hardwood/pine combinations. Currently no stands are under age 13. Periodic timber harvest is taking place on private land in the headwaters and upper Long Cane Creek drainage. Private land timber harvesting is usually done on a shorter rotation age for economic returns and not necessarily for providing multiple use benefits. Other benefits from timber harvesting (such as habitat for wildlife) are usually secondary to these main objectives. Other land management activities in the drainage are expected to continue at current levels.

Direct and Indirect Effects of Alternative 2

The majority of the stands proposed for seed tree regeneration consist of loblolly pine stands that are greater than 70 years old. The stands are over mature, and as a result, are increasingly susceptible to mortality from pine beetle attacks and disease. Seed tree regeneration is the appropriate method of regeneration in the proposed stands, because there are enough available seed trees for adequate stocking. The initial seed cut during the seed tree method would remove the majority of loblolly pine. Residual pine seed tree density would leave approximately 10-12 quality trees per acre along with preferred hard and soft mast species over ten inches in diameter. Mast producing species outside inclusions and riparian corridors six inches to ten inches in diameter would be harvested in order to limit logging damage and encourage sprouting. Healthy shortleaf pines with full crowns, free of little leaf disease would be retained in order to maintain future restoration opportunities.

The seed trees would be left on site for approximately 3-4 years (the time it takes for a new stand to develop from the seed deposited by the seed trees). Seed tree regeneration would return the treated stands to an early successional stage, providing opportunities for species of

plants and animals that thrive in an open canopy environment. Early pioneering hardwood species would establish quickly in response to the newly opened canopy as well as in those areas reseeded after construction of log landings and skid trails. The dominant tree species would consist primarily of *Liquidambar styraciflua* (sweetgum), loblolly pine, sourwood, hornbeam, *Nyssa sylvatica* (blackgum), and *Acer rubrum* (red maple), with smaller percentages of shortleaf pine, southern red oak, white oak, and hickory. In general, forb coverage would be greatest within the first year of regeneration, while grass coverage would reach its maximum within the first four years (Miller et al., 1995; Schultz, 1997). The proportion of forbs and grasses would slowly decrease with the growth of shrubs and woody vegetation, as well as with the development of sufficient canopy cover (Miller et al., 1995; Schultz, 1997). Trees within two-hundred feet of Clarks Hill Lake would not be harvested.

Drum chopping in regeneration units would promote natural regeneration of pine and the establishment of younger age classes which are also lacking in the project area. Chopping also reduces the competition between pine and early pioneering species. Herbicides would be used to release selected trees.

Herbicide use would ensure release of crop trees in regeneration harvest units leading to the establishment of majority sapling size pine stands. Desirable crop trees would include hardwoods consisting of hard and soft mast species. This would add to species variety.

Regenerated areas would be surveyed to determine stocking levels approximately three years after the initial harvest, at which time these areas would be evaluated for additional treatment requirements. Release treatments are commonly employed in the southeast to help reduce competition from early pioneering hardwoods, such as sweetgum and to improve the growth of the regenerating stand (Muir et al., 1998; Schultz, 1997). Pine seedling growth is inversely related to the amount of competition from pioneering species and high levels of competition for light, nutrients, and water can increase the potential for damage from southern pine beetle attacks (Schultz, 1997).

Given adequate stocking (this is generally the rule rather than the exception (Cain, 1995)). The remaining pine seed trees would be eventually removed. Harvesting of the remaining seed trees would result in minimal damages to soils and vegetation during this early successional stage of development of the regenerating stand (Schultz, 1997).

Chemical release (hack-and-squirt and foliar method) would be used to control pine and early pioneering species development. Hard/softmast hardwoods along with loblolly pine are the preferred species to be left during chemical treatments. Some of the preferred species may be inadvertently sprayed during treatments. Triclopyr and Arsenal AC or equivalent active ingredients would be used to control early pioneering species such as red maple and sweetgum during the stand development process. Loblolly pine adjacent to a healthy hard/soft mast species such as oaks (*Quercus spp*.), hickories (*Carya spp*.), dogwood and blackgum would be sprayed. Green ash (*Fraxinus pennsylvanica*) is also a preferred leave tree species. Generally, in regeneration areas, the release work occurs during the first and third growing season. Survival checks would determine whether or when a release is needed.

As a result of the proposed treatments, regenerating loblolly and preferred hard mast and soft mast hardwoods would have greater seedling success, growth, and ability to resist pathogens and insect attacks, resulting in a long-term, moderate, beneficial impact on vegetation within the treatment sites. Overall, loblolly pine would remain the dominant species within the project area. However, the proportion of hardmast hardwoods would increase over time, enabling a greater number of hardwoods to eventually become established in the canopy.

Damage to advanced hard/softmast regeneration and mature hardwoods would occur during logging. Merchantable hardwoods such as sweetgum, red maple and elm would be harvested. Non-merchantable trees of these species would be sprayed or injected during chemical release activities following timber harvest. The majority of the advanced regeneration damage during logging would sprout back. Impacts on non-target vegetation would be minor, due to the use of direct foliar spray herbicide and the hack and squirt delivery methods (USDA, 1989b).

Skidding of trees would cause the most severe damage to hard/softmast advanced regeneration; however, this damage would only occur to trees near the skid trails. Felling of pine would cause the most damage to older hard/softmast trees. Damage to seedlings during seed tree removal would be limited to the seedlings within the established skid trail locations.

Design criteria would protect hardwood inclusions one-half acre and larger, riparian vegetation and limit disturbance from temporary road and skid trail crossings. Shade is provided by the canopy and leaf litter provides a long term source of organic matter recruitment to streams. Vegetation in riparian buffers traps eroded soil, reducing the amount that eventually reaches streams.

Trees marked for harvest would be cut using conventional logging equipment, then loaded on trucks and transported to a processing facility. During the harvest operation small trees and understory vegetation would be damaged and/or kill by the logging equipment. Some of the damage caused by logging equipment can be less severe, such as skinning or removal of some of the bark. Damaged trees can provide a vector for insect and disease to enter causing direct and indirect tree mortality. Seed tree regeneration (10-12) seed trees per acre is the appropriate method of regenerating the stands proposed for regeneration because, there is not enough preferred advance hardwood regeneration to adequately stock the new stand.

Cumulative Effects of Alternative 2

Leaving 10-12 trees/acre would expose the residual seed trees to wind throw during high wind events. Regeneration harvest would increase the amount of Open Canopy/Recently cleared from 0 percent to 23 percent on national forest system land within the Lower Long Cane Creek drainage. In order to increase the hard and soft mast component in the regeneration areas, it may be necessary to perform a mechanical release in the form of a pre-commercial thin 4-6 years following chemical release, because of the slow growth rates of the preferred hard/soft mast species. Overall within the Lower Long Cane Creek drainage this would represent an increase in open canopy habitat. These changes are small and insignificant. Given the large percentage of forested area in the drainage (75 percent) with past activities on federal and private land there is unlikely to be any reductions in this category in the foreseeable future. Forest management activities including thinnings and regeneration harvests on federal

lands would ensure maintaining healthy forested conditions and a sustained supply of forest products in the long term.

Prescribed burning occurs mostly on federal lands. This represents six percent of the Little River drainage. The effects on vegetation are considered an improvement because it adds to the variety of habitat found in the area and provides desirable conditions not found on private land. The effects are small and not cumulatively significant when considered in context to the vegetative conditions as a whole.

The seed tree regeneration areas would not be burned during the development of the new stand. Private land early successional habitat that provides habitat for wildlife is usually subordinate to other land management objectives of agriculture and timber. Habitat managed specifically for meeting long term wildlife objectives particularly for species associated with early successional grassland is found mostly on public lands. Late seral pine and pine/hardwood mixed forests are expected to dominate a majority of the landscape for the long term. Forest management activities on federal lands are expected to consist of intermediate and regeneration harvests on a portion of this acreage with the intent being to improve forest health and increase the variety, structure and function of forest ecosystems.

Other projects in the drainage include: use of herbicides to control non-native invasive species, road maintenance, southern pine beetle control, timber harvests and livestock grazing. Cumulatively these activities would not significantly impact the vegetation component.

3.2.2 Non-Native Invasive Plants (NNIS)

Affected Environment

A non-native invasive species (NNIS) is not native to the ecosystem under consideration and its introduction causes or is likely to cause economic or environmental harm. The Forest Service has identified NNIS as one of four critical threats to our nation's ecosystems. The goal of the Forest Service is to reduce, minimize, or eliminate the potential for the introduction, establishment, spread, and impact of NNIS across all landscapes and ownerships.

It is estimated that both plant and animal NNIS cause major environmental damages and losses that add up to almost $120 billion each year in the United States (Pimentel et al. 2005). Pimentel et al. (2005) also report that about 42% of all federally threatened and endangered species are at risk primarily because of NNIS.

NNIS threaten rare communities, habitat for rare and endangered species, timber and wildlife resources, and soil and water quality. NNIS plant infestations are most commonly found along forest edges and openings, old homesites, roadsides, wildlife openings, trail corridors and floodplains. Oswalt (2004) found that 40% of Forest Inventory and Analysis plots sampled in South Carolina contained at least one NNIS plant species, and that sites of high infestation were most often correlated with high moisture and/or high light.

The piedmont of South Carolina has a long history of intensive agriculture that created conditions causing accelerated erosion and the loss of original topsoil. Much of the Long Cane

Ranger District was established in the 1930s when the federal government acquired severely eroded and abandoned farmland. Because of the history of soil disturbance across the area, NNIS, which thrive on disturbed sites, are common on the District.

Several NNIS infestations have been documented within the Reedy Project. Table 3.2.2-1 lists non-native invasive plant species that are known to occur within or adjacent to the project area.

Table 3.2.2-1. Non-native Invasive Species (NNIS) located within or adjacent to the Reedy Project, Long Cane Ranger District, Sumter National Forest		
Common Name	**Scientific Name**	**Location (Compartment, Stand)**
Autumn olive	*Eleagnus umbellate*	C-235, S-4; C-236, S-4; C-236, S-7
Chinaberry	*Melia azedarach*	C-235, S-4
Chinese Privet	*Ligustrum sinsense*	C-235, S-4; Adjacent to C-241, S-17; C-254, S-12
Chinese Wisteria	*Wisteria sinensis*	Adjacent to C-226, S-2; C-235, S-4
Japanese honeysuckle	*Lonicera japonica*	Common throughout
Kudzu	*Pueraria lobata*	Adjacent to C-234, S-9

There may be other species of invasive plants that occur within or adjacent to the project area that were not documented during initial inventories. These include: Japanese stiltgrass (*Microstegium vimineum*), mimosa (*Albizia julibrissin*), non-native roses (*Rosa* spp.), periwinkle (*Vinca minor, V. major)*, sericea lespedeza (*Lespedeza cuneata*), and tree-of-heaven (*Ailanthus altissima*).

Direct and Indirect Effects of Alternative 1

Under the No Action alternative, seed tree regeneration, roller drum chopping of the seed tree units, herbicide treatment of seed tree regeneration areas, and connected actions (skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction, and erosion control measures) would not take place. As such, the introduction of NNIS within the project area – through management activities – is not expected to occur under the No Action alternative. However, NNIS may still be introduced within the project area through natural means, such as via animal-dispersed seeds.

Under Alternative 1, there would be no new ground disturbance or other management activities that would create conditions conducive to the introduction of non-native invasive plant species. While existing NNIS infestations could continue to spread under the No Action alternative, the rate of spread would be greatly decreased.

Connected Actions

Actions are considered connected if they: (1) automatically trigger other actions which may require NEPA documentation, (2) cannot or will not proceed unless other actions are taken previously, or (3) are interdependent parts of a larger action and depend on the larger action for their justification. Skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction, and erosion control measures are examples of connected actions. There would be no effects to NNIS related to connected actions since none would occur with the No Action alternative.

Cumulative Effects of Alternative 1

Typical ongoing activities in the Reedy Project area include timber harvesting, prescribed burning, wildlife habitat improvements and road maintenance. Any activity that results in soil disturbance or increased light availability along roads, trails, or in the forest can lead to NNIS introduction or the spread of established infestations. Additionally, NNIS infestations occur on private property adjacent to National Forest Land. This allows for the introduction and spread of NNIS to occur across ownerships. Considering the fragmented ownership pattern on

the Long Cane Ranger District, control efforts are often hindered by ownership boundaries. The level of infestation is not expected to increase or decrease under the No Action alternative.

Direct and Indirect Effects of Alternative 2

The proposed action (seed tree regeneration, roller drum chopping of the seed tree units, and herbicide treatment of seed tree regeneration areas) and connected actions (skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction, and erosion control measures) could lead to the introduction of NNIS and would likely spread existing infestations. Disturbed soils, increased light availability, and unintentional movement of invasive plant propagules on equipment would increase the chances of establishment and spread. It is possible that NNIS could spread from the roads into forest stands once timber is harvested. Skid trails and logging decks are also especially vulnerable because of their proximity to existing NNIS occurrences.

To mitigate these effects, the Sumter National Forest has an existing decision which provides for the treatment of NNIS across the Forest. Any existing or new NNIS infestations within the Reedy Project would be considered for treatment under this decision after careful consideration of District priorities for treatment.

Connected Actions

Skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction, and erosion control methods could all lead to an increased chance in the introduction of NNIS or the spread of existing infestations. As with the proposed action, any activity that results in disturbed soils or increased sunlight has the potential to spread NNIS.

Cumulative Effects of Alternative 2

Non-native invasive plants continue to increase throughout the state and few incentives exist for private land owners to control these species once established. However, opportunities exist for private and state landowners to cost-share with federal agencies to control invasive plants. Through the Wyden Amendment authority, the Forest Service can treat adjacent private or state lands when invasive plant populations pose a threat. Implementation of the proposed action would result in an increased threat of introducing or spreading invasive plants, and the cumulative effects of infestations on private land would have an impact on NNIS across the landscape. However, the existing decision to allow for NNIS treatments could be used to mitigate the effects.

3.2.3 Rare Plant Communities

Affected Environment

Rare plant communities are assemblages of plants that occupy a small proportion of the landscape but contribute significantly to plant diversity. Table 3.2.3-1 lists the rare communities that are recognized as occurring on the Sumter National Forest.

Table 3.2.3-1. Rare Plant Communities that occur on the Sumter National Forest

Rare Community Group	Rare Plant Community[1]
Bogs, Seeps, and Ponds	Piedmont Gabbro Upland Depression Forest
	Atlantic Upland Depression Willow Oak Swamp Forest
	Piedmont Low Elevation Headwater Seepage Swamp
Riverine Vegetation	Floodplain Canebrake
	Southern Piedmont Oak Bottomland Forest
	American Beech – Southern Sugar Maple/Common Pawpaw Forest
	Piedmont Triassic Basin Oak Bottomland Forest
Basic Mesic Forests	Basic Piedmont Mesic Mixed Hardwood Forest
Cliffs and Bluffs	Granitic Dome or Dome Woodland
Rock Outcrops	Granitic Flatrock
Glades, Barrens, and Associated Woodlands	Piedmont Blackjack Prairie
	Piedmont Diabase Barren
	Piedmont Acid Hardpan Woodland
	Piedmont Montmorillonite Woodland
	Xeric Hardpan Forest
	Mafic Xeric or Dry-Mesic Piedmont Oak Forest
	Mafic Shortleaf Pine-Oak Woodland
	Rich Granitic Lower Piedmont Deciduous Woodland
	Southern Inner Piedmont Mafic Barren
Abandoned Mines	

[1]Rare plant community definitions are based on NatureServe's "*Carolinas and Georgia Piedmont Vegetation*" (December 2001).

Three rare plant communities occur within or adjacent to the Reedy Project area. An "American Beech-Southern Sugar Maple/Common Pawpaw/Poison-ivy/Eastern Sedge Forest" occurs adjacent to a drain in compartment 227, stand 3. This association represents temporarily flooded levee forest in the piedmont, which is dominated by beech (*Fagus grandifolia*).

A stand of dwarf palmetto (*Sabal minor*) occurs in compartment 256, stand 1. This plant community most closely matches the "Piedmont Low Elevation Headwater Seepage Swamp" community, which is described as having saturated vegetation that is found in seepage areas, often on edges of floodplains or in headwaters of small steams in the piedmont of South Carolina.

A "Basic Piedmont Mixed Mesic Hardwood Forest" occurs adjacent to compartment 240, stand 1. Basic mesic forests are one of the rarest and most spectacular wildflower

communities in South Carolina (Porcher and Rayner 2001). The herbaceous layer of this community is a distinctive characteristic. Some herbaceous plants are disjunct from the mountains, some are typical of rich bottomlands, and some are found only in this community.

Direct and Indirect Effects of Alternative 1

Under this alternative, proposed actions (seed tree regeneration, roller drum chopping of the seed tree units, and herbicide treatments of seed tree units) and connected actions (skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction and erosion control measures) would not occur. Current management activities would continue in the project area.

Direct Effects

Direct effects are effects to the species known or assumed to occur in the proposed project area. They occur at the same time and place as the project activity. There would be no direct effects to any of the rare communities under this alternative since no activities would take place.

Indirect Effects

Indirect effects include the consequences of management activities that result in the modifications of habitat and ecological conditions. They are caused by the project activities, but are later in time or farther removed in distance. There would be no indirect effects to any of the rare communities under the No Action alternative.

Connected Actions

Actions are considered connected if they: (1) automatically trigger other actions which may require NEPA documentation, (2) cannot or will not proceed unless other actions are taken previously, or (3) are interdependent parts of a larger action and depend on the larger action for their justification. Skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction and erosion control measures are examples of connected actions. There would be no effects to any of the rare communities related to connected actions since none would occur with the No Action alternative.

Cumulative Effects of Alternative 1

There are other projects being implemented and/or planned on the Long Cane Ranger District that would continue under the No Action alternative. Projects include timber harvesting, prescribed burning for hazard fuel reduction and wildlife habitat improvement, road maintenance, and trail construction and maintenance. With the No Action alternative, no additional activities would take place so there would be no additional cumulative effects within the project area or across the district.

Direct and Indirect Effects of Alternative 2

Direct Effects

The rare plant communities in compartment 227, stand 3 and compartment 256, stand 1 are designated as hardwood inclusions and as such would not be directly affected by vegetation management practices. Forest Plan Standard FW-24 states: "In the piedmont, hardwood inclusions (1/2 acre in size or larger) in pine stands dominated by hard and soft mast producing trees (i.e., oaks, hickories, walnuts, black gum, black cherry, persimmon) will be retained."

The basic mesic forest adjacent to compartment 240, stand 1 would not be directly affected by the proposed action because it does not occur within the treatment area.

Indirect Effects

Regeneration of the adjacent timber would increase the amount of sunlight along the edges of the rare plant communities, potentially affecting soil temperatures, moisture availability, and vegetation composition. This could potentially have an adverse effect on the edges of the rare plant communities in compartment 227, stand 3 and the one adjacent to compartment 240, stand 1. The dwarf palmetto community in compartment 256, stand 1 would likely not be adversely affected, as this species generally responds favorably to increased sunlight.

Connected Actions

All connected actions would not take place within the rare plant communities. There would be no effect from skidding, decking, and hauling of logs, seed tree removal, and road maintenance and temporary road construction.

Cumulative Effects of Alternative 2

Most rare plant communities on National Forest land are identified and protected, either by Forest Plant standards and guidelines or project-specific design criteria. Many rare communities on private land do not benefit from such protective measures. Although rare plant communities would not be directly affected by project activities, the edges of some rare plant communities could be affected by adjacent harvest of timber. This effect may occur to other rare plant communities across the District, potentially contributing to some cumulative effects.

3.2.4 Wildlife (MIS)

Affected Environment

A wide variety of wildlife species occur throughout the Long Cane Ranger District of the Sumter National Forest. Wildlife habitat within the Reedy Project consists of loblolly pine and mixed pine-hardwood stands of varying ages, hardwood inclusions, some open habitats, and wildlife openings. Several understory species associated with the proposed treatment stands are important sources of food and cover for wildlife and also provide nesting habitat for some species.

Management indicator species (MIS)[1] are representative of the diversity of species and associated habitats. MIS can be used as a tool for identifying specialized habitats and creating habitat objectives and standards and guidelines. The MIS concept is to identify a few species that are representative of many other species, and to evaluate management direction by the effects of management on MIS habitats. Both population and habitat data are used to monitor MIS on National Forests. The 2004 Sumter National Forest *Revised Land and Resource Management Plan* (Forest Plan) lists 13 species as MIS; 12 are avian species and one is a mammal.

Trends in MIS populations are normally assessed relative to trends in their respective habitat. This section focuses on terrestrial MIS. Aquatic species are addressed in the Aquatic Communities section. Sumter National Forest MIS are listed in Table 3.2.4-1, along with general comments regarding their habitats. General discussions of these species and their relationship to monitoring can be found in the Forest Plan.

Table 3.2.4-1. Management Indicator Species (MIS) for the Sumter National Forest

Species	Habitats
Hooded Warbler *Wilsonia citrina*	Uses mesic deciduous forest with a shrubby understory; frequents dense thickets; fairly common in upland and bottomland woodlands
Scarlet Tanager *Piranga olivacea*	Uses mature deciduous forest and some mixed conifer-hardwood forests; requires large areas of forest for breeding
Pine Warbler *Dendroica pinus*	Uses middle-aged to mature open pine forest; seldom in hardwoods; overwinters throughout much of its breeding range
Acadian Flycatcher *Empidonax virescens*	Uses mesic sites with a diverse canopy structure; found in heavily wooded deciduous bottomlands, swamps, riparian thickets, and in the wooded ravines of drier uplands
Brown-headed Nuthatch *Sitta pusilla*	Uses open, mid-late successional pine (age classes over 20 years); not common in dense stands of pines; will overwinter
Prairie Warbler *Dendroica discolor*	Frequents brushy old fields, open pine stands, and other early successional habitats
Field Sparrow *Spizella pusilla*	Uses woodland, grassland, and savanna habitats; fairly common in old fields, open brushy woodlands, and forest edge habitats

[1] Management indicator species (MIS): A species whose presence in a certain location or situation at a given population indicates a particular environmental condition. Their population changes are believed to indicate effects of management activities on a number of other species or water quality.

Table 3.2.4-1. Management Indicator Species (MIS) for the Sumter National Forest	
Species	**Habitats**
American Woodcock *Scolopax minor*	Often found in shrub- and seedling-dominated regeneration areas in association with riparian areas; requires moist soil conditions for feeding
Pileated Woodpecker *Dryocopus pileatus*	Uses mature and extensive forests, primarily in deciduous forests; occurs in both deep woods and swamps as well as in rather open and upland forests; excavates nesting and roosting cavities
Northern Bobwhite *Colinus virginianus*	Uses fields, grasslands, brushy habitats, and open woodlands; significantly declining over most of its range due to habitat loss and changes in farming practices
Swainson's Warbler *Limnothlypis swainsonii*	Uses canebrakes and other early-successional riparian habitats
Black Bear *Ursus americanus*	Trends in population indices and harvest levels will be used to help evaluate the results of management activities on this high profile species
Eastern Wild Turkey *Meleagris gallopavo*	This species is most common in extensive bottomland forests where the understory is moderate; also occurs in extensive upland hardwood or mixed forests, less so in pine forests

Based on habitat within the Reedy Project and the biological requirements of the species, 12 MIS are considered and analyzed in this Environmental Assessment (EA). Black bear is excluded from analysis because it is rare on the Long Cane Ranger District. There is not a breeding population of black bear on the district; they only occur as occasional transients.

Vegetation manipulation changes the diversity and abundance of wildlife species in a given area. Planning regulations define diversity as "the distribution and abundance of different plant and animal communities and species within [an] area…" (36 CFR 219.3(g)). In general, forested areas that are in various stages of development and include periodic openings support a wide diversity of species and habitats. Management activities that result in different types of habitats, including prescribed burning, thinning, and herbicide use, tend to increase wildlife diversity. Impacts beneficial to wildlife are typically greater with a combination of management activities versus any of the treatments separately. Table 3.2.4-2 lists the MIS that occur or have habitat within the proposed project area. These are the species that are analyzed in this EA. Following the table are effects to these MIS by alternative.

Table 3.2.4-2. Habitat associations of management indicator species (MIS) that occur or have habitat within or immediately adjacent to the Reedy Project, Long Cane Ranger District, Sumter National Forest	
Habitat Association	**Species**
Early Successional/Disturbance Dependent	Prairie Warbler, Field Sparrow, Northern Bobwhite
Late Successional Pine	Brown-headed Nuthatch, Pine Warbler
Mixed Pine-Hardwood Forest	Hooded Warbler, Scarlet Tanager, Pileated Woodpecker, Eastern Wild Turkey
Riparian Areas	Acadian Flycatcher, American Woodcock, Swainson's Warbler

Direct and Indirect Effects of Alternative 1

Under this alternative, proposed actions (seed tree regeneration, roller drum chopping of the seed tree units, and herbicide treatments of seed tree units) and connected actions (skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction and erosion control measures) would not occur. Current management activities would continue in the project area.

Direct Effects

Direct effects are effects to the species known or assumed to occur in the proposed project area. They occur at the same time and place as the project activity. There would be no direct effects to any of the MIS under this alternative since no activities would take place.

Indirect Effects

Indirect effects include the consequences of management activities that result in the modifications of habitat and ecological conditions that affect food, water, shelter, and other biological requirements for a species.

MIS associated with Early Successional/Disturbance Dependent habitats (Prairie Warbler, Field Sparrow, Northern Bobwhite)

Additional habitat for these species would not be restored or enhanced under the No Action alternative. Prairie warbler, field sparrow, and northern bobwhite use open, early successional habitats that are maintained by frequent disturbance. Under alternative 2, regeneration harvests would benefit MIS associated with early successional/disturbance dependent habitats by providing 1,275 acres of short-term early successional habitat. Under the No Action alternative, this activity would not take place. Without seed tree regeneration, many stands within the project area would continue to develop into mature mixed pine-hardwood forests with dense midstories dominated by sweetgum and other shade-tolerant woody plants and little herbaceous vegetation on the forest floor. These conditions would not provide suitable habitat for early successional/disturbance dependent species.

MIS associated with Late Successional Pine (Brown-headed Nuthatch, Pine Warbler)

The No Action alternative would benefit those MIS that use late successional pine forests to meet their biological needs, since a mature and continuous forest canopy would be allowed to develop. However, over a prolonged period of time it is possible that senescent pine trees would become less vigorous, susceptible to insect outbreaks and disease, and replaced by sweetgum and other undesirable species, resulting in reduced habitat quality for brown-headed nuthatch, pine warbler, and other species associated with late successional pine.

MIS associated with Mixed Pine-Hardwood Forest (Hooded Warbler, Scarlet Tanager, Pileated Woodpecker, Eastern Wild Turkey)

The No Action alternative would benefit those MIS that use mixed pine-hardwood forests, since a more mature and continuous forest canopy would develop under this alternative. However, over a prolonged period of time the abundance of pioneering species within the project area would increase and would slowly replace pine and preferred hard mast species. This condition would be detrimental to these species.

MIS associated with Riparian Areas (Acadian Flycatcher, American Woodcock, Swainson's Warbler)

The No Action alternative would benefit MIS associated with riparian habitats. There would be no regeneration of stands adjacent to riparian areas, which could cause changes to riparian vegetation.

Connected Actions

Actions are considered connected if they: (1) automatically trigger other actions which may require NEPA documentation, (2) cannot or will not proceed unless other actions are taken previously, or (3) are interdependent parts of a larger action and depend on the larger action for their justification. Skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction and erosion control measures are examples of connected actions. There would be no effects to any of the MIS related to connected actions since none would occur with the No Action alternative.

Cumulative Effects

There are other projects being implemented and/or planned on the Long Cane Ranger District that would continue under the No Action alternative. Projects include timber harvesting, prescribed burning for hazard fuel reduction and wildlife habitat improvement, road maintenance, and trail construction and maintenance. With the No Action alternative, no additional activities would take place so there would be no additional cumulative effects within the project area or across the district.

Direct and Indirect Effects of Alternative 2

Direct Effects

Direct effects are not expected to occur to MIS. All MIS are highly mobile avian species that would relocate to undisturbed areas if they were displaced by proposed activities. However, it is possible that if any of these species were nesting during seed tree regeneration, roller drum chopping of the seed tree units, herbicide treatments, or connected actions, nests and nestlings could be lost due to the activities. These effects are considered minor since only a portion of the area would be managed at any one time. In addition, project activities would have to occur at the exact time when species are most vulnerable and also occur over successive years to have substantial impacts. This is unlikely given past management

practices. In addition, avian species will re-nest multiple times throughout the nesting season.

Herbicide treatments as proposed in this alternative are not expected to have a direct effect on MIS. While the use of some herbicides can have direct effects on wildlife by causing injury or mortality from direct spray, drift, or ingestion of contaminated food or water, the herbicides proposed in this alternative, namely imazapyr and triclopyr, are practically non-toxic to birds and other wildlife species (Durkin and Follansbee 2004, Durkin 2011).

Fletcher (1983a,b) found that no mortality to birds was observed at imazapyr concentrations of up to 5,000 ppm in the diet. These acute exposures were equivalent to average daily doses of 674 mg/kg in northern bobwhite (*Colinus virginianus*) and 1,149 mg/kg in mallard ducks (*Anas platyrhynchos*). Similarly, in 18-week dietary studies, no effects on reproductive endpoints (e.g., egg production, hatchability, survival of hatchlings) were observed at dietary concentrations of up to 2,000 ppm. These 18-week exposures were equivalent to average daily doses of 200 mg/kg in both quail and ducks (Fletcher et al. 1995a,b). The LD_{50}[2] of imazapyr for quail and ducks are both greater than 2,150 mg/kg (Fletcher et al. 1984a,b). Acute toxicity studies (5-day) found no adverse effects at dietary concentrations up to 5,000 ppm (Fletcher et al. 1984a,b). Imazapyr is rapidly eliminated in the urine and feces of animals, and is not known to accumulate in animal tissues. This herbicide is also not expected to bioaccumulate in the food chain (Durkin and Follansbee 2004).

The acute oral LD_{50} of triclopyr for mallard ducks and northern bobwhite are 1,698 mg/kg and 2,935 mg/kg, respectively (Tu et al. 2001). A one-generation reproduction study showed no reproductive effects, symptoms of toxicity, or abnormal behavior when mallards were given up to 500 ppm of triclopyr in their diet for a 20-week period, including ten weeks prior to egg laying and ten weeks during egg laying. Newton et al. (1990) predicted that triclopyr would not be present in animal forage in doses large enough to cause either acute or chronic effects to wildlife, and concluded that the tendency for triclopyr to dissipate quickly in the environment would preclude any problems with bioaccumulation in the food chain. Two field studies, Boren et al. (1993) and Schulz et al. (1992a), looked at triclopyr use in the range of application rates that may be used in Forest Service management activities. Both studies concluded that triclopyr applications had no adverse effects on birds. Additionally, Schulz et al. (1992b) suggested that some bird species would benefit from the application of triclopyr and other herbicides due to changes in vegetation that improved habitat conditions.

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[2] Acute toxicity is commonly measured by the lethal dose (LD) that causes death in 50 percent of treated laboratory animals (LD_{50}). LD_{50} indicates the dose of a chemical per unit body weight of an animal and is expressed as milligrams per kilogram (mg/kg). Chemicals are highly toxic when the LD_{50} value is small and practically nontoxic when the value is large.

Indirect Effects

MIS associated with Early Successional/Disturbance Dependent habitats (Prairie Warbler, Field Sparrow, Northern Bobwhite)

Seed tree regeneration and roller drum chopping would result in nearly immediate habitat for early successional/disturbance dependent MIS. Within one to two years post-harvest, native grasses and forbs would become established in the understories of these forest stands. MIS associated with early successional/disturbance dependent habitats would use these areas during their early stages of development. However, as the stands mature the quantity and quality of early successional habitat would decline.

Chemical release of desired seedlings during the first and third year after harvest would perpetuate early successional habitat in the short-term. However, like seed tree regeneration and roller drum chopping, this activity would only provide short-term habitat conditions that these MIS would use. Over time, forest stands would mature and become less suitable for species associated with early successional habitats.

MIS associated with Late Successional Pine habitats (Brown-headed Nuthatch, Pine Warbler)

These MIS use middle-aged to mature pine habitats, although pine warbler can be found in pine woods in a variety of age classes. Seed tree regeneration harvests, roller drum chopping, and herbicide treatment within seed tree units would remove mature pines, reducing habitat in the short-term for these species. Brown-headed Nuthatch is a year-round resident that nests in dead trees near or in pines. This species would take advantage of any standing snags left after regeneration harvests, but otherwise would have to move to other areas dominated by mature pines to nest.

MIS associated with Mixed Pine-Hardwood Forest (Hooded Warbler, Scarlet Tanager, Pileated Woodpecker, Eastern Wild Turkey)

Habitat for MIS associated with mixed pine-hardwood forests would be reduced with the implementation of seed tree regeneration harvests, roller drum chopping, and herbicide treatments as mature trees would be removed. Although availability of mixed pine-hardwood forest would decrease with these activities, this habitat type is not limited across the Sumter National Forest.

MIS associated with Riparian Areas (Acadian Flycatcher, American Woodcock, Swainson's Warbler)

Although seed tree regeneration, roller drum chopping, and herbicide treatments would not occur directly within riparian areas, implementation of the proposed action could adversely affect adjacent riparian habitat. Regeneration harvests could increase the amount of sunlight within adjacent riparian areas. This could increase vegetative competition and decrease moisture availability, resulting in modified riparian plant communities. This potential change

to riparian plant communities, and the change in microclimate, could result in a decrease in the quality and quantity of available habitat for those MIS associated with these areas.

Connected Actions

Connected actions include skidding, decking, and hauling of logs, 1,275 acres of seed tree removal, road maintenance and temporary road construction and erosion control measures. All these connected actions could temporarily disturb and, to some degree, displace all of the MIS. After the disturbance is over, however, these species would likely reoccupy the area. It is possible that nests and nestlings could be lost due to these activities. These effects are considered minor since only a small portion of the project area would be affected. Additionally, avian species will re-nest multiple times throughout the nesting season, so no significant decrease in MIS reproductive success is expected.

Cumulative Effects

Cumulative effects are effects to the species and their habitats over time, and consider past, present, and future actions. This cumulative effects analysis tiers to the *Management Indicator Species Population and Trends* (USDA 2001), which provides context for species and their habitats across the Sumter National Forest.

Typical ongoing activities in the Reedy Project include timber harvesting, prescribed burning, wildlife habitat improvements and management activities and road maintenance. Habitats for all MIS, with the exception of early successional/disturbance species and those species that use riparian areas, are generally increasing on the Sumter National Forest. The proposed action would increase short-term habitat for early successional species and would result in potential impacts to riparian habitats.

MIS associated with Early Successional/Disturbance Dependent habitats (Prairie Warbler, Field Sparrow, Northern Bobwhite)

All MIS associated with early successional/disturbance dependent habitats are experiencing population declines across their geographic range and on the Sumter National Forest. From 1992 to 2004, prairie warbler, field sparrow, and northern bobwhite populations on the Francis Marion & Sumter National Forests (FMS) declined 8.1%, 19.1%, and 10.0% per year, respectively (La Sorte et al. 2007). The most commonly accepted reason for decline is loss and fragmentation of habitat. The proposed action would increase breeding, foraging, and wintering habitat for these species.

MIS associated with Late Successional Pine habitats (Brown-headed Nuthatch, Pine Warbler)

Brown-headed nuthatch populations have increased 5.4% per year on the FMS from 1992 to 2004. Pine warbler populations have remained relatively stable (0.2% annual decline) over the same period of time (La Sorte et al. 2007). The population stability of these MIS is a reflection of the quantity and quality of available habitats on the Sumter National Forest. While implementation of the proposed action may result in short-term loss of late successional

pine forests, it should not affect the Forest-wide relative abundance of MIS that are associated with these habitat conditions.

MIS associated with Mixed Pine-Hardwood Forest habitats (Hooded Warbler, Scarlet Tanager, Pileated Woodpecker, Eastern Wild Turkey)

The populations of hooded warbler (0.6% per year decline) and scarlet tanager (1% per year decline) have remained relatively stable, with slight declines, on the FMS from 1992 to 2004 (La Sorte et al. 2007). This is likely because mixed pine-hardwood forests are abundant across the Sumter National Forest. While implementation of the proposed action may result in localized short-term impacts on these species, it should not affect their relative abundance across the Forest.

Trend estimates indicate that populations of pileated woodpecker are stable across the southeastern United States. This species uses extensive areas of late successional coniferous and deciduous forest. However, young forests that retain scattered, large, dead trees also provide suitable habitat. This species is versatile in utilizing various forest habitats and adapts well to human habitation. Habitat exists for pileated woodpecker on private property across the Piedmont, including in rural and suburban settings. There would be a short-term loss of habitat for this species with the implementation of the proposed action, but proposed management activities would perpetuate habitat for this species in the future.

Populations of eastern wild turkey suffered dramatic declines in the early 1900s. Aggressive stocking programs successfully reintroduced eastern wild turkey to most of its eastern range where populations continue to increase. This species uses upland forests of oaks, hickories, and pines as well as bottomland forest. Habitat management should center on maintaining mature bottomland hardwood forest, open upland forests, and scattered openings dominated by herbaceous cover. Under this alternative no management activities will occur within bottomland hardwood habitats, however harvest of adjacent stands could affect riparian habitats.

MIS associated with Riparian Areas (Acadian Flycatcher, American Woodcock, Swainson's Warbler)

Acadian flycatcher generally uses relatively undisturbed, mature, deciduous forests in riparian areas. This species has declined 1.2% per year on the FMS from 1992 to 2004 (La Sorte et al. 2007). American woodcock populations within the Piedmont region (Bird Conservation Region 29) have experienced a 2% annual decline from 1966 to 2011 (Sauer et al. 2012). Population trends are unavailable for the FMS because this species is not usually detected during annual bird monitoring. Swainson's warbler uses bottomland forests with a rich understory. They are often associated with extensive canebrake habitats. Swainson's warbler has experienced a positive population trend on the FMS, increasing 8.2% per year from 1992 to 2004 (La Sorte et al. 2007). Although project activities could indirectly affect riparian habitats, cumulative effects are not expected because of the small amounts of habitat that would be affected.

3.2.5 Proposed, Endangered, Threatened and Sensitive Species (PETS)

Affected Environment

Several proposed, endangered, threatened, and sensitive (PETS) plant and animal species occur throughout the Long Cane Ranger District of the Sumter National Forest. Habitat in the Reedy Project consists of loblolly pine stands of varying ages, hardwood inclusions, some open habitats and wildlife openings. For additional information and descriptions of affected environment for PETS species and associated habitats see the Environmental Impact Statement for the 2004 *Revised Land and Resource Management Plan Sumter National Forest* (Forest Plan).

A Biological Assessment/Biological Evaluation (BA/BE) was prepared to determine whether the Reedy Project is likely to affect any PETS species or habitats. The BA/BE is included in this Environmental Assessment (EA) as an appendix item and includes the complete list of PETS species for the Sumter National Forest. All species on this list were considered for this BA/BE. Using a step-down process and best available science, species and potential habitat in the project area were identified by:

1) Evaluating the location and nature of the proposed project;
2) Determining which, if any, project areas are within Management Area 1[3] (MA-1);
3) Reviewing District records of known PETS species occurrences, which includes records from the South Carolina Heritage Trust Geographic Database of Rare, Threatened, and Endangered Species;
4) Considering the species' range, life history, and available habitat information; and
5) Reviewing the US Fish and Wildlife Service (USFWS) Distribution Records of Endangered, Threatened, Candidate and Species of Concern (2011).

There are no known occurrences of any PETS species within the project areas. Wood stork (*Mycteria americana*), bald eagle (*Haliaeetus leucoocephalus*), indigo bush (*Amorpha schwerini*), piedmont aster (*Eurybia mirabilis*), sweet pinesap (*Monotropsis odorata*), Oglethorpe oak (*Quercus oglethorpensis*), Georgia aster (*Symphyotrichum georgianus*), lanceleaf trillium (*Trillium lancifolium*), and nodding trillium (*T. rugelli*) have potential habitat within or adjacent to some project areas. While potential habitat does not currently exist for Bachman's sparrow (*Aimophila aestivalis*), the project would provide habitat for this species. All other species on the Sumter National Forest PETS list are eliminated from further analysis because they are not known to occur or they lack habitat in the proposed project areas.

The USFWS Distribution Records list Carolina heelsplitter (*Lasmigona decorata*), Florida gooseberry (*Ribes echinellum*), and red-cockaded woodpecker (*Picoides borealis*) as occuring in Greenwood and McCormick Counties. Carolina heelsplitter and Florida gooseberry were

[3] Management Area 1 (MA-1) contains critical habitat for Carolina heelsplitter (*Lasmigona decorata*) and has been specifically designated to maintain or improve habitat for this and other freshwater mussels and aquatic species.

eliminated from analysis because they are not known to occur and potential habitat does not exist within the project area. The project area is not within MA-1 (applies to Carolina heelsplitter). Red-cockaded woodpecker was eliminated from the Sumter National Forest PETS list based on analysis in the Forest Plan.

Direct and Indirect Effects of Alternative 1

Under the No Action alternative, there would be no direct, indirect or cumulative effects on all PETS species or their habitats, with the exception of Bachman's warbler and Georgia aster. Proposed actions (seed tree regeneration, roller drum chopping of the seed tree units, and herbicide treatments of seed tree units) and connected actions (skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction, and erosion control measures) would not occur. Current management activities would continue in the project area.

Under the proposed action, regeneration harvests would benefit Bachman's sparrow and Georgia aster by providing 1,275 acres of short-term early successional habitat. Under the No Action alternative, seed tree regeneration would not take place. Without regeneration harvests, many stands within the project area would continue to develop into mature mixed pine-hardwood forests with dense midstories. These conditions would not provide suitable habitat for Bachman's sparrow or Georgia aster.

Cumulative Effects of Alternative 1

In the past, projects on the Long Cane Ranger District included timber harvesting, timber stand improvement practices, storm-damaged timber salvage, prescribed burning, mechanical and chemical control of non-desirable species (including non-native invasive species), southern pine beetle control, wildlife opening construction and maintenance, trail construction and maintenance, road construction and maintenance (including culvert repair), and erosion control practices. On privately owned lands within the National Forest boundary, the primary land uses are timber management, farming, livestock production, hunting and residential uses. Management activities on national forest system (NFS) lands and private lands are expected to continue into the future.

No cumulative adverse effects are expected to wood storks or bald eagles from past, present and future actions on NFS system land. There would be no cumulative adverse effects to riparian and mesic forest species and habitats given the large amount that exists and its distribution across the district. There would be no beneficial cumulative effects to woodland and savanna/opening/roadside species and habitats with the no action alternative. Past, present and future activities on NFS and private lands are expected to have reduced beneficial effects to species and the habitat when compared with alternative 2.

Direct and Indirect Effects of Alternative 2

See the attached BA/BE for the analysis of direct, indirect and cumulative effects of the Proposed Action on PETS species. Below is a summary of the effects for each species.

The proposed action is not likely to affect wood stork or potential habitat. Four project areas are adjacent to shallow wetlands, which may provide habitat for post-breeding wood stork. However, any project-related disturbance would simply cause them to relocate to undisturbed areas. There would be no effect to wood stork habitat.

There would be beneficial impacts to Bachman's sparrow and Georgia aster with the implementation of the proposed action. Bachman's sparrow uses open stands of pine with well-developed grassy understories, whereas Georgia aster is a sun-loving species that occupies open sites, such as woodlands and meadows. Seed tree regeneration, roller drum chopping, and chemical release of desired seedlings would provide short-term early successional habitat that would benefit these species.

Four project areas provide potential habitat for nesting bald eagles, however no active nests have been found since 2001. As with wood stork, if bald eagles were present during project implementation, they could be disturbed but would simply relocate to nearby areas. Seed tree regeneration would eliminate potential nest trees in the project area, but thousands of acres along Lake Thurmond would remain unaffected. The proposed action may impact individuals but is not likely to cause a trend to federal listing or loss of viability.

There would be no impacts to indigo bush, piedmont aster, sweet pinesap, Oglethorpe oak, lanceleaf trillium, and nodding trillium. These species are not known to occur within the project area, so there would be no direct effects. Adjacent habitat near some project areas may be affected by project activities in the short-term, but considering the amount of potential habitat on the District, there would be no long-term cumulative effects.

Cumulative Effects of Alternative 2

Refer to the BA/BE for more detailed information. In the past, projects on the Long Cane Ranger District included timber harvesting, timber stand improvement practices, storm-damaged timber salvage, prescribed burning, mechanical and chemical control of non-desirable species (including non-native invasive species), southern pine beetle control, wildlife opening construction and maintenance, trail construction and maintenance, road construction and maintenance (including culvert repair), and erosion control practices. On privately owned lands within the National Forest boundary, the primary land uses are timber management, farming, livestock production, hunting and residential uses. Management activities on national forest system (NFS) lands and private lands are expected to continue into the future.

No cumulative adverse effects are expected to wood storks or bald eagles from past, present and future actions on NFS system land. There would be no cumulative adverse effects to riparian and mesic forest species and habitats given the large amount that exists and its distribution across the district. There would be beneficial cumulative effects to woodland and savanna/opening/roadside species and habitats given that the habitat is limited across the district. Past, present and future activities on NFS and private lands are expected to have beneficial effects to species and the habitat.

3.2.6 Migratory Birds

Affected Environment

The Forest Service is recognized as a national and international conservation leader and plays a pivotal role in the conservation of migratory bird populations and their habitats. Within the National Forest System, conservation of migratory birds focuses on providing a diversity of habitat conditions at multiple spatial scales and ensuring that bird conservation is addressed when planning for other land management activities.

The Long Cane Ranger District occurs within a geographic area known as the piedmont in South Carolina. This area is associated with Bird Conservation Region (BCR) 29 – Southern Piedmont. The 47 million-acre BCR 29 is a transitional area between the coastal plain and the Appalachian Mountains that is dominated by pine and mixed pine-hardwood forests with some interior wetlands, reservoirs, and riverine systems. This BCR provides habitat for 140 breeding bird species, many of which have experienced steep population declines in recent decades.

The following sources, along with an analysis of species' range, life history, and available habitat information, were reviewed to identify priority migratory birds that are likely to occur in the project area: (1) Partners in Flight (PIF) Priority Bird List for BCR 29; (2) USFWS Birds of Conservation Concern for BCR 29; (3) South Carolina Breeding Bird Atlas; and (4) *The Land Manager's Guide to the Birds of the South* (Hamel 1992). The results of this analysis produced the following table of priority migratory birds that are associated with and potentially affected by the Reedy Project.

Table 3.2.6-1. Priority migratory birds that are associated with the Reedy Project, Long Cane Ranger District, Sumter National Forest

Species	Habitat Association
Bachman's Sparrow *Aimophila aestivalis*	Woodland, savanna, grassland
Brown Thrasher *Toxostoma rufum*	Forests with well-developed forest understories or thickets
Brown-headed Nuthatch *Sitta pusilla*	Mature pine or mixed pine-hardwood forests
Carolina Wren *Thryothorus ludovicianus*	Forests with well-developed forest understories or thickets
Chuck-will's-widow *Caprimulgus carolinensis*	Pine/hardwood forest types, especially near open areas
Eastern Towhee *Pipilo erythrophthalmus*	Forests with well-developed forest understories or thickets
Eastern Wood-Pewee *Contopus virens*	Mature pine or mixed pine-hardwood forests
Field Sparrow *Spizella pusilla*	Woodland, savanna, grassland
Indigo Bunting *Passerina cyanea*	Woodland, savanna, grassland
Kentucky Warbler *Oporonis formosus*	Forests with well-developed forest understories or thickets

Table 3.2.6-1. Priority migratory birds that are associated with the Reedy Project, Long Cane Ranger District, Sumter National Forest	
Species	**Habitat Association**
Loggerhead Shrike *Lanius ludovicianus*	Woodland, savanna, grassland
Northern Bobwhite *Colinus virginianus*	Woodland, savanna, grassland
Northern Flicker *Colaptes auratus*	Mature pine or mixed pine-hardwood forests
Pine Warbler *Dendroica pinus*	Mature pine or mixed pine-hardwood forests
Prairie Warbler *Dendroica discolor*	Woodland, savanna, grassland
Red-headed Woodpecker *Melanerpes erythrocephalus*	Mature pine or mixed pine-hardwood forests
Whip-poor-will *Caprimulgus vociferus*	Pine/hardwood forest types, especially near open areas
White-throated Sparrow *Zonotrichia albicollis*	Forests with well-developed forest understories or thickets
Wood thrush *Hylocichla mustelina*	Forests with well-developed forest understories or thickets
Yellow-throated Vireo *Vireo flavifrons*	Mature pine or mixed pine-hardwood forests

All other migratory bird species that occur in BCR 29 were excluded from analysis because they were not identified as PIF priority species or USFWS birds of conservation concern, the project area occurs outside of their known breeding, wintering, or migratory range, and/or suitable habitat does not exist within the project area.

Direct and Indirect Effects of Alternative 1

Under the No Action alternative, current management actions would continue to guide management within the project area. The natural resources and ecological processes within the project area would continue at the existing level of human influence. The characteristics of the forest environment would be affected primarily by natural disturbances such as insects, disease, and weather events. Custodial management of recreation areas, roads, prescribed burning, and other projects already approved under prior decisions will continue under this alternative.

Direct Effects

Direct effects are effects to the species known or assumed to occur in the proposed project area. They occur at the same time and place as the project activity. There would be no direct effects to any of the priority migratory birds under this alternative since no activities would take place.

Indirect Effects

Indirect effects include the consequences of management activities that result in the modifications of habitat and ecological conditions that affect food, water, shelter, and other

life requirements for a species. Habitat for priority migratory bird species would not be modified under the No Action alternative. This would benefit those species that are associated with forests with well-developed forest understories or thickets, mature pine or mixed pine-hardwood forest, or pine/hardwood forest types since the Reedy Project area is dominated by mature forest conditions. However, habitat would not be created or enhanced for priority migratory bird species associated with woodlands, savannas, and grasslands. Considering that these open land habitats are one of the most limited habitat types on the Forest, species associated with early successional conditions could be adversely affected by the No Action alternative.

Connected Actions

Actions are considered connected if they: (1) automatically trigger other actions which may require NEPA documentation, (2) cannot or will not proceed unless other actions are taken previously, or (3) are interdependent parts of a larger action and depend on the larger action for their justification. Skidding, decking, and hauling of logs, seed tree removal, road maintenance and temporary road construction, and erosion control measures are examples of connected actions. There would be no effects to any of the priority migratory birds related to connected actions since none would occur with the No Action alternative.

Cumulative Effects

Cumulative effects are effects to the species and their habitats over time, and consider past, present, and future actions. There are other projects being planned and implemented on the Long Cane Ranger District that would continue under the No Action alternative. Projects include timber harvesting, storm-damaged timber salvage, southern pine beetle (SPB) control efforts, prescribed burning, wildlife habitat improvements and management activities, trail construction and maintenance, herbicide control of non-desirable species (including non-native invasive species), road maintenance (including culvert repair and replacement), and erosion control practices. In the future, all activities are expected to continue at about the same levels, except timber salvage and SPB control which are difficult to predict. On privately owned lands, the primary land uses are timber management, farming, and livestock production. Private lands are also used for residential areas and recreation such as hunting. Current activities on National Forest land have the potential to benefit priority migratory birds. With the No Action alternative, no additional activities would take place, so there would be no additional cumulative effects within the project area or across the District.

Direct and Indirect Effects of Alternative 2

Direct Effects

Direct effects are not expected to occur to priority migratory bird species. Birds, being highly mobile, would relocate to undisturbed areas if they were disturbed by proposed activities. It is possible that individual nests and nestlings of avian species could be lost due to proposed activities and connected actions. These effects are considered minor for several reasons: vegetation management activities may or may not occur while nests are active, project activities are of relatively short duration in any given location, and many avian species raise multiple broods or are known to re-nest if disturbed during the nesting season. Additionally,

project activities would have to occur over successive years to have substantial impacts on population trends. Consequently, no measurable decline in reproductive success of migratory birds is expected from any of the proposed activities.

Herbicide treatments as proposed in this alternative are not expected to have a direct effect on MIS. While the use of some herbicides can have direct effects on wildlife by causing injury or mortality from direct spray, drift, or ingestion of contaminated food or water, the herbicides proposed in this alternative, namely imazapyr and triclopyr, are practically non-toxic to birds and other wildlife species (Durkin and Follansbee 2004, Durkin 2011).

Fletcher (1983a,b) found that no mortality to birds was observed at imazapyr concentrations of up to 5,000 ppm in the diet. These acute exposures were equivalent to average daily doses of 674 mg/kg in northern bobwhite (*Colinus virginianus*) and 1,149 mg/kg in mallard ducks (*Anas platyrhynchos*). Similarly, in 18-week dietary studies, no effects on reproductive endpoints (e.g., egg production, hatchability, survival of hatchlings) were observed at dietary concentrations of up to 2,000 ppm. These 18-week exposures were equivalent to average daily doses of 200 mg/kg in both quail and ducks (Fletcher et al. 1995a,b). The LD_{50}[4] of imazapyr for quail and ducks are both greater than 2,150 mg/kg (Fletcher et al. 1984a,b). Acute toxicity studies (5-day) found no adverse effects at dietary concentrations up to 5,000 ppm (Fletcher et al. 1984a,b). Imazapyr is rapidly eliminated in the urine and feces of animals, and is not known to accumulate in animal tissues. This herbicide is also not expected to bioaccumulate in the food chain (Durkin and Follansbee 2004).

The acute oral LD_{50} of triclopyr for mallard ducks and northern bobwhite are 1,698 mg/kg and 2,935 mg/kg, respectively (Tu et al. 2001). A one-generation reproduction study showed no reproductive effects, symptoms of toxicity, or abnormal behavior when mallards were given up to 500 ppm of triclopyr in their diet for a 20-week period, including ten weeks prior to egg laying and ten weeks during egg laying. Newton et al. (1990) predicted that triclopyr would not be present in animal forage in doses large enough to cause either acute or chronic effects to wildlife, and concluded that the tendency for triclopyr to dissipate quickly in the environment would preclude any problems with bioaccumulation in the food chain. Two field studies, Boren et al. (1993) and Schulz et al. (1992a), looked at triclopyr use in the range of application rates that may be used in Forest Service management activities. Both studies concluded that triclopyr applications had no adverse effects on birds. Additionally, Schulz et al. (1992b) suggested that some bird species would benefit from the application of triclopyr and other herbicides due to changes in vegetation that improved habitat conditions.

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[4] Acute toxicity is commonly measured by the lethal dose (LD) that causes death in 50 percent of treated laboratory animals (LD_{50}). LD_{50} indicates the dose of a chemical per unit body weight of an animal and is expressed as milligrams per kilogram (mg/kg). Chemicals are highly toxic when the LD_{50} value is small and practically nontoxic when the value is large.

Indirect Effects

Migratory birds associated with woodland, savanna, and grassland habitats (Bachman's sparrow, field sparrow, indigo bunting, loggerhead shrike, northern bobwhite, prairie warbler)

The proposed action would result in nearly immediate short-term early successional habitat. Many of the migratory birds that are associated with woodland, savanna, and grassland habitats would benefit from these conditions. Within one to two years post-harvest, native grasses and forbs would become established in the understories of these forest stands. Migratory birds associated with woodland, savanna, and grassland habitats would use these areas during their early stages of development. However, as the stands mature the quantity and quality of early successional habitat would decline.

Migratory birds associated with forests with well-developed forest understories or thickets (brown thrasher, Carolina wren, eastern towhee, Kentucky warbler, white-throated sparrow, wood thrush); mature pine or mixed pine-hardwood forests (brown-headed nuthatch, eastern wood-pewee, northern flicker, pine warbler, red-headed woodpecker, yellow-throated vireo); and pine/hardwood forest types, especially near open areas (chuck-will's-widow, whip-poor-will)

The proposed action would result in the short-term loss of habitat for priority migratory birds associated with mature forest conditions. Mature trees, predominantly loblolly pine, would be harvested on 1,275 acres, leaving 10-12 seed trees per acre. While some species may use the early successional habitat conditions (namely, brown thrasher, Carolina wren, eastern towhee, white-throated sparrow), most would have to look elsewhere for suitable habitat conditions. However, once these areas regenerate, habitat would become available once more.

Connected Actions

Connected actions include skidding, decking, and hauling of logs, 1,275 acres of seed tree removal, road maintenance and temporary road construction and erosion control measures. All these connected actions could temporarily disturb and, to some degree, displace all of the priority migratory birds. After the disturbance is over, however, these species would likely reoccupy the area. It is possible that nests and nestlings could be lost due to these activities. These effects are considered minor since only a small portion of the project area would be affected. Additionally, avian species would re-nest multiple times throughout the nesting season, so no significant decrease in reproductive success is expected.

Cumulative Effects

Habitats for all migratory birds, with the exception of species that use woodland, savanna, and grassland habitats, are generally remaining stable or increasing on the Sumter National Forest. Bird monitoring is done on an annual basis to assess the presence/absence and frequency of occurrence of bird species by habitat conditions across the Long Cane Ranger District. According to Forest Service monitoring data from 1992-2004, a significant number of priority migratory bird species have experienced population declines on the Francis Marion and Sumter National Forest (La Sorte et al. 2007). Table 3.2.5-2 lists the population trends for

priority migratory bird species that are associated with the Reedy Project; these data include range-wide (Southern Piedmont Physiographic Region) population trends, as well as trends for the Francis Marion and Sumter National Forests.

Table 3.2.6-2. Population trends for priority migratory birds that are associated with the Reedy Project, Long Cane Ranger District, Sumter National Forest

Species	Percent Annual Change in Number of Observations per Count[1]	
	Southern Piedmont Physiographic Region 1992-2004	Francis Marion & Sumter National Forests 1992-2004
Bachman's Sparrow Aimophila aestivalis	-6.0	-6.3
Brown Thrasher Toxostoma rufum	-3.6	ND[2]
Brown-headed Nuthatch Sitta pusilla	2.7	5.4
Carolina Wren Thryothorus ludovicianus	-1.8	ND
Chuck-will's-widow Caprimulgus carolinensis	-44.2	ND
Eastern Towhee Pipilo erythrophthalmus	-10.6	-3.1
Eastern Wood-Pewee Contopus virens	3.1	-3.1
Field Sparrow Spizella pusilla	-16.1	-19.1
Indigo Bunting Passerina cyanea	-2.6	ND
Kentucky Warbler Oporonis formosus	6.8	8.4
Loggerhead Shrike Lanius ludovicianus	ND	ND
Northern Bobwhite Colinus virginianus	-17.3	ND
Northern Flicker Colaptes auratus	-0.4	-6.6
Pine Warbler Dendroica pinus	-4.2	-0.2
Prairie Warbler Dendroica discolor	-8.9	-8.1
Red-headed Woodpecker Melanerpes erythrocephalus	1.5	-7.1
Whip-poor-will Caprimulgus vociferus	ND	ND
White-throated Sparrow Zonotrichia albicollis	ND	ND
Wood thrush Hylocichla mustelina	-10.8	-9.9
Yellow-throated Vireo Vireo flavifrons	3.4	-4.4

[1] From La Sorte et al. (2007)
[2] No data

In general, the declining population trends for most for species listed in Table 3.2.5-2 reflect the long-term population declines of songbirds across the eastern United States. For decades, avian researchers have documented decreasing population trends among migratory and resident song birds (Faaborg and Arendt 1992, Gauthreaux 1992, Sauer and Droege 1992, Robbins et al. 1989). Most population declines are attributed to loss and fragmentation of breeding, migratory stop-over, and wintering habitats.

As stated in the indirect effects analysis, the proposed action should result in short-term habitat improvements for priority migratory birds that use woodlands, savannas, and grasslands (Bachman's sparrow, field sparrow, indigo bunting, loggerhead shrike, northern bobwhite, prairie warbler). The proposed action would result in the short-term loss of habitat for priority migratory birds associated with forests with well-developed forest understories or thickets (brown thrasher, Carolina wren, eastern towhee, Kentucky warbler, white-throated sparrow, wood thrush); mature pine or mixed pine-hardwood forests (brown-headed nuthatch, eastern wood-pewee, northern flicker, pine warbler, red-headed woodpecker, yellow-throated vireo); and pine/hardwood forest types, especially near open areas (chuck-will's-widow, whip-poor-will). While the implementation of this project may affect the population status of species associated with mature forest conditions on a very local scale, regeneration harvests, roller drum chopping, herbicide treatments, and connected actions are not expected to affect range-wide population trends.

Forest fragmentation occurs when large, continuous forests are divided into smaller blocks, either by roads, agricultural development, urbanization, or other human activities. Fragmentation can have adverse effects on wildlife species, and has been linked to declines in forest interior birds by increasing their susceptibility to predation and nest parasitism. Forest interior birds tend to avoid edge habitats and require low levels of disturbance during the breeding season. Priority migratory birds that are considered forest interior species include Kentucky warbler, wood thrush, and yellow-throated vireo (Hamel 1992).

It is important to distinguish between a forested landscape that is fragmented by agricultural or urban development and a forest composed of a mosaic of stands ranging from mature trees to regenerating forests. Forests that are fragmented by agricultural or urban development typically result in permanent habitat loss and can have the greatest impact on biodiversity. On the other hand, timber harvesting may only cause a temporary reduction in habitat for species that rely on mature forests while at the same time providing habitat for early successional species.

Research suggests that forest road density can adversely affect the distribution and reproductive success of forest interior birds (Ortega and Capen 1999, Rich et al. 1994). King and DeGraaf (2002) found that small (<25 feet wide) forest roads had no negative effects on reproductive success of forest song birds and that ovenbirds (*Seiurus noveboracensis*) – a species known to be sensitive to forest fragmentation – did not actively avoid nesting near roads that meet this description. Although approximately 22 miles of existing system roads would be maintained during timber harvest operations, there would be no new system roads constructed for this project. Only 0.3 mile of small, temporary roads would be used.

Robinson et al. (1995) report that large landscapes with at least 70-80% forest cover offer high potential as quality habitat for species that depend on unfragmented forests. According to data derived from the National Land Cover Dataset (2006), 77.8% of the landscape within the Long Cane Ranger District proclamation boundary is forested. Considering that the proposed action would not result in permanent forest fragmentation (it would contribute to the mosaic of different habitat types), that the Reedy Project would take place within a predominantly forested landscape, and that road density would not significantly increase under the proposed action, adverse effects on priority migratory birds that are forest interior species are not expected.

3.2.7 Aquatic Communities

Affected Environment

The proposed timber project is located in the Lower Long Cane Creek watershed. Long Cane Creek is a tributary to Little River which flows to the Savannah River. District watersheds contain a warm water aquatic community that includes fish, crayfish, aquatic insects, macroinvertebrates and mollusks. The warm water aquatic community serves as a management indicator that is monitored to indicate the effects of management on riparian resources. Aquatic species that may occur in the project area watershed are listed in the following tables.

Table 3.2.7-1 Fish species known to occur in the Savannah River watershed (Rhode, et.al. 2009).

Scientific Name	Common Name	Scientific Name	Common Name
Anguillidae		**Clupeidae**	**Herrings**
Anguilla rostrata	American eel	*Dorosoma cepedianum*	Gizzard shad
Aphredoderidae	**Pirate Perches**	*Dorosoma petenese*	Threadfin shad
Aphredoderus sayanus sayanus	Eastern pirate perch	**Cyprinidae**	**Carps and Minnows**
Catostomidae	**Suckers**	*Clinostomus funduloides*	Rosyside dace
Erimyzon oblongus oblongus	Creek chubsucker	*Ctenopharyngodon idella*	Grass carp
Hypentelium nigricans	Northern hog sucker	*Cyprinella nivea*	Whitefin shiner
Minytrema melanops	Spotted sucker	*Cyprinus carpio*	Common carp
Moxostoma collapsum	Notchlip redhorse	*Hybognathus regius*	Eastern silvery minnow
Moxostoma robustum	Robust redhorse	*Hybopsis rubrifrons*	Rosyface chub
Moxostoma rupiscartes	Striped jumprock	*Nocomis leptocephalus*	Bluehead chub
Moxostoma sp. 4	Brassy jumprock	*Notemigonus crysoleucas*	Golden shiner
Centrarchidae	**Sunfish**	*Notropis altipinnis*	Highfin shiner
Lepomis auritus	Redbreast sunfish	*Notropis cummingsae*	Dusky shiner
Lepomis cyanellus	Green sunfish	*Notropis hudsonius*	Spottail shiner
Lepomis gibbosus	Pumpkinseed	*Notropis lutipinnis*	Yellowfin shiner
Lepomis gulosus	Warmouth	*Notropis petersoni*	Coastal shiner
Lepomis macrochirus	Bluegill	*Notropis scepticus*	Sandbar shiner
Lepomis marginatus	Dollar sunfish	*Semotilus atromaculatus*	Creek chub
Lepomis microlophus	Redear sunfish	**Esocidae**	**Pikes**
Micropterus coosae	Redeye Bass	*Esox americanus.*	Redfin pickerel
Micropterus salmoides	Largemouth bass	*Esox niger*	Chain pickerel
Pomoxis annularis	White crappie	**Percidae**	**Perches**
Pomoxis nigromaculatus	Black crappie	*Etheostoma fusiforme*	Swamp darter
Ictaluridae	**Bullhead Catfishes**	*Etheostoma hopkinsi hopkinsi*	Christmas Darter
Ameiurus brunneus	Snail bullhead	*Etheostoma inscriptum*	Turquoise Darter
Ameiurus catus	White catfish	*Etheostoma olmstedi*	Tessellated darter
Ameiurus natalis	Yellow bullhead	*Perca flavescens*	Yellow perch
Ameiurus nebulosus	Brown bullhead	*Percina nigrofasciata*	Blackbanded Darter
Ameiurus platycephalus	Flat bullhead	**Poeciliidae**	**Livebearers**
Ictalurus punctatus	Channel catfish	*Gambusia holbrooki.*	Eastern mosquitofish
Noturus gyrinus	Tadpole madtom		
Noturus insignis insignus	Margined madtom		
Noturus leptacanthus	Speckled madtom		

The robust redhorse is ranked as G1 (critically imperiled) by NatureServe (2013). This ranking indicates that the species is at a very high risk of extinction due to extreme rarity (often five or fewer populations), very steep population declines, or other factors. Robust redhorse is also listed as endangered by the American Fisheries Society (AFS; Jelks et. al. 2008) indicating the species is in danger of extinction throughout all or a significant portion of its range. AFS lists the snail bullhead and flat bullhead as vulnerable (Jelks et. al. 2008). This indicates that the species may become endangered or threatened by relatively minor disturbances to their habitat(s), or that they deserve careful monitoring of their distribution and abundance in continental waters of the United States to determine their status.

The SC Comprehensive Wildlife Conservation Strategy (Kohlsaat et. al. 2005) includes the South Carolina's Priority Species List. These species warrant conservation concern to maintain diversity in South Carolina waters. The species are ranked in conservation priority as moderate, high and highest. The American eel, redeye bass, Christmas darter and robust redhorse are ranked as highest priority. The turquoise darter is ranked with a high priority. The snail bullhead, white catfish, flat bullhead, rosyface chub and notchlip redhorse are all ranked with a moderate priority.

Table 3.2.7-2.Crayfish species known to occur in the Savannah River watershed (Eversole and Jones 2004).

Scientific Name	Common Name	Conservation Status			
		NatureServe	State	AFS	State priority
Cambaridae					
Cambarus acuminatus	Acuminate crayfish	G4	S4	CS	
Cambarus bartonii	Common crayfish	G5		CS	
Cambarus diogenes	Devil crawfish	G5		CS	
Cambarus howardi	Chattahoochee crayfish	G3		CS	
Cambarus latimanus	Variable crayfish	G5	S4?	CS	
Cambarus reduncus	Sickle crayfish	G4G5	S4	CS	
Cambarus reflexus	Pine savannah crayfish	G4	S3	CS	Highest
Cambarus striatus	Hay crayfish	G5		CS	
Distocambarus carlsoni	Mimic crayfish	G2G3		T	Highest
Distocambarus crockeri	Piedmont prairie burrowing crayfish	G3	S3	T	High
Distocambarus hunteri	Saluda burrowing crayfish	G1		E	Highest
Procambarus clarki	Red swamp crayfish	G5		CS	
Procambarus raneyi	Disjunct crayfish	G4		CS	
Procambarus spiculifer	White tubercled crayfish	G5		CS	
Procambarus troglodytes	Eastern red swamp crayfish	G5	S4S5	CS	

The Saluda burrowing crayfish is ranked as G1 by the SC Natural Heritage Program. The mimic crayfish is ranked G2G3. The Chattahoochee crayfish and the Piedmont prairie burrowing crayfish are ranked as G3. The Piedmont prairie burrowing crayfish and pine savannah crayfish are also rated as S3 by the SC Natural Heritage Program. American Fisheries Society status ranks (Taylor et al 2007) include CS (currently stable), V (vulnerable), T (threatened), E (endangered) and E* (endangered, possibly extinct). The T rank indicates that a species is likely to become endangered throughout all or a significant portion of its range. The E rank indicates a species is in danger of extinction throughout all or a significant portion of its range.

The SC Comprehensive Wildlife Conservation Strategy ranks the mimic crayfish, pine savannah crayfish, and Saluda burrowing crayfish as highest priority. The Piedmont prairie burrowing crayfish is rated as high priority.

Table 3.2.7-3. Mollusk species known to occur in the Savannah River watershed (Alderman 1990, 1998, 2005, 2009).					
Scientific Name	**Common Name**	**Conservation Status**			
		NatureServe	**State**	**AFS**	**State Priority**
Corbiculidae					
Corbicula fluminea	Asiatic clam				
Physidae					
Physa sp.	A freshwater snail				
Planorbidae					
Helisoma anceps	Two-ridge rams-horn	G5			
Pleuroceridae					
Elimia catenaria	Gravel elimia	G4			
Unionidae					
Alasmidonta varicosa	Brook floater	G3	S?		Highest
Elliptio complanata	Eastern elliptio	G5		CS	Moderate
Elliptio icterina	Variable spike				Moderate
Elliptio producta	Atlantic spike	G3		SC	Moderate
Elliptio angustata	Carolina lance	G4		SC	Moderate
Lampsilis cariosa	Yellow lampmussel	G3G4		T	Highest
Lasmigona decorata	Carolina heelsplitter	G1	S1	E	Highest
Pyganodon cataracta	Eastern floater	G5		CS	
Strophitus undulatus	Creeper	G5		CS	Highest
Utterbackia imbecillis	Paper pondshell	G5		CS	
Villosa delumbis	Eastern creekshell	G4		CS	Moderate
Villosa vibex	Southern rainbow	G5		CS	Highest
Viviparidae					
Campeloma decisum	Pointed campeloma	G5			

The project area's aquatic community includes one federally listed endangered species, the Carolina heelsplitter (a mussel) and one forest sensitive mussel species, the brook floater. They have heritage ranks of G1 and G3, respectively. Carolina heelsplitter and brook floater are known to occur in the Lower Long Cane Creek watershed. The Atlantic spike is also ranked as G3. The majority of mollusk species are unranked by the SC Natural Heritage Program. A non-native clam species, Asiatic clam, has widespread occurrence. American Fisheries Society status ranks are from Williams, et. al. 1992 and include CS (currently stable), U (undetermined), SC (special concern), T (threatened) and E (endangered).

The brook floater, Carolina heelsplitter, creeper, yellow lampmussel and Southern rainbow are ranked as highest priority by the SC Comprehensive Wildlife Conservation Strategy. The Eastern elliptio, Carolina lance, Atlantic spike, Eastern creekshell and variable spike are ranked as moderate priority.

Aquatic insect surveys have not been conducted in recent years.

Direct and Indirect Effects of Alternative 1

There would be no direct or indirect impacts to aquatic communities under this alternative. The aquatic community would remain in its present state and any current population trends would continue.

Cumulative Effects of Alternative 1

There would be no cumulative impacts to aquatic communities from the no action alternative.

Direct and Indirect Effects of Alternative 2

Alternative 2 proposes seed tree regeneration on 1,275 acres. In addition, roller drum chopping of the seed tree units would occur after initial timber harvest. It is also proposed to preform herbicide treatment on same area in the first and third year after harvest and remove seed trees once the understory is fully stocked.

Stands proposed to be treated are predominately in upland areas. There is no management proposed within riparian corridors. Connected actions include temporary road reconstruction and maintenance, skid road construction, log landing construction, mechanical and chemical site preparation and erosion control.

Timber Harvest and Connected Actions

Soil and vegetation disturbance occurring near streams from tree removal, log landings, road reconstruction and maintenance, skid roads/trails and site preparation could result in the addition of sediments to project area streams. Sedimentation can cause direct mortality to macroinvertebrate and fish life stages through burial and suffocation of eggs and larvae. Turbidity can cause gill damage which interferes with respiration, abrasion, changes in feeding behavior, and macroinvertebrate drift resulting in a shift in community dynamics. Indirectly, sediment can fill in and destroy habitat niches within a stream impacting reproductive success, refugia and food sources. Sediment deposition can result in a reduction of fish and macroinvertebrate density and biomass in a stream. There would be no removal of trees or site preparation activities within any riparian corridors or along the edges of gullies. Therefore, there should be no sediment impacts from tree removal. There would be no skid road/trail construction or crossings associated with riparian corridors. There is 0.3 mile temporary road construction proposed for this project. There would be no log landing or loading locations within any riparian areas. Skid roads and log landings would be revegetated immediately following harvest activities in individual units. Check dams would be installed as erosion control in ephemeral stream channels to slow the increased water flow from harvested areas where needed to reduce soil erosion and sedimentation into downstream intermittent and perennial stream reaches. Check dams would not be used in intermittent or perennial streams.

Forest standards from the *Revised Land and Resource Management Plan, Sumter National Forest*, 2004 (Forest Plan) and *South Carolina Best Management Practices for Forestry* (BMP) would be applied to all activities associated with this project. As a minimum, channeled ephemeral stream zones would extend 25 feet either side of channeled ephemeral streams. Minimum widths for perennial streams, lakes, ponds and wetlands are associated

with slope class. At 0-30% slope, the minimum width is 100 feet; at 31-45%, 125 feet; and at 46+%, 150 feet. For intermittent streams the minimum widths associated with these slope classes are 50 feet, 75 feet and 100 feet respectively. These lands are unsuitable for timber production (FS 11.-24). Channeled ephemeral stream zones and riparian corridors are managed for large woody debris recruitment. Removal of large woody debris is determined on a case-by-case basis and should include interdisciplinary input. Logging slash should not be placed in streams (FW-13; FS 11.-2). For cable logging, at least partial suspension is required when yarding logs over ephemeral streams (FW-7).

Road Maintenance

There is no road construction or reconstruction proposed with the project. System road maintenance (22 miles) and temporary road construction (0.3 miles) would produce a sediment source through grading and ditching. These activities would be accomplished in a manner that would prevent sediment runoff into area waters. Erosion control devices would be installed during road maintenance activities where needed to deter soil runoff from streams. Road ditch lines would not be routed toward stream crossings, but instead into vegetative buffers. Drainage from existing roadside ditches would be directed away from streams prior to filling or excavation activities.

There would be some replacement of rusting and failing culverts with road maintenance. If culverts are removed, stream banks and channels must be restored to natural size and shape and all disturbed soil must be removed and stabilized (FS 11.-23). New stream crossings would be evaluated and where necessary constructed so that they do not adversely impact the passage of aquatic organisms (FS 11.-8).

The removal and placement of stream culverts would produce sediment input to the stream. This activity may also impact individuals through direct mortality to those animals in the immediate area that cannot move quickly from the site during culvert replacement. Erosion control would be placed between the road and all waters prior to soil disturbance to prevent sediment loading. Excavated soils would not be placed next to the stream bank, but off-slope from the stream. Erosion control measures such as matting, silt fences, diversions and temporary rock sediment dams would be installed to trap sediment in areas where runoff water is leaving the project site. Erosion control devices would be maintained in working order throughout project activities and until plant growth is established and stable enough to control runoff and erosion. Riparian areas and stream crossings would be seeded and mulched as soil disturbance occurs. Stream culverts may be installed with aquatic organism passage crossings per (Riparian Corridor Standard 11.-8). These would consist primarily of bottomless arch culverts placed on the slope of the streambed. Culvert width would be equal to stream bank full width.

These crossings include:

NFSR 599 (Tanyard) - Culvert at mile post 0.42 is on a live stream, replacing it would meet aquatic stream guidelines.

Streams and culvert replacement sites would be evaluated for the need of aquatic organism passage structures.

Herbicide Use

Herbicide application would occur in seed tree units (1,275) during the first and third year after harvest. Imazapyr with water soluble dye and a d-limonene adjuvant would be used with hand application methods to target vegetation by speckling the leaf surfaces during the period of mid-June through September of the second or third growing season. This period is usually when rainfall is at the lowest during the year. Imazapyr and triclopyr would be used in hack - and - squirt application of targeted vegetation greater than six feet tall. There would be no broadcast application of herbicides. No herbicides would be applied in riparian corridors.

Imazapyr – Sunlight rapidly degrades imazapyr in aquatic systems with a half-life of three to five days in surface water. It is slowly degraded by soil microorganisms and can be relatively persistent in soils with a half-life of one to seven months. Imazapyr does not bind strongly to soils and can be highly available in the environment. Heavy rainfall can cause significant movement of the herbicide with soil particles and leaching up to 50 cm deep in soils. Imazapyr is of low toxicity to fish and aquatic invertebrates. The LC50s for channel catfish, bluegill sunfish, rainbow trout and Daphnia magna are all >100 mg/l. An imazapyr formulation, Habitat, is registered for use in aquatic environments (Tu et al 2001). The Environmental Protection Agency (EPA) determined that there is no risk to non-vascular aquatic plants, but there are ecological risks of concern with the use of imazapyr for non-target aquatic vascular plants. Toxicity studies indicate that imazapyr is highly toxic and expected to exert detrimental effects to aquatic vascular plants through runoff and drift. Indirect impacts to aquatic animal life can result from the loss of habitat, feeding or cover requirements. Imazapyr is not expected to bioaccumulate in aquatic organisms (EPA 2006).

Triclopyr – There are two formulations of triclopyr; a triethamine salt and a butoxyethyl ester. In soils, both degrade to the parent compound, triclopyr acid. The average half-life of triclopyr acid in soil is 30 days. Offsite movement through surface or subsurface runoff is possible, as it is relatively persistent and has only moderate rates of soil particle absorption. In water, the salt formulation is soluble and may degrade in several hours with adequate sunlight. The ester form is not water soluble and can take significantly longer to degrade in water. It can bind with organic material in the water column and be transported and deposited as sediments. Triclopyr acid and the salt formulation are slightly toxic to fish and aquatic invertebrates. The LC50 for rainbow trout of the acid and the salt formulation is 117 mg/l and 552 mg/l respectively. For bluegill, the LC50 is 148 mg/l and 891 mg/l respectively. The ester formulation is highly toxic to fish and aquatic invertebrates with an LC50 of 0.74 mg/l for rainbow trout and 0.87 mg/l for bluegill sunfish. The ester formulation is readily absorbed through fish tissues and rapidly converted to triclopyr acid. The acid can be accumulated to a toxic level when fish are exposed to sufficient concentrations or for sufficient durations. There is a significant chance of acute lethal effects to fish exposed to low levels residues for more than six hours and delayed lethal effects have been seen in fish exposed to high concentrations for a short duration. If applied properly, triclopyr would not be found in concentrations adequate to kill aquatic organisms. However, some water bodies remain at risk of lethal contamination levels, especially those that are shallow and have slow velocity where

dissipation is slow and those that are heavily shaded where photodegradation is reduced (Tu et al 2001).

Adjuvants – An adjuvant is any compound (including surfactants) that is added to an herbicide formulation or tank mix to facilitate the mixing, application, or effectiveness of that herbicide. There is little information on the effects of adjuvants to aquatic systems. Some adjuvants have the potential to be mobile and pollute surface or groundwater sources. The use of adjuvants near water may have adverse effects in some aquatic species (Tu et al 2001). It is recommended to use an adjuvant with the active ingredient of d-limonene, a byproduct of the citrus industry, for the herbicide applications. The formulated product is practically nontoxic to freshwater fish and slightly toxic to freshwater invertebrates on an acute basis (EPA 1994).

Forest Plan Standards and BMPs would be applied to all activities associated with this project. For all herbicide applications, the following forest wide standards apply. Application equipment, empty herbicide containers, clothes worn during treatment and skin are not cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported to the site (FW-47). Herbicide mixing, loading, or cleaning areas are not located within 200 feet of private land, open water or wells or other sensitive areas (FW-48). Weather is monitored and the project is suspended if temperature, humidity or wind becomes unfavorable as described (FW-42). Herbicides and application methods are chosen to minimize risk to human and wildlife health and the environment (FW-40). Minimum widths for perennial streams, lakes, ponds and wetlands are associated with slope class. At 0-30% slope, the minimum width is 100 feet; at 31-45%, 125 feet; and at 46+%, 150 feet. For intermittent streams the minimum widths associated with these slope classes are 50 feet, 75 feet and 100 feet respectively. Soil active herbicides are not broadcast within channeled ephemeral stream zones. Stream zones are identified before treatment, so applicators can easily avoid them (FW-15). Pesticide mixing, loading, or cleaning areas are not located within the channeled ephemeral stream zone (FW-16). As a minimum, channeled ephemeral stream zones would extend 25 feet either side of channeled ephemeral streams. BMPs state to avoid applying pesticides if surface water is present in ephemeral streams.

Determination of Effect

There are no federally listed or forest sensitive aquatic species within the project area. This project may have direct impacts on individuals of the aquatic community through culvert replacement, but is not likely to impact community diversity. This project may have indirect impacts on the aquatic habitat from sediment input through road maintenance and reconstruction but is not likely to impact aquatic community diversity. The implementation of Forest Plan Standards associated with riparian areas and streams, site-specific design criteria and SC Best Management Practices would minimize impacts to the aquatic community.

Cumulative Effects of Alternative 2

Under the 2004 Plan Revision for the Sumter National Forest, a Watershed Condition Rank (WCR) was assigned to 5th level watersheds across the Forest. The Long Cane Creek watershed received a rank of “Average”, which denotes that the potential to adversely affect aquatic resources as moderate on a scale of low, moderate and high. Forest objectives in moderate ranked watersheds include maintaining and improving aquatic health through the

implementation of the Riparian Corridor management prescription (11), conducting watershed assessments at the project level, and pre-project monitoring efforts to determine biota health. Sediment was determined to be a risk factor for aquatic species viability in this watershed.

Other activities across the project area include prescribed burning, wildlife opening maintenance, road reconstruction, non-native invasive species treatment, and various recreational activities. Each of these projects has been or will be analyzed for impacts to aquatic resources and mitigation measures implemented where needed. In addition to Forest activities, private land activities occur across the landscape within the Forest boundary. Sedimentation is occurring at the intersection of county road S-33-117 and Bold Branch on private land. Currently ditching is extending directly to the stream channel causing increased sedimentation and turbidity.

Direct and indirect impacts to the aquatic community would be minimum and short term and are not likely to impact community diversity. There should be no cumulative impacts to the aquatic community from Reedy Analysis Area project activities with the implementation of Forest Plan Standards and Guidelines associated with riparian areas and streams and SC Best Management Practices.

3.3 Social Environment

3.3.1 Recreation and Visual Resources

Affected Environment

Visitors come to the Sumter National Forest to participate in a wide variety of recreation opportunities in an outdoor setting. Since visitor perception of an outdoor setting is often greatly affected by changes in the visual quality of an area, these two resource areas are discussed together in this section.

Visual character in the piedmont on the Sumter National Forest is characteristic of a rural area, consisting of forested and agricultural landscapes. Forested areas are often in various stages of regeneration as a result of harvesting activities on both private and national forest system lands, while a patchwork of small rural farms often provide added visual contrast.

Small, rural communities or residence groupings are periodically found throughout the area. The RPA is located within MA 4. The treatment units are located within management prescription 10.B. The landscape character under these prescriptions is generally natural appearing. The sights and sounds of human activities are evident in many areas (USFS, 2004a). Primarily, the RPA consists of closed-canopy forest, approximately 70 percent of which is in mid- to late-successional conditions.

Scenic Integrity Objectives (SIOs) are established for each management area (MA) in the Sumter NF (USFS, 2004a). SIO is a desired level of excellence based on physical and sociological characteristics of an area and refers to the degree of acceptable alterations of the characteristic landscape (USFS, 2004b). MA 4 within the RPA has SIO’s that include: High, Moderate, and Low.

- High: Human activities are not visually evident to the casual observer. Activities may only repeat attributes of form, line, color, and texture found in the existing landscape character.
- Moderate: Landscapes appear slightly altered. Noticeable human created deviations must remain visually subordinate to the landscape character being viewed.
- Low: Landscapes appear moderately altered, human created deviations begin to dominate the valued landscape character being viewed but borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed.

The majority of the project area is designated as low with only four stands totally 99 acres are categorized as moderate. These stands are located adjacent or near to J. Strom Thurmond Reservoir. Riparian corridors are designated as high. No project activities are planned in riparian corridors.

Management prescription 10.B provides for recreational opportunities in roaded natural and rural settings. These areas are very accessible and provide for a variety of recreational opportunities, foremost of which is hunting (USFS, 2004a). The area also contains a small arm of the J. Strom Thurmond Reservoir and two developed boat landings: Long Cane Creek and Highway 28 Boat Access.

While several trails run through the Long Cane Ranger District, no maintained trails are located within the RPA. The closest trails are the Parsons Mountain OHV Trail and the Long Cane Horse Trail, both located north of the analysis area.

Dispersed recreation, particularly hunting, some fishing and boating is the primary visitor use throughout the project area. The area provides a wide variety of habitats for varied game, including deer, wild turkey, rabbit, quail, and woodcock.

Direct and Indirect Effects of Alternative 1

No immediate impacts on visual resources are anticipated under the No Action alternative. The RPA would appear in character with closed-canopy forested conditions. While there would be no direct effects on recreation as a result of Alternative 1, minor indirect effects could occur to dispersed recreation within and adjacent to the project area over the long-term. Over time, forested areas within the project area would likely support a decreased diversity of plants and wildlife, which may lead to a long-term, minor, localized, adverse impact on dispersed recreation from an associated decrease in opportunities for hunting, fishing and plant and wildlife viewing.

Cumulative Impacts of Alternative 1

Longer term, adverse effects from southern pine beetle would be more likely.
Tree mortality caused by the SPB could have adverse visual impacts due to high levels of down wood and snags or a general appearance of lack of care for the forest. Early pioneering hardwood species response to open forest conditions would bring about the development of predominantly non-mast producing species such as sweetgum, yellow poplar and red maple. Over time this could increase the scenic integrity of the area by providing a much broader

array of fall color. An increase in fall color could bring about more forest visitors and increase in foot traffic. There would be no cumulative impacts from other forest management activities such as the treatment of non-native invasive species and road maintenance. Cumulative impacts from prescribed burning would include heavy fuel loading from SPB killed trees, smoke management and air quality issues along with the possibility of no burning due to the aforementioned impacts.

Direct, Indirect and Cumulative Effects of Alternative 2

The implementation of mitigation measures would limit impacts to the scenic integrity objective (SIO). Temporary impacts on recreation and visual resources would occur as a result of timber harvest activities, the seed tree regeneration and seed tree removal a few years later, and the herbicide treatment through the connected actions. Because there are no inventoried trails in the project area, no impacts on recreational users of these facilities would occur. However, disturbance to boat landings (particularly Long Cane Creek boat access) and dispersed recreation users could occur, and could include noise and visual disturbance from increased truck and logging equipment traffic or from timber harvesting operations at the treatment sites themselves. In addition, noise from equipment would temporarily disturb wildlife adjacent to the treatment areas, potentially causing the temporary displacement of some species, subsequently limiting hunting opportunities. All impacts (e.g., noise, presence of workers and equipment, etc.) from timber harvest operations would be short-term, and would only affect a very small proportion of forest users. To reduce some of the noise and traffic, timber harvesting would be restricted to weekdays and non-holidays only in compartment 238 stand 8, compartment 240 stands 1 and 7 and compartment 254 stand 5 (units adjacent to or near J. Strom Thurmond Reservoir). Any additional effects on visual resources or recreation activities are expected to be minimal and transient during herbicide release or tree stocking surveys.

Tree cutting and removal would alter the local visual character of the area. After the initial seed-tree harvest, the sites would essentially be an open area with several large standing mature trees. These trees, during the early stage in the stands' development, would provide some screening to minimize the contrast of the initial cut. After these stands are adequately restocked, the seed trees would be removed. Tree height of the new stand would be approximately 3-4' tall. Within its immediate vicinity, the seed tree regeneration sites would be visibly an area where vegetation diversity is high, and size contrast of vegetation is evident. Through this process, variety in composition would be created by an arrangement of vegetation of different sizes, shapes, species mixtures and colors. Overall, variation in the vegetative textures, sizes, and types may be considered to have the benefit of providing increased visual variety in the landscape. However, impacts to the observer would vary, and some observers may consider the visual quality of the site to be degraded until the stand develops further.

The seed tree regeneration sites would also essentially be an open area, but with pine-hardwood stands remaining. The remaining hardwoods would likely provide additional seasonal visual contrasts and textures as a result of leaf color changes and leaf loss during the fall and winter months. To reduce other visual impacts, where possible, harvest units would leave visually attractive trees that provide some diversity of form and color. This would

include areas that contain scattered desirable hardwoods such as oaks and hickories. Any hardwood inclusions would be left inside harvest units.

Design criteria would be included to reduce adverse impacts to scenery in stands where scenic integrity is rated as moderate. A 200 foot no cut buffer would be established along units adjacent to or near J. Strom Thurmond Reservoir in compartment 238 stand 8, compartment 240 stands 1 and 7 and compartment 254 stand 5. This would reduce visual impacts from timber harvesting. Temporary roads that are closed and revegetated for erosion and sediment control purposes would also reduce visual impacts in harvested units.

Recreation visitors may avoid the areas treated with seed-tree regeneration because of the dense shrubs, vines, and young trees that occupy the openings after a harvest cut. Skid roads would be blocked by the Forest Service, where there is the potential for it to be used illegally by ATV riders. Illegal ATV or off-road use of roads and trails would be handled by law enforcement. Hiking is often slow-going and difficult in these areas; however, additional benefits for observing wildflowers, wildlife, and better hunting may be expected. In general, these sites would likely see reduced use for scenic viewing, but would see opportunities increased for hunting and wildlife viewing. Increased visibility into stands, improved access, increased understory plant development and enhanced wildlife viewing opportunities would benefit dispersed recreational users.

Short-term, minor, localized, adverse impacts on dispersed recreation within and around the treatment areas would result from herbicide treatments under Alternative 2. In accordance with the provisions of the Forest Plan, signs would be posted around areas in which herbicides would be used, limiting dispersed recreational uses of these areas for 24 hours. Short-term impacts on visual quality from herbicide treatments and roller drum-chopping would also decrease the recreational value of the project areas for the duration of visual impacts. In addition, herbicide use and roller-drum chopping would lead to a short-term decrease in plant diversity and wildlife habitat, which would likely reduce the number of species using the areas over the short-term. Moving forward, resulting impacts on recreation would be a decrease in hunting and wildlife and plant viewing opportunities. However, there would still be hundreds of forest areas surrounding the treatment sites, as well as in the remainder of the forest, in which recreational users could participate in hunting and/or wildlife and plant viewing. Therefore, short-term impacts on recreation resulting from Alternative 2 would be minor.

The landscape in the project area is rural with a mix of open and forested land that is intermingled with national forest system lands. Active management occurs on both federal and private lands and forms the context for consideration of impacts to recreation and scenery.

Past projects on the Long Cane Ranger District have included timber harvesting, timber stand improvement practices, storm-damaged timber salvage, prescribed burning, mechanical and chemical control of non-desirable species (including non-native invasive species), southern pine beetle control, wildlife opening construction and maintenance, trail construction and maintenance, road construction and maintenance (including culvert repair), and erosion control practices. Activities on private lands consist of farming, ranching and timber harvesting. Recreational activities such as fishing, hunting, hiking, biking, wildlife viewing

and camping occur on both federal and private lands. Management activities on federal and private land are expected to continue at the same rate into the future. Forest Plan standards and site-specific design criteria would limit cumulative adverse impacts to recreation in the project area. Likewise, following Forest plan standards and site specific design criteria would limit cumulative visual impacts from activities in the project area on both federal and private lands. Cumulative adverse impacts to recreation and scenery are not expected from project activity when considering the context and past, present and reasonably foreseeable future activities.

3.3.2 Cultural Resources

Affected Environment

A cultural resources inventory was completed for the Area of Potential Effects (APE) for historic properties within the Reedy Project analysis area. The purpose of the inventory was to identify and document any archeological resources and evaluate their eligibility for listing in the National Register of Historic Places (NRHP) using the criteria established under 36 CFR 60 and 38 CFR 800.

A total of 63 archeological sites were identified through archival research and during intensive cultural resource surveys (Benson 2012). The surveys consisted of a literature review of archival cultural resources information for the APE, intensive field surveys, and site evaluations to determine individual site eligibility for inclusion in the NRHP. The South Carolina State Historic Preservation Office (SHPO) and Tribal Historic Preservation Office (THPO) of the Eastern Band of Cherokee Indians reviewed the survey report and were consulted on historic property eligibility and effects. The inventory identified eight sites that are possibly eligible for listing in the NHRP, but unevaluated. The remaining 55 sites were determined not eligible for the NRHP.

Direct, Indirect and Cumulative Effects of Alternative 1 (“No Action”)

There would be no effect on known historic properties. There would be no potential for cumulative effects to known historic properties or unevaluated sites as a result of the no-action alternative.

Direct and Indirect Effects of Alternative 2

The action alternative would avoid effects to known historic properties and unevaluated archeological sites. Cultural resource surveys have identified historic properties in the APE. The eight unevaluated sites (38MC2398, 38MC2399, 38MC2423, 38MC2433, 38MC2438, 38MC2446, 38MC2515, 38MC2505) and two historic period cemeteries (38MC1261, 38MC1700) would be marked with painted boundaries to be protected from ground disturbance.

An evaluation of proposed activities under the action alternative would minimize the potential effects to undiscovered sites. In accordance with the signed Memorandum of Understanding (MOU) with (SHPO), if any additional cultural resource sites are encountered during any project related activity, they would be treated as an unanticipated discovery. The District

Archeologist would be notified and activities suspended at that location until the location is evaluated using unanticipated discovery protocols in accordance with 36 CFR 60 and 43 CFR 10.

The SHPO and THPO have reviewed the cultural resource survey reports and documentation of previous cultural resource surveys. They have been consulted on this project including the determination of National Register eligibility of all sites in the APE. Letters concurring with Forest Service eligibility determinations were received.

Cumulative Effects of Alternative 2

Avoidance of known historic properties and unevaluated archeological sites would result in no cumulative adverse effects to cultural resources. In addition, the Sumter National Forest has completed a cultural resources overview of the Sumter National Forest (Benson 2006). The overview establishes a context for heritage resources on the Long Cane Ranger District and provides a basis for evaluating cumulative effects to cultural resources.

3.3.3 Economics

Affected Environment

The Reedy project is located within the Long Cane Ranger District of the Sumter National Forest in McCormick County, South Carolina. McCormick County is considered a rural community with no metropolitan areas. This analysis focuses on incremental economic differences between the proposed action and the other alternatives for comparison. The economic analysis estimates the value of the timber to be cut based on appraisals of fair market value. The analysis included only variable costs associated with the alternatives. Fixed costs such as general administration and program management do not change among alternatives; therefore, they are not included in the analysis.

Direct, Indirect and Cumulative Effects of Alternative 1

No costs or revenues would be realized under the no-action alternative. Overstocked and over mature pine stands would continue to have high mortality attributed to pine beetles, senescence and competition related mortality. Wood products not harvested and lost growth would be revenue foregone under this alternative. There would be minor impacts on local mills.

An indirect effect of the no action alternative would be the loss of long-term economic potential of pine stands. Pine stands would eventually be replaced with low quality hardwoods, consisting of sweetgum, winged elm, red maple, sourwood, dogwood and yellow poplar that would have low economic value. This would not be the case in areas where pine stands are at an oak/hickory subclimax stage of succession.

Past, present and foreseeable projects do have a cumulative economic benefit as they provide opportunities for resource related employment opportunities on federal and private lands.

Intrinsic values such as wildlife viewing, aesthetic quality were not factored into costs or benefits.

Direct, Indirect and Cumulative Effects of Alternative 2

Cost used in the economic analysis included hauling road maintenance, temporary road construction seeding and fertilizing skid trails/log landings and herbicide release of crop trees. Revenue comes from both sawtimber and pulpwood volume that would be sold to timber purchasers.

Table 3.3.3-1 Economic Comparison of the Alternatives

	Alternative 1	Alternative 2
Present Value of the Costs	**0**	$3,432,303.49
Present Value of the Benefits	**0**	$10,665,668.97
Present Net Value	**0**	$7,233,365.49
B/C Ratio	**0**	3.11

3.3.4 Environmental Justice and the Protection of Children

Affected Environment

Executive Order 12898 is designed to focus the attention of federal agencies on the human health and environmental conditions in minority and low-income communities. Environmental justice analyses are performed to identify potential disproportionately high and adverse impacts to these target populations from proposed federal actions and to identify alternatives that might mitigate these impacts. The region of influence for this action is considered to be located solely within the Reedy project area in McCormick County, South Carolina.

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, directs federal agencies to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and ensure that its policies, programs, activities and standards address disproportionate risks to children.
Data use for this analysis was produce from the Economic Profile System – Human Dimensions Toolkit. The demographic information was extracted for McCormick County and is compared to the State of South Carolina.

There are no county schools within the project area. There are school bus routes in the area that would travel some of the same state and county roads that logging trucks would be using. However there is no identified disproportionate risk to children on these roads as compared to other rural roads in adjacent areas. Most roads provide access to private lands, residences and communities and are frequently used for a variety of agricultural and other commercial uses.

Table 3.3.4-1 lists the percentage of minorities and persons living below the poverty level within the McCormick County compared to the State of South Carolina as a whole.

Table 3.3.4-1 Percentage of Minorities and Persons/Families Living Below Poverty Level in McCormick County as compared to the State of South Carolina			
Location	**Minority Persons (% of Entire Population)**	**Persons Below Poverty Level (% of Entire Population)**	**Families Below Poverty Level (% of Entire Population)**
McCormick County	50.0	14.5	11.1
South Carolina	36.9	17.0	12.7

Direct, Indirect and Cumulative Effects of Alternative 1

This alternative would not adversely affect minority and low-income communities or cause disproportionate environmental health risks or increase safety risks to children.

Direct and Indirect Effects of Alternative 2

Vegetation management activities within McCormick County would consist of layout and marking of sale units by Forest Service or private contractors. This activity would involve increased Forest Service or private individual vehicle traffic in the project area. The secondary traffic related to this project would involve timber purchasers and employees. The final and most substantial increase in traffic would involve logging equipment moving from site to site with log trucks transporting forest products to processing plants.

The area within and surrounding the project area does not contain a disproportionate number of minority persons or persons/families living below the poverty level when compared to the State of South Carolina. Therefore, additional environmental justice analysis is not required. Similarly, children would not be disproportionately affected by the action alternative. All members of the public would be restricted from work areas to maintain safety. There is a long history of timber management activities in the Piedmont and local residents are familiar with these management practices. No significant, adverse impacts to children are anticipated.

Cumulative Impacts of Alternative 2

There would be no disproportionate adverse cumulative impacts regarding environmental justice or protection of children issues under the action alternatives.

3.3.5 Human Health and Safety

Affected Environment

The Forest Service Handbook (FSH) and the Forest Service Manual (FSM) provide guidance and establish required measures to protect human health and safety during forest management activities. The Sumter National Forest also has a spill response program in place to contain and remove contaminants from management activities.

Direct, Indirect and Cumulative Effects of Alternative 1

There would be no direct, indirect or cumulative effects to human health and safety from currently approved projects because Forest Plan standards and Occupational Safety and Health Administration (OSHA) regulations would be followed during management activities. No additional road maintenance would occur under this alternative which may result in increased safety risks.

Direct and Indirect Effects of Alternative 2

Timber harvest activities, temporary road construction and maintenance of system roads would require the use of heavy equipment (such as dozers, skidders, loaders and log trucks). The use of heavy equipment and the movement of fallen timber present the highest potential for safety risks during timber harvest activities. There is a risk of injury to both workers and recreational visitors. Harvesting is mostly mechanized but would require some manual felling of trees by chainsaws. These effects described here tiers to the Final Environmental Impact Statement, Vegetation Management in the Coastal Plain/Piedmont (VEG EIS) which analyzes similar types of activities related to manual and mechanical effects from vegetation management.

In accordance with Forest Service Health and Safety Code Handbook (FSH 6709.11), vegetation management activities require all Forest Service workers to wear safety equipment, including hard hats, gloves, eye and ear protection. Monitoring of compliance with the Forest safety code would be accomplished through on-site inspections and reviews of accident reports (USDA, 1989b).

For all mechanical treatments in the project area, equipment operators must demonstrate proficiency with the equipment and be licensed to operate it. In addition, a helper must direct the operator where safety is compromised by terrain or limited sight distances (USDA, 1989b).

The private timber sale contractor conducting the harvest would be responsible for adhering to OSHA regulations safety specifications during the entire harvest process. These requirements include:

- Installation of temporary traffic controls on roads and trails open to public travel to warn users of hazardous or potentially hazardous conditions;
- Development of a specific traffic control plan; and
- Use of appropriate devices, such as barricades, where necessary, to control entry to the

site (USDA, 2000a).

Monitoring and inspections during and after the project would be used to ensure that proper procedures were followed. These instructions would provide guidance for measures to protect human health and safety. The potential for adverse impacts on human health and safety under the action alternative would result primarily from the use of heavy equipment during vegetation management and road work activities. Any risks to workers or the public would be minor and temporary. Adherence to the safety measures described above would minimize or eliminate adverse human health and safety effects.

Cumulative Effects of Alternative 2

Cumulative impacts on human health and safety could occur if other vegetative management or public activities that are going on the same time as this project. Other Forest activities that may affect human health and safety include road maintenance, logging traffic from private operations, invasive species control, hunters and prescribed burning.

Road maintenance is designed in part to improve safety conditions for Forest personnel and public users. Alternative 2 would extend this direction by providing safer road conditions for vegetation management activities. While this would have a beneficial cumulative effect on human health and safety, this effect would not be significant.

The USFS also conducts prescribed fire within and adjacent to the project area as part of its normal maintenance and general management of the Sumter National Forest. Threats to human health and safety during a prescribed fire are smoke inhalation and injury from the fire itself in the event that a controlled burn escapes the area. Various safety measures are in place to protect workers and the public from adverse effects during prescribed fires. A prescribed fire plan is required for each managed burn, which includes a smoke mitigation plan in the event that planned conditions change. Roads and highways are closed if the smoke impairs visibility enough to threaten public safety (USDA, 2000b). The public is notified through signs and closed roads, if necessary, and nearby residents adjacent to the Forest are notified prior to a prescribed burn. In addition, standards and guidelines and mitigation measures provided in the Forest Plan are adhered to during prescribed fires, which minimize or eliminate public human health and safety concerns resulting from smoke exposure and fire injuries. All burns are conducted by trained staff, supervised by an experienced burn boss, and monitored through review of burn plans, on-site inspections, and post-burn evaluations (USDA, 1989b).

Past, present, and future actions in and adjacent to the project area would be required to comply with established standards, guidelines, and mitigation measures in the Forest Plan. The activities planned under the action alternative would not be conducted at the same time on the same acres as other activities. These other management actions occur in numerous stages over several years to achieve the desired condition, which would reduce the potential for cumulative, adverse safety impacts. With strict adherence to required safety measures, no significant, cumulative impacts on human health and safety would occur, regardless of the type and amount of activity conducted.

3.3.6 Irreversible and Irretrievable Commitment of Resources

An irreversible commitment of resources refers to an action that could affect resources that are renewable only after a long period of time (such as soil productivity) or are non-renewable resources (such as cultural resources or mineral extraction). An irretrievable commitment of resources refers to losses of productivity or the use of renewable resources. This represents opportunities foregone for the period of time that the resource cannot be used.

Direct, Indirect and Cumulative Effects of Alternative 1

There would be no irreversible commitment of resources under this alternative. Slow growing stands and tree mortality from competition and Southern pine beetle that could not be salvaged would be an economic loss.

Direct, Indirect and Cumulative Effects of Alternative 2

There would be no irreversible commitment of resources under any of the alternatives in this analysis. Impacts to soil productivity are not substantial, when adhering to Forest Plan standards and with the addition of site-specific design criteria. These design criteria limit surface disturbance associated with soil compaction and displacement. Regeneration treatments would reduce the risk of insect and disease over large areas of the pine type. This protects vegetation cover which in turn protects soils and maintains long-term productivity. There would be no effect to heritage resources as known sites and potential sites eligible for the National Register of Historic Places would be avoided. Professional evaluations have been completed by archaeologist and consultation and concurrence has been received from SHPO.

Regeneration harvest would harvest wood volume that has an economic benefit while at the same time establishing a new stand of trees. There would be no loss in stand productivity.

Chapter 4 - *Consultation and Coordination*

Forest Service ID Team Members:

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Jeff Magniez	Zone Wildlife Biologist
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Other Forest Service Personnel Consulted:

Name	Discipline
Jay Purnell	Forest Silviculturist
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Dick Rightmyer	Soil Scientist
Chad Yocum	Hydrologist
Jim Knibbs	Forest Environmental Coordinator
Joseph Robles	Forest Outdoor Recreation Program Manager

Agency, State and Tribal Consultation

United States Fish and Wildlife Service

South Carolina Archives and History Center – State Historic Preservation Office

Tribal Historic Preservation Office – Eastern Band of Cherokee Indians

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