United States
Department of
Agriculture

1989
Francis Marion National Forest
After Hurricane Hugo

2016
Francis Marion
National Forest

Final Environmental Impact Statement Appendices

for the Final Revised Land Management Plan

Forest Service | Region 8 | Francis Marion National Forest | R8-MB 151 C | January 2017

Francis Marion National Forest
Final Environmental Impact Statement
Appendices

Berkeley and Charleston Counties, South Carolina

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Appendix A: The Public Involvement Process

Starting in the fall of 2012, the planning team held two public meetings to kick off the plan revision process and invite the public to collaborate on the development of plan components. Between the winter of 2013 and fall 2013, the Francis Marion hosted two public meetings on sustainable recreation and ecological sustainability. The following six themes emerged during this series of public meetings from October 2012 through September 2013 to start the forest plan revision process.

Theme 1	**Maintain, improve, or restore the unique landscapes and features on the Francis Marion National Forest**
Theme 2	**Improve the quality of life and health for stakeholders**
Theme 3	**Respond to challenges**
Theme 4	**Share operational and planning resources among partners; keep ongoing collaborative efforts vibrant and develop new ones**
Theme 5	**Develop a monitoring strategy that provides information for rapid responses to changing conditions**
Theme 6	**Manage resources by integration and coordination**

In January 2014, a meeting between USDA Forest Service officials and the Catawba Indian Nation was held to discuss the plan revision process and the findings in the assessment. Discussions focused on special forest products that might be of interest to local tribes.

In the winter of 2014, the assessment, need for change, and proposed management strategies were posted online on the public website for the Francis Marion plan revision. These documents are available at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb5393142. In February 2014, the Francis Marion hosted an open house on the proposed action, which was followed by scoping the proposed action starting in May 2014. The scoping process involved mailing a scoping letter summarizing the assessment, need for change on the 1996 Plan, and proposed management strategies, to more than 60 people on the Francis Marion's project mailing list. In addition, an email announcing the availability of the assessment, need for change, and the proposed management strategies was sent out to over 200 people that had signed up on the Francis Marion list.

The public collaborative planning process to develop plan components consisted of 5 subsequent meetings and 1 field trip during the spring and summer of 2014 with up to 60 participants at one meeting. Other Federal and state agency representatives, local officials, adjacent landowners, non-governmental organization and user group representatives, members of the academic community, and other interested individuals participated. At each meeting participants had the opportunity to learn something about the Francis Marion's resources, give suggestions for plan components, and review and refine work from the previous meeting.

The notice of intent (NOI) to prepare an EIS was published in the *Federal Register* on April 30, 2014. The NOI asked for public comment on the proposal from May 1, 2014, to June 16, 2014. The information from the public comment period was uses to develop a rolling alternative. A public meeting was held on the rolling alternative in September 2014 with approximately 80 participants. Generally, comments were favorable and supportive of the "rolling" alternative,

which emphasizes prescribed burning, restoration of Longleaf Pine Ecosystems, and hydrologic function, and sustainable recreation opportunities.

Starting in fall 2014, Forest Service employees appeared monthly on “Low Country Live.” While topics of the interviews include a variety of subjects that relate to management of the Francis Marion, the plan revision efforts have been discussed. Due to vacancies, this outreach effort lasted only a few months.

Targeted outreach efforts to youth and low-income populations include various activities. The Forest Service has developed partnerships with TRIO (Federal program working with middle school to college-level students) and the local technical colleges in South Carolina.

- Through TRIO, the Forest Service hosts a booth at the annual TRIO conference and is developing a job shadowing program so students can learn about careers in the Forest Service.
- The Francis Marion and Sumter National Forests are co-sponsors of a widget development competition that targets women in the technical college system. As part of this program, Forest Service employees discuss job opportunities.

A 90-day comment period was initiated on August 14, 2015, with the publication of the NOI in the *Federal Register*. For the release of the draft forest plan and associated draft environmental impact statement (EIS), a public meeting was held in fall 2015 and team members completed numerous one-on-one briefings with state and county officials and non-profit organizations. We received approximately 37 letters during the 90-day comment period, and we reviewed them and developed concern statements. Specialists addressed these concern statements; their responses are provided in Appendix H of this final EIS. Letters from government officials are attached to the end of Appendix H. Public input was also used to update the revised forest plan and its associated final EIS. All changes were considered minor and were within the scope of the analysis in the draft EIS.

This FEIS was also subject to a pre-decisional objection process pursuant to 36 Code of Federal Regulation (CFR) § Part 219 Subpart B. A 60-day objection period on the draft Record of Decision (ROD), revised forest plan, and final environmental impact statement ran concurrently with an objection period for the Francis Marion’s list of species of conservation concern (SCC). This objection period was initiated on August 26, 2016 with the publication of the Notice of Objection Filing Period in *The State* newspaper. One objection was received during the objection filing period. The objector brought up issues concerning forest plan components and related analysis in the FEIS, as well as concerns about the process and documentation related to the selection of the Francis Marion’s SCC. These two topics are addressed by different reviewing officers and separate meetings were held with the objector to discuss their objection issues.

On December 1, 2016, the reviewing officer for Region 8 and his staff met with the objector and agreed to changes in forest plan components, the draft ROD and the FEIS that primarily addressed issues with plan component specificity, old growth, riparian management zones, management requirements for the Red-cockaded woodpecker, habitat conditions for other at-risk species and clarified the process used for ecological sustainability (including species grouping and key characteristics of their habitat conditions). These changes are detailed in a document titled –*Summary of Changes to the Revised Plan and FEIS* and is available on the Forest’s website at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb5393142.

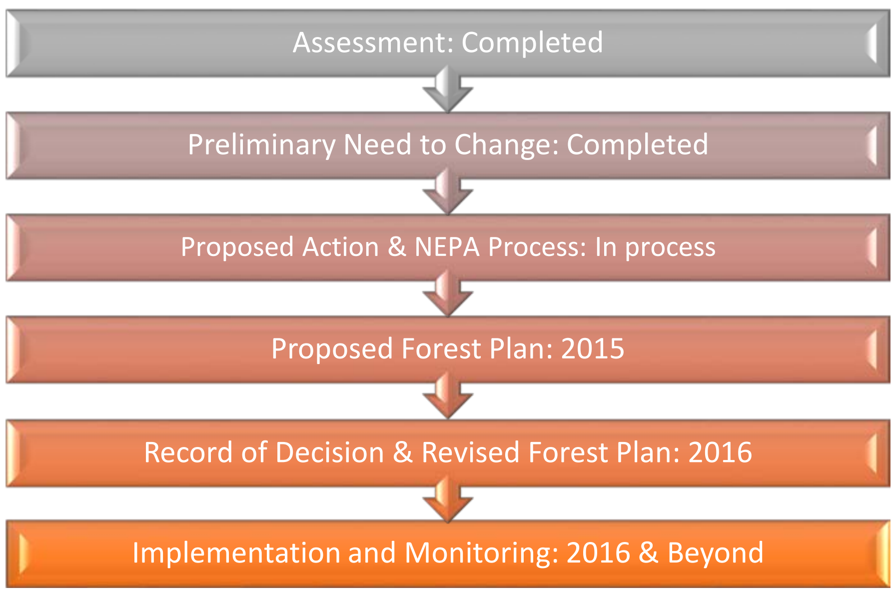
Appendix B: The Planning and Analysis Process

The National Forest Management Act of 1976 requires each national forest to develop a land management plan (commonly referred to as a forest plan) and amend or revise the forest plan every 10 to 15 years. This appendix describes the required steps and how the Francis Marion forest plan revision process fulfilled those steps. Documents identified are included in the process record and are available online at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb5393142

The Francis Marion National Forest's forest plan was approved in 1996, and in the fall of 2012 Francis Marion personnel began revising this forest plan under guidance of the 2012 planning rule. Planning and revision for a national forest plan is an iterative process that includes three phases:

1. Assessment (36 CFR 219.6);
2. Developing, amending, or revising a forest plan (§§ 219.7 and 219.13); and
3. Monitoring (§ 219.12).

The following diagram indicates the steps involved for each phase and the year completed:



The 2012 Planning Regulations at 36 CFR 219.7(c) identifies the process for plan development or plan revision. The steps in this process are described as follows.

Identify a Preliminary Need to Change the Existing Plan and to Inform the Development of Plan Components and Other Plan Content (§ 219.7(c)(2)(i)).

Assessment

The assessment evaluated existing information, forest plan amendments, and annual monitoring reports. Additionally, we considered outcomes from public meetings and other outreach efforts.

All these sources provided valuable information about changes needed in the existing forest plan. A copy of the final assessment is available online at the address shown on page 1.

Need to Change

The findings from the assessment, along with the following information, were then used to develop a "preliminary need to change":

- Public preferences about the future of the Francis Marion National Forest (which emerged during a series of public meetings from October 2012 through September 2013);
- Managers' needs; and
- Compliance with laws, regulations, and policies.

A copy of the preliminary need to change document is also available online at the address shown on page 1.

The preliminary need to change identified six themes (below) to start the forest plan revision process. These themes are broad concepts relating to public preferences and forest management needs:

Theme 1	**Maintain, improve, or restore the unique landscapes and features on the Francis Marion National Forest**
Theme 2	**Improve the quality of life and health for stakeholders**
Theme 3	**Respond to challenges**
Theme 4	**Share operational and planning resources among partners; keep ongoing collaborative efforts vibrant and develop new ones**
Theme 5	**Develop a monitoring strategy that provides information for rapid responses to changing conditions**
Theme 6	**Manage resources by integration and coordination**

Using these themes the planning team developed statements that describe specific needs for changing the existing forest plan. We then developed a management emphasis statement for each theme. While this process recommended a preliminary need to change the existing forest plan; it did not include every topic that will be addressed in the revised forest plan.

Consider the Goals and Objectives of the Forest Service Strategic Plan (§ 219.7(c)(2)(ii))

The following goals and objectives of the current Forest Service Strategic Plan, as applicable to the Francis Marion National Forest (referred to as the Francis Marion), are being addressed in the revised forest plan for the Francis Marion.

Goal 1. Restore, Sustain, and Enhance the Nation's Forests and Grasslands

Objective 1.1 Reduce the risk to communities and natural resources from wildfire

Objective 1.2 Suppress wildfires efficiently and effectively

Objective 1.3 Build community capacity to suppress and reduce losses from wildfires

Objective 1.4 Reduce adverse impacts from invasive and native species, pests, and diseases

Objective 1.5 Restore and maintain healthy watersheds and diverse habitats

Goal 2. Provide and Sustain Benefits to the American People

Objective 2.1 Provide a reliable supply of forest products over time that (1) is consistent with achieving desired conditions on National Forest System lands and (2) help maintain or create processing capacity and infrastructure in local communities

Objective 2.3 Help meet energy resource needs

Goal 4. Sustain and Enhance Outdoor Recreation Opportunities

Objective 4.1 Improve the quality and availability of outdoor recreation experiences

Objective 4.2 Secure legal entry to national forest lands and waters

Objective 4.3 Improve the management of off-highway vehicle use

Goal 5. Maintain Basic Management Capabilities of the Forest Service

Objective 5.1 Improve accountability through effective strategic and land management planning and efficient use of data and technology in resource management

Objective 5.2 Improve the administration of national forest lands and facilities in support of the agency's mission

Identify the Various Physical, Biological, Social, Cultural, and Historic Resources on the Plan Area; and Consider Conditions, Trends, and Stressors (§ 219.7(c)(2)(iii & iv))

The biological, social, cultural and historic resources on the plan area; along with their conditions, trends and stressors, are described in the plan assessment which can be viewed online at http://www.fs.usda.gov/scnfs. Summaries of these resources, conditions, and trends are also provided in Chapter 3 of this Final EIS.

In assessing the resources, conditions, and trends, the sources of the scientific information used are documented in the plan assessment and the "References" section of the final EIS.

The following information and analytical tools were also used:

- Stand examination inventory data collected in the field is entered into our corporate database for tracking overstory vegetation with fields of information such as forest type, stand age, condition, and acres. Our current GIS (geographic information system) utilizes ArcGIS version 10.1, which links to our FSVeg tabular database using SDE (spatial database engine) to connect to FSVeg Spatial (oracle database).
- Other types of inventory data collected and entered into corporate databases and our GIS include roads and trails and conditions, recreation sites and conditions, archeological sites, stream networks, certain wildlife habitats, fire history, digital elevation, and land ownership.
- Federal and state agency, local government, and tribal websites are a source of information about other programs and plans, lists of rare species and occurrence records, some economic information, forest health information, soil and water information.
- NatureServe's ecological systems (2004) are used as a starting point to define ecosystem types on the Francis Marion National Forest.
- Place-based knowledge and information is contributed by participants in the collaborative planning process.

- U.S. Census Bureau data is used to summarize demographics and some economic information.
- Citations listed in the “References” section provide additional information including the best available scientific information in regard to specific analysis topics.
- The Fire Emission Production Simulator (FEPS) is a tool developed by the Forest Service Fire and Environmental Applications Research Team (FERA) to produce hourly emissions and heat release data for prescribed and wildland fires.
- VSMOKE is a simple smoke screening model developed by Lee Lavdas.
- FireFamilyPlus (FFP) is a Windows program that combines fire climatology and fire occurrence analysis. FFP was used here to organize weather data from Remote Automated Weather Station(s) (RAWS) and fire occurrence data for export into the BehavePlus and ArcGIS programs.
- LANDFIRE (also known as Landscape Fire and Resource Management Planning Tool) is an interagency vegetation, fire and fuel characteristics mapping program that provides a national interagency database of spatial coverage for reference, in this case, for forested lands outside the Francis Marion boundary and within the analysis area.
- BehavePlus is a PC-based program that is a collection of models that describe fire and the fire environment. It is a flexible system that produces tables and graphs and can be used for a multitude of applications.
    - The primary modeling capabilities of BehavePlus as used for this assessment include surface fire spread and intensity.
- FlamMap is a fire behavior prediction and assessment model that is widely used across the Nation and in many other countries. It was produced by Dr. Mark Finney of the Missoula Fire Lab in 2006. FlamMap here will be used to assess fire type.
- The Kernel Density tool found in the ArcGIS Spatial Analyst extension. By definition the Kernel Density tool calculates the density of features in a neighborhood around those features. Kernel density was applied to wildland fire ignitions in order to analyze both size and frequency characteristics.
- The climate projection ensembles considered in the Francis Marion National Forest plan assessment were produced from 15 downscaled global climate models (GCMs) by The Nature Conservancy’s Climate Wizard (Girvetz et al. 2009). Examining ensembles of climate projections helps to quantify the range of possible future climates, instead of considering a single or comparing across individual GCMs. The downscaled GCMs were produced by the Coupled Model Intercomparison Project Phase 3 (CMIP3; Meehl et al. 2007), a critical source of data to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (AR4, IPCC; IPCC 2007).

Identify and Evaluate Lands that May Be Suitable for Inclusion in the National Wilderness Preservation System (§ 219.7(c)(2)(v))

See Appendix D of this FEIS for a description of the lands identified and evaluated for possible inclusion in the National Wilderness Preservation System.

Identify the Eligibility of Rivers for Inclusion in the National Wild and Scenic River System (§ 219.7(C)(2)(Vi))

See Appendix C of this FEIS for a description of the rivers considered and determined to be eligible for inclusion in the National Wild and Scenic River System.

Determine Whether to Recommend Any Additional Areas for Designation (§ 219.7(c)(2)(vii))

The plan assessment identifies any areas that the public or other agencies have suggested/recommended for a special designation.

The alternatives in the FEIS show the additional areas that were considered for designation, and the revised forest plan shows those areas that are being recommended for a special designation.

Identify the Suitability of Areas for the Appropriate Integration of Resource Management and Uses; Including Identifying Lands Which Are Not Suitable for Timber Production (§ 219.7(C)(2)(Viii))

The revised forest plan (Chapter 4) identifies the suitability of various uses and activities within different land delineations on the Francis Marion. The revised forest plan (see Appendix B) and the FEIS (Chapter 3) shows the identification of the lands not suitable for timber production, which is also summarized here.

Suitability for Timber Production

There are two "steps" in determining lands suitable for timber production. The first identifies the lands that are non-forest, lands withdrawn from timber production, lands that cannot be adequately restocked, etc., to identify the lands "may be suitable" for timber production. The second identifies the lands that "may be suitable for timber production" that are not appropriate for timber production. These two steps are detailed below.

Step 1: Lands That May Be Suited for Timber Production

The first step is to identify lands that are not suited based on legal and technical factors at 36 CFR 219.11 (a) (i), (ii), (iv), (v,) and (vi). For the Francis Marion National Forest this centers on two factors:

1. Lands on which timber production is prohibited or lands withdrawn from timber production, and
2. Identifying non-forest land.

The first category combines factors (i) and (ii) in the regulations, and includes designated wilderness areas and Guilliard Lake Research Natural Area. The largest subcategories of non-forest land, category (vi) in the regulations, include brush, water and marsh, permanent wildlife openings, and rights-of-way. The land base remaining after these two categories of land are subtracted from the total land area, leaving lands that may be suitable for timber production.

The regulations describe two other categories of lands in the first step that are not suited for timber production. There are no lands in the Francis Marion that are judged to be in these categories, but they are described in the following paragraphs.

> Category (iv) in the regulations states that "The technology is not currently available for conducting timber harvest without causing irreversible damage to soil, slope, or other

watershed conditions." On most national forests such lands are usually those having steep or very erodible slopes. These do not occur on the Francis Marion National Forest. Timber harvest is restricted during wet conditions by standard 17 and guidelines 8 and 9 in the revised forest plan and timber sale contract provisions to avoid resource damage. These make irreversible soil and watershed damage unlikely.

Category (v) addresses lands where "There is no reasonable assurance that such lands can be adequately restocked within 5 years after final regeneration harvest." This can be a concern, usually in western forests, due to elevation, dry ecotones on the edge of forests, rocky soils, and a number of other factors. This not a concern, however, on the Francis Marion. Trees will grow, it is more a matter of taking steps to encourage the growth of the desired tree species.

Step 2: Lands Suited for Timber Production

This step is based on the compatibility of timber production with the desired conditions and objectives for those lands. Desired conditions, objectives, management areas and other plan components vary among alternatives. The result of this two-step analysis is shown in Table B-1.

The overlap of categories in Table B-1 makes consistent acreages difficult. For example, the recommended wilderness in alternative 3 includes acres of brush, pond pine, red-cockaded woodpecker clusters, riparian management zones, water, and wildlife openings. Resolution of these differences is contained in the planning record for plan revision. Note that riparian management zones are narrower in alternative 1, the 1996 plan.

Lands classified as suitable for timber production does not mean that timber production is the primary purpose of management activities. When land is classified as suitable for timber production, it means that timber production is compatible with the achievement of desired conditions and objectives in the plan (36 CFR 219.11(a)(1)(iii)), and some regular flow of timber products may be expected. The suitability for timber production classification is not based on silvicultural or timber volume considerations. An estimate must be made, however, of the amount of timber that may be sold from these lands.

The forest types on the Francis Marion generally have growth rates that can allow for some flow of timber products. The exception to this is pond pine, and consequently, this forest type is unsuitable for timber production. Achieving the desired conditions of the revised forest plan, and maintaining these forest conditions and habitats, generally requires regular, planned harvest entries. These harvest entries produce a regular, at least modest, flow of timber. If it becomes apparent that this may not be the case for some lands, their suitability for timber production may be reconsidered.

For alternative 1 the planning record was difficult to follow and translate regarding management area 29. Table B-1 shows 12,712 acres of land not suitable for timber production. The narrative in the 1996 plan shows 5,644 acres unsuitable for timber production. Maps in the planning record did not seem to agree with the narrative acres, and this sizeable difference between what was indicated in maps versus the plan narrative could not be resolved.

Table B-1. Lands suitable for timber production (acres)

Classification	Alternative 1	Alternative 2	Alternative 3
Total National Forest System Lands	259,625	259,625	259,625
Non-forest lands			
Water and marsh	817	817	817
Brush	6,757	6,757	6,757
Wildlife openings	555	555	555
Rights-of-way	126	126	126
Administrative sites	20	20	20
Developed recreation sites	80	80	80
Borrow pits	6	6	6
Cemeteries	6	6	6
Lands withdrawn from timber production			
Wilderness areas	13,649	13,649	13,649
Guilliard Lake Research Natural Area	23	23	23
Lands That May be Suitable for Timber Production	237,586	237,586	237,586
Lands where timber production is not compatible with achieving desired conditions and objectives (lands not appropriate for timber production.)	53,243	43,563	60,279
Santee Experimental Forest	5,966	5,966	5,966
Recommended wilderness			20,362
Pond pine forest types	5,696	6,132	5,610
Riparian management zones (w/in 100' of perennial waterbodies or within 50' of intermittent waterbodies in Alts 2-3)	15,212	21,401	20,407
Inventoried roadless area	1,394	1,394	
Red-cockaded woodpecker clusters	6,461	6,481	5,745
Genetic resource management area (seed orchard)	673	673	673
Special uses	18	18	18
Cedar Hill Island	802	802	802
Guilliard Lake Scenic Area	1,054	1,054	1,054
Battery Warren Historic Area	74	74	74
Big Ocean Bay	287		
Blue Springs	4		
Ion Swamp	1,101		
MA 29 Core Linkage Area	2,412		
MA 29 Outside HMA	10,330		
Sewee Historic Area	263		
Tibwin Plantation	1,149		
Watahan Plantation Historic Area	347		
Lands Suitable for Timber Production	184,343	193,483	176,875
Lands Not Suitable for Timber Production	75,282	66,142	82,750

For alternative 1 it became apparent from the process record that riparian management zones were not modeled as unsuitable for timber production. However, because 1996 plan direction for these areas made it plain that timber production is not compatible with achieving desired conditions and objectives, these acres are shown as unsuitable for timber production. This does not agree with the table in Appendix B of the EIS for the 1996 plan.

For alternatives 2 and 3, the following describes some of the lands where it was determined they should be classified as suitable for timber production.

In frosted flatwoods salamander designated critical habitat, the desired condition is fire maintained, open-canopy, longleaf pine habitat. Trees grow through the years, their crowns expand, and younger trees come into the forest. Gradually the density of trees exceeds the desired open canopy condition. Periodic timber harvest helps reduce this density to maintain an open canopy and provide enough light for an herbaceous understory and for young longleaf pine to eventually replace the older trees in the forest. For these reasons timber production is compatible with this desired condition.

The same is true for most of the rare plant communities. These fire-adapted species need a fire-maintained open-canopy longleaf pine overstory, which requires some form of timber management to maintain the open canopy.

For the red-cockaded woodpecker, nesting clusters were not considered suitable for timber production, but foraging habitat was considered suitable for timber production. Similar to the rare plant communities, the red-cockaded woodpecker needs a fire-maintained, open-canopy, longleaf pine overstory. As described above, regular planned harvest entries are needed to create and maintain the desired habitat conditions.

The intent with the semi-primitive areas is to gate the roads accessing the area to provide the semi-primitive motorized recreation experience. The desired condition is otherwise the same for the vegetation in the rest of management area 1. In management area 1, an open-canopy, longleaf pine forest is generally the desired condition for the uplands. The semi-primitive area contains red-cockaded woodpeckers. Regular periodic harvest entries are needed to maintain foraging habitat for the species. This would produce a flow of timber, and the production of timber when meeting the vegetative desired conditions is compatible with this recreation experience.

The Francis Marion archaeologist has articulated that the desired condition for the historic districts should include managing the forested portions as described for the forests of management area 2. Regular, planned harvest entries are needed to maintain these desired conditions. Therefore, timber production is compatible with the desired conditions for the historic districts. Harvest operations will take more coordination here than in most places, but timber management is desired to maintain the ecological conditions within these historic districts.

In team discussion about the wild and scenic rivers, the team concluded that they have maintained their outstandingly remarkable values while being managed for the last 70 or 80 years in a way similar to what is proposed. Wambaw Creek is in the middle of a wilderness, so it is not suitable for timber production. National Forest lands near the other eligible rivers are suitable for timber production, at least in the context of eligibility for wild, scenic, or recreational river status, because the desired condition of the surrounding lands include a component of young age forest. Creating this young age component is most readily achieved with regular, planned harvest entries. The same is true for maintaining desired stand densities described in many of the desired conditions.

The outcome of the team discussion on the Ion Swamp special area was that it should be managed like the remainder of the Francis Marion and not be maintained as a special area.

Desired conditions for old growth are not expected to affect acres suitable for timber production. All of the (1) upland longleaf pine and (2) flatwoods and wet-pine savanna ecosystems will be managed so that the older trees will be at least 120-years old, as recommended in the 2003 revision of the Recovery Plan for the Red-cockaded Woodpecker. In time, most of these longleaf pine types in MA 1 should have old-growth conditions, even though they are managed.

For alternative 2, a quick analysis of unsuitable acres shows:

	Unsuitable Ac	Suitable Ac	Percent Unsuitable/ Future Old Growth
Cypress-tupelo	21,494	31,216	41
Bottomland HWD and HWD pine	15,818	40,042	28
Upland hardwoods	547	1,907	22

A similar analysis for alternative 3 shows:

	Unsuitable Ac	Suitable Ac	Percent Unsuitable/ Future Old Growth
Cypress-tupelo	24,505	28,204	46
Bottomland HWD and HWD pine	20,102	35,760	36
Upland hardwoods	665	1,789	27

This analysis indicates that future old growth for the three analysis groups above should provide a distribution and representation of these old-growth communities across the Francis Marion for alternatives 2 and 3. Based on the acres unsuitable for timber production in Table B-1, each of the three alternatives should have significant acreages for the three groups above. Loblolly pine is not considered an old-growth type.

The habitat needs of species of conservation concern are provided by the desired conditions and plan components for alternatives 2 and 3. This is not the case for alternative 1, given the alignment of management area 26 with feasibility for prescribed burning.

Land Stratification, Analysis Units

The following portions of this appendix discuss land stratification and timber modeling assumptions. None of the alternatives make decisions on silvicultural systems. Those decisions are made at the project level. Desired conditions and objectives drive the plan and project decisions (modeling assumptions do not). Also note that while ecological systems have been modeled for alternatives 2 and 3, this mapping is an imperfect approximation. Under alternatives 2 or 3, field verification and judgment of the applicable ecosystem will be used to identify the applicable desired conditions. For timber growth and yield to be modeled and analyzed, ecological systems had to be translated into forest types and grouped into analysis units.

Each of the alternatives had the following three analysis units:

- Upland Hardwoods
- Cypress-Tupelo
- Bottomland Hardwoods and Hardwood-Pine

For alternatives 2 and 3, the bottomland hardwoods and hardwood-pine analysis unit also includes loblolly pine and mixed loblolly pine-hardwood forest types in what were modeled as bottomland or swamp ecosystems. The process record for the 1996 plan (alternative 1) shows that

all modeling was based on even-aged assumptions. That methodology has been followed again, except that regeneration of pine stands in the red-cockaded woodpecker habitat management area is assumed to be two-aged for consistency with current direction.

Alternatives 2 and 3 have three other analysis units; these are:

- Management Area 1, Upland Longleaf Pine
- Management Area 1, Wet Pine Savannas and Flatwoods
- Management Area 2, Loblolly Pine and Pine-Oak

The process record for the 1996 plan (alternative 1) showed how longleaf pine and loblolly pine forest types were modeled across the Francis Marion. In Table B-2, MA is short for management area; HMA is short for habitat management area, HMAs are the designated areas which are managed for red-cockaded woodpecker habitat. The analysis unit names show whether the primary species modeled is longleaf pine or loblolly pine. The number that follows is the modeled rotation length in years.

How Desired Conditions Informed Modeling Assumptions on Regeneration

A few notes are needed to describe how desired conditions translate into either even-aged rotation ages or tree ages for uneven-aged management.

- **Even-aged systems.** For alternatives 2 and 3, in management area 2, the desired condition for Mixed Pine/Hardwood or Loblolly Pine Forests states: "*…12–20 percent of the forest is young age component (0–10 years old*)." When modeled as even-aged systems, approximately 12 to 20 percent of the mixed pine/hardwood and loblolly pine forests would be regenerated each decade. The inverse of these percentages is 8 and 5 (decades). Based on this desired condition, these forests would be regenerated somewhere between age 50 and 80. The modeling assumption for this analysis group is a rotation age of 60. The majority of the timber yield would be loblolly pine and would remain predominantly loblolly pine for the foreseeable future.

- **Uneven-aged systems.** For alternatives 2 and 3, in management area 1, the desired condition for Upland Longleaf and Loblolly Pine Woodlands states that: "*In the long term, the young age component (0–10) of the forest comprises about 6–8.5 percent of the ecosystem*." Using the same approach as above, the result in this case is that average number of decades represented in these forests is between 12 and 17. Since these are modeled as uneven-aged, the older components will reach average ages of between 120 and 170 years.

Additional assumptions by alternative are discussed below.

For **alternative 1**,

- Rotation length for upland hardwoods is 100 years.
- Rotation length for cypress-tupelo is 120 years.
- For bottomland hardwoods and hardwood-pine the rotation is 120 years.
- For the pine analysis areas within the habitat management area for red-cockaded woodpeckers, but outside the red-cockaded woodpecker cluster area, regeneration is two-aged to be consistent with direction.

- In the HMAs, basal areas of mature stands are maintained between 70–110 square feet per acre to be consistent with 1995 red-cockaded woodpecker direction.

Table B-2. Longleaf pine and loblolly pine analysis units for alternative 1

	Loblolly Pine Forest Types	Longleaf Pine Forest Types
MA26, HMA upland longleaf systems	Longleaf 120	Longleaf 120
MA26, HMA outside upland longleaf	Loblolly 100	Longleaf 120
MA26, non-HMA, upland longleaf system	Longleaf 70	Longleaf 70
MA26, non-HMA, not upland longleaf	Loblolly 60	Longleaf 70
MA27, HMA	Loblolly 100	Longleaf 120
MA27, non-HMA	Pine-hardwood 120	Longleaf 120
MA28, HMA	Loblolly 100	Longleaf 120
MA28, non-HMA	Loblolly 60	Longleaf 70
MA29, HMA	Loblolly 150	Longleaf 200
1. MA29, non-HMA	Unsuitable	Unsuitable

For **alternatives 2 and 3** key assumptions for the analysis units are:

- **Management area 1 upland longleaf pine**
  - Desired conditions for red-cockaded woodpecker habitat and a suite of related fire-adapted plant species are the primary driver of management. Timber management modeling follows general guidelines for silviculture found in the Recovery Plan for the Red-cockaded Woodpecker. This is reflected in the ages of the oldest component of these forests. As described previously, the oldest trees in the forest are carried to ages exceeding 120 years.
  - Long-term management is uneven-aged. At age 120 stands enter uneven-aged management. Most stands remain even-aged over the next 5 decades.
  - Loblolly pine stands age 20–50 years are converted to longleaf pine. *Note:* Guideline G4 addresses exceptions to the requirement of CMAI. Tree stands planned for regeneration harvest should generally have reached culmination of mean annual increment of growth. Typically, even-age regeneration harvests should not be made prior to age 35 for loblolly pine or age 50 for longleaf pine. However, plantations of loblolly pine on longleaf pine sites may be harvested for restoration purposes as soon as they are merchantable. Generally, hardwood regeneration harvests will not be made prior to age 50.
  - Loblolly pine stands over age 50 are assumed to be functional foraging habitat for the red-cockaded woodpecker and are not converted to longleaf pine until age 100+. These stands are maintained at basal areas between 40 and 70 square feet per acre in order to meet foraging requirements.
- **Management area 1 wet pine savannas and flatwoods**

  The three assumptions above are the same, except 30 percent of stands are assumed to be too wet for planting and prompt conversion to longleaf pine.

- **Management area 2 loblolly pine and pine-oak**
  Management is even-aged. Rotation age is 60 years.

- **Bottomland hardwoods and hardwood-pine**
  Management is even-aged or two-aged. Rotation age is 100 years.

- **Upland hardwoods**
  Management is even-aged or two-aged. Rotation age is 100 years.

- **Cypress-Tupelo**
  Management is even-aged or two-aged. Rotation length is 140 years.

Growth and Yield Modeling

Growth and volume yield were largely modeled using the Forest Vegetation Simulator (FVS). Forest Inventory and Analysis (FIA) data from South Carolina was the basis for the model simulations. The geographic sources for the plots were matched as tightly to the Francis Marion as possible while still maintaining ample sample sizes. For each analysis unit, plot data was examined to screen out forest types not matching what had been set in the filter requests. It was also examined to screen out plots with basal areas that seemed out of bounds compared to what would reasonably be expected.

The FVS model was calibrated for defect, radial-diameter growth rates and basal area maximums. Francis Marion timber sale data was used to calibrate defect for loblolly pine sawtimber. Defect for all other species was set based on wider area averages found in FIA data. Growth and yield literature was examined to set the basal area maximums in the FVS model runs for the different analysis areas.

Results were compared to growth and yield literature and estimates made by other national forests to be sure they seemed within reason. Average volumes from first thinning sales on the Francis Marion were used for those harvests.

To ensure that yield estimates are reasonable, the following steps were incorporated into modeling efforts:

- Yields for longleaf pine were estimated at 32.5 cubic foot/acre/year compared to Homochitto National Forest estimates of 43 cubic foot/acre/year.

- Estimated yields from the bottomland hardwood and hardwood-pine group are about half of the cubic foot yields for loblolly pine. Most of the timber produced from this group will consist of loblolly pine and will remain predominantly loblolly pine for the foreseeable future. Complete notes on yield modeling are in the process record.

During the three decades from the 1960s through the 1980s (pre-Hugo), the Francis Marion sold an average of about 45 MMBF per year. In current conversions this equates to approximately 90,000 CCF per year. That figure is relatively close to the results shown in the next table.

No specific operational limitations that modify or reduce yields have been identified in the desired conditions and other plan components.

Volumes from the FVS analysis are in cubic feet, and the sustained yield limit (SYL) and the projected wood sale quantity (PWSQ) are calculated in cubic feet. When cubic feet need to be converted to board feet, a conversion factor of 5 board feet/cubic foot has been used.

Identify the Maximum Quantity of Timber that May Be Removed from the Plan Area (219.7(c)(2)(ix))

After lands suitable for timber production were determined, grouped into analysis units, and yield estimates made, an estimated timber sale program was calculated for each alternative. Sustained yield limit calculations, timber scheduling, and changes in vegetation species composition, condition and age were modeled using an excel workbook. Formulas that moved calendar year 2014 acres in 10-year increments were entered by vegetation type and age. The formulas accounted for acres modeled to change vegetation types due to restoration treatments. The resulting timber sale program estimates are shown below in Table B-3.

Three factors greatly affected timber scheduling and the uneven volumes from decade to decade. First of these, especially in alternatives 2 and 3, is the intent to convert very large acreages of loblolly pine to longleaf pine in the first decade. This tends to create a large spike in harvest the first decade, and a large drop in the following few decades. This repeats when the acres regenerated to longleaf pine come of age for thinning in future decades.

Table B-3. Projected wood sale quantity (PWSQ) for all products by decade (MCF/decade)

	Decade 1	Decade 2	Decade 3	Decade 4	Decade 5
Alternative 1	95,470	84,244	88,229	79,102	83,846
Alternative 2	98,643	95,439	78,887	78,735	96,187
Alternative 3	100,396	93,455	78,687	81,952	97,337
Sustained Yield Limit = 113,844					

The second factor owes to the effects of Hurricane Hugo. Because of that event, the acreage in age 20- to 30-year-old forest is quite large, comprising approximately 27 percent of the Francis Marion. Equally important is a following trough of very few acres 0 to 20 years of age.

Related to the first two factors, the third is a large need for thinning to maintain desired tree densities in pine stands to maintain foraging habitat for red-cockaded woodpecker, reduce susceptibility to southern pine beetle attack, and maintain tree vigor and forest health.

For alternatives 2 and 3, mostly due to the first factor above, no harvest was scheduled in either hardwood types or cypress-tupelo in the first decade so that harvest levels would not exceed sustainable levels.

Identify Questions and Indicators for the Plan Monitoring Program (§ 219.7(c)(2)(x))

Forest plan monitoring questions and indicators were identified through the planning process, which began with the plan assessment and continued through iterative development of the plan and its specific components. Each step in this process included reviews of existing information sources and literature, engagement with scientists in numerous related fields and the public, and the interactions of an interdisciplinary planning team. Through this process, plan components have been developed to reflect the best and most measurable aspects of available science.

Each monitoring question and its associated indicators address the nine requirements of the 2012 Planning Rule, use the best scientific information available, and meet the criteria described in Appendix F of the revised forest plan. Thus, every question and its associated indicators to some degree is important for ecological, social and/or economic sustainability; addresses a stressor or threat; has some risk of non-attainment; public interest; management has the technical and fiscal capability to achieve; partners who are willing to work with us; and reflects a long-term commitment.

See Chapter 5 of the revised forest plan for a description of the questions and indicators for the plan monitoring program.

The plan monitoring program addresses the following nine monitoring items required by the planning regulations (36 CFR 219.12(a)(5):

2. The status of select watershed conditions.
3. The status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.
4. The status of focal species to assess the ecological conditions required under § 219.9.
5. The status of a select set of ecological conditions required under § 219.9 to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern.
6. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.
7. Measurable changes to the plan area related to climate change and other stressors that may be affecting the plan area.
8. Progress toward meeting the desired conditions and objectives related to social and economic sustainability (this must be addressed according to FSH 1909.12 chapter 30).
9. Progress toward meeting the desired conditions and objectives in the plan, including providing multiple-use opportunities.
10. The effects of each management system to determine that they do not substantially and permanently impair the productivity of the land (16 U.S.C. 1604(g)(3)(C)).

Identify Potential other Content in the Plan (§ 219.7(c)(2)(xi))

The “other plan content” involves:

- Identifying watersheds that are a priority for maintenance or restoration (see Chapter 2 and Appendix E in the revised forest plan)
- Describe the plan area's distinctive roles and contributions within the broader landscape (see Chapter 1 of the revised forest plan)
- Include the monitoring program (see Chapter 4 and Appendix F of the revised forest plan)
- Identify proposed and possible actions that may occur on the plan area (see Appendix C of the proposed forest plan)

Identify Other Public Planning Efforts (§ 219.4(b)(2)

Review of county and state government plans include:

- **Berkeley County 2010 Comprehensive Plan. Planning the Future While Preserving the Past.** This plan can be viewed at https://www.berkeleycountysc.gov/drupal/zoning/plan
- **Charleston County, South Carolina: Comprehensive Plan Update. Guiding the Future for a Lasting Lowcountry**. This plan can be viewed at http://www.charlestoncounty.org/departments/zoning-planning/index.php
- **Our Region, Our Plan. Envisioning the Future of Berkeley, Charleston and Dorchester Counties, Preferred Plan Overview, March 27, 2012.** The plan can be viewed at http://www.bcdcog.com
- **South Carolina's 2010 Statewide Forest Resource Assessment and Strategy.** This plan is located at http://www.state.sc.us/forest/scfra.htm

South Carolina State Comprehensive Outdoor Recreation Plan. The SCORP can be viewed at https://www.scprt.com/recreation/statewide-comprehensive-outdoor-recreation-plan

Information from the Charleston County and the Berkeley County comprehensive plans and the three goals and other information from SCORP were incorporated into Chapter 9, "Multiple Uses," Section 9.1.1.2 of the assessment and eventually in the need for change. The SCFRA was also considered in the development of the assessment.

Reviews of Charleston County and Berkeley County's comprehensive plans, the Berkeley-Charleston-Dorchester Council of Government's Plan, SCORP, and the South Carolina's 2010 Statewide Forest Resource Assessment and Strategy, did not indicate any conflicts with the forest plan for the Francis Marion. Language from the Berkeley and Charleston Counties' land use plans was used to develop desired conditions and objectives in the resource integration zones. These agencies are facing similar challenges as the Forest Service, and there are many opportunities to coordinate on common goals and objectives across boundaries.

Some county and state plans that have been recently released include:

- **South Carolina's State Wildlife Action Plan, 2015.** This plan can be viewed at http://www.dnr.sc.gov/swap/index.html
- **Charleston County, People 2 Parks, Implementation Study, January 2016.** This can be viewed at https://www.ccprc.com/1207/Comprehensive-Plans

A review of South Carolina's State Wildlife Action Plan did not indicate any conflicts with the revised forest plan. There are many common goals and areas where the Forest Service and the South Carolina Department of Natural Resources can work together, such as monitoring. Charleston County's "People 2 Parks" had some themes that are similar to the revised forest plan, notably connecting people to nature and providing outdoor recreation opportunities that promote a healthy lifestyle. No conflicts were identified between the revised forest plan and Charleston County's "People 2 Parks" plan.

The Francis Marion consulted with Catawba Indian Nation on their concerns. Team members made three presentations to the Charleston County Agriculture Commission and one presentation to the Berkeley County Supervisor over the last 4 years. Forest Service personnel have met with city and county personnel including emergency management services staff on the development of community wildfire protection plans. In addition, local city and county personnel were invited to public meetings on the Francis Marion plan revision effort.

Considering the Environmental Effects of the Proposal (§ 219.7(c)(1))

The process for plan development or revision also includes the step to analyze the environmental effects of the proposal and alternatives to that proposal.

Here is a description of some of the other models and tools that were used to assist in the analysis of the environmental effects of the proposal and its alternatives, which have not been described previously.

See Appendix E of this FEIS for a description of the ecological sustainability framework used to support forest plan revision for the Francis Marion National Forest. This framework is built on a foundation of ecological system diversity.

The sediment model employed analysis tools that have been used for analyzing effects of timber sale and prescribed burning proposals on the Francis Marion National Forest. Many of the basic methods, which were also used for the previous forest plan, use the Revised Universal Soil Loss Equation that uses slope, rainfall, slope length, and cover. The references used were summarized by Hansen et al. (1994). Many of the references are quite old including Dissmeyer and Stump (1978) who reported on estimates of erosion within all major physiographic areas in the southeast. The 10 percent figure for the sediment delivery ratio was estimated considering Roehl (1962) for terrain with more gradient and quicker response, but lowered based on the influence of increased lag time between rainfall and discharge in coastal plain (Lu et al. 2003). The sediment model used to create the existing condition estimate used coefficients developed from Dissmeyer and Stump (1978) plus other references and cover calculations with the intent to improve coefficients to the practices of today that employ BMPs and spend more time in avoiding. The erosion estimates never were intended to be accurate and precise to fit all circumstances, but provide a consistent reference that could be applied to consider complex land use and activity conditions to produce a relative comparison by which alternatives can be compared.

The sediment and water yield estimates applied factors or coefficients to each land use activity and practice as disclosed in the FEIS. A spreadsheet of existing activity and land use then added in the activities by alternative to get an estimate for sediment (tons/decade) and water yield (acre feet and percent increase). To further clarify, estimates of sediment and water yield were calculated for current activities and land uses by subwatershed before adding in estimated activities by alternative. In this process, as described above, erosion was converted to sediment delivered to streams with the 10 percent sediment delivery ratio and then the mean suspended

sediment concentration was estimated over the decade by dividing the tons of sediment by decade by estimated tons of water for the decade assuming water yield was 10 inches per year. The spreadsheets of existing sediment are a byproduct of existing land uses and practices from information in GIS. The potential activities for each alternative with sediment estimates were then added to the existing amounts by subwatershed to obtain the overall estimates.

The spreadsheets that contain acreages of activities by subwatershed were used with the coefficients for water yield increase or decline by activity to estimate water yield change by subwatershed. Even though there were some increases in water yield from some of the activities that would further reduce the concentrations, it was felt that it would be easier to compare alternatives if all just assumed the 10 inches water yield.

Social Economic Impact Analyses

This section describes the methodology and data used to model the economic impacts of public land management decisions on communities surrounding Federal lands. Input-output models, such as the Impact Analysis for Planning (IMPLAN) model, provide a quantitative representation of the production relationships between individual economic sectors. Thus, the economic modeling analysis uses information about physical production quantities and the prices and costs for goods and services. The inputs required to run the IMPLAN model are described in the following narrative and tables. The resulting estimates from the IMPLAN model, by alternative, are summarized in Section 3.4.15, “Social, and Economic Benefits to People” and detailed in Appendix F of this FEIS. Below is a description of general aspects of the IMPLAN model and how it was used to estimate economic impacts. The remaining sections provide additional information on the data and methodologies used to analyze recreation, timber harvests, and Federal employment and expenditures.

Forest Contribution and Economic Impact Analyses

Economic contributions associated with the Francis Marion were measured using IMPLAN v3 and a Forest Service-developed Microsoft Excel workbook known as FEAST. IMPLAN is a widely accepted economic model commonly used for regional contribution and impact analyses, and FEAST serves as an interface between forest resource data and the IMPLAN model. The IMPLAN model provides a mathematical representation of the local economy which enables the flow of money, goods, and services to be tracked and reported in terms of regional jobs and income. After the local analysis area has been identified, IMPLAN models the way a dollar injected into one sector creates a ripple-like effect as it is spent and re-spent in other sectors of the local economy. This ripple effect, also known as the “multiplier effect,” reflects changes in economic activity in sectors that may not be directly impacted by management actions, but are linked to industries that are directly impacted. In IMPLAN, these ripple effects are termed indirect impacts (for changes in industries that sell inputs to the industries that are directly impacted) and induced impacts (for changes in household spending as household income increases or decreases as a result of changes in production).

The analysis conducted for the revised Francis Marion forest plan used two IMPLAN v3 models; an 8-county model to analyze forest resource uses (such as recreation and timber), and 11-county model to examine Forest Service salary and non-salary expenditures. At the time of this analysis 2012 data was the most recent IMPLAN data available, so all cost and price data were converted to 2012 dollars to ensure consistency. The current IMPLAN model represents the U.S. economy through 440 economic sectors, 355 of which were represented in the 8-county planning area and 381 were present in the 11-county study area. National IMPLAN production coefficients were

adjusted to reflect the interactions between sectors active within the study area. These coefficients are calculated based data specific to the Francis Marion region of South Carolina, including employment estimates, labor earnings, and total industry output; and are used to measure the amount of local economic activity stimulated by resource outputs from the Francis Marion (such as recreation visits, timber harvests, and annual expenditures). IMPLAN’s adjusted response coefficients are also used to measure potential changes in local economic activity resulting from resource output levels anticipated under alternative management scenarios.

Contributions and impacts to local economies are generally measured in terms of the employment and labor income they support. Although employment is expressed in number of jobs, jobs reported from IMPLAN are an annual average and not full-time equivalents. Estimates of jobs supported by activities associated with the Francis Marion include all full-time, part-time, and temporary positions. Since IMPLAN jobs are annual average monthly jobs, a job can be interpreted as one job lasting 12 months = two jobs lasting 6 months each = three jobs lasting 4 months, etc. Although IMPLAN provides a means by which changes in employment stemming from Forest Service management can be measured, its data cannot determine the number of hours worked, the relative percentage of full-time to part-time employment, or identify the number of local employees associated with these annual average monthly jobs.

Since resource outputs from Francis Marion are aggregated to the Francis Marion level, response coefficients were constructed at a regional (multi-county) scale and analyses were conducted at the multi-county level. While these aggregations enable changes from the baseline to be quantified, impacts for individual counties and communities cannot be disaggregated from regional results. Since data for recreation use, timber harvests, and operating expenses is not available at a finer community level, impacts to individual counties and communities within the planning area could not be quantified.

Recreation

The Francis Marion supports outstanding opportunities for a wide range of recreational activities. Popular activities on the Francis Marion include hunting and fishing, hiking, camping, OHV and horseback riding, mountain biking, and wildlife viewing. Average annual recreation visits were derived from Round 2 of the National Visitor Use and Monitoring survey for the Francis Marion and Sumter National Forests. Although these forests are surveyed together as a single administration unit, visitation for the Francis Marion National Forest was derived from survey results collected specifically on the Francis Marion.

On their way to the planning area, and once they arrive, these visitors spend money on goods and services such as gas, food, lodging, and souvenirs. In contrast to many other resource and land uses, outdoor recreation is not captured by any one industrial sector. Instead, spending associated with recreational visits to these National Forest System lands stimulates economic activity in a wide range of economic sectors associated with accommodations and food service, arts and entertainment, passenger transportation, and retail trade (Marcouiller and Xia 2008).

Rather than measuring economic impacts, the economic analysis for recreation examined the local economic significance of outdoor recreation on the Francis Marion National Forest. While both impact and significance analyses measure the amount of economic activity attributable to outdoor recreation within a defined area, impact analysis only includes spending by visitors who reside outside of the local region since their spending constitutes "new dollars" being injected into the local economy. A significance analysis however, includes the effects of spending by all visitors, both those who reside in the planning area and those who do not. Since much of the

spending by local recreationists would likely be shifted to other sectors of the local economy, the results of this analysis do not reflect the loss to the local economy if recreational opportunities on the Francis Marion National Forest were eliminated. Instead, the significance analysis shows the size and nature of economic activity associated with these recreational experiences to show how important they are to the local economy.

Outdoor recreationists participating in activities on public lands have unique spending profiles. Analyses of expenditures reported by national forest visitors has shown that the primary factor determining the amount of money spent on a recreational visit to public lands was the type of trip taken rather than the specific activity they intended to participate in while visiting (White et al. 2013). Based on this assumption, annual average visitation to the Francis Marion National Forest was segmented into local and non-local visits and then by trip type. Trip segments examined in the significance analysis included:

Visitors who reside greater than 50 miles from the Francis Marion:

- Non-local residents on day trips
- Non-local residents staying overnight on the Francis Marion
- Non-local residents staying overnight off the Francis Marion

Visitors who live within 50 miles of the Francis Marion:

- Local residents on day trips
- Local residents staying overnight on the Francis Marion
- Local residents staying overnight off the Francis Marion

Expenditures associated with these visits were estimated using national forest visitor spending profiles developed by the U.S. Forest Service from NVUM survey responses[1]. Spending profiles for average spending forests (Table B-5) were applied to visitation estimates for the planning area (Table B-4) in order to quantify visitor spending attributable to recreation on the Francis Marion. Economic contributions of current recreation use levels, and those anticipated under alternative management actions, were modeled in IMPLAN to estimate the direct, indirect, and induced effects of recreation-related spending in terms of the employment and income it supports across the 8-county analysis area.

[1] National average spending profiles are developed for seven trip type segments: day trips and overnight trips involving stays on and off the forest for local and non-local visitors, and visitors whose primary trip purpose was not recreation on the Forest. Distinct spending profiles are also estimated for high and low spending areas and for selected recreation activity subgroups.

Table B-4. Annual Francis Marion recreation visits[1] by trip segment

	Non-local Segments			Local Segments			Non-Primary
	Day	Overnight on NF	Overnight off NF	Day	Overnight on NF	Overnight off NF	
Percent of National Forest Visits[2]	11	1	3	69	4	2	10

[1] The market segments shown here relate to the type of recreation trip taken. A recreation trip is defined as the duration of time beginning when the visitor left their home and ending when they got back to their home. "Non-local" trips are those where the individual(s) traveled greater than approximately 50 miles from home to the site visited. "Day" trips do not involve an overnight stay outside the home, "overnight on-forest" trips are those with an overnight stay outside the home on National Forest System land, and "overnight off-forest" trips are those with an overnight stay outside the home off National Forest System land.

[2] A "national forest visit" is defined as the entry of one person onto a national forest to participate in recreation activities for an unspecified period of time. A "national forest visit" can be composed of multiple "site visits."

Table B-5. Spending profiles (in 2012 dollars) by trip segments for average spending national forests[1]

	Non-local Segments			Local Segments			Non-Primary
	Day	Overnight on NF	Overnight off NF	Day	Overnight on NF	Overnight off NF	
Lodging	0	64	183	0	31	55	136
Restaurant	16	28	119	5	7	36	95
Groceries	10	60	73	7	72	59	46
Gas and Oil	25	57	76	14	41	43	51
Other Transportation	1	2	4	0	0	1	3
Activities	4	9	29	2	4	6	18
Admissions/Fees	5	10	19	2	4	7	12
Souvenirs/Other	7	21	46	5	15	21	34
Total	**67**	**249**	**550**	**35**	**173**	**228**	**397**

[1] Dollar figures are expressed in 2012 dollars and represent the spending of the entire group on Forest Service lands and within 50 miles of the boundary of Forest Service lands during the trip. Figures have been adjusted to 2012 dollars using the Bureau of Labor Statistics' CPI Inflation Calculator, available online: http://www.bls.gov/data/inflation_calculator.htm. The spending figures depicted in this table are one of three sets of national-level spending averages developed from the NVUM data. The shown spending averages are those determined to be most applicable to the selected forest based on statistical analysis. For more information see "Estimation of National Forest Visitor Spending Averages from National Visitor Use Monitoring: Round 2" (White et al. 2013), available online: http://www.fs.fed.us/pnw/pubs/pnw_gtr883.pdf

Source: White et al. (2013).

Timber

The timber analysis examined economic activity of stumpage flowing through logging companies, sawmills, post and pole operations, and firewood sales. Baseline information on the average annual volume (cubic feet) cut on the Francis Marion was obtained from the Region 8 Cut and Sold Report for the Francis Marion National Forest and estimates of harvests anticipated under the alternatives were provided by the Francis Marion's timber specialist (see FEIS, "Section 3.4.1 Forest Products/Timber Harvesting" for additional information). The direct effects were estimated using direct response coefficients developed from a national Timber Mill Survey conducted by the University of Montana's Bureau of Business and Economic Research (BBER) (Table B-6). BBER timber response coefficients are broken into multi-state regions and are considered more accurate than those available from IMPLAN.

Data from the Francis Marion shows that 57 percent of the softwood sawtimber volume and 51 percent of the hardwood sawtimber volume was processed in the study area. Most of that was processed by sawmills, but a small percentage was processed by veneer mills and other wood products manufacturing. Only 44 percent of the roundwood was processed in the study area. Of that, most was processed by pulp mills, with a small percentage going to reconstituted wood products manufacturing. Given the location of sawmills, anticipated to process volume from the Francis Marion National Forest, BBER direct response coefficients for Southeast States (includes Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Virginia) were used to estimate direct effects associated with timber harvests on the Francis Marion (Table B-6). Indirect and induced employment and income effects were modeled using IMPLAN.

Federal Expenditures and Employment

Management of the Francis Marion National Forest directly contributes to the local economy by employing individuals living within the area and by spending federally appropriated dollars on goods and services to carry out management programs. The Francis Marion's annual appropriated budget has been gradually declining, but was assumed to stay relatively constant over the planning period. Annual expenditures on Francis Marion programs and personnel for the Francis Marion National Forest have averaged $10.4 million a year between 2009 and 2011. This was the most recent data available at the time of this analysis. It should be noted that program-related expenditures do not include expenditures associated with emergency fire suppression since these cannot be considered consistent contributions to the area economy.

Although field support for the Francis Marion comes from the District Ranger's Office in Huger, financial and administrative support for the Francis Marion is provided by the Francis Marion Supervisor's Office in Columbia. To more accurately analyze how these expenditures affect employment and income, the analysis area was expanded to include the Calhoun, Lexington, and Richland. Annual expenditures were then partitioned between salary and non-salary expenditures and were bridged to IMPLAN economic sectors based on a spending profile specific to the Francis Marion National Forest.

Table B-6. Keegan timber response coefficients for Southeast States

	Direct Response Coefficients	
Industry Sector	**Employment[1]**	**Income[2]**
Logging	8	349
Sawmills	11	578
Plywood and Veneer Softwood	22	1,303
Plywood and Veneer Hardwood	80	4,133
Oriented Strand Board (OSB)	8	468
Processors of Roundwood Pulp Wood	9	1,836
Other Timber Products	30	1,174
Residue From Sawmills	4	507
Residue From Residue From Plywood/Veneer	4	507

[1] Jobs per MMCF.

[2] Thousands of 2012 dollars per MMCF.

Source: Morgan et al. (2008)

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Appendix C: Francis Marion National Forest Wild and Scenic Rivers

Introduction

This appendix summarizes the process to eligible wild and scenic rivers that were considered for the revision of the Francis Marion Forest Plan. It describes the assessment process, rivers considered, and then lists eligible rivers and a description of their values. This is the first step in the process toward consideration for designation.

The overall policy directed by the Wild and Scenic Rivers Act (WSRA) is as follows (Section 1b and 1c):

> It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.
>
> The purpose of this Act is to implement this policy by instituting a national wild and scenic rivers system, by designating the initial components of that system, and by prescribing the methods by which and standards according to which additional components may be added to the system from time to time.

The WSRA directs Federal agencies to evaluate potential river segments for inclusion during its land management planning, as per section 5(d)1:

> In all planning for the use and development of water and related land resources, consideration shall be given by all Federal agencies involved to potential national wild, scenic and recreational river areas, and all river basin and project plan reports submitted to the Congress shall consider and discuss any such potentials. The Secretary of the
>
> Interior and the Secretary of Agriculture shall make specific studies and investigations to determine which additional wild, scenic and recreational river areas within the United States shall be evaluated in planning reports by all Federal agencies as potential alternative uses of the water and related land resources involved.

Evaluating Rivers

The process for evaluating Francis Marion National Forest Rivers focused on determining eligibility of potential rivers. To be eligible for inclusion, a river segment must be free-flowing and, in combination with its adjacent land area, possess one or more outstandingly remarkable values.

a. Free Flow

To be eligible, a river must be “free-flowing,” as defined in the Wild and Scenic Rivers Act (Section 16(b)) as follows:

> “Free flowing” as applied to any river or section of a river means existing or flowing in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway. The existence, however, of low dams, diversion works, or other minor structures at the time any river is proposed for inclusion in the [National System] shall not automatically bar its consideration for such inclusion: Provided, that this shall not be construed to authorize, intend, or encourage future construction of such structures within components of the [National System].

Further, the USDA-USDI Guidelines state: “[t]he fact that a river segment may flow between large impoundments will not necessarily preclude its designation. Such segments may qualify if conditions within the segment meet the eligibility criteria.”

b. Outstandingly Remarkable Values

For a river to be eligible for inclusion in the National System, the river and its adjacent land area (referred to as the “river area”) must have one or more outstandingly remarkable values. Under the Act, the categories of outstandingly remarkable values include “scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values.”

“Outstandingly remarkable” values are not specifically defined in the Wild and Scenic Rivers Act. As the Forest Service Handbook (FSH 1909.12, Sec. 8.21) notes,

> There is no way to write criteria to mechanically or automatically determine that certain values are so rare or unique as to make them outstandingly remarkable. Dictionary definition of the two words would indicate that such a value would be one that is a conspicuous example of a value from among a number of similar values that are themselves uncommon or extraordinary…

However, congressional decisions and agency practice helped the Interagency WSR Coordinating Council (IWSRCC) establish basic guidelines for defining outstandingly remarkable values individual to each river (from IWSRCC study process paper by Diedrich and Thomas [1999]):

> In order to be assessed as outstandingly remarkable, a river-related value must be a unique, rare or exemplary feature that is significant at a comparative regional or national scale. Dictionary definitions of the words “unique” and “rare” indicate that such a value would be one that is a conspicuous example from among a number of similar values that are themselves uncommon or extraordinary. One possible procedure would be to list all of the river’s special values and then assess whether they are unique, rare or exemplary within the state, physiographic province, ecoregion, or the other area of comparison. Only one such value is needed for eligibility. The area, region or scale of comparison is not fixed, and should be defined as that which serves as a basis for meaningful comparative analysis; it may vary depending on the value being considered.

> Typically, a "region" is defined on the scale of an administrative unit, a portion of a state, or an appropriately scaled physiographic or hydrologic unit.

While the spectrum of resources that may be considered is broad, all features considered should be directly river-related. River values should meet at least one of the following criteria:

1) They must be located in the river or on its immediate shorelands (generally within 1/4 mile on either side of the river);

2) Contribute substantially to the functioning of the river ecosystem; and/or

3) Be river-dependent and owe their location or existence to the presence of the river.

The study process description developed by the IWSRCC further develops eligibility criteria for individual types of values (scenery, recreation, geology, fish, wildlife, prehistory, history, and other values) but notes:

> The following eligibility criteria are offered to foster greater consistency within the federal river-administering agencies. They are intended to set minimum thresholds to establish ORVs and are illustrative but not all-inclusive. If utilized in an agency's planning process, these criteria may be modified to make them more meaningful in the area of comparison, and additional criteria may be included.

Eligible river segments may flow between impoundments or have their flows affected by upstream water projects, but in the segment they must be generally free-flowing and without extensive channel modifications.

There is no minimum sized river or amount of flow. The WSRA notes that a river may be "a flowing body of water or estuary or section, portion, or tributary thereof, including rivers, streams, creeks, runs, kills, rills, and small lakes."

c. Rivers considered on Francis Marion National Forest

The Forest Service initially evaluated rivers within the Francis Marion boundary that were:

- Shown on a 1:24,000 scale map, (all named rivers on a 7.5 minute quadrangle map)
- Listed on Nationwide Rivers Inventory (USDI 1996), or
- Listed on American Rivers Listing (Huntington and Echeverria 1991), or
- Specifically identified through scoping or preliminarily evaluated by the ID team as having relatively high value, or
- Contain river-dependent sites listed on the National Register of Historic Places, or
- Contain designated geologic areas, or contain portions of a National Historic or National Recreation Trail where the river corridor contributes significantly to the trail's designation.

The rivers listed in the following table were considered.

Table C-1. Rivers considered on the Francis Marion

Name	Miles on National Forest land	Miles on Non-National Forest land	Total Miles within Administrative Boundary
Awendaw Creek	0.16	6.53	6.69
Echaw Creek	5.28	6.54	11.82
Hampton Creek		1.80	1.80
Santee River	0.35		0.35
Wadboo Creek	3.51	7.42	10.94
Wambaw Creek	13.93	1.99	15.92
Bark Island Slough	0.73		0.73
Bay Branch	1.55	1.61	3.16
Bell Creek	2.24	0.13	2.37
Big Morgan Branch	1.82		1.82
Browns Branch	2.96	1.76	4.72
Bullhead Run	3.64	2.87	6.51
Callum Branch	1.66	1.59	3.26
Canady Branch	0.66	1.92	2.58
Cane Branch	3.72		3.72
Cane Gully Branch	6.44	1.66	8.10
Cane Pond Branch	2.82	0.19	3.02
Cedar Creek	1.20	2.08	3.28
Chicken Creek	4.35		4.35
Cooter Creek	2.06	1.20	3.26
Dutart Creek	4.48	1.35	5.83
Gal Branch	3.02	0.01	3.02
Gravel Hill Swamp	0.62	4.26	4.89
Gum Branch	0.63		0.63
Island Branch	0.32	2.37	2.68
June Pond Strand	1.91	0.16	2.07
Little Morgan Branch	2.74		2.74
Mattassee Branch	0.13	0.37	0.50
Mechaw Creek	2.15	1.00	3.15
Mill Branch	3.01	0.49	3.51
Mill Creek	0.45		0.45
Persimmon Branch	2.90	0.18	3.08
Put-on Branch	2.21	0.89	3.10
Red Bluff Creek	2.22		2.22
Sarah Drain	0.29	0.13	0.42
Savanna Creek	3.00	3.54	6.54
Steed Creek	2.86	0.39	3.25
Stewart Creek	0.62	0.94	1.55

Name	Miles on National Forest land	Miles on Non-National Forest land	Total Miles within Administrative Boundary
Velvet Branch	0.96		0.96
Wedboo Creek	5.55	2.74	8.29
Whiskinboo Creek	1.78	3.31	5.10
Withey Wood Canal	2.45		2.45
Guerin Creek	3.14	0.15	3.29
Huger Creek	0.52	2.69	3.20
Quimby Creek	1.74	4.46	6.20
Alligator Creek	2.44	3.06	5.50
Beauford Branch	2.24	1.32	3.56
Bennett Branch	1.97	1.00	2.97
Buck Branch	1.02		1.02
Cooks Creek	2.39	0.00	2.40
Cropnel Dam Creek	1.27		1.27
Darlington Creek	0.96		0.96
Deep Branch	1.37	0.85	2.22
Devils Lodge Branch	0.98	0.98	1.96
Fogarty Creek	2.96	0.14	3.10
Fourth of July Branch	1.11		1.11
Fox Gully Branch	1.96		1.96
Gough Creek	2.38	0.73	3.11
Gravel Run	1.22		1.22
Halfway Creek	1.21		1.21
Harleston Dam Creek	3.28	0.01	3.30
Huitt Branch	3.25	0.64	3.88
Jericho Branch	1.25		1.25
Keepers Branch	1.27	0.46	1.73
Kutz Creek	2.66		2.66
Lachicotte Creek	2.00	0.68	2.69
Meeting House Branch	1.51	2.54	4.05
Mepkin Creek	0.94	1.17	2.11
Muddy Creek	1.86		1.86
Negro Field Branch	3.62		3.62
Nicholson Creek	6.46	0.44	6.89
Northampton Creek	1.90		1.90
Oakie Branch	2.24	0.31	2.55
Old House Creek	1.79		1.79
Old Man Lead	0.59		0.59
Pepper Gully	1.81		1.81
Turkey Creek	7.38	0.35	7.73

Name	Miles on National Forest land	Miles on Non-National Forest land	Total Miles within Administrative Boundary
Washaw Creek	1.16	0.93	2.10
York Bottom Creek	0.97	2.18	3.15
Beaman Branch	0.11	2.92	3.03
Broad Ax Branch		2.91	2.91
Byno Creek		0.61	0.61
California Branch		0.01	0.01
Collins Creek	0.26	4.98	5.24
Deep Creek		0.10	0.10
Doe Hall Creek		0.48	0.48
East Branch Cooper River		0.15	0.15
Fox Swamp		2.31	2.31
French Quarter Creek	0.34	4.82	5.16
Hester Canal		1.01	1.01
Jeremy Creek		0.34	0.34
Kelley Branch		1.34	1.34
Little Johnson Creek		1.05	1.05
Mary Anne Branch	0.27	2.95	3.21
Menzer Run		3.79	3.79
Mingo Branch		0.59	0.59
Montgomery Creek		2.19	2.19
Old Santee Canal		1.52	1.52
Pinckney Reserve Branch	0.15	2.23	2.38
Pole Branch		1.32	1.32
Ponteaux Branch		1.59	1.59
Sandy Point Creek		1.28	1.28
Tailrace Canal		1.58	1.58
Tibwin Creek	0.26	0.79	1.05
Walker Swamp		2.65	2.65
Wando River	3.26	3.37	6.63
Grand Total	184.82	135.41	320.23

d. Evaluation of Rivers

Several rivers were selected for further review by the interdisciplinary team input (based on free flow conditions and potential for outstandingly remarkable values) and included the following:

- Santee River (Main, South, North, and cutoffs)
- Dutart Creek (or other river-right feeder tributaries)
- Echaw Creek and feeder tributaries
- Chicken Creek

- Wambaw Creek and feeder tributaries
- Hampton Creek
- Awendaw Creek (and feeder tributaries, Steed and Bell)
- Wando River
- Guerin Creek
- Huger Creek and feeder tributaries
- Wadboo Creek and feeder tributaries

The assessment recognized that values may vary along a river and guidelines allow segments to be tailored to highlight changes in values or potential classification (wild, scenic, or recreational). In addition, rivers were evaluated to include segments that sometimes extend beyond the Francis Marion's administrative boundary if those values also extend beyond those borders. When river segments leave the Francis Marion or have large proportions of adjacent land in private ownership, it raises issues that are central to a suitability determination.

e. ID Team and Public Involvement

The forest plan planning team (an interdisciplinary team as well as additional natural resources specialists) met and considered the rivers and their potential outstandingly remarkable values. The team considered the rivers and documented the outstandingly remarkable values of several rivers from the entire list. Several rivers were eliminated from the larger initial list due to very little or no national forest ownership or are smaller tributaries to non-eligible reaches of rivers/streams.

The Francis Marion planning team has had several general planning open houses during the planning process. The Francis Marion also hosted a series of collaborative meetings in 2014, including one specific to sustainable recreation, wilderness, and wild and scenic river eligibility. Following that meeting, there was a public field trip that focused on recreation, including wild and scenic rivers.

Eligible Rivers

Based on ID team evaluation the following rivers are eligible for wild and scenic designation (see details by river below):

- Lower Santee River
- Wambaw Creek
- Echaw Creek
- Wadboo Creek
- Awendaw Creek

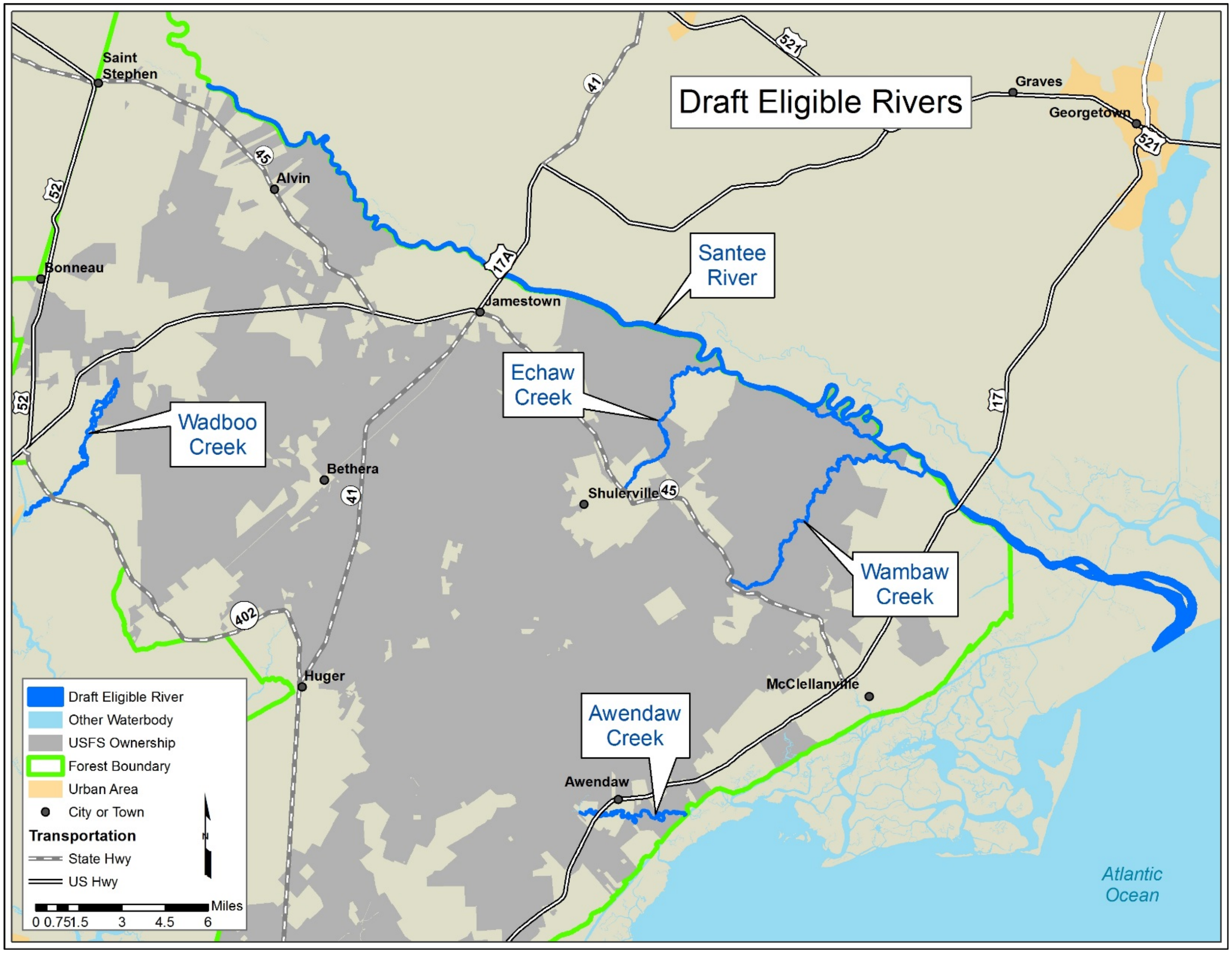


Figure C-1. Rivers eligible for wild and scenic designation

Lower Santee River

The study area includes the river from Lake Moultrie outlet to saltwater, including Chicken/Hampton Creek braids, but not including the Wadmacon Creek or the North Santee braids (which are not adjacent to National Forest lands). A potentially shorter designated segment may reach from Jamestown Bridge (Highway Alternative 17) to the coast. The width of the study corridor is approximately 0.5 mile (0.25 mile from the ordinary high water line on both sides of the river). Boundaries could be adjusted to be wider at tributary creek mouths or to include remnant river features (e.g., Lake Guilliard) and narrower on the private land side to reduce private land oversight yet still provide a scenic or ecological buffer (e.g., 200 to 300 feet). The entire river would be classified “scenic” (minimal development except at road/railroad crossings).

Outstandingly Remarkable Values

The Lower Santee River has outstandingly remarkable ecological and cultural values. Despite dramatic flow reductions due to the Cooper-Santee Hydroelectric Project, the “Mighty Santee” provides an important ecological connection between the Piedmont and the coast, offering a relatively undisturbed riparian corridor with old growth forests, coastal marshes, and estuaries. Examples of specific values include:

- The predominant landform on South Carolina’s low country and Atlantic coast are vast broad river valleys, and the Santee is one of the best examples without substantial development.
- The river provides a longitudinal connection between the state’s low country and the coast, offering a large, unfragmented corridor for fish and wildlife movement.
- Although the Santee corridor was extensively harvested for timber in the 1700s and 1800s, there has been less forestry activity in the past century and many areas now have late succession or mature Tupelo Cypress forests (some areas have been undisturbed for nearly 150 years). This is rare on the populated southeastern seaboard.
- Marine mammals including the West Indian Manatee (near north end of their range) and dolphins regularly use the river and adjacent coastal waters. Dolphins have been observed schooling prey fish onto riverine mudflats, a river-related behavior that may be relatively unique.
- Notable fish species include Atlantic and Shortnose sturgeon, catadromous Atlantic Eel, and Atlantic shad (16 percent of all shad freshwater shad catch in South Carolina occurs in the Santee).
- Rare swallow-tailed kites use the river for nesting and pre-migration staging. They nest in the larger pines and cypress on the borders of the river.
- The river has several resident raptors, including bald eagles and osprey.
- Ivory-billed woodpeckers (North America’s largest), now considered “definitely or probably” extinct, were regularly seen along the Santee swamps into the 1930s, and may have been seen as late as the 1960s, which is indicative of the habitat quality and remoteness of the area.
- The river has diverse populations of lizards and amphibians.

Culturally, the river has been a travel corridor for Indians and early European settlers, and has important cultural sites relevant to Revolutionary and Civil War history.

- The Santee can be described as a “prehistoric interstate.” Indigenous peoples traveled by boat along rivers and the ocean for hunting, fishing, gathering, and trading. Coastal sites show evidence of this use (e.g., shell rings and middens); however, there are no known archeological sites on the river itself.
- Francis Marion, the Revolutionary War’s “Swamp Fox,” is widely credited with adapting guerrilla war strategies to frustrate British regular troops in the area. In one celebrated incident, he and his troops swam across Chicken Creek and then ferried across the larger Santee to evade British capture.
- Remnant rice plantation canals are visible on several tributaries and adjacent to the Santee and its associated braids (e.g., Hampton Creek and Chicken Creek). These plantations were critical developments in the state’s history, with the planting and harvesting of “Carolina Gold” (starting about 1700) largely responsible for the huge influx of slave labor and phenomenal prosperity enjoyed by white colonists. Charlestown (now Charleston) became one of the richest and most fashionable cities on the eastern seaboard due to the rice plantation economy.
- Hampton Plantation, on the banks of a Santee River braid (Hampton Creek), offers a well-preserved example of a rice plantation with preserved buildings and grounds. The plantation house is considered one of the finest examples of a Georgian-style mansion (erected 1735). The plantation was also the residence of South Carolina’s poet laureate, Archibald Rutledge (1883–1973), whose collected works in “Deep River,” highlight his interest in surrounding natural features. The plantation buildings and immediate surroundings are part of a popular state park that offers guided tours and interpretive trails. Other lands associated with the plantation are managed by the National Forest.
- The Santee River was a potentially important travel corridor during the Civil War, and a major railroad crossing near Jamestown was defended by Southern forces at a relatively well-preserved riverine earthen fort, the Warren Battery, on a bluff along a bend in the river. Although no Northern troops tested the blockade at this site, it provides an example of Robert E. Lee’s general strategy of developing advantageous positions that allowed smaller units to effectively combat the larger armies of the North for most of the war. The site has been preserved with an interpretive trail accessible from land and the river; it is also on the National Historic Register.
- After the collapse of the rice plantation economy following the Civil War, many former slaves left plantations but stayed in the area, settling along the coast and rivers where their Gullah culture continued to develop in relative isolation. Speaking a unique dialect (Geechee) with remnant African vocabulary and grammar, this community developed rich story-telling, music, crafts, folk beliefs, and subsistence farming and fishing traditions influenced by West and Central African culture.

Other Values

The Santee River also offers high quality fishing opportunities for regional residents, although these do not rise to the description of “outstandingly remarkable.” Most of this use occurs from small powerboats. Many regional residents also use the river for canoeing, kayaking, waterskiing or similar powerboat sports, and swimming. There is a relatively unique multi-day canoeing or kayaking trip available from Lake Moultrie to the coast, offering Twain-esque scenery and wooded environments for boating, fishing, camping, and swimming. The Forest Service has developed a popular access point at McConnell Landing, which offers primitive road-accessible camping. Santee recreation use is connected to potential trips on Wambaw or Echaw Creeks.

The Santee has relatively rare limestone deposits along its banks between Dutart and Chicken Creek. These are regionally unique geological features that may also feature in local history. John Lawson, an early explorer, noted limestone use in local houses that probably came from the Santee and are regionally significant in the low country because there were few other natural sources for large construction rocks.

Wambaw Creek

The study area includes the entire river from headwaters to its confluence with the Santee. The designated reach is the same as the designated Wambaw Wilderness, but then extends with a 0.5-mile corridor to the confluence. Boundaries are to be adjusted to be wider in the swampy headwaters or at tributary creek mouths. The Wilderness section of the river would be classified Wild, while the segment below Echaw Road to the confluence with the Santee could be classified scenic (slightly higher development because of the road and motorized use from Santee River recreation).

Outstandingly Remarkable Values

Wambaw Creek has outstandingly remarkable ecological, scenic, recreation, and cultural values.

Ecologically, the river offers one of the best regional examples of a Tupelo cypress black water low country stream, with diverse trees, plants, fish, and wildlife. More specific ecological resources include:

- Relatively mature cypress trees, some approaching 150 years, although none are as old as 1,500 year old trees on the Black and South River in North Carolina.
- A considerable diversity of neo-tropical song birds. Although most occur on similar streams in the South, the Wambaw is an unmodified corridor that attracts high densities that are viewable by recreation users in boats.
- Rare swallow-tailed kites use the river for nesting and pre-migration staging. They nest in the larger pines and cypress on the borders of the river.
- Wayne’s black-throated green warbler, a rare sub-species of black-throated green warblers, that breeds only in the South Atlantic Coastal Plain from extreme southeastern Virginia to South Carolina.
- The river has several resident raptors, including bald eagles and osprey.
- Several mammals, including river otters and white tailed-deer, are frequently seen.
- There are also diverse populations of reptiles and amphibians, including alligators, which are at the northern end of their range.

Scenic assets focus on the contrasting mature cypress Tupelo forest, a diverse hardwood understory, and water. Although these vistas are not unique to the Wambaw, the river offers a textbook example of a scenic low country riparian area that has been minimally disturbed in the past century and a half. The river offers diversity in textures and colors in a majestic, multi-layered forest, while visitors travel on a meandering black water stream that offers longer vistas at each bend. Flowering plants, including bromeliads and orchids, further enhance the foreground of the scenery.

Recreational assets on the Wambaw include canoeing and kayaking to view scenery and wildlife, with possible connections to historical sites such as Hampton Plantation (see Santee River description above).

- Most visitors access the river at Still Landing or Echaw Road, and travel can occur between the two, or down to the confluence. Well-timed visits can take advantage of tides (in both directions) to decrease paddling effort.
- Most trips are half-day trips to view the tupelo cypress scenery, abundant birdlife, and occasional alligators or mammals. The emphasis is on natural history and wilderness-like character (lack of development and lower use levels), although a few local users also fish.
- Commercial trips also focus on intimate experiences, with purposeful smaller groups on most trips.
- Over 60 percent of commercial kayakers are visitors from outside the region, illustrating that creek resources are regional attractions.
- The river can be floated onto Hampton Creek and to Hampton Plantation operated by South Carolina State Parks. Although the landing at the plantation is informal, it offers riparian access to a preserved plantation house that would be unique within the wild and scenic river system.
- There is some motorized use on Wambaw Creek from the Santee braids, although most powerboats travel at no wake speeds to explore the first mile or so of the creek's mouth or to find fishing sites. The narrow meandering creek is not conducive to higher speed travel.

Cultural assets of Wambaw Creek are similar to those on the Santee River, with a greater focus on the rice plantation period. Remnant rice plantation canals are visible and can be partially explored from Wambaw Creek. The canals were developed to control irrigation, access the fields, and transport harvested rice, providing the critical development that allowed successful production of "Carolina Gold." Together with the labor of West African slaves, the rice plantation economy allowed South Carolina to become among the wealthiest in colonial America.

Echaw Creek

The study area includes the entire river from headwaters to its confluence with the Santee. The designated reach would be a 0.5-mile wide corridor. Boundaries could be adjusted to be wider in the swampy headwaters or at tributary creek mouths. The entire river would be "wild."

Outstandingly Remarkable Values

Echaw Creek has outstandingly remarkable ecological, scenic, and recreation values. Although the river has similar ecological and scenic resources to Wambaw Creek, it is slightly smaller and more intimate.

Ecologically, the river offers very similar resources to Wambaw Creek, with particularly exceptional calcareous-influenced bottomland hardwood forests.

- The National Forest (Richard Porche and Jean Everett in 2012) has identified, inventoried, and monitored a large botanical area (536 acres) along Echaw Creek. The area has been described as a "beautiful, enchanting" swamp forest, linking the area's ecological resources with their recreation appreciation values.

- The Blue Hole, a natural spring that empties into the Echaw Creek, has regionally unique turquoise waters and botanical diversity from the nearby limestone formations.

Scenic and recreation values on Echaw are likewise similar to those on Wambaw, but with even lower human use, thus offering even more wilderness-like conditions for visitors.

Wadboo Creek

The study area includes the entire river from headwaters to its confluence with the Old Santee Canal/Cooper River. The Francis Marion boundary is at Highway 402, and might signify the end of the designated reach). The designated reach would be a ½ mile wide corridor. Boundaries could be adjusted to be wider in the swampy headwaters or at tributary creek mouths. The entire river would be Wild until Highway 402. If designated below the highway, the river would be classified Recreational to reflect higher use and adjacent development.

Outstandingly Remarkable Values

Wadboo Creek has outstandingly remarkable ecological, scenic, and recreation values. Additional notes about its values include:

- Although the river has similar ecological and scenic resources to Wambaw and Echaw Creeks (see descriptions above), it is a smaller creek in its headwaters, and has slightly different hydrologic conditions (the gradient is slightly steeper, it drains quicker, and has a sandier bottom). This creates more adventurous recreation opportunities that require greater boating maneuverability, opportunistic users (to take advantage of smaller boatable flow windows), and effort (to handle portages or other challenges negotiating the smaller stream).
- There is a well-developed and popular boat landing where the river crosses Highway 402. This is the take-out from downstream canoe/kayak use, and offers access for other craft (including powerboats) to the Old Santee Canal and Cooper River. The river south of 402 is off the National Forest and probably would not be considered for wild and scenic river designation.

Wadboo Creek also has some additional cultural values associated with Francis Marion, who used the area for encampments, and dismissed his troops at the end of the war at a documented meeting at Wadboo Creek Bridge near Highway 402.

Awendaw Creek

The study area includes the entire river from the confluence of Bell Creek and Steed Creek (which forms the Awendaw) to its confluence with the Intracoastal Waterway near Buck Hall access. The designated reach would be a 0.5-mile wide corridor. Boundaries could be adjusted to be wider to include coastal marsh and estuaries. The river would be classified “recreational” to reflect higher use and adjacent development.

Potential OR Values

Awendaw Creek has outstandingly remarkable recreation values associated with its access to a representative coastal tidal forest and marsh environment. Its location within close proximity to Charleston and nearby tourism centers makes it attractive for non-local commercial recreation, which can help produce local economic benefits. More specific features include:

- Nearby pre-colonial shell rings and middens illustrate indigenous use of the area. Although sites on the river are not as exceptional as others on the coast, the density of sites is high, and they can be visited during short river-based trips to/from Buck Hall.
- The river offers coastal forests, marshes, and estuaries in a short mile reach; the diversity of environments enhances short boating-based visits.
- There is good fishing and crabbing near the mouth of the river.
- There are short sandy bluffs and cliffs along the river, providing topographic relief and swallow nesting sites that are unusual for the low country.
- Tidal currents provide opportunities for visitors to cover much of the river during a short visit.
- The Forest Service has developed launching facilities at Buck Hall and Rosa Green Roads for easy access.
- The river is used by motorized and non-motorized boats; several residents have private docks on the river that provide access to the Intracoastal Waterway.

The Palmetto Trail (hiking and biking) begins at Buck Hall and follows the Awendaw for a few miles), offering land-based access to the corridor and its features.

Appendix D: Inventory and Evaluation of Areas that May be Suitable for Inclusion in the Wilderness Preservation System

Inventory and Evaluation of Lands that May be Suitable

Introduction

As part of the forest plan revision process, the Francis Marion conducted a forestwide inventory, evaluation, analysis, and determination of lands that may be suitable for inclusion in the Wilderness Preservation System. Areas qualify for placement in inventory if they meet the statutory definition of wilderness. The Francis Marion used the Draft Forest Service Handbook (FSH) 1909.12 Chapter 70, which prescribes the inventory criteria used to determine if an area meets the statutory definition of wilderness. The Forest Service is making the process of determining whether to recommend lands for wilderness designation pursuant to the Wilderness Act or Eastern Wilderness Act more transparent and consistent across forests. Each forest, however, is unique and responsible officials should set the scope for this effort to meet the unique needs of their forests; no prescribed scope is intended (Draft 12-19-2013 Proposed FSH 1909.12, Chapter 70).

The process for the Francis Marion National Forest included the following steps:

An **inventory** of all Francis Marion National Forest System lands included:

- A forestwide analysis of Francis Marion-administered lands to identify lands that may be suitable using the Draft FSH 1909.12 chapter 70 inventory criteria.
- Analysis of areas proposed during the forest plan revision process,
- Consideration of possible additions to existing wilderness areas.

The **evaluation** of the wilderness characteristics of each area in the inventory using a set of criteria based on the Wilderness Act of 1964 and the Eastern Wilderness Act of 1975 and a documentation of each of the evaluations. Not all areas that were evaluated must be brought forward into the analysis phase.

An **analysis** of areas in the applicable National Environmental Policy Act (NEPA) documents. These areas must be identified within the applicable NEPA document as part of one or more alternatives. Not all lands included in the inventory and subsequent evaluations are required to be brought forward and analyzed for recommended wilderness in the applicable NEPA document.

The responsible official shall make a decision, based upon the analysis disclosed in the applicable NEPA document and input from tribes, state and local governments and the public, as to which areas, if any, to recommend for inclusion in the National Wilderness Preservation System. The responsible official shall identify any such lands in the final decision document for the plan.

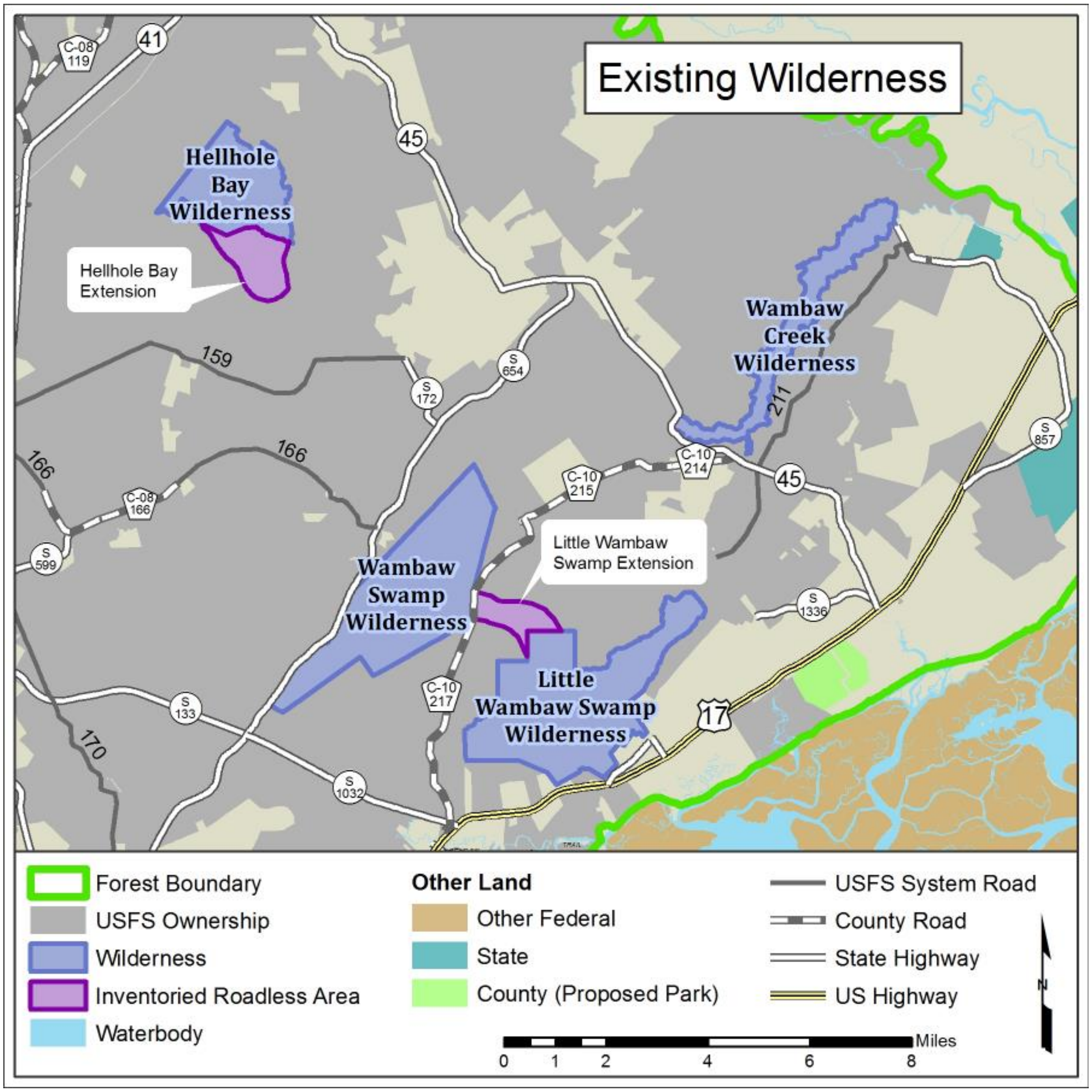


Figure D-1. Existing wilderness within the plan area

Background

The Francis Marion National Forest was established in the 1930s from lands that were previously under private ownership and, in many cases, had been heavily farmed and logged. The patchwork of private and public lands that still characterize the Francis Marion means that few areas are undisturbed or unaffected by nearby human habitation. With roads that provided access to the national forest lands and also serve as through routes to private lands, areas that were available for wilderness areas are limited in size and extent on the Francis Marion. Four wildernesses exist on the Francis Marion. Several areas were recommended for wilderness in the RARE II process and were subsequently designated as wilderness areas by Congress in 1980. This added areas in the eastern National Forests to the National Wilderness Preservation System including the four wilderness areas on the Francis Marion National Forest.

In the current forest plan (1996), there were two areas that were evaluated as inventoried roadless areas, Hellhole Bay Extension and Little Wambaw Swamp Extension. These areas are currently

managed as roadless (with limited tree cutting and road building) and maintain some characteristics similar to wilderness.

Identification of Lands That May Be Suitable for Inclusion in the Wilderness Preservation System

This process for identifying these lands has a sequence of steps, all of which include intergovernmental coordination as well as opportunities for public participation and collaboration, identification and inventory, evaluation, analysis, and decision. A preliminary step of reviewing all polygons of contiguous forest lands was considered, including areas less than 5,000 acres.

Developing the Inventory

Based on direction in Draft FSH 1909.12, chapter 70, section 71, the first step in analyzing suitable lands during forest plan revision was to identify and inventory all areas within National Forest System lands that satisfied the definition of wilderness in section 2(c) of the 1964 Wilderness Act. The criterion for the inventory follows.

Size Criteria (FSH 1909.12, chapter 70, section 71.21)

According to the Wilderness Act, a wilderness area "[h]as at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition."

Areas to be included must meet one of the following criteria:

1. The area contains 5,000 acres or more.
2. The area contains less than 5,000 acres, but is of sufficient size as to make practicable its preservation and use in an unimpaired condition. Examples of such areas can be as small as a self-contained island or canyon, or large enough to be effectively managed as a separate unit of the National Wilderness Preservation System.
3. Areas contiguous to existing wilderness, primitive areas, administratively recommended wilderness, or wilderness inventories of other Federal ownership, regardless of their size.

Improvements Criteria (FSH 1909.12, chapter 70, section 71.22)

Pursuant to the Wilderness Act, include in the inventory areas "where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean... as an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation;..."

A. Road Improvements

1. Include in the inventory areas that may contain the following road improvement attributes:

    a. Areas that contain forest roads maintained to level 1;

b. Areas with any routes that are decommissioned, unauthorized or temporary, or forest roads that are identified for decommissioning in a previous decision document, or as identified in a travel management plan (36 CFR 212.51) or a travel analysis (36 CFR 212.5(b));

c. Areas with forest roads that will be reclassified to level 1 through a previous decision document, or as identified in a travel management plan (36 CFR 212.51) or a travel analysis (36 CFR 212.5(b));

d. Areas in forests, grasslands, prairies and other administrative units east of the 100th meridian with forest roads maintained to level 2 that are identified as closed to motor vehicles yearlong in a previous decision document, or as identified in a travel management plan (36 CFR 212.51) or a travel analysis (36 CFR 212.5(b));

e. Areas with forest roads that have been proposed by the Forest Service for consideration as recommended wilderness as a result of a previous forest planning process or that the responsible official merits for inclusion in the inventory from public involvement during the assessment.

f. Areas with historical wagon routes, historical mining routes, or other settlement era transportation features considered part of the historical and cultural landscape of the area.

g. Areas with maintenance level 2 roads that do not meet any of the criteria in subsection 2(c) below.

2. Except as provided in (1)(b), (c), (d) or (e) above, exclude from the inventory areas that contain:

a. Permanently authorized roads validated by a Federal court or the Department of the Interior for which a valid easement or interest has been properly recorded.

b. Forest roads maintained to levels 3, 4, or 5.

c. Level 2 roads that meet one or more of the following criteria and are not in proposed areas as provided in (1)(e) above:

(1) have been improved and are maintained by mechanical means to ensure relatively regular and continued use,

(2) have cumulatively degraded wilderness character or precluded future preservation of the area as wilderness,

(3) have been identified for continued public access and use in a project level or travel planning decision supported by NEPA, or

(4) otherwise preclude evaluation and consideration of the area during the public participation and intergovernmental outreach processes as potentially suitable for wilderness, based on Assessment information or on-the-ground knowledge.

3. Evaluate areas that contain forest roads maintained to level 2, or levels 3, 4 or 5 where those roads are anticipated to be disinvested to a level 2. Include such areas in the

inventory unless they are clearly unsuitable for inclusion in the National Wilderness Preservation System, based on one or more of the following factors:

a. The road has been improved and is maintained by mechanical means to ensure relatively regular and continuous use.

b. Road density is so high that either wilderness character is clearly not present, or future preservation of the area as wilderness would not be possible.

c. A project-level decision supported by NEPA analysis has been made in favor of continuous public access to and use of the road.

d. Other on-the-ground knowledge of the level 2 road that would preclude evaluation and consideration of the area during the public participation process as potentially suitable for wilderness recommendation.

B. Other Improvements

For areas east of the 100th meridian, consistent with the Eastern Wilderness Act, recognize that these improvements may achieve wilderness character through passive or active restoration. See the Draft Forest Service Handbook 1909.12, chapter 70, section 71 and Table 1.

Using these criteria, the Francis Marion conducted a GIS analysis of existing wilderness areas and an overall forestwide review of any tracts of land that could be suitable for inclusion in the Wilderness Preservation System. It is important to note that lands included in the inventory provide a starting point for further evaluation, and their inclusion is not a designation that conveys or requires a particular kind of management.

Table D-1. Determination of whether areas with certain types of improvements were included or excluded in the inventory

Improvement Type	Remarks
Airstrips	Airstrips were excluded from the inventory, if any exist.
Heliports	These are temporary structures and included in the inventory if there were any.
Vegetation treatments that are not substantially noticeable.	These were included in the inventory.
Timber harvest areas where logging and prior road construction are not substantially noticeable.	Timber harvest areas where logging and prior road construction are not substantially noticeable were included in the inventory. Areas where regeneration harvest had taken place within the last 20+ years were reviewed to determine if they should be included in the inventory.
Permanently installed vertical structures, such as electronic installations including cell towers, television, radio, and telephone repeaters, provided their impact, as well as their maintenance and access needs, is minimal.	It was determined that these vertical structures had minimal impact, including their maintenance and access requirements; therefore, areas with vertical structures were included in the inventory.
Areas of historic mining where impacts are not substantially noticeable.	Areas of historic mining activity are very limited on the Francis Marion; therefore, any areas were included.
Areas of mining activity where impacts are not substantially noticeable.	Areas of mining activity are very limited on the Francis Marion National Forest; therefore, these areas were included in the inventory.
Range improvement areas, involving minor structural improvements (for example fences or water troughs) and non-structural improvements (chaining, burning, spraying, potholing, and so forth) that are not substantially noticeable.	There are no range improvements on the Francis Marion National Forest.
Recreational improvements, such as occupancy spots, or minor hunting, or outfitting camps. As a general rule, do not include developed sites. Areas with minor, easily removable recreation developments may be included.	Areas with such as dispersed camping sites were included in the inventory as they are temporary and easily removed. Areas with developed recreation sites were excluded from the inventory. Trails are not considered to be a recreational improvement.
Ground-return telephone lines, electric lines, and powerlines if a right-of-way has not been cleared. Exclude powerlines with cleared right-of-ways, pipelines, and other permanently installed linear right-of-way structure.	Right-of-ways that have not been cleared, if any, were included in the wilderness inventory.
Watershed treatment areas (contouring, diking, channeling) that are not substantially noticeable, or if wilderness character can be maintained or restored through appropriate management actions. Areas may include minor watershed treatments that have been accomplished manually such as small hand-constructed gully plugs.	Areas of watershed treatment are very limited on the Flathead National Forest; therefore these areas were included in the inventory.
Lands adjacent to development or activities that impact opportunities for solitude. The fact that the non-wilderness activities or uses can be seen or	Areas adjacent to development or activities were included in the inventory.

Improvement Type	Remarks
heard from within any portion of the area, shall not, of itself, preclude inclusion in the inventory.	
Structures, dwellings and other relics of past occupation when they are considered part of the historical and cultural landscape of the area.	Areas with structures, dwellings, and other relics of past occupation when they are considered part of the historical and cultural landscape of the area were included in the inventory.

Summary of Results

The summaries below provide an overview of the results from these analyses. Additional details for each area considered are within each detailed write-up.

Areas Inventoried

A preliminary step of reviewing all contiguous blocks of forest lands was conducted and all polygons were considered, including areas less than 5,000 acres. The following outlines the steps:

1. Changes in land ownership around wilderness areas were reviewed to see if there were any **appropriate areas for expansion i**n adjacent areas. The Francis Marion has four existing designated wilderness areas, Wambaw Creek Wilderness, Wambaw Swamp Wilderness, Little Wambaw Swamp Wilderness and Hellhole Bay Wilderness Areas; and two inventoried roadless areas adjacent to existing wilderness, Little Wambaw Swamp Extension and Hellhole Bay Extension. There were four areas surrounding the existing wilderness areas that will be included and considered
2. Any areas that are **less than 5,000 acres but of sufficient size** as to make practicable its preservation and use in an unimpaired condition. If a polygon was less than 5,000 acres and did not border an existing wilderness or recommended wilderness study area, it was reviewed for consideration if the size and/or shape would make it practical to preserve the area in an unimpaired condition. There were no areas less than 5,000 acres that could be considered practical to preserve and use in an unimpaired condition. GIS information was used and the areas were checked for roads, hydrology, improvements, and terrain. These areas, smaller than 5,000 acres were not further considered for the inventory.
3. In addition to the above, the Francis Marion utilized resource data from the GIS database as a tool to conduct analysis of any **larger blocks of land of greater than 5,000 acres** that would warrant further consideration as areas that may be suitable for wilderness. There are two areas that are over 5,000 acres. These two areas will be included and considered.

Analysis of Areas during the Forest Plan Revision Process

During the forest plan revision process, the Francis Marion planning team considered the additions to the existing wilderness and two other stand-alone wilderness areas, totaling over 31,000 acres, for evaluation. The Francis Marion planning team reviewed this information with the community and public at public meetings. No other areas were identified or brought forward during this part of the planning process.

Areas Included in the Inventory

There were six areas found on the Francis Marion that qualified for placement in the inventory. The areas listed in Table D-2 are areas identified and included in the inventory and were carried forward for further evaluation. The wilderness evaluation, the second step, took a more detailed look at these inventoried areas to determine their wilderness characteristics using a set of criteria based on the Wilderness Act of 1964.

Table D-2. Wilderness identification and inventory, August 2014

Area	Acres
Wambaw Creek Addition Area	5,747
Little Wambaw Swamp Additional Area	6,859
Wambaw Swamp Additional Area	2,306
Hellhole Bay Additional Area	4,535
Area A	6,643
Area B	5,098
TOTAL	31,188

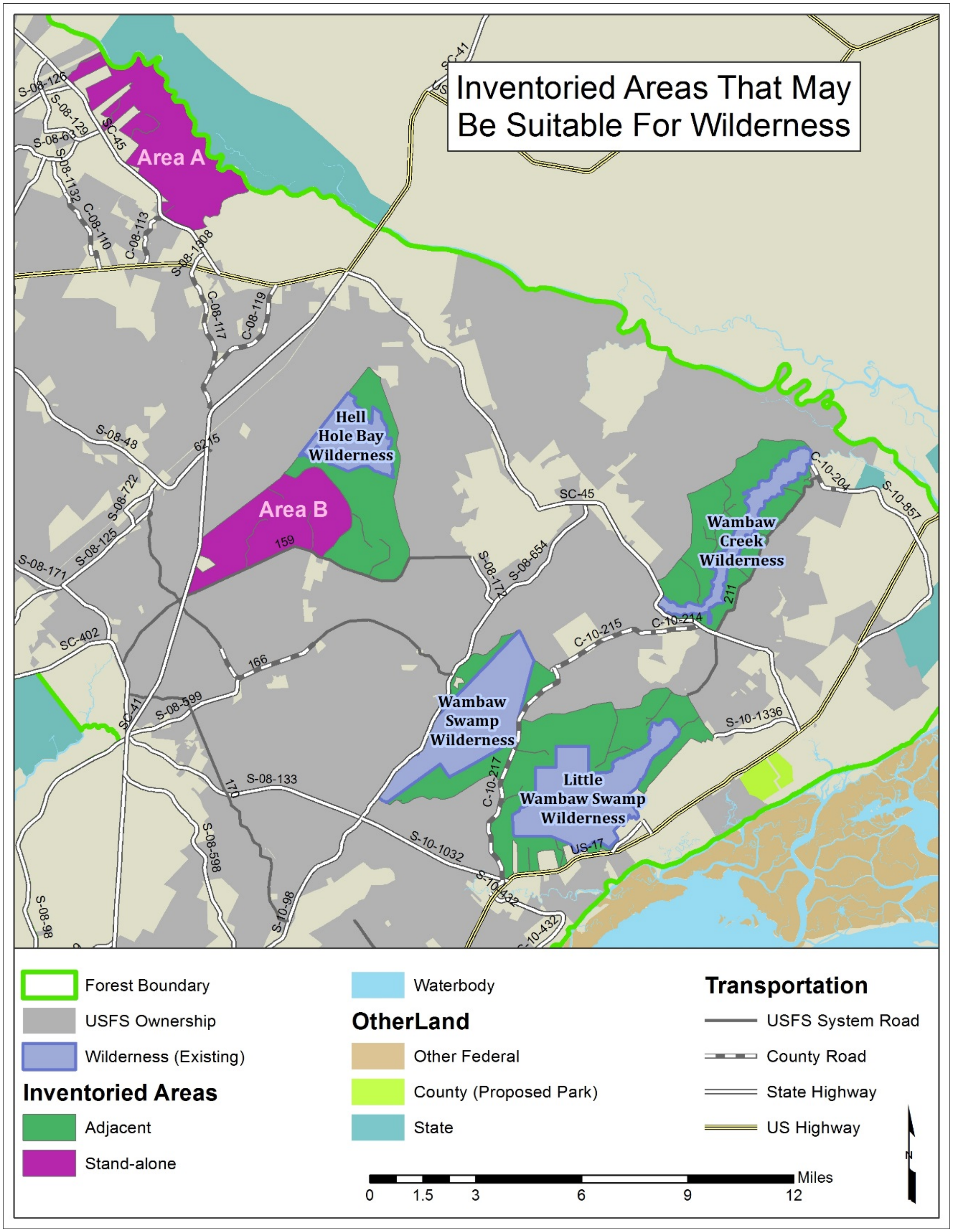


Figure D-2. Preliminary results of wilderness inventory

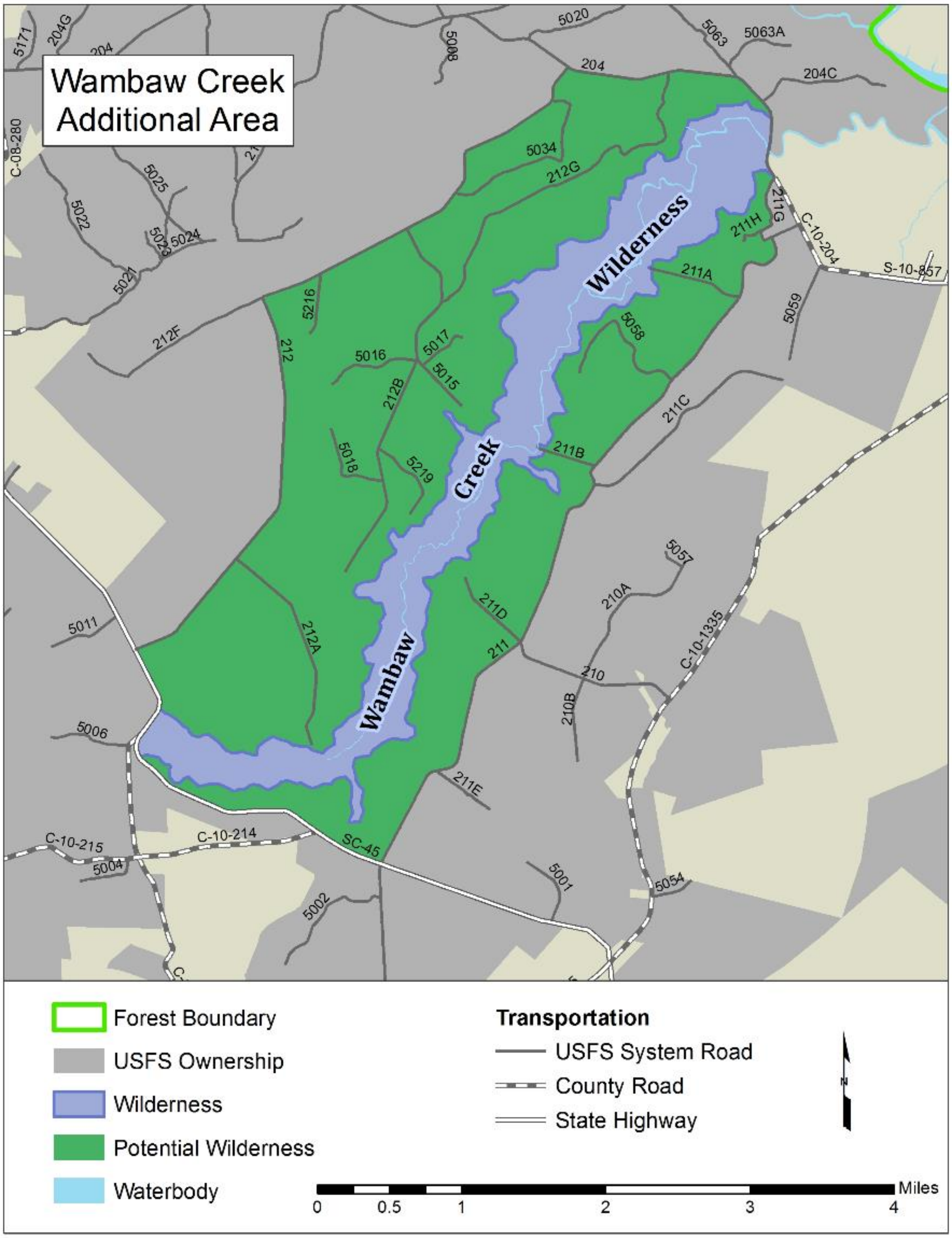
Evaluation of Lands that May be Suitable for Inclusion in the Wilderness Preservation System

Note: Wilderness evaluations begin on the next page.

Evaluation: Wambaw Creek Additional Area

Francis Marion National Forest, Wilderness Evaluation Worksheet

Wambaw Creek Additional Area **Total acres: 5,742**



Criteria 1: Evaluate the degree to which the area generally appears to be affected primarily by the forces of nature, with the imprints of man's work substantially unnoticeable.

Question 1a: What is the composition of plant communities within the area, including the communities already within the adjacent wilderness? (How many miles of maintenance level 1 roads affect the area? What is the density of the road network on the area?)

Current composition of vegetation is longleaf pine and a mix of sweet bay, swamp tupelo, red maple (about 10 percent of the area is in loblolly pine.)

There are over 100 occurrences of invasive species within the area. There are over 7 miles of closed level 1 road within the area. Over 90 percent of the area has over 2 miles of road per 1000 acres, a high road density.

Question 1b: What is the extent to which the area reflects ecological conditions that would normally be associated with the area without human intervention? (Describe the departure from natural range of variation in forest composition, structure, patterns and ecological processes? Describe the amount of the area that is primarily affected by the force of nature?)

All of the area is being prescribed burned, including where appropriate the existing wilderness. The majority of area that is being evaluated is in upland longleaf pine woodlands and forests and the wet pine savannah and flatwoods ecogroup (ecosystem), both which are frequently burned. The following table shows the potential ecological groups of the area.

Potential Wilderness Area Extension (Areas adjacent to Wambaw Creek Wilderness)			
Ecogroup	Total Acres (Including Wilderness)	Acres (Outside Wilderness)	Acres (Inside Wilderness)
Maritime Forests and Salt Marsh	28	21	7
Broad Forested Swamps and Large River Floodplain Forests	2,506	722	1,784
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	874	865	9
Oak Forests and Mesic Hardwood Forests	150	136	14
Wet Pine Savannas and Flatwoods	2,278	2,264	14
Depressional Wetlands and Carolina Bays	2	2	0
Upland Longleaf Pine Woodlands and Forests	1,733	1,731	2
Grand Total	7,545	5,742	1,823

Question 1c: What is the extent to which improvements (improvement criteria 71.22 from FSH 1909.12 chap 70) included in the inventory represent a departure from naturalness?

Improvement Type	Outcome
Airstrips	None
Heliports	None
Vegetation treatments that are not substantially noticeable.	Several WLOs in area, over 100 acres
Timber harvest areas where logging and prior road construction are not substantially noticeable.	Some small areas of thinning, since Hurricane Hugo
Permanently installed vertical structures, such as electronic installations including cell towers, television, radio, and telephone repeaters, provided their impact, as well as their maintenance and access needs, is minimal.	None
Areas of historic mining where impacts are not substantially noticeable.	None
Areas of mining activity where impacts are not substantially noticeable.	None
Range improvement areas	None
Recreational improvements, such as occupancy spots, or minor hunting, or outfitting camps.	None, Elmwood Camp immediately adjacent
Ground-return telephone lines, electric lines, and powerlines if a right-of-way has not been cleared. Exclude powerlines with cleared right-of-ways, pipelines, and other permanently installed linear right-of-way structure.	None
Watershed treatment areas (contouring, diking, channeling) that are not substantially noticeable, or if wilderness character can be maintained or restored through appropriate management actions.	Moderate historic diking and channeling
Lands adjacent to development or activities that impact opportunities for solitude.	No inholdings or private lands
Structures, dwellings and other relics of past occupation when they are considered part of the historical and cultural landscape of the area.	None

Criteria 2: Evaluate the degree to which the area has outstanding opportunities for solitude or for a primitive and unconfined type of recreation.

Question 2a: What is available for outstanding opportunity for solitude? (Describe the proximity to private lands and non-Forest Service roads. Describe the general topography of the area in context of sight, sound, and screening.)

Over 95 percent of the area is in a roaded-natural ROS class. The area is coastal plain, generally flat landform. Climate is temperate with hot, moist summers and mild winters. There is no private land in the adjacent to the area. There are some private inholdings within a mile of the north east edge of the area.

The area is bounded by gravel roads suitable for passenger cars and paved roads on one edge. The area has moderate seasonal traffic on the gravel roads and regular traffic on the paved county road. The area is about 2 miles from the 40-mile motorized trail, but noise if not a factor from this trail.

Question 2b: What is available in the area for opportunity for primitive and unconfined recreation? (Describe the types of primitive recreation activities in the area.)

> *Hunting is the main primitive recreation activity. Other activities for recreation are driving for pleasure, nature viewing, and primitive camping. The area is entirely in the Waterhorn Wildlife Management Area. The area is managed for hunting and has over 50 maintained wildlife openings (over 100 acres) within the area.*

Criteria 3: Evaluate how an area less than 5,000 acres is of sufficient size as to make it practical its preservation and use in an unimpaired condition.

This criterion was not included in these evaluations because it is was not applicable to additions to wilderness areas and was not applicable to stand alone areas greater than 5,000 acres.

Criteria 4: Evaluate the degree to which the area may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Question 4a: Does the area contain rare plant or animal communities; rare ecosystem for wildlife habitat; rare ecosystem for aquatics; rare ecosystem for terrestrial; any biodiversity hotspots; coarse scale key connectivity for multiple species, or underrepresented/rare vegetation types? (Describe areas richness in terms of threatened and endangered, species of conservation concern, area of key connectivity, etc.)

> *Data collection indicates there are several species of threatened and endangered plants in the area.*
>
> *All (or portions) of over 37 foraging partitions for the red-cockaded woodpecker are located with the area.*

Question 4b: Is there any outstanding landscape features such as waterfalls, mountains, viewpoints, water bodies, or geologic features? (Describe acres of distinctive scenic class or areas of outstanding geologic landscapes.)

> *The existing wilderness is an outstanding blackwater swamp landscape feature and there are some small portions of the area that have similar characteristics, but the majority of a typical longleaf forest.*

Question 4c: Is there historic or cultural resources of historic value in the area?

> *There is a moderate to high historic resource value within the area, with some areas reaching 18 sites per square mile.*

Question 4d: Is there high quality water resources or important watershed features in the area?

> *Yes, water quality in Wambaw Creek and its associated watershed are considered to be an important watershed feature. All watersheds on the Francis Marion are considered in fair condition based on the watershed condition class index.*

Question 4e: Is there any special areas and/or research natural areas in the areas? (Describe and areas of special botanical area or research natural area.)

> *There are no research natural areas within the area.*

Question 4f: Is there any scientific or education features in the area?

The area is adjacent to Wambaw Creek Wilderness and potentially has multiple scientific and education features.

Criteria 5: Evaluate the degree to which the area may be managed to preserve its wilderness characteristics.

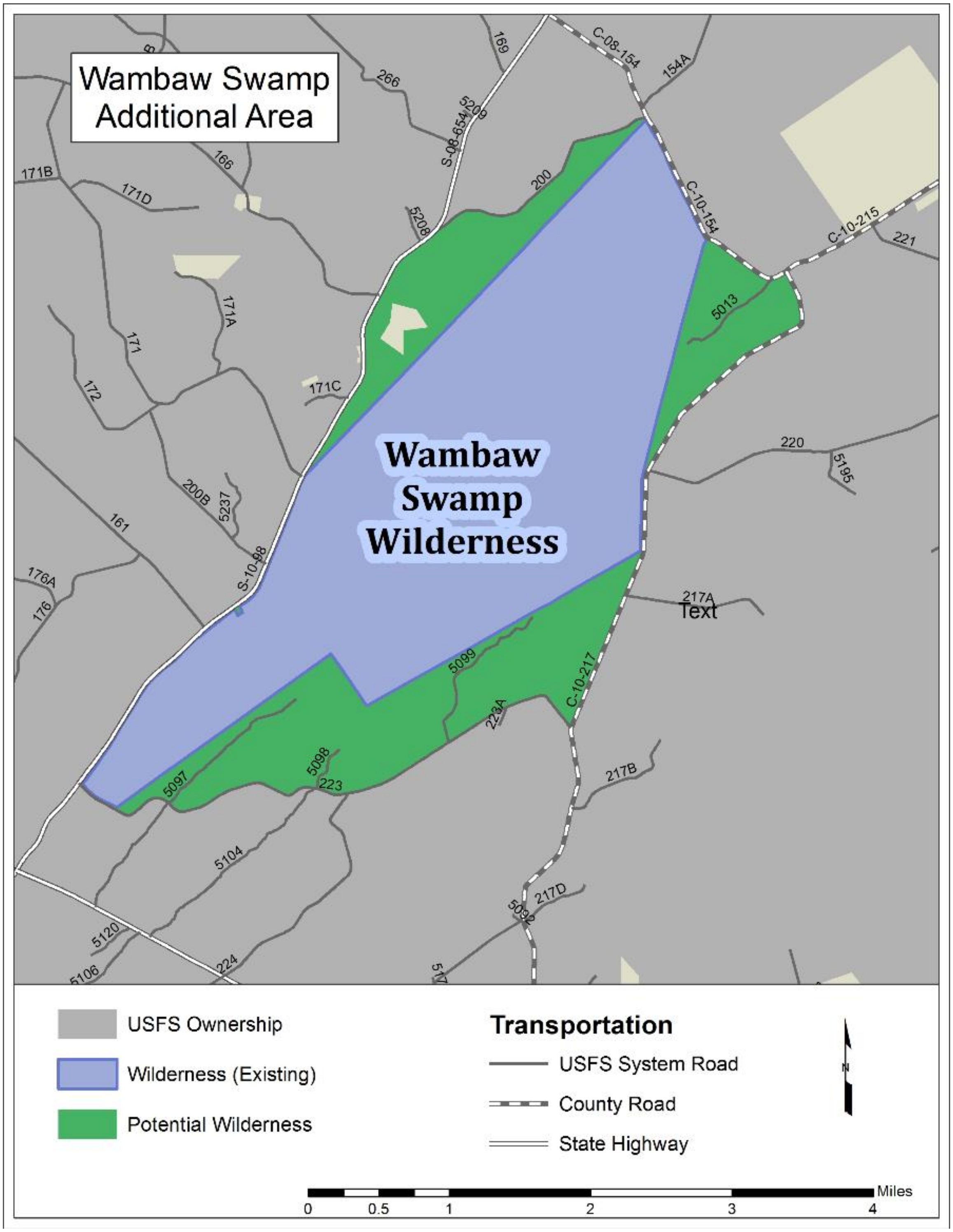
Question 5a: How can the area be managed to preserve its wilderness character? (Describe the shape and configuration of the area. Describe if there are any legally established rights or uses within the area. Are there specific Federal or state laws that may be relevant to availability of the area for wilderness or the ability to manage the area to protect wilderness characteristics? Describe the management of adjacent lands. Describe the current management of the area. Acres and percent total of wildland-urban interface in the area. Describe the type and extent of management restrictions within the area.

The area is generally dissected with roads and has open roads that influence the shape, which would make the area more difficult to maintain the wilderness character. There are no legally established rights within the area. At the present time there is no Federal or state law that affects the availability of the area for wilderness. Adjacent lands include Forest Service lands with forest management that includes vegetation management, wildlife habitat and frequent prescribed burning.

Evaluation: Wambaw Swamp Additional Area

Francis Marion National Forest, Wilderness Evaluation Worksheet

Wambaw Swamp Additional Acres **Total acres: 2,306**



Criteria 1: Evaluate the degree to which the area generally appears to be affected primarily by the forces of nature, with the imprints of man's work substantially unnoticeable.

Question 1a: What is the composition of plant communities within the area, including the communities already within the adjacent wilderness? (How many miles of maintenance level 1 roads affect the area? What is the density of the road network on the area?)

The entire area was impacted by Hurricane Hugo. Current composition of vegetation is a majority of sweet bay, swamp tupelo, red maple (69 percent), longleaf pine (12 percent) and a mix of cypress tupelo and about 1 percent of the area is in loblolly pine.

There are over 3.59 miles of closed level 1 road within the area. The majority of the area has a higher road density (more than 2 miles of road per 1,000 acres).

Question 1b: What is the extent to which the area reflects ecological conditions that would normally be associated with the area without human intervention? (Describe the departure from natural range of variation in forest composition, structure, patterns and ecological processes? Describe the amount of the area that is primarily affected by the force of nature?)

The majority of the area is being prescribed burned (in existing burn units), including where appropriate into the adjacent existing wilderness.

The majority of area is in wet pine savannah and flatwoods ecogroup, upland longleaf pine woodlands and narrow forested swamps and blackwater stream floodplains. There are an additional 200 acres of pocosins. The following table shows the potential ecological groups of the area.

Potential Wilderness Area Extension (Area adjacent to Wambaw Swamp)			
Ecogroup	Total Acres (Including Wilderness)	Acres (Outside Wilderness)	Acres (Inside Wilderness)
Broad Forested Swamps and Large River Floodplain Forests	2,797	55	2,742
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	1,353	612	741
Pocosins	1,066	217	849
Wet Pine Savannas and Flatwoods	1,064	864	200
Depressional Wetlands and Carolina Bays	54	51	3
Upland Longleaf Pine Woodlands and Forests	787	569	218
Grand Total	7,121	2,367	4,753

Question 1c: What is the extent to which improvements (improvement criteria 71.22 from FSH 1909.12 chap 70) included in the inventory represent a departure from naturalness?

Improvement Type	Outcome
Airstrips	None
Heliports	None
Vegetation treatments that are not substantially noticeable.	Few WLOs in area, about 6 acres
Timber harvest areas where logging and prior road construction are not substantially noticeable.	Some areas of thinning or biomass, since Hurricane Hugo
Permanently installed vertical structures, such as electronic installations including cell towers, television, radio, and telephone repeaters, provided their impact, as well as their maintenance and access needs, is minimal.	None
Areas of historic mining where impacts are not substantially noticeable.	None
Areas of mining activity where impacts are not substantially noticeable.	None
Range improvement areas	None
Recreational improvements, such as occupancy spots, or minor hunting, or outfitting camps.	None
Ground-return telephone lines, electric lines, and powerlines if a right-of-way has not been cleared. Exclude powerlines with cleared right-of-ways, pipelines, and other permanently installed linear right-of-way structure.	None
Watershed treatment areas (contouring, diking, channeling) that are not substantially noticeable, or if wilderness character can be maintained or restored through appropriate management actions.	Moderate historic diking and channeling, common occurrence
Lands adjacent to development or activities that impact opportunities for solitude.	Private inholding
Structures, dwellings and other relics of past occupation when they are considered part of the historical and cultural landscape of the area.	None

Criteria 2: Evaluate the degree to which the area has outstanding opportunities for solitude or for a primitive and unconfined type of recreation.

Question 2a: What is available for outstanding opportunity for solitude? (Describe the proximity to private lands and non-Forest Service roads. Describe the general topography of the area in context of sight, sound, and screening.)

Over 95 percent of the area is in a roaded-natural ROS class, there is very small portion of semi-primitive motorized. The area is coastal plain, generally flat landform. Climate is temperate with hot, moist summers and mild winters. There is one private inholding within the area.

The area is bounded by paved county roads, along the northern edge, county roads along two other sides and gravel roads suitable for passenger cars. The area has low to moderate seasonal traffic on the gravel roads and regular traffic on the paved county roads. Along the northern boundary (Halfway Creek Road) is the 40-mile Wambaw Motorcycle Trail.

Question 2b: What is available in the area for opportunity for primitive and unconfined recreation? (Describe the types of primitive recreation activities in the area.)

Hunting is the main primitive recreation activity. Other activities for recreation are nature viewing and primitive camping. The area is entirely in the Wambaw Wildlife Management Area and has about six maintained wildlife openings within the area. Wet terrain and dense vegetation discourages some use.

Criteria 3: Evaluate how an area less than 5,000 acres is of sufficient size as to make it practical its preservation and use in an unimpaired condition.

This criterion was not included in these evaluations because it was not applicable to additions to wilderness areas and was not applicable to stand alone areas greater than 5,000 acres.

Criteria 4: Evaluate the degree to which the area may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Question 4a: Does the area contain rare plant or animal communities; rare ecosystem for wildlife habitat; rare ecosystem for aquatics; rare ecosystem for terrestrial; any biodiversity hotspots; coarse scale key connectivity for multiple species, or underrepresented/rare vegetation types? (Describe areas richness in terms of threatened or endangered, species of conservation concern, area of key connectivity, etc.)

There are few surveys of invasive species in the area; however there are two occurrences of cogon grass on southern boundary along FS Road 223.

All (or portions) of over 12 foraging partitions for the red-cockaded woodpecker are located with the area.

Question 4b: Is there any outstanding landscape features such as waterfalls, mountains, viewpoints, water bodies, or geologic features? (Describe acres of distinctive scenic class or areas of outstanding geologic landscapes.)

The existing wilderness is an outstanding swamp landscape feature and there are some small portions of the area that have similar characteristics, including a connection to the roadless area (Little Wambaw Swamp Extension [530 acres]) across county road. During the wetter season some parts of the area are flooded.

Question 4c: Is there historic or cultural resources of historic value in the area?

There are a low amount of sites within the area; however, there have been fewer inventories in this area.

Question 5d: Is there high quality water resources or important watershed features in the area?

Yes, water quality in Wambaw Swamp and its associated watershed are considered to be an important watershed feature. All watersheds on the Francis Marion are considered in fair condition based on the watershed condition class index.

Question 4e: Is there any special areas and/or research natural areas in the areas? (Describe and areas of special botanical area or research natural area.)

There are no research natural areas within the additional area. There are several stands of potential old growth forest (sweetbay, swamp tupelo, red maple and bald cypress, water tupelo) in the area.

Question 4f: Is there any scientific or education features in the area?

The area is adjacent to Wambaw Swamp Wilderness and potentially has multiple scientific and education features.

Criteria 5: Evaluate the degree to which the area may be managed to preserve its wilderness characteristics.

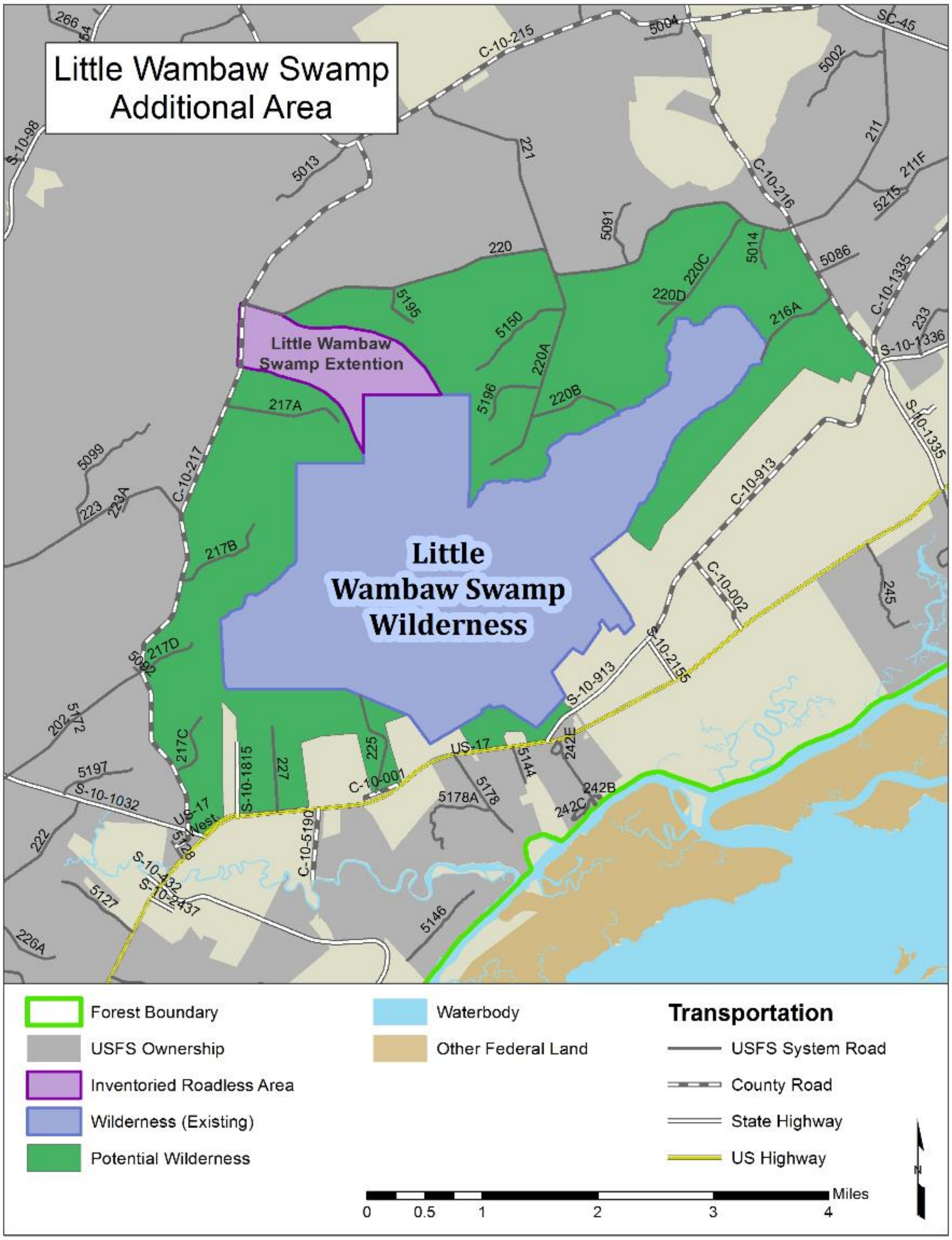
Question 5a: How can the area be managed to preserve its wilderness character? (Describe the shape and configuration of the area. Describe if there are any legally established rights or uses within the area. Are there specific Federal or state laws that may be relevant to availability of the area for wilderness or the ability to manage the area to protect wilderness characteristics? Describe the management of adjacent lands. Describe the current management of the area. Acres and percent total of wildland urban interface in the area. Describe the type and extent of management restrictions within the area.)

The area is generally bounded by roads and that influence the shape. There are few open roads bisecting the area. There are no legally established rights within the area. At the present time there is no Federal or state law that affects the availability of the area for wilderness. Adjacent lands include national forest lands with forest management that includes vegetation management, red-cockaded woodpecker habitat improvements, and prescribed burning. Other influences include private ownership within the area.

Evaluation – Little Wambaw Swamp Additional Area

Francis Marion National Forest: Wilderness Evaluation Worksheet

Little Wambaw Swamp Additional Area **Total acres: 6,859**



Criteria 1: Evaluate the degree to which the area generally appears to be affected primarily by the forces of nature, with the imprints of man's work substantially unnoticeable.

Question 1a: What is the composition of plant communities within the area, including the communities already within the adjacent wilderness? (How many miles of maintenance level 1 roads affect the area? What is the density of the road network on the area?)

The entire area was impacted by Hurricane Hugo. Current composition of vegetation is longleaf pine (30 percent) and a mix of cypress tupelo, sweet bay, swamp tupelo, red maple, sweet gum (about 2 percent of the area is in loblolly pine.)

There are several occurrences of invasive species within the area, over 100 points or communities. There are over 3.45 miles of closed level 1 road within the area. Some parts of the area have a lower road density (less than 0.5 mile of road per 1,000 acres), where directly adjacent to the existing wilderness.

Question 1b: What is the extent to which the area reflects ecological conditions that would normally be associated with the area without human intervention? (Describe the departure from natural range of variation in forest composition, structure, patterns and ecological processes? Describe the amount of the area that is primarily affected by the force of nature?)

The majority of the northern portions of the area is being prescribed burned (in existing burn units), including where appropriate the existing wilderness. The majority of area is in wet pine savannah and flatwoods ecogroup and narrow forested swamps. The following table shows the potential ecological groups of the area.

Potential Wilderness Area (Areas adjacent to Little Wambaw Swamp Wilderness)			
Ecogroups	**Total Acres (Including Wilderness)**	**Acres (Outside Wilderness)**	**Acres (Inside Wilderness)**
Broad Forested Swamps and Large River Floodplain Forests	4,543	679	3,864
Depressional Wetlands and Carolina Bays	52	52	0
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	2,198	1,632	566
Pocosins	733	646	87
Upland Longleaf Pine Woodlands and Forests	525	525	0
Wet Pine Savannas and Flatwoods	3,756	3,078	678
Grand Total	**11,807**	6,612	5,195

Question 1c: What is the extent to which improvements (improvement criteria 71.22 from FSH 1909.12 chap 70) included in the inventory represent a departure from naturalness?

Improvement Type	Outcome
Airstrips	None
Heliports	None
Vegetation treatments that are not substantially noticeable.	Few WLOs in area, 6 acres
Timber harvest areas where logging and prior road construction are not substantially noticeable.	Some areas of thinning or biomass, since Hurricane Hugo
Permanently installed vertical structures, such as electronic installations including cell towers, television, radio, and telephone repeaters, provided their impact, as well as their maintenance and access needs, is minimal.	None
Areas of historic mining where impacts are not substantially noticeable.	None
Areas of mining activity where impacts are not substantially noticeable.	None
Range improvement areas	None
Recreational improvements, such as occupancy spots, or minor hunting, or outfitting camps.	None
Ground-return telephone lines, electric lines, and powerlines if a right-of-way has not been cleared. Exclude powerlines with cleared right-of-ways, pipelines, and other permanently installed linear right-of-way structure.	None
Watershed treatment areas (contouring, diking, channeling) that are not substantially noticeable, or if wilderness character can be maintained or restored through appropriate management actions.	Moderate historic diking and channeling
Lands adjacent to development or activities that impact opportunities for solitude.	Private lands along southern boundary and Hwy 17
Structures, dwellings and other relics of past occupation when they are considered part of the historical and cultural landscape of the area.	None

Criteria 2: Evaluate the degree to which the area has outstanding opportunities for solitude or for a primitive and unconfined type of recreation.

Question 2a: What is available for outstanding opportunity for solitude? (Describe the proximity to private lands and non-Forest Service roads. Describe the general topography of the area in context of sight, sound, and screening.)

Over 50 percent of the area is in a roaded-natural ROS class, there are some portions that are semi-primitive motorized and a very small portion of semi-primitive non-motorized. The area is coastal plain, generally flat landform. Climate is temperate with hot, moist summers and mild winters. There is no private land in the adjacent to the area. There are private landowners interspersed along the southern edge of the area. This southern portion of the area is within the wildland-urban interface.

The area is bounded by paved roads, including Highway 17 along the southern edge, county roads along two other sides and gravel roads suitable for passenger cars along the northern

edge. The area has moderate seasonal traffic on the gravel roads and regular traffic on the paved county road and high traffic on Highway 17.

Question 2b: What is available in the area for opportunity for primitive and unconfined recreation? (Describe the types of primitive recreation activities in the area.)

Hunting and trail use is the main primitive recreation activity. The Palmetto Trail winds through a portion of the area. Other activities for recreation are nature viewing and primitive camping. The area is entirely in the Wambaw Wildlife Management Area and has about five maintained wildlife openings within the area. Wet terrain and dense vegetation discourages some use.

Criteria 3: Evaluate how an area less than 5,000 acres is of sufficient size as to make it practical its preservation and use in an unimpaired condition.

This criterion was not included in these evaluations because it was not applicable to additions to wilderness areas and it is not applicable to stand alone areas greater than 5,000 acres.

Criteria 4: Evaluate the degree to which the area may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Question 4a: Does the area contain rare plant or animal communities; rare ecosystem for wildlife habitat; rare ecosystem for aquatics; rare ecosystem for terrestrial; any biodiversity hotspots; coarse scale key connectivity for multiple species, or underrepresented/rare vegetation types? (Describe areas richness in terms of threatened or endangered species or species of conservation concern, area of key connectivity, etc.)

The surveys to date include threated and endangered plants that include chaffseed, giant orchid, yellow fringeless orchid, sneezeweed. Several stands (90 acres) along the Highway 17 included in the area have at-risk habitats that require burning. Data collection is limited in the area for invasive plants.

All (or portions) of over 20 foraging partitions for the red-cockaded woodpecker are located with the area.

Question 4b: Is there any outstanding landscape features such as waterfalls, mountains, viewpoints, water bodies, or geologic features? (Describe acres of distinctive scenic class or areas of outstanding geologic landscapes.)

The existing wilderness is an outstanding swamp landscape feature and there are some small portions of the area that have similar characteristics, including the inventoried roadless area (Little Wambaw Swamp Extension [530 acres]). During the wetter season some parts of the area are flooded.

Question 4c: Is there historic or cultural resources of historic value in the area?

There is a low to moderate amount of sites within the area, except on the most northern portion, where several sites are located. However, there have been fewer inventories in this area.

Question 4d: Is there high quality water resources or important watershed features in the area?

Yes, water quality in Little Wambaw Swamp and its associated watershed are considered to be an important watershed feature. All watersheds on the Francis Marion are considered in fair condition based on the watershed condition class index.

Question 4e: Is there any special areas and/or research natural areas in the areas? (Describe and areas of special botanical area or research natural area.)

There are no research natural areas within the additional area, there is one research natural area within the Little Wambaw Swamp. There are several stands of old-growth forest (longleaf, sweetbay, sweetgum-oak and water tupelo) in the area.

Question 4f: Is there any scientific or education features in the area?

The area is adjacent to Little Wambaw Swamp Wilderness and potentially has multiple scientific and education features.

Criteria 5: Evaluate the degree to which the area may be managed to preserve its wilderness characteristics.

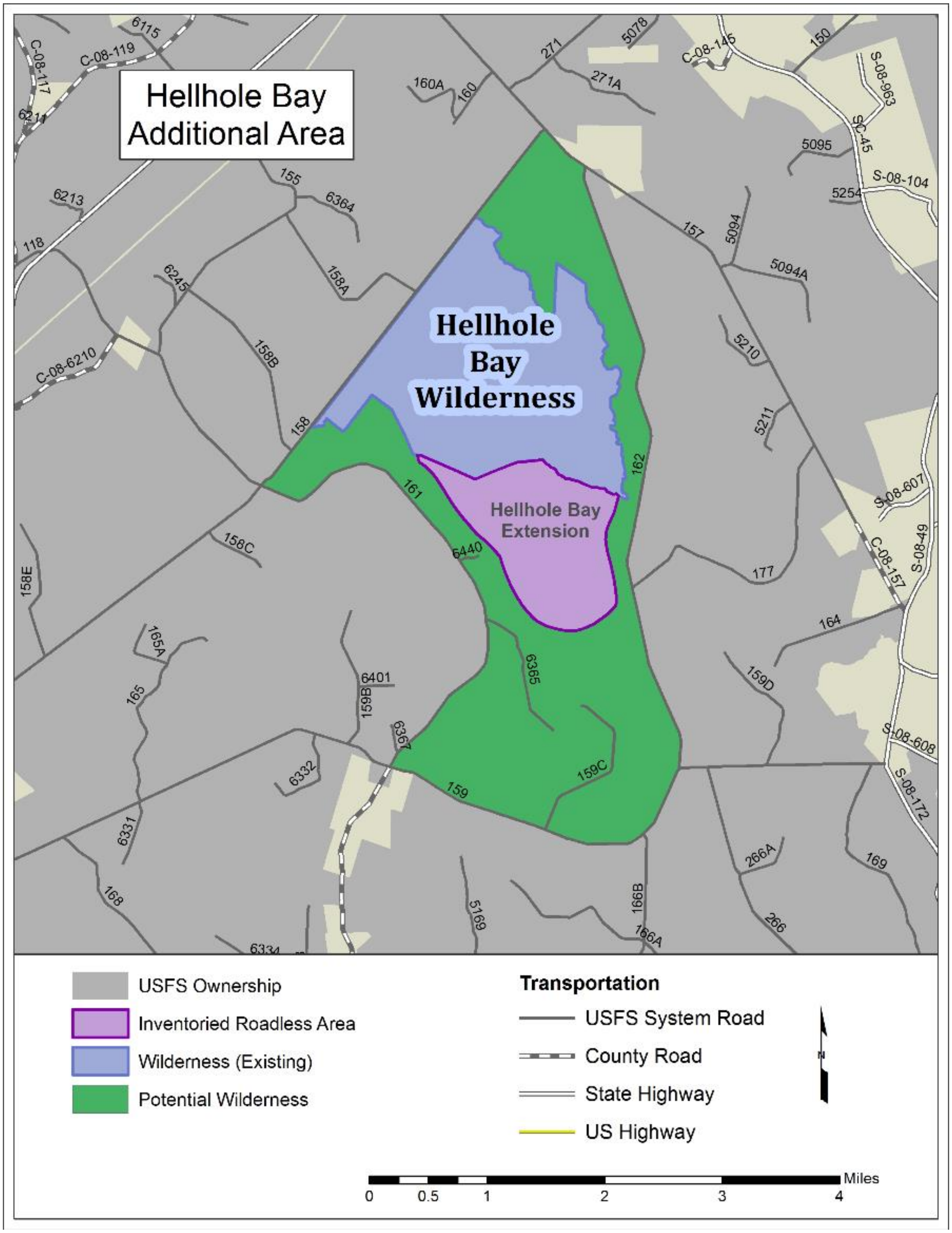
Question 5a: How can the area be managed to preserve its wilderness character? (Describe the shape and configuration of the area. Describe if there are any legally established rights or uses within the area. Are there specific Federal or state laws that may be relevant to availability of the area for wilderness or the ability to manage the area to protect wilderness characteristics? Describe the management of adjacent lands. Describe the current management of the area. Acres and percent total of wildland urban interface in the area. Describe the type and extent of management restrictions within the area.)

The area is generally dissected with roads and has open roads that influence the shape, which would make the area more difficult to maintain the wilderness character. There are no legally established rights within the area. At the present time there is no Federal or state law that affects the availability of the area for wilderness. Adjacent lands include national forest lands with forest management that includes vegetation management, red-cockaded woodpecker habitat improvements and frequent prescribed burning on the northern edge. Other influences include multiple private ownerships along the southern boundary.

Evaluation – Hellhole Bay Additional Area

Francis Marion National Forest: Wilderness Evaluation Worksheet

Hellhole Bay Additional Area **Total acres: 4,535**



Criteria 1: Evaluate the degree to which the area generally appears to be affected primarily by the forces of nature, with the imprints of man's work substantially unnoticeable.

Question 1a: What is the composition of plant communities within the area, including the communities already within the adjacent wilderness? (How many miles of maintenance level 1 roads affect the area? What is the density of the road network on the area?)

The entire area was impacted by Hurricane Hugo. Current composition of vegetation is a majority of cypress tupelo (41 percent), loblolly pine (18 percent), longleaf pine (17 percent) and bottomland hardwood/pine (14 percent).

There are .20 miles of closed level 1 road within the area. The majority of the area has a higher road density (more than 2 miles of road per 1,000 acres). However, there is a portion of the area adjacent to Hellhole Bay Wilderness and within the Hellhole Bay Inventoried Roadless Area that has a few hundred acres of low road density (less than 0.5 mile per 1,000 acres).

Question 1b: What is the extent to which the area reflects ecological conditions that would normally be associated with the area without human intervention? (Describe the departure from natural range of variation in forest composition, structure, patterns and ecological processes? Describe the amount of the area that is primarily affected by the force of nature?)

The majority of the area is being prescribed burned (in existing burn units), including where appropriate into the adjacent Hellhole Bay Wilderness.

The majority of area is in broad forested swamps and large river floodplain forests and wet pine savannah and flatwoods ecogroups. The following table shows the potential ecological groups of the area.

Potential Wilderness Area Extension (Area adjacent to Hellhole Bay)			
Ecogroup	Total Acres (Including Wilderness)	Acres (Outside Wilderness)	Acres (Inside Wilderness)
Broad Forested Swamps and Large River Floodplain Forests	4,716	2,770	1,947
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	250	204	47
Pocosins	71	56	14
Wet Pine Savannas and Flatwoods	1,554	1,455	100
Depressional Wetlands and Carolina Bays	36	26	10
Upland Longleaf Pine Woodlands and Forests	33	29	4
Grand Total	6,661	4,540	2,121

Question 1c: What is the extent to which improvements (improvement criteria 71.22 from FSH 1909.12 chap 70) included in the inventory represent a departure from naturalness?

Improvement Type	Outcome
Airstrips	None
Heliports	None
Vegetation treatments that are not substantially noticeable.	One WLO in area, about 6 acres
Timber harvest areas where logging and prior road construction are not substantially noticeable.	Fewer areas of thinning or biomass, since Hurricane Hugo
Permanently installed vertical structures, such as electronic installations including cell towers, television, radio, and telephone repeaters, provided their impact, as well as their maintenance and access needs, is minimal.	None
Areas of historic mining where impacts are not substantially noticeable.	None
Areas of mining activity where impacts are not substantially noticeable.	None
Range improvement areas	None
Recreational improvements, such as occupancy spots, or minor hunting, or outfitting camps.	None
Ground-return telephone lines, electric lines, and power lines if a right-of-way has not been cleared. Exclude powerlines with cleared right-of-ways, pipelines, and other permanently installed linear right-of-way structure.	None
Watershed treatment areas (contouring, diking, channeling) that are not substantially noticeable, or if wilderness character can be maintained or restored through appropriate management actions.	Moderate historic diking and channeling
Lands adjacent to development or activities that impact opportunities for solitude.	None
Structures, dwellings and other relics of past occupation when they are considered part of the historical and cultural landscape of the area.	None

Criteria 2: Evaluate the degree to which the area has outstanding opportunities for solitude or for a primitive and unconfined type of recreation.

Question 2a: What is available for outstanding opportunity for solitude? (Describe the proximity to private lands and non-Forest Service roads. Describe the general topography of the area in context of sight, sound, and screening.)

Over 95 percent of the area is in a roaded-natural ROS class, there is small portion of semi-primitive non-motorized acres. The ROS of semi-primitive non-motorized generally corresponds to the Hellhole Bay Extension Inventoried Roadless Area. The area is coastal plain, generally flat landform. Climate is temperate with hot, moist summers and mild winters. There are no inholdings or other private land along the boundaries.

The area is bounded by a paved county roads and gravel roads suitable for passenger cars. The area has low to moderate seasonal traffic on the gravel roads and regular traffic on the paved county roads.

Question 2b: What is available in the area for opportunity for primitive and unconfined recreation? (Describe the types of primitive recreation activities in the area.)

Hunting is the main primitive recreation activity. Other activities for recreation are nature viewing and primitive camping. There are some trail users within the existing wilderness along an existing hike/canoe trail. The area is entirely in the Hellhole Wildlife Management Area and has one maintained wildlife openings within the area. Wet terrain and dense vegetation discourages some use.

Criteria 3: Evaluate how an area less than 5,000 acres is of sufficient size as to make it practical its preservation and use in an unimpaired condition.

This criterion was not included in these evaluations because it was not applicable to additions to wilderness areas and it is not applicable to stand alone areas greater than 5,000 acres.

Criteria 4: Evaluate the degree to which the area may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Question 4a: Does the area contain rare plant or animal communities; rare ecosystem for wildlife habitat; rare ecosystem for aquatics; rare ecosystem for terrestrial; any biodiversity hotspots; coarse scale key connectivity for multiple species, or underrepresented/rare vegetation types? (Describe areas richness in terms of threatened or endangered species or species of conservation concern, area of key connectivity, etc.)

Data collection is limited in the interior of the area for invasive plants however; there are multiple occurrences of the invasive Japanese climbing grass along multiple roads that bound the area.

All (or portions) of over five foraging partitions for the red-cockaded woodpecker are located with the area.

Question 4b: Is there any outstanding landscape features such as waterfalls, mountains, viewpoints, water bodies, or geologic features? (Describe acres of distinctive scenic class or areas of outstanding geologic landscapes.)

The existing wilderness is an outstanding swamp landscape feature and there are some small portions of the area that have similar characteristics, including Hellhole Bay Extension Inventoried Roadless Area (Little Wambaw Swamp Extension [890 acres]). During the wetter season some parts of the area are flooded.

Question 4c: Is there historic or cultural resources of historic value in the area?

There is a lower historic site density within the area; however, there have been fewer inventories in this area.

Question 4d: Is there high quality water resources or important watershed features in the area?

Yes, water quality in Hellhole Bay Wilderness and its associated watershed are considered to be an important watershed feature. All watersheds on the Francis Marion are considered in fair condition based on the watershed condition class index.

Question 4e: Is there any special areas and/or research natural areas in the areas? (Describe and areas of special botanical area or research natural area.)

There are no research natural areas within the area. There are no stands of potential old growth forest in the area.

Question 4f: Is there any scientific or education features in the area?

The area is adjacent to Hellhole Bay Wilderness and potentially has multiple scientific and education features.

Criteria 5: Evaluate the degree to which the area may be managed to preserve its wilderness characteristics.

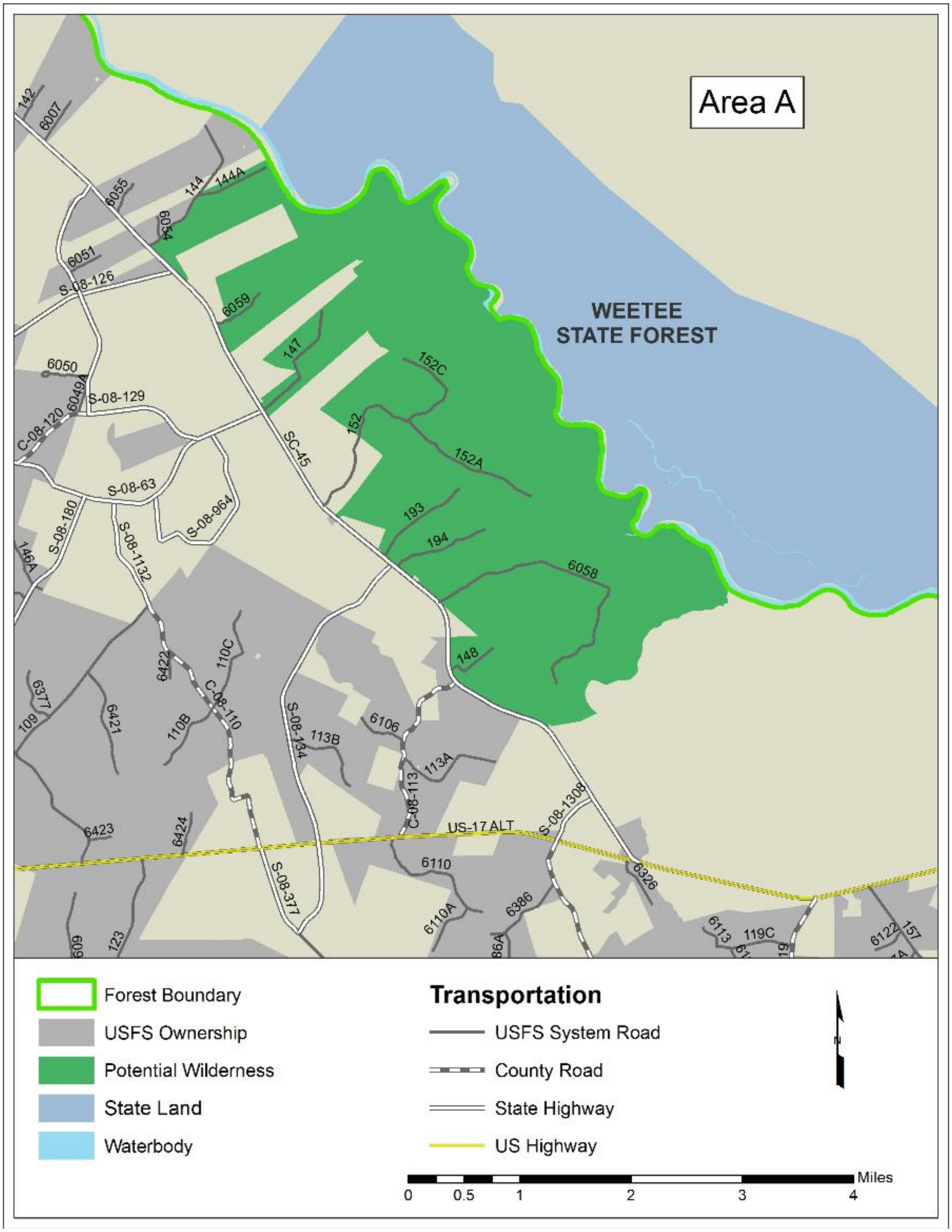
Question 5a: How can the area be managed to preserve its wilderness character? (Describe the shape and configuration of the area. Describe if there are any legally established rights or uses within the area. Are there specific Federal or state laws that may be relevant to availability of the area for wilderness or the ability to manage the area to protect wilderness characteristics? Describe the management of adjacent lands. Describe the current management of the area. Acres and percent total of wildland urban interface in the area. Describe the type and extent of management restrictions within the area.)

The area is generally bounded by roads and that influences the shape. There are few open roads bisecting the area. There are no legally established rights within the area. At the present time there is no Federal or state law that affects the availability of the area for wilderness. Adjacent lands include national forest lands with forest management that includes vegetation management, red-cockaded woodpecker habitat improvements and prescribed burning.

Evaluation – Area A

Francis Marion National Forest: Wilderness Evaluation Worksheet

Area A **Total acres: 6,643**



Criteria 1: Evaluate the degree to which the area generally appears to be affected primarily by the forces of nature, with the imprints of man's work substantially unnoticeable.

Question 1a: What is the composition of plant communities within the area, including the communities already within the adjacent wilderness? (How many miles of maintenance level 1 roads affect the area? What is the density of the road network on the area?)

The entire area was impacted by Hurricane Hugo. Current composition of vegetation is a majority of longleaf pine (42 percent), cypress tupelo (43 percent), sweet bay, swamp tupelo, red maple (3 percent), and loblolly pine (9 percent).

There are 2.8 miles of closed level 1 road within the area. The majority of the area has a higher road density (more than 2 miles of road per 1,000 acres). However, there is a portion of the area that has about 1,300 acres of lower road density (less than 0.5 mile per 1,000 acres).

Question 1b: What is the extent to which the area reflects ecological conditions that would normally be associated with the area without human intervention? (Describe the departure from natural range of variation in forest composition, structure, patterns and ecological processes? Describe the amount of the area that is primarily affected by the force of nature?)

About half the area is being prescribed burned (in existing burn units).

The majority of area is in upland longleaf pine woodlands and forest and a smaller percentage is in broad forested swamps and large river floodplain forests, oak forests and mesic hardwoods and narrow forested swamps and blackwater stream floodplain forests ecogroups (ecosystems). The following table shows the potential ecological groups of the area.

Potential Wilderness Area A		
Ecogroup	**Total Acres**	**% of Area**
Broad Forested Swamps and Large River Floodplain Forests	2,526	11%
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	678	11%
Pocosins	0	0%
Oak Forests and Mesic Hardwood Forests	923	14%
Wet Pine Savannas and Flatwoods	372	6%
Depressional Wetlands and Carolina Bays	11	0%
Upland Longleaf Pine Woodlands and Forests	1,932	30%
Grand Total	6,442	100%

Question 1c: What is the extent to which improvements (improvement criteria 71.22 from FSH 1909.12 chap 70) included in the inventory represent a departure from naturalness?

Improvement Type	Outcome
Airstrips	None
Heliports	None
Vegetation treatments that are not substantially noticeable.	One WLOs in area, 1 acre
Timber harvest areas where logging and prior road construction are not substantially noticeable.	Several areas of thinning or biomass, since Hurricane Hugo
Permanently installed vertical structures, such as electronic installations including cell towers, television, radio, and telephone repeaters, provided their impact, as well as their maintenance and access needs, is minimal.	None
Areas of historic mining where impacts are not substantially noticeable.	None
Areas of mining activity where impacts are not substantially noticeable.	None
Range improvement areas	None
Recreational improvements, such as occupancy spots, or minor hunting, or outfitting camps.	None
Ground-return telephone lines, electric lines, and powerlines if a right-of-way has not been cleared. Exclude powerlines with cleared right-of-ways, pipelines, and other permanently installed linear right-of-way structure.	None
Watershed treatment areas (contouring, diking, channeling) that are not substantially noticeable, or if wilderness character can be maintained or restored through appropriate management actions.	Minimal, if present, historic diking and channeling
Lands adjacent to development or activities that impact opportunities for solitude.	Private lands interspersed with Forest Service boundaries
Structures, dwellings and other relics of past occupation when they are considered part of the historical and cultural landscape of the area.	None

Criteria 2: Evaluate the degree to which the area has outstanding opportunities for solitude or for a primitive and unconfined type of recreation.

Question 2a: What is available for outstanding opportunity for solitude? (Describe the proximity to private lands and non-Forest Service roads. Describe the general topography of the area in context of sight, sound, and screening.)

Over 50 percent of the area is in semi-primitive motorized acres and the other portion is roaded natural, there are small areas with semi-primitive non-motorized. The area is coastal plain, generally flat landform. Climate is temperate with hot, moist summers and mild winters. There are no inholdings or other private land along the boundaries.

The area is bounded by a paved county road and gravel roads suitable for passenger cars. The area has low traffic on the gravel roads and moderate to high traffic on the paved State Highway 45.

Question 2b: What is available in the area for opportunity for primitive and unconfined recreation? (Describe the types of primitive recreation activities in the area.)

Hunting is the main primitive recreation activity. Other activities for recreation are fishing, nature viewing, and primitive camping. The area is entirely in the Santee Wildlife Management Area and has one maintained wildlife opening within the area.

Criteria 3: Evaluate how an area less than 5,000 acres is of sufficient size as to make it practical its preservation and use in an unimpaired condition.

This criterion was not included in these evaluations because it is not applicable to additions to wilderness areas and it is not applicable to stand alone areas greater than 5,000 acres.

Criteria 4: Evaluate the degree to which the area may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Question 4a: Does the area contain rare plant or animal communities; rare ecosystem for wildlife habitat; rare ecosystem for aquatics; rare ecosystem for terrestrial; any biodiversity hotspots; coarse scale key connectivity for multiple species, or underrepresented/rare vegetation types? (Describe areas richness in terms of threatened or endangered species or species of conservation concern, area of key connectivity, etc.)

There are hundreds of occurrences of the invasive Japanese climbing grass in the interior of the Area A.

There are no foraging partitions for the red-cockaded woodpecker located with the area.

Question 4b: Is there any outstanding landscape features such as waterfalls, mountains, viewpoints, water bodies, or geologic features? (Describe acres of distinctive scenic class or areas of outstanding geologic landscapes.)

Views of the Santee River and across into WeeTee State forest are excellent on the northern boundary of the area.

Question 4c: Is there historic or cultural resources of historic value in the area?

There is a moderate to high historic site density within the area. Several sites are clustered on the higher parts of the area.

Question 4d: Is there high quality water resources or important watershed features in the area?

All watersheds on the Francis Marion are considered in fair condition based on the watershed condition class index.

Question 4e: Is there any special areas and/or research natural areas in the areas? (Describe and areas of special botanical area or research natural area.)

There are no research natural areas within the area. There are no stands of potential old growth forest in the area.

Question 4f: Is there any scientific or education features in the area?

No specific scientific or education features known specific to this area.

Criteria 5: Evaluate the degree to which the area may be managed to preserve its wilderness characteristics.

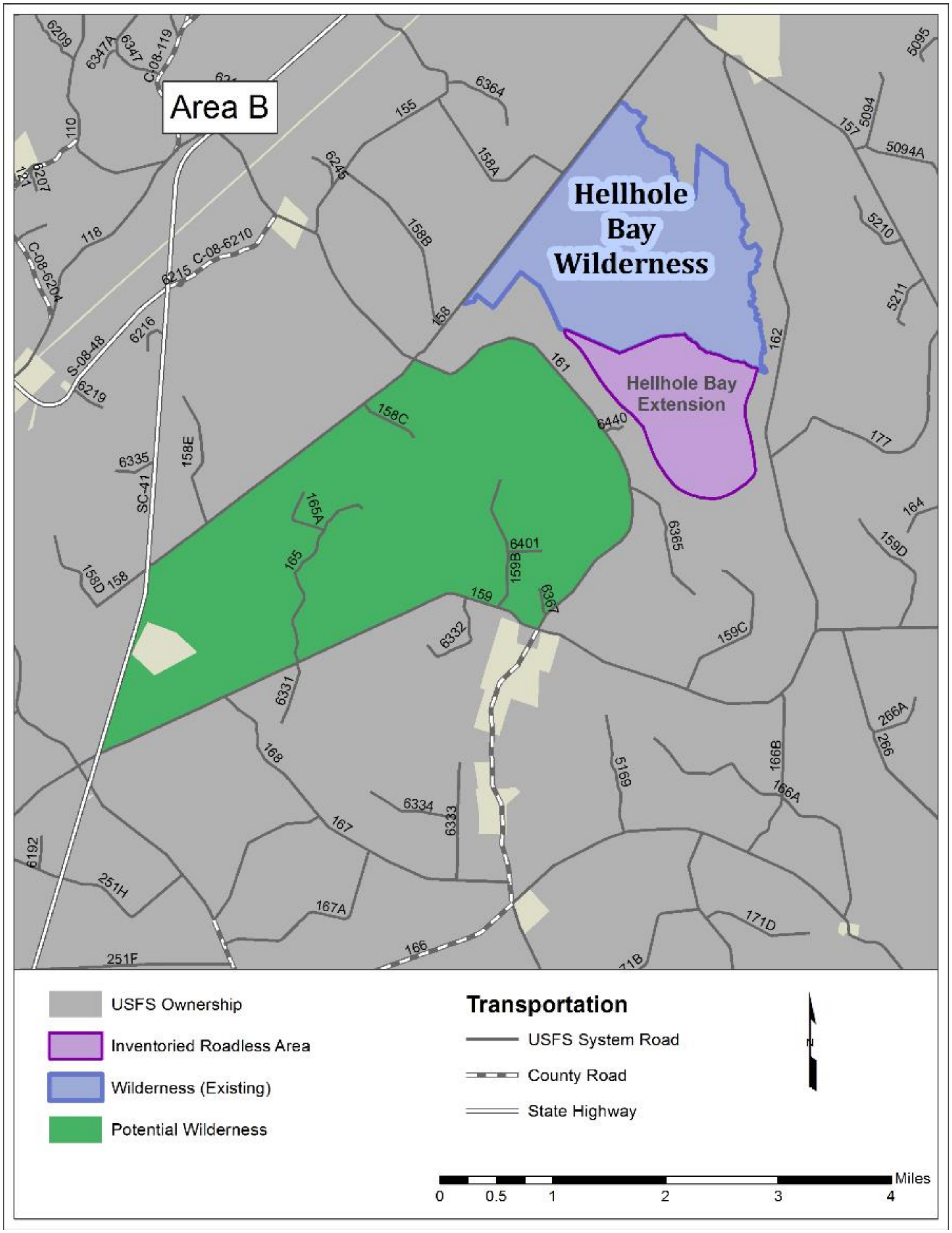
Question 5a: How can the area be managed to preserve its wilderness character? (Describe the shape and configuration of the area. Describe if there are any legally established rights or uses within the area. Are there specific Federal or state laws that may be relevant to availability of the area for wilderness or the ability to manage the area to protect wilderness characteristics? Describe the management of adjacent lands. Describe the current management of the area. Acres and percent total of wildland-urban interface in the area. Describe the type and extent of management restrictions within the area.)

The area is generally bounded by roads and multiple private lands on the northern portion of the area, as well as the natural boundary of the Santee River (eligible wild and scenic river). There is an open road bisecting the area. There are no legally established rights within the area. At the present time there is no Federal or state law that affects the availability of the area for wilderness. Adjacent lands include national forest lands with forest management that includes vegetation management, red-cockaded woodpecker habitat improvements and prescribed burning and also private lands with agricultural land uses.

Evaluation – Area B

Francis Marion National Forest: Wilderness Evaluation Worksheet

Name: Area B **Total acres: 5,098**



Criteria 1: Evaluate the degree to which the area generally appears to be affected primarily by the forces of nature, with the imprints of man's work substantially unnoticeable.

Question 1a: What is the composition of plant communities within the area, including the communities already within the adjacent wilderness? (How many miles of maintenance level 1 roads affect the area? What is the density of the road network on the area?)

The entire area was impacted by Hurricane Hugo. Current composition of vegetation is a majority of longleaf pine (42 percent), sweet bay, swamp tupelo, red maple (30 percent), loblolly pine (14 percent), cypress tupelo (4 percent) and bottomland hardwood/pine (5 percent).

There are 1.1 miles of closed level 1 road within the area. The majority of the area has a higher road density (more than 2 miles of road per 1,000 acres). However, there is a portion of the area adjacent that has about 300+ hundred acres of lower road density (less than 0.5 mile per 1,000 acres).

Question 1b: What is the extent to which the area reflects ecological conditions that would normally be associated with the area without human intervention? (Describe the departure from natural range of variation in forest composition, structure, patterns and ecological processes? Describe the amount of the area that is primarily affected by the force of nature?)

Less than half of the potential area is being prescribed burned (in existing burn units).

The majority of area is in wet pine savannah and flatwoods broad forested swamps and broad river floodplain forests ecogroups (ecosystems). The following table shows the potential ecological groups of the area.

Potential Wilderness Area B	
Ecogroup	**Total Acres**
Broad Forested Swamps and Large River Floodplain Forests	1,790
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	301
Oak Forests and Mesic Hardwood Forests	1
Wet Pine Savannas and Flatwoods	2,907
Depressional Wetlands and Carolina Bays	51
Upland Longleaf Pine Woodlands and Forests	47
Grand Total	5,098

Question 1c: What is the extent to which improvements (improvement criteria 71.22 from FSH 1909.12 chap 70) included in the inventory represent a departure from naturalness?

Improvement Type	Outcome
Airstrips	None
Heliports	None
Vegetation treatments that are not substantially noticeable.	Three WLOs in area, 4.5 acres
Timber harvest areas where logging and prior road construction are not substantially noticeable.	Few areas of thinning or biomass, since Hurricane Hugo
Permanently installed vertical structures, such as electronic installations including cell towers, television, radio, and telephone repeaters, provided their impact, as well as their maintenance and access needs, is minimal.	None
Areas of historic mining where impacts are not substantially noticeable.	None
Areas of mining activity where impacts are not substantially noticeable.	None
Range improvement areas	None
Recreational improvements, such as occupancy spots, or minor hunting, or outfitting camps.	None
Ground-return telephone lines, electric lines, and powerlines if a right-of-way has not been cleared. Exclude powerlines with cleared right-of-ways, pipelines, and other permanently installed linear right-of-way structure.	None
Watershed treatment areas (contouring, diking, channeling) that are not substantially noticeable, or if wilderness character can be maintained or restored through appropriate management actions.	Moderate historic diking and channeling
Lands adjacent to development or activities that impact opportunities for solitude.	Private Inholding, adjacent to SC State Highway 41
Structures, dwellings and other relics of past occupation when they are considered part of the historical and cultural landscape of the area.	None

Criteria 2: Evaluate the degree to which the area has outstanding opportunities for solitude or for a primitive and unconfined type of recreation.

Question 2a: What is available for outstanding opportunity for solitude? (Describe the proximity to private lands and non-Forest Service roads. Describe the general topography of the area in context of sight, sound, and screening.)

Over 60 percent of the area is in a roaded-natural ROS class, there is portion of semi-primitive motorized acres. The area is coastal plain, generally flat landform. Climate is temperate with hot, moist summers and mild winters. There are no inholdings or other private land along the boundaries.

The area is bounded by a paved county road and gravel roads suitable for passenger cars. The area has low to moderate traffic on the gravel roads and moderate to high traffic on the paved SC State Highway 41.

Question 2b: What is available in the area for opportunity for primitive and unconfined recreation? (Describe the types of primitive recreation activities in the area.)

Hunting and trail use is the main primitive recreation activity. Other activities for recreation are nature viewing and primitive camping. The area is entirely in the Hellhole Wildlife Management Area and has three maintained wildlife openings within the area. The Jerico Horse Trail winds through portions of the area.

Criteria 3: Evaluate how an area less than 5,000 acres is of sufficient size as to make it practical its preservation and use in an unimpaired condition.

This criterion was not included in these evaluations because it was not applicable to additions to wilderness areas and it is not applicable to stand alone areas greater than 5,000 acres.

Criteria 4: Evaluate the degree to which the area may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Question 4a: Does the area contain rare plant or animal communities; rare ecosystem for wildlife habitat; rare ecosystem for aquatics; rare ecosystem for terrestrial; any biodiversity hotspots; coarse scale key connectivity for multiple species, or underrepresented/rare vegetation types? (Describe areas richness in terms of threatened or endangered species or species of conservation concern, area of key connectivity, etc.)

Data collection is limited in the interior of the area for invasive plants however; there are occurrences of the invasive Japanese climbing grass along multiple roads that bound the area and on roads interior to the area.

All (or portions) of over seven foraging partitions for the red-cockaded woodpecker are located with the area.

Question 4b: Is there any outstanding landscape features such as waterfalls, mountains, viewpoints, water bodies, or geologic features? (Describe acres of distinctive scenic class or areas of outstanding geologic landscapes.)

No outstanding landscape features.

Question 4c: Is there historic or cultural resources of historic value in the area?

There is a low historic site density within the area; however, there have been fewer inventories in this area.

Question 4d: Is there high quality water resources or important watershed features in the area?

All watersheds on the Francis Marion are considered in fair condition based on the watershed condition class index.

Question 4e: Is there any special areas and/or research natural areas in the areas? (Describe and areas of special botanical area or research natural area.)

There are no research natural areas within the area. There are no stands of potential old growth forest in the area.

Question 4f: Is there any scientific or education features in the area?

No specific scientific or education features known specific to this area.

Criteria 5: Evaluate the degree to which the area may be managed to preserve its wilderness characteristics.

Question 5a: How can the area be managed to preserve its wilderness character? (Describe the shape and configuration of the area. Describe if there are any legally established rights or uses within the area. Are there specific Federal or state laws that may be relevant to availability of the area for wilderness or the ability to manage the area to protect wilderness characteristics? Describe the management of adjacent lands. Describe the current management of the area. Acres and percent total of wildland urban interface in the area. Describe the type and extent of management restrictions within the area.)

The area is generally bounded by roads and that influences the shape. There are three open roads within the area. There are no legally established rights within the area. At the present time there is no Federal or state law that affects the availability of the area for wilderness. Adjacent lands include national forest lands with forest management that includes vegetation management, red-cockaded woodpecker habitat improvements and prescribed burning.

Analysis of Lands Suitable for Inclusion in the Wilderness Preservation System

All of the areas in the inventory of lands that may be suitable for inclusion in the wilderness preservation system were brought forward to be analyzed in the alternatives in this environmental impact statement, except for one, “Area A”.

Area A was not brought forward to be further analyzed for possible wilderness recommendation in an alternative in this document because of the presence of Japanese climbing fern and the need to control this highly invasive plant using herbicides. Additional ecosystem and watershed restoration is needed and a wilderness recommendation at this time would limit the use of heavy equipment needed to restore desired conditions. There are no proposed activities in the alternatives that would preclude a future recommendation during the next round of plan revision.

Table D-3 shows how all the other areas identified in the inventory were addressed in the alternatives.

Table D-3. Summary by alternative

Area	Alternative 1	Alternative 2	Alternative 3
Wilderness	13,812	13,812	13,812
Wilderness Study Area			16,881
Inventoried Roadless Areas	1420	1,420	0
Semi Primitive, Motorized	0	11,139[1]	0

[1] This acreage included the inventoried roadless areas.

Note: GIS acres are approximate.

Table D-4. Detailed recommendations by alternative

Existing Area	Recommended	Alternative 1	Alternative 2	Alternative 3
Wambaw Creek Wilderness		1,825	1,825	1,825
	Wilderness Expansion	0	0	5,747
	Semi-primitive, Motorized	0	0	0
Total Wilderness		1,825	1,825	7,572
Wambaw Swamp Wilderness		4,815	4,815	4,815
	Wilderness Expansion	0	0	1,745[1]
	Semi-primitive, Motorized	0	1,745[2]	0
Total Wilderness		4,815	4,815	6,560
Little Wambaw Swamp		5,047	5,047	5,047
Inventoried Roadless Area		530	530	0
	Wilderness Expansion	0	0	4,854[3]
	Semi-primitive Motorized	0	4,324	0
Total Wilderness		5,047	5,047	9,901
Hellhole Bay Wilderness		2,125	2,125	2,125
Inventoried Roadless Area		890	890	0
	Wilderness Expansion	0	0	4,535
	Semi-primitive Motorized	0	3,650	0
Total Wilderness		2,125	2,125	6,665
	Area A	0	0	0
	Area B	0	0	3,814[4]
Total Wilderness		0	0	3,814

[1] Wilderness Study Area boundaries were refined, in some cases to improve manageability by reducing interface with private lands as well as open roads. Therefore acres will not match inventory acres exactly.

[2] Semi-primitive Motorized boundaries were refined to improve manageability by reducing interface with private lands as well as open roads. Therefore acres will not match inventory acres exactly.

[3] Wilderness Study Area boundaries were refined to improve manageability by reducing interface with private lands as well as open roads. Therefore acres will not match inventory acres exactly.

[4] Boundary of Area B were refined to improve manageability with interface of private lands, acres changed accordingly. Therefore acres will not match inventory acres exactly.

Note: GIS acres are approximate.

Alternative 1

1996 Forest Plan

No additional areas were recommended for wilderness in the 1996 forest plan. In alternative 1, four existing wilderness are maintained, totaling over 13,000 acres. Two inventoried roadless areas (Hellhole Extension and Wambaw Extension) are maintained. No road closures are needed to implement this alternative.

Alternative 2

Alternative 2 increases opportunities for remoteness by emphasizing a semi-primitive, motorized desired condition on national forest land adjacent to three existing wilderness areas. Four existing wilderness and two inventoried roadless areas are maintained. Three of those wildernesses have additional acres that emphasize a remote experience totaling over 11,000 acres, but do not restrict mechanical activities in the area (turquoise colored) in the map below. Over time with additional road closures (7 miles) in the areas improve wilderness character and lower open road density in the area. Roads that would need to be gated are highlighted in red. These gated roads would be used for administrative access. Road closure would require a site-specific NEPA decision.

Alternative 3

In alternative 3, four existing wilderness are expanded with four additions totaling over 16,000 acres (including two inventoried roadless areas). Over time, additional road closures (27 miles) in the areas improve wilderness character and lower road density in the tan-colored area in the map below. Roads that would be closed and obliterated are highlighted in red. A road closure would require a site-specific NEPA decision.

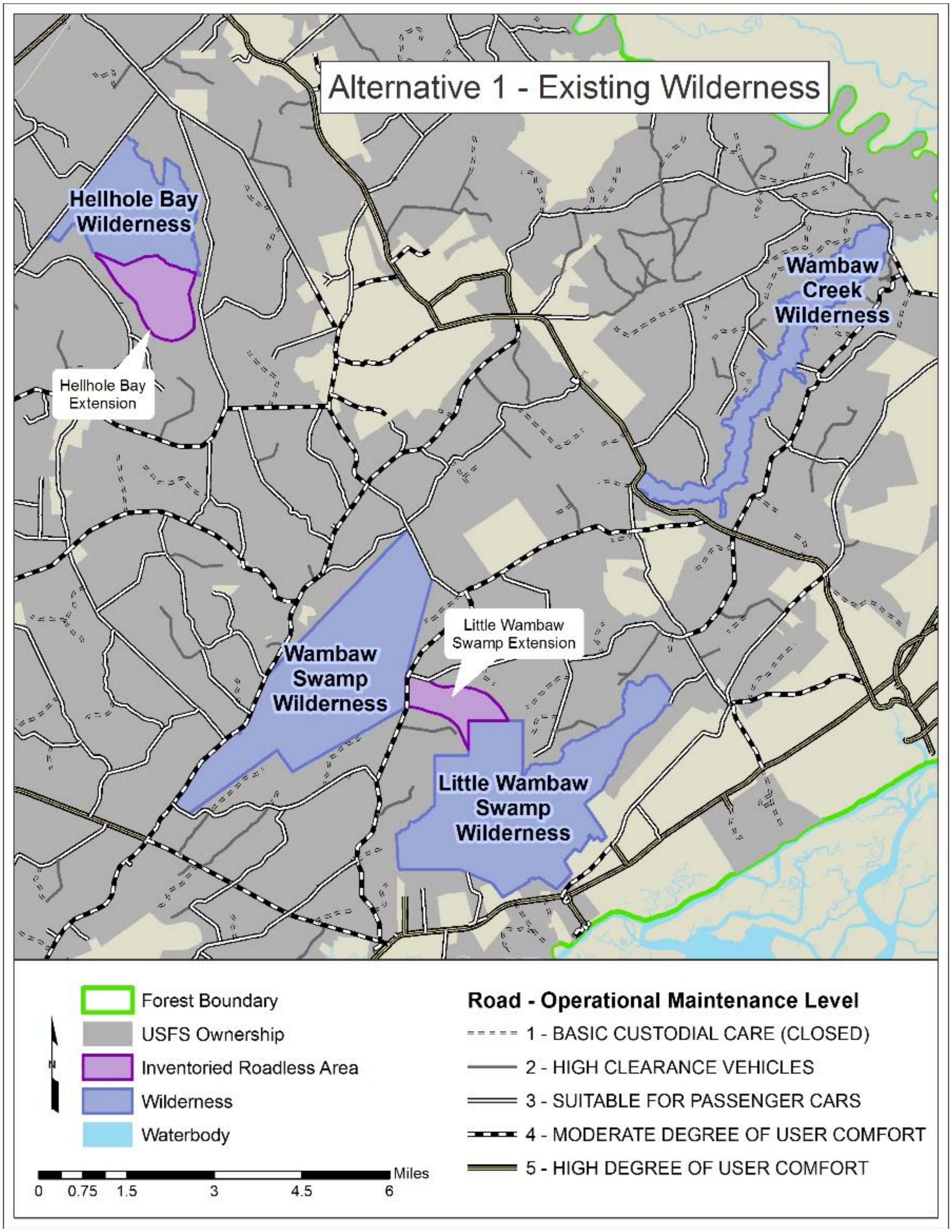


Figure D-3. Alternative 1, existing wilderness

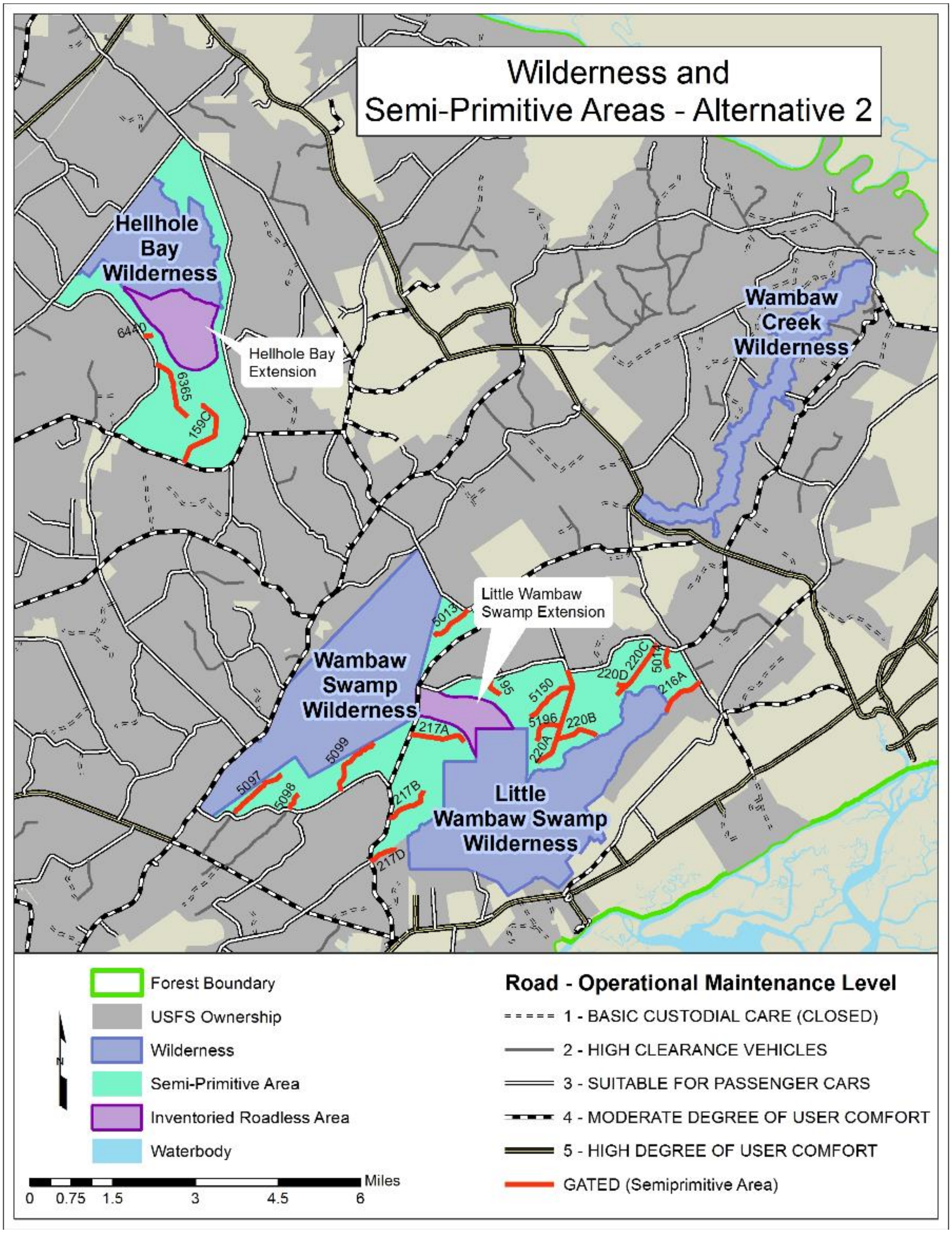


Figure D-4. Alternative 2, semiprimitive areas

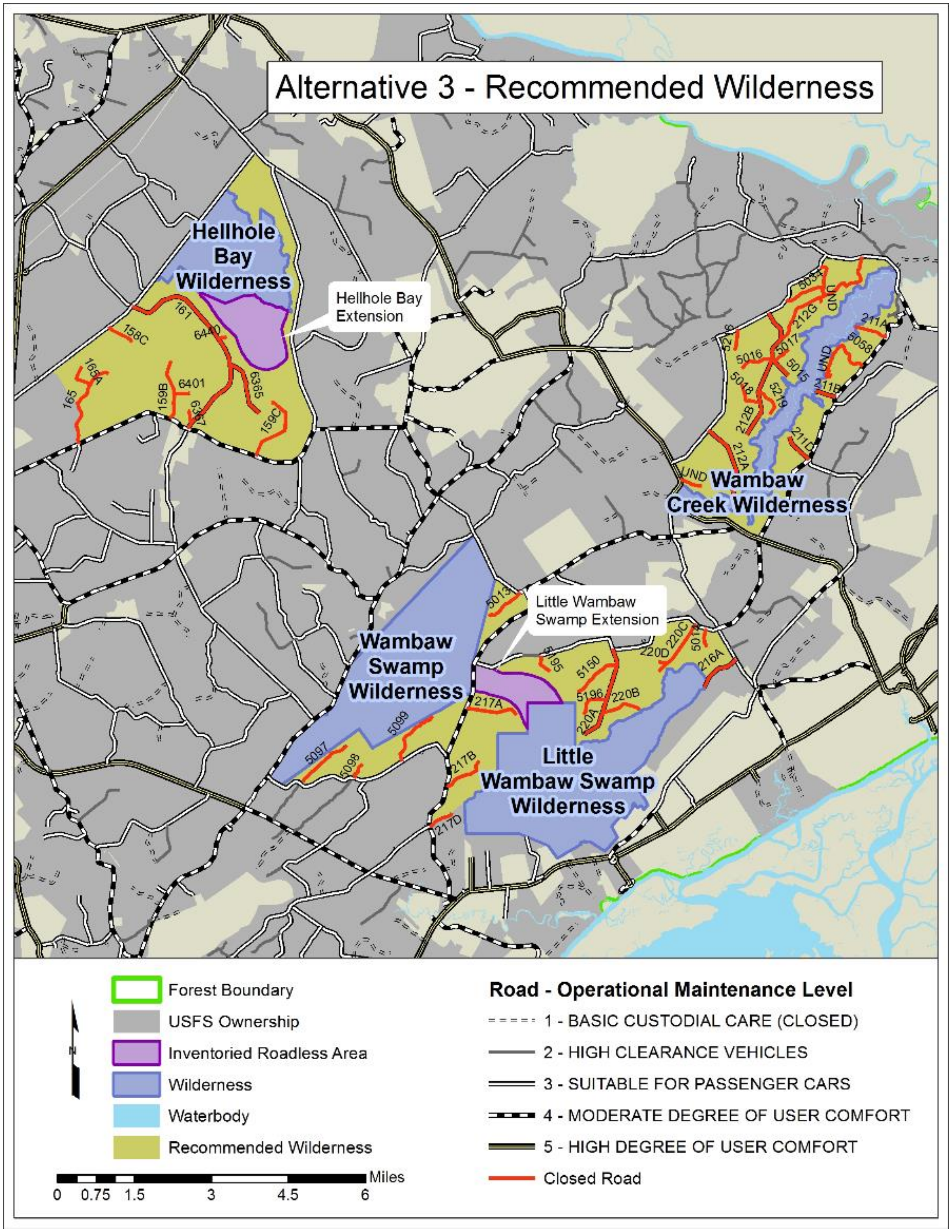


Figure D-5. Alternative 3, recommended wilderness

Glossary

Road Maintenance levels. The level of service provided by, and maintenance required for, a specific road.

Level 1. These are roads that have been placed in storage between intermittent uses. The period of storage must exceed 1 year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are to "prohibit" and "eliminate" all traffic. These roads are not shown on motor vehicle use maps. Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic but may be available and suitable for non-motorized uses.

Level 2. Assigned to roads open for use by high clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Warning signs and traffic control devices are not provided with the exception that some signing, such as W-18-1 “No Traffic Signs,” may be posted at intersections. Motorists should have no expectations of being alerted to potential hazards while driving these roads. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to “discourage” or “prohibit” passenger cars. “Accept” or “discourage” strategies may be employed for high clearance vehicles.

Level 3. Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. The manual on uniform traffic control devices is applicable. Warning signs and traffic control devices are provided to alert motorists of situations that may violate expectations. Roads in this maintenance level are typically low speed with single lanes and turnouts. Appropriate traffic management strategies are either to "encourage" or "accept" passenger cars. "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users.

Level 4. Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. The manual on uniform traffic control devices is applicable. The most appropriate traffic management strategy is to "encourage" passenger cars. However, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times.

Level 5. Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated. The manual on uniform traffic control devices is applicable. The appropriate traffic management strategy is to "encourage" passenger cars.

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Appendix E: Ecosystems and Species Diversity Report

Introduction

The 2012 Planning Rule (36 CFR 219) contains guidance providing for sustainability (CFR 219.8) and diversity of plants and animals (CFR 219.9). This guidance uses a complementary ecosystem and species-specific approach to maintaining the diversity of plant and animal communities and the persistence of native species in the plan area. Specifically, forest plans must contain components designed to maintain or restore the following elements:

- The ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore their structure, function, composition, and connectivity.
- The diversity of ecosystems, including the following:

  (i) Key characteristics associated with terrestrial and aquatic ecosystem types;

  (ii) Rare aquatic and terrestrial plant and animal communities; and

  (iii) The diversity of native tree species similar to that existing in the plan area.
- The ecological conditions to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area. Collectively these species groups are referred to as at-risk species consistent with Forest Service planning direction (FSH 1909.12).

Forest Service regulations define ecological integrity as "The quality of condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence" (36 CFR 219.19). The effects of alternative management on these resources allows evaluation of sustainability of ecosystems and a diversity of species in the future. The ecological sustainability framework described below provides information to make strategic decisions in the forest planning framework.

By restoring and maintaining the key characteristics, conditions, and functionality of native ecosystems, the Francis Marion National Forest should be able to not only improve ecosystem diversity, but also provide for the needs of diverse plant and animal species on the Francis Marion. Most plant and animal species needs are expected to be met by sustaining ecosystem diversity, but species-specific analyses were conducted to evaluate whether additional provisions were needed for federally listed species, Regional Forester's sensitive species, and locally rare species. The Regional Forester's sensitive species are evaluated in a biological evaluation. Some sensitive species are included as species of conservation concern and species groups are used to evaluate indirect effects in the biological evaluation (see appendix G).

Appendix E describes the analysis process used to identify, evaluate, and develop guidance for sustaining ecological diversity. This report and the ecological sustainability evaluation database

from which it was derived not only provide the overall framework for many of the forest plan components and the systems-based direction in the revised forest plan, but are also provide an important source of data and guidance for sustaining native ecological systems and species when implementing the forest plan.

The framework for our ecological sustainability analysis was developed in coordination with NatureServe. NatureServe is an international non-profit organization, formerly part of The Nature Conservancy. Its mission is to develop, manage, and distribute authoritative information critical to conservation of the world's biological diversity.

Public Involvement

There have been multiple opportunities provided for the public to provide input on the ecosystem and species diversity process used in the revision of the Francis Marion Forest Plan.

Summaries of the following public meetings are posted at
(http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb5394710)

- Crowdbright workshop on sustainable recreation (2/26/13)
- Preliminary need to change (2/26/14)
- At-risk species (4/15/16 to 4/17/16)
- The new proposed plan (9/23/14)
- The proposed plan (10/26/15)

Opportunities for the Public to Submit Comments include:

- Scoping on the proposed action (April 30, 2014) http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3799692.pdf. Information on the ecological sustainability and species of conservation concern used for scoping is contained in the following documents posted on the web:
    - Francis Marion National Forest, Draft Forest Plan Assessment http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3814187.pdf
    - Francis Marion Plan Revision: Proposed Management Strategies http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3805368.pdf
- 90-day Comment Period on the Draft Forest Plan (August 15, 2015) and DEIS http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb53931422

  To view all written public comments received during scoping and the 90-day comment on the draft forest plan, go to https://cara.ecosystem-management.org/Public/ReadingRoom?project=40695

Overview of Ecological Sustainability analysis

The ecological sustainability framework is based on The Nature Conservancy Conservation Action Planning process with changes in terminology to match Forest Service planning regulations (Table E-1). Using a coarse-filter/fine-filter approach, the Francis Marion identified ecosystems and associated at-risk species, key ecological characteristics for ecosystems, forest

plan level indicators for evaluating their status, forest plan strategies, and resulting ecosystem sustainability ratings. We considered the natural range in variation in evaluating our departure from reference conditions, and in developing forest plan components for maintaining and restoring ecological sustainability and integrity.

Table E-1. Crosswalk between conservation planning term used in Forest Service planning direction and The Nature Conservancy's Conservation Action Planning Workbook (2005)

Forest Service Terms	The Nature Conservancy Terms
Watersheds, Ecosystems, At-risk Species	Conservation Targets
Key Characteristics of Ecosystems and/or Watersheds	Key Ecological Attributes
Indicators	Indicators
Forest Plan Components (desired conditions, objectives, standards and guidelines)	Strategies
Sustainability Rating	Indicator Rating

Based on the structure of the Nature Conservancy planning tool, the Forest Service developed a relational database called the ecological sustainability evaluation tool. The ecological sustainability evaluation tool follows the open standards for conservation and served as the primary process record for the species and ecosystem diversity analysis. This tool also includes documentation of some of the scientific and other sources consulted, and data gaps during development of the database. Data gaps are also disclosed in the final environmental impact statement. The tool documented relationships among parts of the ecological sustainability framework. For example, species were often related to one or more ecosystem characteristics, and a given forest plan component frequently affected multiple ecological systems or species.

The following steps were used to build an ecological sustainability framework, with each step documented within the ecological sustainability evaluation tool (ESE tool). This iterative process was methodical and utilized sequential steps, as described below.

1. Identify and define ecosystems

To define terrestrial ecological sustainability, all terrestrial ecosystems on the Francis Marion National Forest were identified using NatureServe's International Ecological Classification Standards (NatureServe 2004a, 2004b). In 2009, the Forest Service entered into a national memorandum of understanding with NatureServe to cooperate in the development and application of ecological classification and mapping standards, and in biodiversity conservation information. Several state classifications of natural vegetation are available and were consulted in development of a revised ecosystem framework and at-risk species groups including those for South Carolina (Nelson 1986), North Carolina (1990), and Georgia (Edwards et al. 2013). The NatureServe Ecological System Framework (2012) is a mid-scale ecosystem classification which is based on the International Vegetation Classification System, and forms the basis of LANDFIRE (Landscape Fire and Resource Management Planning Tools) and Southeast Gap Analysis Project collaborative vegetation mapping tools. NatureServe's ecosystem classification is informed by previous vegetation classification efforts, and incorporates physiognomy, biogeography, and hydrology into one classification, representing the next step in ecological classification.

Through coordination with NatureServe, ecosystems were refined to ensure all systems on national forest land were represented and could be identified and mapped using existing vegetation indicators of natural vegetation and ecological classification modeling based also on

soils and landform. Current acreage of each system was calculated based on associated ecological classification units using Forest Service geographic information system (GIS) data.

2. Identify species

To assess species diversity, a comprehensive list of rare or sensitive plant and animal species was compiled by combining species lists from a variety of sources, including: federally-listed threatened and endangered species including proposed and candidate species obtained from the U.S. Fish and Wildlife Service, State species of concern obtained from the South Carolina Natural Heritage Program, State Comprehensive Wildlife Conservation Strategy, the Birds of Conservation Concern list compiled by the U.S. Fish and Wildlife Service, and the Regional Forester's sensitive species. The list of 140 potential species of conservation concern were listed in the assessment. Additional species were added based on input from recognized conservation experts within the state. Species were then screened for inclusion in the framework and designated as threatened and endangered or species of conservation concern.

3. Identify and define key characteristics of ecosystem sustainability

To identify key characteristics and performance measures for terrestrial ecosystems, an ecological sustainability forum was held in 2014. Experts reviewed lists and definitions of ecosystems and suggested important ecological characteristics and performance measures to be addressed during planning. Final determinations of ecological sustainability components were based on expert input, subsequent additional information from a variety of sources, and habitat needs of associated species.

The framework for sustainability of aquatic ecosystems was based on watersheds. Included in the ecological sustainability evaluation database were all 6^{th}-level hydrologic/watershed units (HUCs) that contained national forest land (Clingenpeel and Leftwich 2006). The framework for addressing characteristics and performance measures for watersheds was developed by regional Forest Service staff for use during national forest planning across the Southern Region. It involved use of standard GIS datasets to assess watersheds in terms of sediment loads, pollution point sources, flow modification by dams and road crossings, and riparian land use.

As performance measures were identified for both terrestrial and aquatic systems, criteria were set for rating each performance measure as poor, fair, good, and very good relative to ecological sustainability. To produce a quantitative result, these ratings were scored as integers 1 to 4 for each element, with multiple elements producing an overall score for the conservation measures being evaluated (Table E-2). In general, poor and fair ratings indicate areas of concern for supporting and sustaining a diversity of species.

Table E-2. Overall sustainability condition scores

Range of Condition Score	Condition	Definition of ecological sustainability evaluation Score Applied To Planning Elements
3.51 - 4.0	Very Good	Element conditions are optimal; associated species' populations should remain robust and potentially even expand.
2.51 - 3.50	Good	Element conditions are acceptable; associated species' populations should remain stable.
1.51 - 2.50	Fair	Element conditions are slightly inadequate; although associated species' populations may persist for some time, they may be subject to gradual decline.
1.00 - 1.50	Poor	Element conditions are severely inadequate. Associated species' populations are expected to severely decline; localized extirpations are occurring or are imminent.

4. Link species to the ecosystems and watersheds and identify any additional needs of species

In the April 2014 meetings, experts helped link terrestrial and aquatic species to ecosystems and watersheds in which they occur. It was determined that species' needs were best met when species were grouped before linking them to ecosystems and, in particular, key characteristics of ecosystems are linked a given species groups' needs. This linkage allowed us to assess how well the ecosystem and watershed frameworks covered needs of these species. Where ecological conditions for these species were not covered by the ecological sustainability framework, additional characteristics, performance measures, and rating criteria were added so these species would be covered. Therefore, all species have their needs covered by ecological sustainability framework, or a combination of the ecological sustainability framework and other additional forest plan components.

5. Develop Forest Plan components

Forest plan components were developed to provide ecosystem sustainability and ecological conditions for identified species based on the ecological sustainability evaluation framework. In some cases, current requirements and processes outside of the planning process were identified that address this goal. All elements of the ecological sustainability framework will be addressed by appropriate management direction in the forest plan.

6. Evaluate Ecological Sustainability Ratings to assess future outcomes at both 10- and 50-year time intervals.

To assess ecological sustainability we calculated a composite condition score for each ecosystem from all key characteristics (see below for more details). Rankings for all indicators were defined, weighted for each ecosystem based on expected outcomes under the three alternatives over 10- to 50-year time periods. Predictions were based on acreage in coarse filter maintenance and restoration management prescriptions, along with trends in those activities at 10- and 50-year intervals. Ecological composite scores were developed by multiplying indicator values by indicator weights then averaging. We then calculated overall scores for each ecosystem group and alternative combination. In general, declining overall scores over time indicate that alternatives may not adequately protect ecosystem sustainability and the diversity of associated species.

Ecosystem Sustainability Framework

The ecological sustainability framework is based on The Nature Conservancy Conservation Action Planning (CAP) process (TNC 2006). Using a coarse-filter, fine-filter approach, the Francis Marion identified conservation targets (with a focus on ecosystems and at-risk species), key ecological characteristics for ecosystems, forest plan level indicators for evaluating their status, forest plan strategies, and resulting ecosystem sustainability ratings. We considered the natural range in variation (NRV) in evaluating our departure from reference conditions, and in developing forest plan components for maintaining and restoring ecological integrity.

Ecosystems

The NatureServe ecosystem framework was used to identify the initial framework for native ecosystems that occur or potentially occur on the Francis Marion National Forest (NatureServe, 2012). Based on Comer et al. (2003), "terrestrial ecosystems are specifically defined as a group of plant community types (associations) that tend to co-occur within landscapes with similar ecological processes, substrates, and/or environmental gradients. Ecosystems represent systematically defined groupings of plant associations that provide the basis for mapping terrestrial communities and ecosystems at multiple scales of spatial and thematic resolution". The systems approach complements the U.S. National Vegetation Classification and provides a basis for interpreting larger-scale ecosystem patterns and concepts. The Francis Marion has a memorandum of understanding with NatureServe and also entered into a forest-level agreement in July, 2012, which included input into ecosystems modeling and refinement of ecosystems descriptions and interpretations used in development of desired conditions.

The NatureServe ecosystem framework served as a basis for the mapping of potential natural vegetation types (PNVTs) by Ecological Modeling and Fire Ecology, Inc. (2014) consistent with the National framework of ecological units developed by the Forest Service in 1993 (Cleland et.al. 1997). Mapping considered landform, taking advantage of LiDAR hillshade imagery, soils, geology, FS stands data, and native vegetation sampled from over 1,000 locations. Field trips to verify the final ecological units involve internal Forest Service personnel, the South Carolina NatureServe Conservancy, and NatureServe, and NatureServe included use of field key to identify and verify ecosystems in the field (NatureServe 2012a). The mapping effort resulted in the identification of 21 ecosystems on the Francis Marion (see Table E-3). The following table shows the acreage in ecosystems which were mapped on the National Forest.

In development of the draft environmental impact statement and draft forest plan, we considered the latest spatial data to further group ecosystems. We also considered fine-scale components, as needed. The 21 ecosystems were grouped into 9 "ecosystem groups", which formed the foundation for developing coarse filter ecosystem-based desired condition and other forest plan strategies. We added loblolly pine as a component of upland longleaf ecosystems due to its abundance on the Francis Marion and importance as a cavity and foraging tree for endangered red-cockaded woodpecker, though as described in the revised plan (page 22), "Open, loblolly pine-dominated woodlands, which support diverse plant and animal communities, will occur until conversion to longleaf pine can be completed. Where open loblolly pine woodlands provide high-functioning nesting and foraging habitat for red-cockaded woodpeckers and other plant and animal species, the conditions are maintained. In the long term, loblolly pine forest types are converted to longleaf pine".

Below is a crosswalk of ecosystems (Table E-3) identified initially by NatureServe (2012), those mapped through 2014 mapping efforts, and ecosystems used in the development of more focused

forest plan strategies, in linking species to desired conditions, and in effects analysis. These ecosystem groups provide habitat for a diversity of plant and animal communities on the Francis Marion, so their sustainability may be interpreted as an indicator of the effects of alternatives on plant and animal species that are associated with each ecosystem.

Table E-3. Crosswalk of Forest Plan Ecosystem, NatureServe Ecological Systems, and mapped ecosystems used in analyses

Forest Plan Ecosystems (2015)	NatureServe Ecological Systems (2012)	Mapped Ecosystems (Simon and Hayden, 2014)
Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Atlantic Coastal Plain Upland Longleaf Woodland	Upland Longleaf Pine Woodland (dry-mesic to mesic phase); Upland Longleaf Pine Woodland (dry to dry-mesic phase); Upland Longleaf Pine Woodland (xeric to dry phase)
Wet Pine Savanna and Flatwoods Ecosystems	Southern Atlantic Coastal Plain Wet Pine Savanna and Flatwoods	Wet Pine Savanna and Flatwoods (wet phase) Wet Pine Savanna and Flatwoods (mesic to wet phase)
Depressional Wetlands and Carolina Bay Ecosystems	Atlantic Coastal Plain Clay-based Carolina Bay Wetland; Southern Atlantic Coastal Plain Depression Pond	Pocosin in Carolina Bay; Carolina Bay Cypress Wetlands; Depression Ponds
Pocosin	Atlantic Coastal Plain Peatland Pocosin and Canebrake; Streamhead Seepage Swamp, Pocosin, and Baygall	Peatland Pocosin and Canebrake; Streamhead Seepage Swamp, Pocosin and Baygall
Oak Forests and Mesic Hardwood Forested Ecosystems	Southern Atlantic Coastal Plain Dry and Dry-Mesic Oak; Southern Coastal Plain Mesic Slope Forest	Dry and Dry-Mesic Oak Forest; Mesic Slope Forest
Narrow Forested Swamps and Blackwater Stream Floodplain Forested Ecosystems	Southern Atlantic Coastal Plain Nonriverine Swamp and Wet Hardwood Forest; Atlantic Coastal Plain Blackwater Stream Floodplain Forest; Small Blackwater River Floodplain Forest	Small Blackwater River Floodplain Forest; Blackwater Stream Floodplain Forest (typic phase); Blackwater Stream Floodplain Forest (headwaters phase); Narrow Nonriverine Swamp and Wet Hardwood Forest
Broad Forested Swamps and Large River Floodplain Forested Ecosystems	Southern Atlantic Coastal Plain Nonriverine Swamp and Wet Hardwood Forest; Southern Coastal Nonriverine Basin Swamp; Southern Atlantic Coastal Plain Large River Floodplain Forest; Southern Atlantic Coastal Plain Tidal Wooded Swamp	Tidal Wooded Swamp; Large River Floodplain Forest; Broad Nonriverine Swamp and Wet Hardwood Forest
Maritime Forests and Salt Marsh	Central Atlantic Coastal Plain Maritime forest; Southern Atlantic Coastal Plain Salt and Brackish Marsh; Southern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh	Salt and Brackish Tidal Marsh; Maritime Forest

Desired conditions were developed for ecosystems in terms of composition, structure, connectivity, drivers, and stressors. In developing desired conditions for ecosystems, we considered ecological site capability, both regional and localized ecosystem descriptions from NatureServe (2012), longleaf maintenance condition class definitions from America's Longleaf and the Longleaf Partnership Council (2014), biophysical setting descriptions from LANDFIRE (www.landfire.gov), and we considered the input of internal personnel and other experts knowledgeable of ecological conditions and their relationships to species and forest health and ecological sustainability—including individuals from NatureServe (Milo Pyne and Carl Nordman), ecological and species experts (Regional Forest Service personnel, Colette Degarady and Eric Krueger of TNC, Jeff Holmes, Dr. Jeff Glitzenstein, Dr. Jean Everett, SC DNR and Heritage biologists). We also queried available digital data from our forest geographic systems, including prescribed fire history, dominant forest vegetation types, ecosystems, longleaf condition class information, known locations for rare species, forest age data, information on possible old growth, road and trail densities, and rare community information.

Ecological Conditions for At-risk Species

A process parallel to the development of an ecosystem framework was the consideration of species most "at risk" from extirpation in the foreseeable future, their distribution and habitat on the Francis Marion, drivers, threats, and ecological needs. Based on the final directives, the list of "at-risk" species for the Francis Marion includes:

- Federally -listed threatened, endangered, proposed and candidate species; and
- Species of conservation concern. Species of conservation concern are those plant and animal species whose long-term persistence within the plan area is of known conservation concern. The 2012 National Forest Planning Rule requires that species of conservation concern be "known to occur in the plan area" and that the Regional Forester identify the species of conservation concern for which "the best available scientific information indicates substantial concern about the species' capability to persist over the long term in the plan area."

During the assessment phase of forest plan revision, a team consisting of a botanist/ecologist, wildlife biologist, and aquatic biologist developed a comprehensive list of 140 plant, wildlife, and aquatic species with the potential to occur on the Francis Marion. This list was based on a variety of sources, including: federally-listed threatened and endangered species occurring in Charleston and Berkeley County obtained from the U.S. Fish and Wildlife Service, State species of conservation concern obtained from the South Carolina Natural Heritage Program, species included in the State Comprehensive Wildlife Conservation Strategy, the Birds of Conservation Concern list compiled by the U.S. Fish and Wildlife Service, and the Forest Service's list of sensitive species. The Francis Marion met with Paula Sisson of the Charleston Office, of the U.S. Fish and Wildlife Service in January, 2015, to review the most updated lists of applicable county lists of endangered, threatened, and at-risk species (Berkeley and Charleston County) and to finalize the list of threatened and endangered species that would be addressed through forest plan strategies and in the biological assessment (see appendix G), and to get input on our lists of species of conservation concern.

Sixty-seven species of Conservation were designated by the Regional Forester on August 11, 2016. Of the 140 species evaluated, 76 at-risk species, comprising 67 potential species of conservation and 9 federally-listed species, were known to occur on the Francis Marion National Forest, and met rarity rankings for inclusion as at-risk species. We ensured consistency in our

criteria for inclusion of species of conservation concern based on a white paper developed by the USDA Forest Service, the Southern Region in August, 2014, and consistent with the final directives, FSH 1909.12, section 12.52 – Species to Consider when Identifying Potential Species of Conservation Concern. The 67 species of conservation concern were recommended in a letter to the Regional Forester dated February 17, 2016. A complete listing of all species considered as species of conservation concern, including criteria used in their designation, including rankings, threats, and number of known occurrences, both on the Francis Marion and within the state, is posted on the Francis Marion and Sumter National Forest website at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb5393142. No additional comments were received on the final draft list of species of conservation concern included in the draft environmental impact statement. Two species of potential conservation concern, northern pine snake and eastern coral snake, were eliminated between draft and final because, respectively, their rarity ranks did not meet criteria for listing and because there were no known occurrences on the Francis Marion.

During the assessment phase, with further refinement throughout the planning process, the biological planning team grouped species into ecosystem associations, based on known habitat requirements, and habitat drivers and threats, and used this information in the identification of key characteristics most important in assessing ecological integrity. We found that all species could be linked to desired conditions ecosystems at the coarse filter scale. We grouped species based on known habitat conditions on forest based on forest digital data on occurrences, survey and monitoring input, as well as opinions of contractors, NatureServe, and species experts. Many species occur in multiple ecosystems or ecosystem groups, but assuring maintenance of species diversity based on the one or two primary ecosystems they are associated with meets regulatory requirements and intent. Table E-4 displays the species groups identified and their relationship to ecosystem or geographic management area, and Tables E-5 through E-15 list of at-risk species associated with each ecosystem group at the coarse filter scale. Species groups listed in Tables E-12 to E-15 crosswalk with specific habitat components that occur in multiple ecosystems. The current condition and effects of forest plan alternatives on all species and species groups can be found in the final environmental impact statement, sections 3.3.3 and 3.3.4.

Public involvement on the development of the ecosystems and at-risk species included:

- Scoping on the assessment as part of the proposed action, (The assessment is posted on-line at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprd3797222)

- Findings from the assessment were presented at the Ecological Sustainability forum held August 6, 2013. (Meeting notes are posted on-line at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb5436948

- At-risk species meetings held April 15-17, 2014 meeting notes are posted on-line at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprd3797222)

A complete list of at-risk species, their relationship to ecological conditions, key characteristics, and forest plan components – including coarse filter and fine filter components, is displayed in Table E-46. The best available science was used in the development of ecological conditions for at-risk species, including species groups (Tables E-5 through E-15), associated ecosystems and habitat acres (Table E-4), key characteristics associated with both at-risk species and associated ecosystems (Tables E-20 through E-36), and associated forest plan and management strategies. Information on ecological conditions for rare plants and associated ecosystems were developed both internally by Forest Botanist/Ecologist Robin Mackie, Interdisciplinary Team Members,

Subject Matter Experts during the Collaborative Specialist Meetings (including subject matter experts from NatureServe, TNC, ARC, fed/state government, academia and other partners) held in 2014, USFS Regional Office Subject Matter Experts and reviewed during the Reference Sites for Ecological Systems field trip held November 7-9, 2012.

The forest also considered plant survey and monitoring efforts of Glitzenstein and Streng (2010,2012a), Everett (2012), Gaddy, Lee, and Nelson (2012, 2014), McMillan, Porcher, and McMillan (2001), Gramling (2003, 2010), Natureserve (2012,2015), Porcher (1995,2005), the Carolina Vegetation Survey (http://cvs.bio.unc.edu/), plant habitats in Weakley – Flora of the Carolinas, Virginia, and Georgia (2015).

For identifying ecological conditions for amphibians and reptiles, the Forest relied on the internal expertise of former Forest Wildlife Biologist Mark Danaher, district biological technician Danny Carlson, Interdisciplinary Team Members, Subject Matter Experts during the Collaborative Specialist Meetings (including subject matter experts from NatureServe, TNC, ARC, fed/state government, academia and other partners) held in 2014, USFS Regional Office Subject Matter Experts. The forest also considered and included numerous literature citations in the process record, as well as the expertise of the Amphibian and Reptile Conservancy (Means, 2005, 2006; Martin et.al., 2016).

References for ecological conditions for aquatic species include former fisheries biologist (Jeannie Riley), acting fisheries biologist (Thomas Scott), and current forest fisheries biologist (James Whalen), Interdisciplinary Team Members, Subject Matter Experts during the Collaborative Specialist Meetings (including subject matter experts from NatureServe, ARC, fed/state government, academia and other partners) held in 2014, USFS Regional Office Subject Matter Experts. The forest also considered numerous references cited in the assessment (including Hansbarger and Dean, 1994; Kohlsaat et.al., 2005).

Best available science for insects considered North American and South Carolina Butterfly Count information and trends, dating back to 1993 (LeGrand and Chapman, 2015; Sutton et.al., 2015), and for bats, birds (La Sorte et.al., 2007), considered the South Carolina Comprehensive Wildlife Strategies (Kohlsaat et.al., 2005; SCDNR, 2015), numerous literature references cited in the FEIS and assessment, as well as by Danaher (2014). Species were reviewed by Interdisciplinary Team Members, Subject Matter Experts during the Collaborative Specialist Meetings held April 15-17, 2014 in Columbia, SC and USFS Regional Office Subject Matter Experts.

Information on the distribution of known species occurrences was confirmed through a review of digital data maintained by the Forest and by South Carolina Heritage Program. The Forest and species and conservation experts recognize that some uncertainty will always exist in predictions of future trends for rare species, their distribution, rarity, management responses, and threats and stresses. New information regarding the list of species of conservation concern will be evaluated periodically consistent with FSH 1909.12, Chapter 20, 21.22b.

Existing ecological conditions, including the status of key characteristics, compared to the expected historic or natural range of variation for each ecosystem, was disclosed in the assessment (FPA2.1_TerrestrialAquaticEcosystem_Watersheds), as is the status of federally-listed species and potential species of conservation concern, and associated species groups and ecological conditions (FPA5.1.5.25.3_AtRiskSpecies; FPS5.4_ThreatenedEndangered_ProposedWildlifeSpecies).

The following is an excerpt from the ecosystem section of the assessment:

> In 2009, the U.S. Forest Service entered into a National Memorandum of Understanding with Natureserve to cooperate in the development and application of ecological classification and mapping standards, and in biodiversity conservation information. Several state classifications of natural vegetation are available and were consulted in development of a revised ecosystem framework and at risk species groups including those for South Carolina (Nelson, 1986), North Carolina (1990), and Georgia (Edwards et.al., 2013). The Natureserve Ecological System framework (2012) is a mid-scale ecosystem classification which is based on the International Vegetation Classification System, and forms the basis of LANDFIRE (Landscape Fire and Resource Management Planning Tools) and Southeast Gap Analysis Project, collaborative vegetation mapping tools. Natureserve's ecosystem classification is informed by previous vegetation classification efforts, and incorporates physiognomy, biogeography, and hydrology into one classification, representing the next step in ecological classification.

And later:

> The National framework of ecological units developed by the Forest Service of the U.S. Department of Agriculture in 1993 (Cleland et.al., 1997), specifies the consideration of landform, soils or geology, and potential natural vegetation in the classification of ecological units and ecological potential at various scales.
>
> Given the new information and technology available since 1996, a revised ecological classification units for the Francis Marion National Forest, at both the landtype association level (LTA), and the landtype (LT) level were developed in 2013 (Simon and Hayden, 2013). This information will be referred to throughout the analysis.
>
> At the finer scale of Landtype and Landtype Phase, Simon and Hayden (2013) modeled ecological systems and acreage, using the Natureserve Ecosystem framework. The following shows the acreage of each ecosystem predicted based on a 1st Draft of Ecological Modeling efforts and based on sampling of vegetation at over 1000 locations (Simon and Hayden, 2013). Detailed descriptions of each of the ecological systems are available on request (Natureserve, 2012), and will be referred to throughout this document. Descriptions of structure and disturbance regimes for ecological systems are addressed in the relevant biophysical setting descriptions from LANDFIRE (www.landfire.gov/).

Existing condition – by ecosystem, for each key characteristic/ecosystem combination, was initially determined and disclosed in the assessment, using the mapped ecological unit layer in GIS, and overlaying existing information - including forest type groups, existing fire regimes, and landscape structural diversity – to compare existing condition to that which would be expected based on the natural and historic range of variation (NRV) for each ecosystem. (Note: 2012 planning regulations refer to natural range of variation hence the change the NRV from HRV). Existing conditions for each forest ecosystem and key characteristic combination - was disclosed in the assessment, then developed for each Alternative at 10- and 50- year intervals and disclosed in the DEIS and FEIS.

The 10- and 50- year predictions for ecological conditions for at-risk species in Alternative 1, consider the distribution at-risk species, in comparison to the fire-adapted ecosystem acreage and distribution within Management Area 26, the management area designated to longleaf restoration with 2-3 year fire return intervals in the 1996 Revised Land Management Plan. In Alternative 1, at the finer scale many of the more newly designated at-risk species would not receive the

protection of the suite of desired conditions, objectives, standards and guidelines in the 2016 Revised Land Management Plan.

The 10- and 50- year predictions for ecological conditions for at-risk species in Alternative 2, considered the distribution of at-risk species, in comparison to the fire-adapted ecosystem acreage within Management Area 1, the management area designated to longleaf and fire-adapted ecosystem restoration within Alternative 2 of the 2016 Revised Land Management Plan. The suite of desired conditions, objectives, standards and guidelines in the 2016 Revised Land Management Plan would also apply. At 10- years, limits for timber management were based on our objectives, and set by our capacity to restore ecosystems through the use of timber management, therefore ecological sustainability scores for longleaf ecosystems increased after 50- years, compared to 10- years.

The 10- and 50- year predictions for ecological conditions supporting at risk species in Alternative 3, considered the distribution of at-risk species, in comparison to the fire-adapted ecosystem acreage within Management Area 1, the management area designated to longleaf and fire-adapted ecosystem restoration within Alternative 3 of the 2016 Revised Land Management Plan. Management Area 1 is smaller in Alternative 3 compared to Alternative 2. At 10-years, the forest is limited in both capacity and time to restore longleaf ecosystems - set by objectives, therefore ecological sustainability scores for fire-adapted ecosystems increased after 50- years, compared to 10- years. In Alternative 3, as in Alternative 2, the suite of desired conditions, objectives, standards and guidelines in the 2016 Revised Land Management Plan apply.

Final conclusions regarding ecological conditions supporting at-risk species viability/recovery, considered the Overall Ecological Sustainability Ratings (Table E-45), which represent a composite or overall condition score for each ecosystem/key characteristic combination and is calculated by multiplying individual key characteristic indicator values by indicator weights and then averaging the score.

Table E-4. At-risk species groups and associated ecosystems, Francis Marion National Forest

Species Group	Ecosystems	Ecosystem Acres
Forested Wetland Associates	Forestwide - Narrow Forested Swamps and Blackwater Stream Floodplain Forested Ecosystems; Broad Forested Swamps and Large River Floodplain Forested Ecosystems	44,209 49,248 93,100
Pine/Wetland Ecotone Associates	Management Area 1 - Pocosins; Narrow Forested Swamps and Blackwater Stream Floodplain Forested Ecosystems	7,239 26,073 33,312
Wet Pine Savanna Associates	Management Area 1 - Wet Pine Savanna and Flatwoods Ecosystems	58,062
Pond Cypress Savanna Associates	Management Area 1 - Depressional Wetlands and Carolina Bay Ecosystems;	6,385
Upland Pine Woodland Associates	Management Area 1 - Upland Longleaf Pine Woodland Ecosystems;	33,407
Calcareous Mesic Hardwood Associates	Forestwide - Oak Mesic Hardwood Forests	5,809
River and Stream Associates	Forestwide - Rivers and Streams	2,499 miles

Table E-5. At-risk species, Forested Wetland Associates

Taxonomic group	Scientific Name	Common Name
Bird	*Elanoides forficatus*	American swallow-tailed kite
Bird	*Haliaeetus leucocephalus*	Bald eagle
Bird	*Mycteria americana*	Wood stork
Insect	*Zale perculata*	Okefenokee zale moth
Mammal	*Corynorhinus rafinesquii*	Rafinesque's big-eared bat
Mammal	*Myotis austroriparius*	Southeastern myotis
Vascular Plant	*Carex crus-corvi*	Ravenfoot sedge
Vascular Plant	*Macbridea caroliniana*	Carolina bird-in-a nest
Vascular Plant	*Ponthieva racemosa*	Shadowwitch orchid
Vascular Plant	*Quercus similis*	Bottomland post oak
Vascular Plant	*Ruellia strepens*	Limestone petunia
Reptile	*Clemmys guttata*	Spotted turtle

Table E-6. At-risk species, Pine Upland/Wetland Ecotone Associates

Taxonomic group	Scientific Name	Common Name
Bird	*Elanoides forficatus*	American swallow-tailed kite
Insect	*Amblyscirtes alternata*	Dusky roadside skipper
Insect	*Danaus plexippus*	Monarch butterfly
Insect	*Euphyes berryi*	Berry's skipper
Mammal	*Corynorhinus rafinesquii*	Rafinesque's big-eared bat
Mammal	*Myotis austroriparius*	Southeastern myotis
Reptile	*Crotalus adamanteus*	Eastern diamondback rattlesnake
Vascular Plant	*Andropogon mohrii*	Mohr's bluestem
Vascular Plant	*Asclepias pedicillata*	Savanna milkweed
Vascular Plant	*Carex elliottii*	Elliott's sedge
Vascular Plant	*Coreopsis integrifolia*	Ciliate-leaf tickseed
Vascular Plant	*Eupatorium anomalum*	Florida thoroughwort
Vascular Plant	*Lysimachia loomisii*	Loomis' loosestrife
Vascular Plant	*Rhynchospora cephalantha* var. *attenuata*	Small bunched beak sedge
Vascular Plant	*Rhynchospora oligantha*	Few-flowered beaked-rush
Vascular Plant	*Rhynchospora stenophylla*	Chapman beakrush

Table E-7. At-risk species, Mesic and Wet Pine Savanna Associates

Taxonomic group	Scientific Name	Common Name
Amphibian	*Ambystoma cingulatum*	Frosted Flatwoods salamander
Amphibian	*Lithobates capito*	Gopher frog
Amphibian	*Pseudobranchus striatus*	Dwarf Siren
Bird	*Picoides borealis*	Red-cockaded woodpecker
Vascular Plant	*Agalinis aphylla*	Coastal plain false-foxglove
Vascular Plant	*Anthaenantia rufa*	Purple silkyscale
Vascular Plant	*Calopogon barbatus*	Bearded grass-pink
Vascular Plant	*Calopogon multiflorus*	Many-flower grass-pink
Vascular Plant	*Carex stricta*	Tussock Sedge
Vascular Plant	*Chasmanthium nitidum*	Shiny spikegrass
Vascular Plant	*Cladium mariscoides*	Twig-rush
Vascular Plant	*Eryngium aquaticum*	Ravenel's Eryngo
Vascular Plant	*Lachnocaulon minus*	Small's Bog Button
Vascular Plant	*Ludwigia lanceolata*	Lance-leaf seedbox
Vascular Plant	*Lysimachia hybrida*	Lance-leaf loosestrife
Vascular Plant	*Platanthera integra*	Yellow fringeless orchid
Vascular Plant	*Rhynchospora breviseta*	Short-bristle baldrush
Vascular Plant	*Rhynchospora globularis* var. *pinetorum*	Beakrush
Vascular Plant	*Sporobolus curtisii*	Pineland dropseed
Vascular Plant	*Sporobolus pinetorum*	Carolina dropseed
Vascular Plant	*Xyris brevifolia*	Short-leaved yellow-eyed grass

Taxonomic group	Scientific Name	Common Name
Vascular Plant	*Xyris flabelliformis*	Savannah yellow-eyed grass
Vascular Plant	*Xyris stricta*	Pineland yellow-eyed grass
Reptile	*Crotalus adamanteus*	Eastern Diamondback Rattlesnake

Table E-8. At-risk species, Pond Cypress Savanna Associates

Taxonomic group	Scientific Name	Common Name
Amphibian	*Ambystoma cingulatum*	Frosted flatwoods salamander
Amphibian	*Lithobates capito*	Gopher frog
Amphibian	*Pseudobranchus striatus*	Dwarf siren
Reptile	*Clemmys guttata*	Spotted turtle
Vascular Plant	*Andropogon gyrans* var. *stenophyllus*	Elliott's bluestem
Vascular Plant	*Anthaenantia rufa*	Purple silkyscale
Vascular Plant	*Burmannia biflora*	Northern burmannia
Vascular Plant	*Helenium pinnatifidum*	Southeastern sneezeweed
Vascular Plant	*Lindera melissifolia*	Pondberry
Vascular Plant	*Lobelia boykinii*	Boykin's lobelia
Vascular Plant	*Myriophyllum laxum*	Piedmont water-milfoil
Vascular Plant	*Oxypolis canbyi*	Canby's dropwort
Vascular Plant	*Rhynchospora harperi*	Harper beakrush
Vascular Plant	*Rhynchospora pleiantha*	Brown beaked-rush
Vascular Plant	*Rhynchospora scirpoides*	Long-beaked beaksedge
Vascular Plant	*Spiranthes laciniata*	Lace-lip ladies'-tresses
Vascular Plant	*Utricularia macrorhiza*	Greater bladderwort
Vascular Plant	*Xyris difformis* var. *floridana*	Florida yellow-eyed grass

Table E-9. At-risk species, Upland Pine Woodland Associates

Taxonomic group	Scientific Name	Common Name
Bird	*Aimophila aestivalis*	Bachman's sparrow
Bird	*Picoides borealis*	Red-cockaded woodpecker
Insect	*Amblyscirtes alternata*	Dusky roadside skipper
Insect	*Danaus plexippus*	Monarch butterfly
Reptile	*Crotalus adamanteus*	Eastern diamondback rattlesnake
Reptile	*Heterodon simus*	Southern hognose snake
Vascular Plant	*Pteroglossapsis ecristata*	Crestless plume orchid
Vascular Plant	*Schwalbea americana*	American chaffseed

Table E-10. At-risk species, Calcareous Mesic Hardwood Associates

Taxonomic group	Scientific Name	Common Name
Vascular Plant	*Asplenium resiliens*	Black-stem spleenwort
Vascular Plant	*Carex basiantha*	Widow sedge
Vascular Plant	*Carex granularis*	Meadow sedge
Vascular Plant	*Carya myristiciformis*	Nutmeg hickory
Vascular Plant	*Listera australis*	Southern twayblade
Vascular Plant	*Matelea flavidula*	Yellow Carolina spinypod
Vascular Plant	*Tridens chapmanii*	Chapman's redtop
Vascular Plant	*Triphora trianthophora*	Threebirds orchid

Table E-11. At-risk species, River and Stream Associates

Taxonomic group	Scientific Name	Common Name
Eel	*Anguilla rostrata*	American eel
Fish	*Acipenser brevirostrum*	Shortnose sturgeon
Fish	*Acipenser oxyrinchus*	Atlantic sturgeon
Mammal	*Trichechus manatus*	West Indian manatee
Reptile	*Clemmys guttata*	Spotted turtle

Table E-12. At-risk species, Stump and Root Mound Associates

Taxonomic group	Scientific Name	Common Name
Amphibian	*Lithobates capito*	Gopher frog
Reptile	*Crotalus adamanteus*	Eastern diamondback rattlesnake

Table E-13. At-risk species, Wildlife Species Sensitive to Road Use Associates

Taxonomic group	Scientific Name	Common Name
Amphibian	Ambystoma cingulatum	Frosted flatwoods salamander
Amphibian	*Lithobates capito*	Gopher frog
Reptile	*Clemmys guttata*	Spotted turtle
Reptile	*Crotalus adamanteus*	Eastern diamondback rattlesnake
Reptile	*Heterodon simus*	Southern hognose snake

Table E-14. At-risk species, Wildlife Snag and Large Diameter Hollow Tree Associates

Taxonomic group	Scientific Name	Common Name
Mammal	*Corynorhinus rafinesquii*	Rafinesque's big-eared bat
Mammal	*Myotis austroriparius*	Southeastern myotis

Table E-15. At-risk species, Forest Opening Associates

Taxonomic group	Scientific Name	Common Name
Mammal	*Corynorhinus rafinesquii*	Rafinesque's big-eared bat
Mammal	*Myotis austroriparius*	Southeastern myotis

Ecosystem Key Characteristics and Indicators

The following are key characteristics identified as important to ecological integrity and associated species/species groups, and for which some Francis Marion-level digital data was available.

Note: Key Characteristics and indicators for rivers and streams ecosystems are described in the "Watershed and River and Streams Ecosystems" section.

Composition: Percent of Ecosystem Dominated by characteristic Native Forest Types

The percent of ecosystem extent in characteristic native forest types was identified as a key characteristic related to composition of all our ecosystems. To develop this value we used stand forest types from FSVEG, and grouped them by dominant and codominant canopy species. We then intersected that information with our ecosystem group layer to identify what the existing composition was in our ecosystems. Acres dominated by longleaf pine is of interest to State Foresters and Longleaf Implementation Teams, the Sewee Landscape Longleaf Initiative, and the South Atlantic Landscape Conservation Cooperative. We assumed that a dominance of loblolly pine provided us with an indication of native ecosystem restoration opportunities because most of the area currently in loblolly stands was planted. Both longleaf pine and fire were discouraged by turn-of-the-century forest management practices and according to historic records, the percentage of loblolly pine dominated forest has increased by upwards of 16 percent since the Francis Marion National Forest was established in 1936. Table E-16 shows existing vegetation on the Francis Marion occurring within each ecosystem group using forest type groups from internal Forest Vegetation data based on dominant forest types (FSVeg).

Table E-16. Existing forest type groups for stands in the Francis Marion by ecosystem (expressed as a percentage of total ecosystem acres)

	Current Forest Type					
	Bottomland Hardwood (including Oak) or Mixed Hardwood/ Yellow Pine or Sweetgum	**Loblolly Pine and Mixtures with Hardwood (no oak listed)**	**Longleaf Pine and Mixtures with Loblolly or Slash Pine**	**Pond Cypress and/or Bald Cypress**	**Pond Pine, Pond Pine/Hardwood, Brush Species, Undrained Flatwoods, Sweetbay, Swamp Tupelo, Red Maple**	**Upland Hardwood (including Oak) or Mixed Hard-wood/Yellow Pine or Shortleaf Pine**
Forest Type Group (R8 Silviculture Handbook)	46, 61, 62, 63, 64	13, 31	21, 22, 27, 29	23, 24, 67	18, 36, 40, 68, 98, 99	10, 11, 44, 47, 48, 49, 53, 57, 58, 77
Upland Longleaf and Loblolly Pine Woodlands and Forests	4.2	51.3	36.1	12.9	4.6	1.2
Wet Pine Savannas and Flatwoods	6.7	53.4	24.7	5.9	8.1	9.0
Depressional Wetlands and Carolina Bays	6.6	31.8	21.2	16.0	21.0	1.3
Pocosins	2.3	7.4	11.2	11.1	67.0	0.6
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	17.0	29.3	13.3	15.0	23.3	1.9
Oak Forests and Mesic Hardwood Forests	22.0	63.3	1.3	3.8	1.0	6.2
Maritime Forests and Salt Marsh	11.0	21.2	2.9	0.6	28.3	3.3
Broad Forested Swamps and Large River Floodplain Forests	16.9	23.5	0.9	36.4	17.2	0.5

Composition: Percent of Ecosystem Extent in "Maintain" Condition Class

The acres of ecosystem in the "maintain" condition class was included as key characteristic for our longleaf ecosystems (see Table E-17). The condition of existing and restorable longleaf was assessed in 2010 with the South Carolina Nature Conservancy and included an estimation of existing and restorable longleaf on the Francis Marion based on soils, past fire regimes, and existing vegetation, in relation to maintenance condition class definitions from America's Longleaf and NatureServe. Field inventories were conducted which evaluated condition of the overstory, midstory and understory conditions on the Francis Marion. The condition class assessment involved evaluation of understory, mid-story, and overstory condition in relation to the definitions below from America's Longleaf Conservation Plan (2009). The Francis Marion Planning Team developed desired conditions for longleaf ecosystems in the forest plan based on a more updated definition of the "maintain" condition class from America's Longleaf and the Longleaf Partnership Council (ALRI 2014).

Maintain. Forest canopy and understory conditions that currently will provide ecosystem functions, processes and assemblages of representative species of plants and animals. The maintain condition class is grouped to include maintain, improve ground only, improve mid-story only, improve canopy only and restore canopy only management classes.

Improve. Longleaf pine may be present, but lack significant components of understory communities and fire regimes to support representative communities. Tree cover may be dense.

Restore. Stands do not currently support a longleaf pine canopy or native, grassy understory but could be re-introduced based on ecological modeling or the presence of representative soils.

Table E-17. Results of 2010 Longleaf Assessment, divided by assessment acres by Longleaf Ecosystem type

Condition Class	Upland Longleaf	Wet Pine Savanna	Other[1]	Total
Improve	8,551 ac (29%)	10,336 ac (22%)	3,568 ac (28%)	22,455 ac (25%)
Maintain	8,213 ac (28%)	8,639 ac (18%)	2,811 ac (22%)	19,663 ac (22%)
Restore	12,458 ac (42%)	28,159 ac (59%)	6,469 ac (50%)	47,086 ac (53%)
No condition class	78 ac (<1%)	198 ac (<1%)	31 ac (<1%)	306 ac (<1%)
Total	29,299 ac	47,331 ac	12,879 ac	89,510 ac

[1] Represents other ecosystems included within stands inventoried as part of the longleaf assessment.

Structure: Percent of the Ecosystem Meeting Age Criteria for Old Growth (≥100 years)

An older forest or old growth component across the landscapes was identified as a key characteristic of all ecosystems important for ecological integrity and habitat for many wildlife species. Existing information is based on the dominant ages of stands in the Forest Service Timber Vegetation database and does not address structure, function, or composition above and beyond age of the oldest age class of trees.

Structure: Landscape Vegetation Structure

Vegetation structural diversity to include low levels of structural departure compared to that which would be expected under natural conditions (NRV) was included as a key characteristic of all our ecosystems. Existing vegetation structural classes on the landscape were compared to predictions in relevant BioPhysical Settings models from LANDFIRE (LANDFIRE a through g, 2006). Ecological departure rankings in regard to vegetation structure alone were calculated using a process described by Low et al. (2010) and based on existing age class data from Forest Service Vegetation databases combined with canopy opening data calculated with LiDAR. Vegetation classes are described in applicable biophysical models, to include both within stand and landscape-level structural diversity as a result of characteristic natural disturbances, including windfall gaps, large scale catastrophic wind disturbance (tornado and hurricane), flood events, and wildfire.

LANDFIRE calls historic (pre-European settlement) ecosystems “Biophysical Settings” or BpS. LANDFIRE is a Landscape Fire and Resource Management Planning Tool, a shared program between the wildland fire management programs of the Forest Service and U.S. Department of Interior. These models used an expert-based development process to create state-and-transition models that describe pre-settlement ecosystem structure and function for every ecological system. Both Southern Atlantic Coastal Plain Wet Pine Savanna and Flatwoods (Biophysical Setting Model 5814500) and Atlantic Coastal Plain Upland Longleaf Pine Woodland (Biophysical Setting 581347), were used in this analysis. We compared vegetation classes from the biophysical settings models, including age class and structural breakouts to define each class, to those found on the Francis Marion using Forest FS VEG even-aged age class data, and LIDAR shade data to quantify canopy opening. A summary of ecological departure rankings used in the initial analysis of existing condition were included in the “Ecosystems” section of the assessment, and were recalculated again for predictions across alternatives, based on the 2nd approximation of the Simon and Hayden Ecosystem Mapping in 2014. Based on Low et al. (2010), we added the lowest range of variables and subtracted from 100, to determine ecological structural departure from reference conditions (Table E-18).

Table E-18. Structural departure rankings for ecosystems[1]

Ecosystem	Early-Class A		Mid-Closed		Mid-Open		Late-Closed		Late-Open		Ecological Departure
	C	P	C	P	C	P	C	P	C	P	
Upland Longleaf	7	13	52	5	24	40	11	2	7	40	55
Wet Pine Savanna and Flatwoods	9	15	45	5	15	35	23	10	9	35	52
Depressional Ponds and Bays	13	15	32	5	12	35	36	10	11	35	49
Pocosins	20	15	15	5	10	35	43	10	12	35	48
Narrow Floodplains and Swamps	5	10	38	25	7	5	43	40	6	20	19
Broad Floodplains and Swamps	2	10	38	17	4	0	54	73	2	0	27
Oak and Mesic Hardwood	2	10	64	35	6	15	26	30	1	10	30
Maritime Forests	35	7	49	22	11	7	6	13	0	51	58

[1] Where C is "Current Condition" and P is "Predicted Condition" (based on NRV descriptions in LANDFIRE). As defined below, Poor = >66%, Fair=51-66%, Good=34-50%, and Very Good=<33%.

Structure: Percent of Ecosystem Extent in Woodland, Savanna, Grassland

Open woodland or savanna canopy structure is an important key characteristic of several fire-adapted ecosystems and associated at-risk species. The following table, which will be referred to in the analysis for all sections, shows the acres in early succession, in savanna, in woodland, and in forested ecosystems, for each of our modeled ecosystems, based on LIDAR analysis of canopy cover, where early succession/grassland equals 0 to 5 percent canopy cover, savanna equals 5 to 26 percent canopy cover, woodland equals 26 to 60 percent canopy cover, and forest equals 60 to 100 percent canopy cover.

Table E-19. Acreage (% of total) in early succession/grassland, savanna, woodland, and forest structural classes by ecological system based on LIDAR-derived canopy cover using GIS

Ecosystem	Early Succession	Savanna	Woodland	Forest	TOTAL
Broad Forested Swamps and Large River Floodplain Forests	493 (1%)	921 (2%)	2,754 (6%)	45,049 (92%)	49,217
Depressional Wetlands and Carolina Bays	245 (3%)	734 (8%)	1,948 (22%)	5,806 (67%)	8,733
Maritime Forests and Salt Marsh	2,237 (57%)	220 (6%)	219 (6%)	1,224 (31%)	3,901
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	604 (1%)	2,356 (5%)	5,473 (12%)	35,773 (81%)	44,205
Oak Forests and Mesic Hardwood Forests	49 (trace)	99 (2%)	377 (6%)	5,284 (91%)	5,809
Pocosins	980 (11%)	1,804 (20%)	1,898 (21%)	4,494 (49%)	9,176
Upland Longleaf Pine Woodlands and Forests	780 (trace)	3,031 (6%)	15,696 (30%)	32,476 (62%)	51,983
Wet Pine Savannas and Flatwoods	1,383 (2%)	6,360 (7%)	19,937 (23%)	58,495 (68%)	86,175
TOTAL	**6,771**	**15,525**	**48,302**	**188,600**	**259,199**

Connectivity Stressors - Off-road vehicle trail density (miles/mile^2), paved open road density (miles/mile^2), and unpaved open road density (miles/mile^2)

The possibility of fragmentation due to roads and off-road vehicle trails were calculated by ecosystem using Forest GIS as a connectivity stressor. This data was calculated using a 0.5-mile buffer around depressional wetland and Carolina bay ecosystems. This data is available upon request.

Composition Stressor - Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species

Non-native invasive species, though not addressed in the 1996 forest plan, are a primary threat to longleaf ecosystems, particularly those undergoing restoration. The percent ecosystem extent occupied by invasive plant species was estimated by existing Forest Service GIS Data.

Process – Percent of Ecosystem Burned at Desired Fire Return Interval AND Percent of Ecosystem Acres burned during the Growing Season

Lack of frequent and growing season prescribed fire is a primary threat to longleaf pine ecosystem integrity particularly herbaceous understory communities. Forest Prescribed fire history since 2004 was intersected with ecosystems to determine these variables, both in the assessment and for the draft and final environmental impact statements.

Key Characteristics Identified but Not Used for Analysis

The following habitat characteristics were initially identified as key characteristics or indicators for one or more ecosystem, but data gaps prevented their use in this analysis:

Percent native herbaceous groundcover

Percent native groundcover occupied by forbs and legumes

Percent ecosystem impacted by feral hogs

Percent ecosystem impacted by fire ants

Percent impacted by hydrologic control structures

Ecosystem Indicator Weights, Ranks, and Current Indicator Values

The following tables present data used to estimate overall sustainability scores. All ecosystem groups except for watersheds, rivers and streams have two associated tables: the first table shows the indicator weights and condition categories and the second shows the indicator values for the current condition and estimated values for the forest plan alternatives. Because of their hierarchical relationships, watersheds, rivers and streams were evaluated slightly differently.

Values for current conditions were based on the best available forest GIS data as of May 2013 for the assessment, and then updated in January 2015 using the 2nd approximation of the ecosystems for use in the forest plan and associated final environmental impact statement. Key characteristics, indicator values, and weights, were based on existing forest data, internal interdisciplinary expertise, and values used in other forest planning efforts in the Southern Region. Indicator values for the three forest plan alternatives were estimated for 10- and 50-year time periods based on expected results of alternative implementation followed by GIS analysis similar to that conducted for current conditions.

Table E-20. Upland Longleaf Pine Woodlands: Key characteristics, indicators, weights and indicator value categories

Key Characteristic	Indicator	Indicator Weight	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Composition	% of Ecosystem Extent in "Maintain" Condition Class	4	<25%	25-50%	51-75%	>75%
Composition	% of Ecosystem Extent in characteristic native forest types	4	<25%	25-50%	51-75%	>75%
Structure	% of Ecosystem meeting age criteria for old growth (>=100 yrs.)	3	<1%	1-9%	10-15%	>15%
Structure	% Structural Departure from NRV	4	>66%	51-66%	34-50%	<33%
Structure	% Ecosystem Extent in Woodland, Savanna, Grassland,	4	<25%	25-50%	51-75%	>75%
Connectivity Stressors	ORV Trail Density (miles/mile^2)	1	>1	0.75-1	50-74	<.5
Connectivity Stressors	Paved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity Stressors	Unpaved Open Road Density (miles/mile^2)	2	>1	0.75-1	.50-.74	<.5
Composition Stressor	Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	3	>5%	1-5%	0-1%	0%
Process or Function	Percent of System Acres Burned at Desired Return Interval	4	<25%	25-50%	51-75%	>75%
Process or Function	Percent of System Acres Burned During the Growing Season	4	<25%	25-50%	51-75%	>75%

Table E-21. Upland Longleaf Pine Woodlands: Indicator values for current conditions and alternatives

Indicator	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
% of Ecosystem Extent in "Maintain" Condition Class	15% Poor	15% Poor	15% Poor	36% Fair	64% Good	36% Fair	51% Good
% of Ecosystem Extent in characteristic native forest types	36% Fair	36% Fair	36% Fair	42% Fair	64% Good	39% Fair	51% Good
% of Ecosystem meeting age criteria for old growth ≥100 yrs.)	5.7% Fair	5.7% Fair	8% Fair	20% Very Good	20% Very Good	17% Very Good	17% Very Good
% Structural Departure from NRV	55 Fair	55 Fair	55 Fair	40 Good	10 Very Good	40 Good	10 Very Good
% Ecosystem Extent in Woodland, Savanna, Grassland,	38 Fair	38 Fair	38 Fair	43 Fair	64 Good	41 Fair	51 Good
ORV Trail Density (miles/mile^2)	0.79 Fair	0.79 Fair	0.79 Fair	0.79 Fair	0.79 Fair	0.79 Fair	0.79 Fair
Paved Open Road Density (miles/mile^2)	0.85 Fair	0.85 Fair	0.85 Fair	0.85 Fair	0.85 Fair	0.85 Fair	0.85 Fair
Unpaved Open Road Density (miles/mile^2)	1.87 Poor	1.87 Poor	1.87 Poor	1.50 Poor	1.50 Poor	1.50 Poor	1.50 Poor
Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	0.5% Good	0.54% Good	1% Fair	0.05% Good	0.05% Good	0.05% Good	0.05% Good
Percent of System Acres Burned at Desired Return Interval	30 Fair	45 Fair	45 Fair	64 Good	64 Good	51 **Good**	51 Good
Percent of System Acres Burned During the Growing Season	12.8 Poor	12.8 Poor	12.8 Poor	64 Good	64 Good	51 Good	51 Good

Table E-22. Wet Pine Savannas: Key characteristics, indicators, weights and indicator value categories

Key Characteristic	Indicator	Indicator Weight	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Composition	% of Ecosystem Extent in "Maintain"" Condition Class"	4	<25%	25-50%	51-75%	>75%
Composition	% of Ecosystem Extent in characteristic native forest types	2	<25%	25-50%	51-75%	>75%
Structure	% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	3	<1%	1-9%	10-15%	>15%
Structure	% Structural Departure from NRV	4	>66%	51-66%	34-50%	<33%
Structure	% Ecosystem Extent in Woodland, Savanna, Grassland	4	<25%	25-50%	51-75%	>75%
Connectivity	ORV Trail Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Paved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Unpaved Open Road Density	3	>1	0.75-1	50-74	<.5
Stressor	% of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	3	>5%	1-5%	<1%	0%
Process or Function	% of Ecosystem Acres Burned at Desired Return Interval	4	<25%	25-50%	51-75%	>75%
Process or Function	% of Ecosystem Acres Burned During the Growing Season	4	<25%	25-50%	51-75%	>75%

Table E-23. Wet Pine Savannas: Indicator values for current conditions and alternatives

Indicator	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
% of Ecosystem Extent in "Maintain" Condition Class	9.5 Poor	9.5 Poor	9.5 Poor	25 Fair	67 Good	25 Fair	58 Good
% of Ecosystem Extent in characteristic native forest types	25 Poor	25 Fair	32 Fair	33 Fair	67 Good	32 Fair	58 Good
% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	6 Fair	6 Fair	10 Good	32 Very Good	32 Very Good	32 Very Good	32 Very Good
% Structural Departure from NRV	52 Fair	52 Fair	52 Fair	40 Good	10 Very Good	40 Good	10 Very Good
% Ecosystem Extent in Woodland, Savanna, Grassland,	32 Fair	32 Fair	32 Fair	39 Fair	67 Good	37 Fair	58 Good
ORV Trail Density (miles/mile^{2})	0.04 Very Good	0.04 Very Good	0.04 Very Good	0.04 Very Good	0.04 Very Good	0.04 Very Good	0.04 Very Good
Paved Open Road Density (miles/mile^{2})	0.39 Very Good	0.39 Very Good	0.39 Very Good	0.39 Very Good	0.39 Very Good	0.39 Very Good	0.39 Very Good
Unpaved Open Road Density (miles/mile^{2})	1.13 Poor	1.13 Poor	1.13 Poor	0.74 Good	0.74 Good	0.74 Good	0.74 Good
Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	0.25 Good	0.25 Good	5 Poor	0.25 Good	0.25 Good	0.25 Good	0.25 Good
Percent of System Acres Burned at Desired Return Interval	30 Fair	30 Fair	30 Fair	67 Good	67 Good	58 Good	58 Good
Percent of System Acres Burned During the Growing Season	13.3 Poor	14 Poor	14 Poor	67 Good	67 Good	58 Good	58 Good

Table E-24. Depressional Wetlands and Carolina Bays: Key characteristics, indicators, weights and indicator value categories

Key Characteristic	Indicator	Indicator Weight	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Composition	% of Ecosystem Dominated by characteristic Native Forest Types	4	<25%	25-50%	51-75%	>75%
Structure	% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	3	<1%	1-9%	10-15%	>15%
Structure	% Ecosystem Extent in Woodland, Savanna, Grassland	4	<25%	25-50%	51-75%	>75%
Connectivity	ORV Trail Density w/in 0.5 miles (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Paved Open Road Density w/in 0.5 miles (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Unpaved Open Road Density w/in 0.5 miles (miles/miles^2)	3	>1	0.75-1	50-74	<.5
Stressor	% of Ecosystem Extent Impacted by Non-Native Invasive Species	4	>5%	1-5%	<1%	0%
Process or Function	% of Ecosystem Acres Burned at Desired Return Interval	4	<25%	25-50%	51-75%	>75%
Process or Function	% of Ecosystem Acres Burned at Desired Growing Season Return Interval	4	<25%	25-50%	51-75%	>75%

Table E-25. Depressional Wetlands and Carolina Bays: Indicator values for current conditions and alternatives

Indicator	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
% of Ecosystem Extent in characteristic native forest types	68.2 Good	50 Fair	50 Fair	70 Good	70 Good	68.2 Good	68.2 Good
% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	13 Good	13 Good	14.8 Good	14.1 Good	16 Very Good	14.1 Good	16 Very Good
% Ecosystem Extent in Woodland, Savanna, Grassland,	33.7 Fair	33.7 Fair	26.5 Fair	72.0 Good	76.6 Very Good	51.6 Good	51.6 Good
ORV Trail Density (miles/mile^2)	0.15 Very Good	0.15 Very Good	0.15 Very Good	0.15 Very Good	0.15 Very Good	0.15 Very Good	0.15 Very Good
Paved Open Road Density (miles/mile^2)	0.32 Very Good	0.32 Very Good	0.32 Very Good	0.32 Very Good	0.32 Very Good	0.32 Very Good	0.32 Very Good
Unpaved Open Road Density (miles/mile^2)	1.26 Poor	1.26 Poor	1.26 Poor	0.7 Good	0.7 Good	0.8 Fair	0.8 Fair
Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	0.09 Good	0.09 Good	3.5 Fair	0.09 Good	0.09 Good	0.09 Good	0.09 Good
Percent of System Acres Burned at Desired Return Interval	18.23 Poor	24.4 Poor	24.4 Poor	76.6 Very Good	76.6 Very Good	50.4 Fair	50.4 Fair
Percent of System Acres Burned During the Growing Season	8.9 Poor	8.9 Poor	8.9 Poor	76.6 Very Good	76.6 Very Good	50.4 Fair	50.4 Fair

Table E-26. Pocosins: Key characteristics, indicators, weights and indicator value categories

Key Characteristic	Indicator	Indicator Weight	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Composition	% of Ecosystem Dominated by characteristic Native Forest Types	4	<25%	25-50%	51-75%	>75%
Structure	% Ecosystem Extent in Woodland, Savanna, Grassland	4	<25%	25-50%	51-75%	>75%
Connectivity	ORV Trail Density w/in 0.5 miles (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Paved Open Road Density w/in 0.5 miles (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Unpaved Open Road Density w/in 0.5 miles (miles/miles^2)	3	>1	0.75-1	50-74	<.5
Stressor	% of Ecosystem Extent Impacted by Non-Native Invasive Species	4	>5%	1-5%	<1%	0%
Process or Function	% of Ecosystem Acres Burned at Desired Return Interval	4	<25%	25-50%	51-75%	>75%
Process or Function	% of Ecosystem Acres Burned at Desired Growing Season Return Interval	4	<25%	25-50%	51-75%	>75%

Table E-27. Pocosins: Indicator values for current conditions and alternatives

Indicator	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
% of Ecosystem Extent in characteristic native forest types	92.6 Very Good	92.9 Very Good	64.3 Good	79 Very Good	79 Very Good	63.2 Good	66 Good
% Ecosystem Extent in Woodland, Savanna, Grassland	51 Good	51.2 Good	37 Fair	74.1 Good	74.1 Good	63.2 Good	63.2 Good
ORV Trail Density (miles/mile^2)	0.07 Very Good	0.07 Very Good	0.07 Very Good	0.07 Very Good	0.07 Very Good	0.07 Very Good	0.07 Very Good
Paved Open Road Density (miles/mile^2)	0.14 Very Good	0.14 Very Good	0.14 Very Good	0.14 Very Good	0.14 Very Good	0.14 Very Good	0.14 Very Good
Unpaved Open Road Density (miles/mile^2)	0.54 Good	0.54 Good	0.54 Good	0.48 Very Good	0.48 Very Good	0.48 Very Good	0.48 Very Good
Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	0.08 Good	0.08 Good	1 Fair	0.08 Good	0.08 Good	0.08 Good	0.08 Good
Percent of System Acres Burned at Desired Return Interval	39.4 Fair	39.5 Fair	39.5 Fair	79 Very Good	79 Very Good	63.2 Good	63.2 Good
Percent of System Acres Burned During the Growing Season	24.2 Poor	24.4 Poor	24.4 Poor	79 Very Good	79 Very Good	63.2 Good	63.2 Good

Table E-28. Oak Forest and Mesic Hardwood Forest Ecosystems: Key characteristics, indicators, weights and indicator value categories

Key Characteristic	Indicator	Indicator Weight	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Composition	% of Ecosystem Extent dominated by characteristic Native Forest Types	4	<25%	25-50%	51-75%	>75%
Structure	% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	3	<1%	1-9%	10-15%	>15%
Structure	% Structural Departure from NRV	4	>66%	51-66%	34-50%	<33%
Connectivity	ORV Trail Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Paved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Unpaved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Composition or Stressor	Percent of Ecosystem Extent Impacted by Non-Native Invasive Species	4	>5%	1-5%	<1%	0%

Table E-29. Oak Forest and Mesic Hardwood Forest Ecosystems: Indicator values for current conditions and alternatives

Indicator	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
% of Ecosystem Extent in characteristic native forest types	36.7 Fair	37.8 Fair	32.4 Fair	51.7 Good	99 Very Good	51.7 Good	100 Very Good
% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	19.4 Very Good	16.4 Very Good	11.8 Good	16.4 Very Good	20 Very Good	16.4 Very Good	21.4 Very Good
% Structural Departure from NRV	30 Very Good	44.7 Good	56.1 Fair	45.8 Good	30.5 Very Good	45.8 Good	30.5 Very Good
ORV Trail Density (miles/mile^2)	0 Very Good	0 Very Good	0 Very Good	0 Very Good	0 Very Good	0 Very Good	0 Very Good
Paved Open Road Density (miles/mile^2)	0.50 Good	0.50 Good	0.50 Good	0.50 Good	0.50 Good	0.50 Good	0.50 Good
Unpaved Open Road Density (miles/mile^2)	1.28 Poor	1.28 Poor	1.28 Poor	1.28 Poor	1.28 Poor	1.28 Poor	1.28 Poor
Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	4.72 Fair	9.5 Poor	18.6 Poor	0.9 Good	0.9 Good	0.9 Good	0.9 Good

Table E-30. Narrow Forested Swamps and Blackwater Stream Ecosystems: Key characteristics, indicators, weights and indicator value categories

Key Characteristic	Indicator	Indicator Weight	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Composition	% of Ecosystem Extent dominated by characteristic Native Forest Types	4	<25%	25-50%	51-75%	>75%
Structure	% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	3	<1%	1-9%	10-15%	>15%
Structure	% Structural Departure from NRV	4	>66%	51-66%	34-50%	<33%
Connectivity Stressor	ORV Trail Density (miles/mile^2)	4	>1	0.75-1	50-74	<.5
Connectivity Stressor	Paved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity Stressor	Unpaved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Composition or Stressor	Percent of Ecosystem Extent Impacted by Non-Native Invasive Species	3	>5%	1-5%	<1%	0%
Stressor	% Ecosystem Extent influenced by Sea Level Rise predicted as a result of Climate Change	3	>30%	16-30%	5-15%	<5%
Process or Function	Percent of System Acres Burned at Desired Return Interval	2	<25%	25-50%	51-75%	>75%

Table E-31. Narrow Forested Swamps and Blackwater Stream Ecosystems: Indicator values for current conditions and alternatives

Indicator	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
% of Ecosystem Extent in characteristic native forest types	71% Good	71% Good	74% Good	71% Good	74% Good	71% Good	74% Good
% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	17% Very Good	17% Very Good	17% Very Good	18% Very Good	18% Very Good	18% Very Good	18% Very Good
% Structural Departure from NRV	19% Very Good	41% Good	41% Good	26% Very Good	26% Very Good	33% Very Good	33% Very Good
ORV Trail Density (miles/mile^2)	0.01 Very Good	0.01 Very Good	0.01 Very Good	0.01 Very Good	0.01 Very Good	0.01 Very Good	0.01 Very Good
Paved Open Road Density (miles/mile^2)	0.2 Very Good	0.2 Very Good	0.2 Very Good	0.2 Very Good	0.2 Very Good	0.2 Very Good	0.2 Very Good
Unpaved Open Road Density (miles/mile^2)	0.6 Good	0.6 Good	0.6 Good	0.6 Good	0.6 Good	0.6 Good	0.6 Good
Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	0.2% Good	0.5% Good	5.6% Poor	0.3% Good	0.3% Good	0.3% Good	0.3% Good
% Ecosystem Extent influenced by Sea Level Rise predicted as a result of Climate Change	3% Very Good	3% Very Good	6% Good	3% Very Good	6% Very Good	3% Very Good	6% Good
Percent of System Acres Burned at Desired Return Interval	31% Fair	54% Good	54% Good	59% Good	58% Good	43% Fair	43% Fair

Table E-32. Broad Forested Swamp and Large River Floodplain Ecosystems: Key characteristics, indicators, weights and indicator value categories

Key Characteristic	Indicator	Indicator Weight	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Composition	% of Ecosystem Extent dominated by characteristic Native Forest Types	4	<25%	25-50%	51-75%	>75%
Structure	% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	3	<1%	1-9%	10-15%	>15%
Structure	% Structural Departure from NRV	4	>66%	51-66%	34-50%	<33%
Connectivity	ORV Trail Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Paved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Unpaved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Composition or Stressor	Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	3	>5%	1-5%	<1%	0%
Stressor	% Ecosystem Extent influenced by Sea Level Rise predicted as a result of Climate Change	2	>30%	16-30%	5-15%	<5%

Table E-33. Broad Forested Swamp and Large River Floodplain Ecosystems: Indicator values for current conditions and alternatives

Indicator	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
% of Ecosystem Extent in characteristic native forest types	76% Very Good	78% Very Good	85% Very Good	78% Very Good	85% Very Good	78% Very Good	85% Very Good
% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	19% Very Good	22% Very Good	43% Very Good	22% Very Good	43% Very Good	22% Very Good	43% Very Good
% Structural Departure from NRV	27% Very Good	38% Good	31% Very Good	38% Good	29% Very Good	38% Good	29% Very Good
ORV Trail Density (miles/mile^2)	0.01 Very Good	0.01 Very Good	0.01 Very Good	0.01 Very Good	0.01 Very Good	0.01 Very Good	0.01 Very Good
Paved Open Road Density (miles/mile^2)	0.1 Very Good	0.1 Very Good	0.1 Very Good	0.1 Very Good	0.1 Very Good	0.1 Very Good	0.1 Very Good
Unpaved Open Road Density (miles/mile^2)	0.6 Good	0.6 Good	0.6 Good	0.5 Good	0.5 Good	0.5 Good	0.5 Good
Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	1.04% Fair	1.8% Fair	8.7% Poor	1.1% Fair	1.5% Fair	1.1% Fair	1.5% Fair
% Ecosystem Extent influenced by Sea Level Rise predicted as a result of Climate Change	1.6 Very Good	1.6 Very Good	14 Good	1.6 Very Good	14 Good	1.6 Very Good	14 Good

Table E-34. Maritime Forests and Salt Marsh: Key characteristics, indicators, weights and indicator value categories

Key Characteristic	Indicator	Indicator Weight	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Composition	% of Ecosystem Extent dominated by characteristic Native Forest Types	4	<25%	25-50%	51-75%	>75%
Structure	% of Ecosystem meeting age criteria for old growth (≥=100 yrs.)	3	<1%	1-9%	10-15%	>15%
Structure	% Structural Departure from NRV	4	>66%	51-66%	34-50%	<33%
Connectivity	ORV Trail Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Paved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Connectivity	Unpaved Open Road Density (miles/mile^2)	3	>1	0.75-1	50-74	<.5
Composition or Stressor	Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	3	>5%	1-5%	<1%	0%
Stressor	% Ecosystem Extent influenced by Sea Level Rise predicted as a result of Climate Change	2	>30%	16-30%	5-15%	<5%

Table E-35. Maritime Forests and Salt Marsh: Indicator values for current conditions and alternatives

Indicator	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
% of Ecosystem Extent in characteristic native forest types	78.8 Very Good	78.9 Very Good	78.9 Very Good	78.1 Very Good	82.3 Very Good	78.1 Very Good	82.3 Very Good
% of Ecosystem meeting age criteria for old growth (≥100 yrs.)	5.7 Fair	5.7 Fair	5.7 Fair	10 Good	10 Good	10 Good	10 Good
% Structural Departure from NRV	58 Fair	52 Fair	52 Fair	50 Good	34 Good	50 Good	34 Good
ORV Trail Density (miles/mile^2)	0 Very Good	0 Very Good	0 Very Good	0 Very Good	0 Very Good	0 Very Good	0 Very Good
Paved Open Road Density (miles/mile^2)	.46 Very Good	.46 Very Good	.46 Very Good	.46 Very Good	.46 Very Good	0.46 Very Good	.46 Very Goo
Unpaved Open Road Density (miles/mile^2)	0.06 Very Good	0.06 Very Good	0.06 Very Good	0.06 Very Good	0.06 Very Good	0.06 Very Good	0.06 Very Good
Percent of Ecosystem Extent Impacted by Non-Native Invasive Plant Species	0.15 Good	0.4 Good	19.2 Poor	0.15 Good	0.15 Good	0.15 Good	0.15 Good
% Ecosystem Extent influenced by Sea Level Rise predicted as a result of Climate Change	3 Very Good	6.1 Good	32.9 Poor	6.1 Good	32.9 Poor	6.1 Good	32.9 Poor

To access the impact on aquatic species included in the River and Stream Associates for the Francis Marion, each sub-watersheds was rated based on 10 indicators. These key characteristics are described in detail in the Francis Marion National Forest, Draft Forest Plan Assessment posted on-line at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3814187.pdf. An 11th indicator was proposed but at this time the Francis Marion is unsure from the models on how “sea level rise” will affect the streams and rivers on the Francis Marion so that indicator was included in the tool but was not populated. Table E-36 lists the key characteristics, indicators and rating values used to assess individual sub-watersheds.

Table E-36. Key characteristics, indicators, and existing ecological sustainability values for River and Stream Associates (sub-watersheds)

Key Characteristic	Indicator Name/Definition	Poor (1)	Fair (2)	Good (3)	Very Good (4)
Course Woody Debris Abundance	% Riparian Forested	<25%	25-50%	51-75%	>75%
Hydrologic Function	Major Hydrologic Electric Dam Proximity/Influence	Directly Impacted	Indirectly Impacted, Tributary with known impacts	**N/A**	No Impact
Hydrologic Function	Riparian Road Density	>2.0%	1.6 – 2.0%	1.0 – 1.5%	<1%
Hydrologic Function	Road Crossing Rating	>3.0	2.1 – 3.0	1.1 – 2.0	0 - 1
Hydrologic Function	Severity of Hydrologic Control Structures	>20	1 - 20	**N/A**	0
Non-Native Invasive Species	Presence/Absence of Non-Native Invasive Species in the Watershed	Present	**N/A**	**N/A**	Absent
Water Quality	Sediment Risk Rating	>150 pounds	100 – 150 pounds	50 – 100 pounds	<50 pounds
Water Quality	Point Source Rating	>10	3 - 10	1 - 3	0
Water Quality	Non-Point Source Rating	>7	3.1 - 7	1 - 3	<1
Water Temperature Regime	Riparian Land Use Rating	<25%	25-50%	51-75%	>75%

To get a composite score for all the watersheds each watershed ranking was given a value of 1 to 4 and then was weighted based on indicator importance and percent national forest land to get an overall score for the rivers and streams ecosystem. The scores for that ecosystem are summarized below in Table E-37 and are presented in the “Environmental Consequences: Rivers and Streams Ecosystems” section of this document.

Listed below in Table E-37 are the 27 sub-watershed that occur within the administrative boundary for the Francis Marion National Forest and were assessed to rate the rivers and streams ecosystem and the habitat for the rivers and streams associates.

Table E-37. Sub-watersheds included in the aquatic analysis

Sub-Watershed Name	Hydrologic Unit Code	National Forest (Percentage)
■Awendaw Creek	030502090201	85.7
■Bull Bay	030502090202	13.9
■Cane Pond Branch	030502010202	70.4
■Cape Romain	030502090101	1.5
■Copahee Sound	030502090203	1.2
■Dutart Creek, Santee River	030501120206	36.9
■East Branch Cooper River	030502010306	8.4
■Echaw Creek	030501120205	69.6
■French Quarter Creek	030502010305	25.7
■Gough Creek	030502010303	51.6
■Guerin Creek	030502010401	42.0
Headwaters Wambaw Creek	030501120301	95.0
Lower Wando River	030502010402	1.0
Nicholson Creek	030502010302	97.4
Outlet Wambaw Creek	030501120302	86.8
Penn Branch, Santee River	030501120106	0.03
Quinby Creek	030502010304	62.0
Rediversion Canal, Santee River	030501120105	3.1
Savanna Creek	030501120202	74.7
South Santee River	030501120303	14.2
Turkey Creek, East Branch Cooper River	030502010301	97.8
Upper Cooper River	030502010705	5.7
Wadboo Creek	030502010203	60.9
Walker Swamp	030502010201	24.0
Wedboo Creek	030501120201	54.3
West Branch Cooper River	030502010701	1.4
Wittee Lake, Santee River	030501120204	10.5

Current conditions were accessed for each sub-watershed as well as the predicted condition for each watershed based on each alternative. Table E-38 lists the results for the current conditions and Tables E-39 to E-44 present the expected conditions for each alternative for 1- and 50-year time periods.

Table E-38. Current ecological sustainability potential of sub-watersheds on the Francis Marion National Forest

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Awendaw Creek	88.4; Very Good	No Impact; Very Good	1.36; Good	2.39; Fair	58; Poor	Present; Poor	34.6; Very Good	0.32; Very Good	1; Good	88.4; Very Good
Bull Bay	64.1; Good	No Impact; Very Good	2.70; Poor	2.57; Fair	43; Poor	Present; Poor	30.9; Very Good	0.82; Very Good	24; Poor	64.1; Good
Cane Pond Branch	96.0; Very Good	No Impact; Very Good	1.37; Good	3.22 Poor	8; Fair	Present; Poor	103.6; Fair	0.36; Very Good	1; Good	96.0; Very Good
Cape Romain	39.5; Fair	No Impact; Very Good	3.15; Poor	0.58; Very Good	2 Fair	Present; Poor	42.0; Very Good	0.04; Very Good	7; Fair	39.5; Fair
Copahee Sound	28.0; Fair	No Impact; Very Good	3.15; Poor	2.28; Fair	1 Fair	Present; Poor	63.6; Good	5.23; Fair	22; Poor	28.0; Fair
Dutart Creek, Santee River	77.3; Very Good	Direct Impact; Poor	0.84; Very Good	2.28; Fair	26; Poor	Present; Poor	52.9; Good	0.66; Very Good	3; Fair	77.3 Very Good
East Branch Cooper River	71.1; Good	Indirect Impact; Fair	1.59; Good	3.56; Poor	17; Fair	Present; Poor	101.0; Fair	0.58; Very Good	2; Good	71.1; Good
Echaw Creek	93.4; Very Good	Indirect Impact; Fair	1.35; Good	2.66; Fair	67; Poor	Present; Poor	49.6; Good	0.73; Very Good	1; Good	93.4; Very Good
French Quarter Creek	86.4; Very Good	No Impact; Very Good	1.50; Good	3.24; Poor	12; Fair	Present; Poor	102.0; Fair	1.44; Good	4; Fair	86.4; Very Good
Gough Creek	87.5; Very Good	No Impact; Very Good	1.56; Fair	3.19; Poor	36; Poor	Present; Poor	97.0: Good	0.34; Very Good	1; Good	87.5; Very Good
Guerin Creek	65.7; Good	No Impact; Very Good	2.30; Poor	2.98; Fair	73; Poor	Present; Poor	40.4; Very Good	3.06; Fair	13; Poor	65.7; Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Headwaters Wambaw Creek	93.3; Very Good	Indirect Impact; Fair	1.14; Good	1.70; Good	36; Poor	Present; Poor	41.6; Very Good	0.10; Very Good	0; Very Good	93.3; Very Good
Lower Wando River	24.0; Poor	Indirect Impact; Fair	2.32; Poor	3.84; Poor	4: Fair	Present; Poor	84.3; Good	15.7; Poor	22; Poor	24.0; Poor
Nicholson Creek	97.6; Very Good	No Impact; Very Good	1.29; Good	1.60; Good	95; Poor	Present; Poor	24.5; Very Good	0.04; Very Good	0; Very Good	97.6; Very Good
Outlet Wambaw Creek	90.5; Very Good	Indirect Impact; Fair	1.37; Good	3.07; Poor	75; Poor	Present; Poor	49.1; Very Good	0.30; Very Good	1; Good	90.5; Very Good
Penn Branch, Santee River	35.4; Fair	Direct Impact; Poor	1.17; Good	1.61; Good	8; Fair	Present; Poor	99.3; Good	6.70; Fair	2; Good	35.4; Fair
Quinby Creek	92.4; Very Good	No Impact; Very Good	1.10; Good	3.16: Poor	52; Poor	Present; Poor	60.5; Good	0.54; Very Good	7; Fair	92.4; Very Good
Rediversion Canal, Santee River	65.1; Good	Direct Impact; Poor	2.37; Poor	4.01; Poor	31; Poor	Present; Poor	186.0 Poor	9.48; Poor	17; Poor	65.1; Good
Savanna Creek	93.9; Very Good	Indirect Impact; Fair	1.11; Good	1.97; Good	43; Poor	Present; Poor	73.5; Good	1.12; Good	0; Very Good	93.9; Very Good
South Santee River	62.6; Good	Direct Impact; Poor	2.33; Poor	2.08; Good	35; Poor	Present; Poor	28.6; Very Good	0.22 Very Good	4; Fair	62.6; Good
Turkey Creek, East Branch Cooper River	91.3; Very Good	No Impact; Very Good	1.26; Good	2.71; Fair	88; Poor	Present; Poor	75.9; Good	0.12; Very Good	1; Good	91.3; Very Good
Upper Cooper River	39.3; Fair	Direct Impact; Poor	0.94; Very Good	1.62; Good	3; Fair	Present; Poor	50.5; Good	6.25; Fair	25; Poor	39.3; Fair
Wadboo Creek	91.5; Very Good	No Impact; Very Good	1.40; Good	2.62; Fair	86; Poor	Present; Poor	36.7; Very Good	1.17; Good	3; Fair	91.5; Very Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Walker Swamp	84.2; Very Good	No Impact; Very Good	2.7; Poor	4.7; Poor	67; Poor	Present; Poor	94.6; Good	6.27; Fair	8; Fair	84.2; Very Good
Wedboo Creek	89.6; Very Good	No Impact; Very Good	1.68; Fair	3.97; Poor	49; Poor	Present; Poor	136.0; Fair	2.66; Good	0; Very Good	89.6; Very Good
West Branch Cooper River	66.2; Good	Direct Impact; Poor	2.11; Poor	4.50; Poor	6; Fair	Present; Poor	74.8; Good	7.61; Poor	18; Poor	66.2; Good
Wittee Lake, Santee River	71.5; Very Good	Direct Impact; Poor	0.72; Very Good	0.34; Very Good	3; Fair	Present; Poor	96.5; Good	3.96; Fair	0; Very Good	71.5; Very Good

Table E-39. Ecological sustainability potential of sub-watersheds on the Francis Marion National Forest for alternative 1, 10 Years

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Awendaw Creek	89.7; Very Good	No Impact; Very Good	1.34; Good	2.36; Fair	58; Poor	Present; Poor	34.6; Very Good	0.31; Very Good	1; Good	90.0; Very Good
Bull Bay	63.7; Good	No Impact; Very Good	2.70; Poor	2.58; Fair	43; Poor	Present; Poor	31.1; Very Good	0.82; Very Good	24; Poor	63.7; Good
Cane Pond Branch	96.7; Very Good	No Impact; Very Good	1.36; Good	3.22 Poor	8; Fair	Present; Poor	103.6; Fair	0.36; Very Good	1; Good	96.7; Very Good
Cape Romain	39.3; Fair	No Impact; Very Good	3.17; Poor	0.58; Very Good	2 Fair	Present; Poor	42.2; Very Good	0.04; Very Good	7; Fair	39.3; Fair
Copahee Sound	27.5; Fair	No Impact; Very Good	3.77; Poor	2.32; Fair	1 Fair	Present; Poor	64.7; Good	5.31; Fair	22; Poor	27.5; Fair
Dutart Creek, Santee River	77.0; Very Good	Direct Impact; Poor	0.84; Very Good	1.46; Good	26; Poor	Present; Poor	53.1; Good	0.66; Very Good	3; Fair	77.0 Very Good
East Branch Cooper River	70.7; Good	Indirect Impact; Fair	1.60; Fair	3.58; Poor	17; Fair	Present; Poor	101.0; Fair	0.58; Very Good	2; Good	70.7; Good
Echaw Creek	94.2; Very Good	Indirect Impact; Fair	1.34; Good	2.64; Fair	67; Poor	Present; Poor	50.0; Good	0.73; Very Good	1; Good	94.2; Very Good
French Quarter Creek	85.6; Very Good	No Impact; Very Good	1.51; Good	3.27; Poor	12; Fair	Present; Poor	103.0; Fair	1.44; Good	4; Fair	85.6; Very Good
Gough Creek	87.8; Very Good	No Impact; Very Good	1.56; Fair	3.19; Poor	36; Poor	Present; Poor	97.0: Good	0.34; Very Good	1; Good	87.8; Very Good
Guerin Creek	65.5; Good	No Impact; Very Good	2.30; Poor	2.99; Fair	71; Poor	Present; Poor	40.5; Very Good	3.06; Fair	13; Poor	65.5; Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Headwaters Wambaw Creek	95.0; Very Good	Indirect Impact; Fair	1.12; Good	1.70; Good	36; Poor	Present; Poor	41.6; Very Good	0.11; Very Good	0; Very Good	95.0; Very Good
Lower Wando River	23.6; Poor	Indirect Impact; Fair	2.36; Poor	3.91; Poor	4: Fair	Present; Poor	85.9; Good	16.0; Poor	22; Poor	23.6; Poor
Nicholson Creek	99.4; Very Good	No Impact; Very Good	1.29; Good	1.60; Good	95; Poor	Present; Poor	24.5; Very Good	0.04; Very Good	0; Very Good	99.4; Very Good
Outlet Wambaw Creek	91.9; Very Good	Indirect Impact; Fair	1.35; Good	3.02; Poor	75; Poor	Present; Poor	49.1; Very Good	0.30; Very Good	1; Good	91.9; Very Good
Penn Branch, Santee River	34.7; Fair	Direct Impact; Poor	1.19; Good	1.60; Good	8; Fair	Present; Poor	101.3; Fair	6.80; Fair	2; Good	34.7; Fair
Quinby Creek	92.9; Very Good	No Impact; Very Good	1.10; Good	3.14: Poor	52; Poor	Present; Poor	60.5; Good	0.54; Very Good	7; Fair	92.9; Very Good
Rediversion Canal, Santee River	63.9; Good	Direct Impact; Poor	2.41; Poor	4.08; Poor	30; Poor	Present; Poor	189.0 Poor	9.66; Poor	17; Poor	63.9; Good
Savanna Creek	94.8; Very Good	Indirect Impact; Fair	1.10; Good	1.95; Good	43; Poor	Present; Poor	73.5; Good	1.10; Good	0; Very Good	94.8; Very Good
South Santee River	62.5; Good	Direct Impact; Poor	2.33; Poor	2.08; Good	35; Poor	Present; Poor	28.7; Very Good	0.22 Very Good	4; Fair	62.5; Good
Turkey Creek, East Branch Cooper River	93.1; Very Good	No Impact; Very Good	1.24; Good	2.66; Fair	88; Poor	Present; Poor	75.9; Good	0.12; Very Good	1; Good	93.1; Very Good
Upper Cooper River	38.6; Fair	Direct Impact; Poor	0.96; Very Good	1.65; Good	3; Fair	Present; Poor	51.4; Good	6.35; Fair	25; Poor	38.6; Fair
Wadboo Creek	92.0;	No Impact; Very Good	1.40; Good	2.61; Fair	86; Poor	Present; Poor	36.7; Very Good	1.17; Good	3; Fair	92.0; Very Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
	Very Good									
Walker Swamp	83.3; Very Good	No Impact; Very Good	2.7; Poor	4.7; Poor	67; Poor	Present; Poor	95.6; Good	6.33; Fair	8; Fair	83.3; Very Good
Wedboo Creek	89.8; Very Good	No Impact; Very Good	1.68; Fair	3.96; Poor	49; Poor	Present; Poor	136.0; Fair	2.66; Good	0; Very Good	89.8; Very Good
West Branch Cooper River	65.0; Good	Direct Impact; Poor	2.15; Poor	4.60; Poor	6; Fair	Present; Poor	76.2; Good	7.75; Poor	18; Poor	65.0; Good
Wittee Lake, Santee River	70.7; Very Good	Direct Impact; Poor	0.73; Very Good	0.34; Very Good	3; Fair	Present; Poor	97.5; Good	4.00; Fair	0; Very Good	70.7; Very Good

Table E-40. Ecological sustainability potential of sub-watersheds on the Francis Marion National Forest for alternative 1, 50 Years

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Awendaw Creek	94.7; Very Good	No Impact; Very Good	1.20; Good	2.22; Fair	58; Poor	Present; Poor	34.6; Very Good	0.29; Very Good	1; Good	95.0; Very Good
Bull Bay	62.3; Good	No Impact; Very Good	2.80; Poor	2.64; Fair	43; Poor	Present; Poor	31.8; Very Good	0.84; Very Good	25; Poor	62.3; Good
Cane Pond Branch	99.6; Very Good	No Impact; Very Good	1.32; Good	3.10 Poor	8; Fair	Present; Poor	103.6; Fair	0.36; Very Good	1; Good	99.6; Very Good
Cape Romain	38.4; Fair	No Impact; Very Good	3.24; Poor	0.60; Very Good	2 Fair	Present; Poor	43.2; Very Good	0.04; Very Good	7; Fair	38.4; Fair
Copahee Sound	25.5; Fair	No Impact; Very Good	4.03; Poor	2.48; Fair	1 Fair	Present; Poor	69.2; Good	5.70; Fair	24; Poor	25.5; Fair
Dutart Creek, Santee River	75.7; Very Good	Direct Impact; Poor	0.86; Very Good	1.46; Good	26; Poor	Present; Poor	54.0; Good	0.66; Very Good	3; Fair	75.7; Very Good
East Branch Cooper River	69.2; Good	Indirect Impact; Fair	1.63; Fair	3.66; Poor	17; Fair	Present; Poor	104.0; Fair	0.58; Very Good	2; Good	69.2; Good
Echaw Creek	97.5; Very Good	Indirect Impact; Fair	1.29; Good	2.54; Fair	67; Poor	Present; Poor	50.0; Good	0.73; Very Good	1; Good	97.5; Very Good
French Quarter Creek	82.4; Very Good	No Impact; Very Good	1.57; Good	3.27; Poor	12; Fair	Present; Poor	107.0; Fair	1.47; Good	4; Fair	82.4; Very Good
Gough Creek	88.9; Very Good	No Impact; Very Good	1.54; Fair	3.14; Poor	36; Poor	Present; Poor	97.0: Good	0.33; Very Good	1; Good	88.9; Very Good
Guerin Creek	64.7; Good	No Impact; Very Good	2.30; Poor	3.02; Poor	63; Poor	Present; Poor	41.0; Very Good	3.10; Fair	13; Poor	64.7; Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Headwaters Wambaw Creek	100.0; Very Good	Indirect Impact; Fair	1.04; Good	1.55; Good	36; Poor	Present; Poor	41.6; Very Good	0.10; Very Good	0; Very Good	100.0; Very Good
Lower Wando River	21.8; Poor	Indirect Impact; Fair	2.54; Poor	4.20; Poor	4: Fair	Present; Poor	92.2; Good	17.2; Poor	24; Poor	21.8; Poor
Nicholson Creek	100.0; Very Good	No Impact; Very Good	1.29; Good	1.40; Good	95; Poor	Present; Poor	24.5; Very Good	0; Very Good	0; Very Good	100.0; Very Good
Outlet Wambaw Creek	97.7; Very Good	Indirect Impact; Fair	1.26; Good	2.82; Fair	75; Poor	Present; Poor	49.1; Very Good	0.30; Very Good	1; Good	97.7; Very Good
Penn Branch, Santee River	31.8; Fair	Direct Impact; Poor	1.29; Good	1.77; Good	8; Fair	Present; Poor	109.2; Fair	7.40; Poor	2; Good	31.8; Fair
Quinby Creek	94.8; Very Good	No Impact; Very Good	1.10; Good	3.08: Poor	52; Poor	Present; Poor	60.5; Good	0.54; Very Good	7; Fair	94.8; Very Good
Rediversion Canal, Santee River	59.0; Good	Direct Impact; Poor	2.59; Poor	4.39; Poor	26; Poor	Present; Poor	203.0 Poor	10.37; Poor	19; Poor	59.0; Good
Savanna Creek	98.6; Very Good	Indirect Impact; Fair	1.05; Good	1.87; Good	43; Poor	Present; Poor	73.5; Good	1.08; Good	0; Very Good	98.6; Very Good
South Santee River	62.0; Good	Direct Impact; Poor	2.35; Poor	2.10; Fair	35; Poor	Present; Poor	28.9; Very Good	0.22 Very Good	4; Fair	62.0; Good
Turkey Creek, East Branch Cooper River	100.0; Very Good	No Impact; Very Good	1.14; Good	2.45; Fair	88; Poor	Present; Poor	75.9; Good	0.12; Very Good	1; Good	100.0; Very Good
Upper Cooper River	35.8; Fair	Direct Impact; Poor	1.02; Good	1.77; Good	3; Fair	Present; Poor	55.0; Good	6.80; Fair	27; Poor	35.8; Fair
Wadboo Creek	94.1; Very Good	No Impact; Very Good	1.40; Good	2.54; Fair	86; Poor	Present; Poor	36.7; Very Good	1.14; Good	3; Fair	94.1; Very Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Walker Swamp	79.8; Very Good	No Impact; Very Good	2.8; Poor	4.9; Poor	67; Poor	Present; Poor	99.5; Good	6.60; Fair	8; Fair	79.8; Very Good
Wedboo Creek	90.8; Very Good	No Impact; Very Good	1.66; Fair	3.92; Poor	49; Poor	Present; Poor	136.0; Fair	2.66; Good	0; Very Good	90.8; Very Good
West Branch Cooper River	60.0; Good	Direct Impact; Poor	2.31; Poor	4.90; Poor	6; Fair	Present; Poor	81.8; Good	8.30; Poor	20; Poor	60.0; Good
Wittee Lake, Santee River	67.6; Very Good	Direct Impact; Poor	0.76; Very Good	0.36; Very Good	3; Fair	Present; Poor	101.6; Fair	4.17; Fair	0; Very Good	67.6; Very Good

Table E-41. Ecological sustainability potential of sub-watersheds on the Francis Marion National Forest for alternative 2, 10 Years

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Awendaw Creek	89.7; Very Good	No Impact; Very Good	1.34; Good	2.36; Fair	56; Poor	Present; Poor	34.1; Very Good	0.31; Very Good	1; Good	90.0; Very Good
Bull Bay	63.7; Good	No Impact; Very Good	2.70; Poor	2.58; Fair	42; Poor	Present; Poor	31.1; Very Good	0.82; Very Good	24; Poor	63.7; Good
Cane Pond Branch	96.7; Very Good	No Impact; Very Good	1.36; Good	3.20 Poor	7; Fair	Present; Poor	102.3; Fair	0.36; Very Good	1; Good	96.7; Very Good
Cape Romain	39.3; Fair	No Impact; Very Good	3.17; Poor	0.60; Very Good	2 Fair	Present; Poor	42.2; Very Good	0.04; Very Good	7; Fair	39.3; Fair
Copahee Sound	27.5; Fair	No Impact; Very Good	3.77; Poor	2.32; Fair	1 Fair	Present; Poor	64.7; Good	5.31; Fair	22; Poor	27.5; Fair
Dutart Creek, Santee River	77.0; Very Good	Direct Impact; Poor	0.84; Very Good	1.46; Good	25; Poor	Present; Poor	53.1; Good	0.66; Very Good	3; Fair	77.0 Very Good
East Branch Cooper River	70.7; Good	Indirect Impact; Fair	1.60; Fair	3.58; Poor	16; Fair	Present; Poor	101.0; Fair	0.58; Very Good	2; Good	70.7; Good
Echaw Creek	94.2; Very Good	Indirect Impact; Fair	1.34; Good	2.64; Fair	65; Poor	Present; Poor	49.2; Very Good	0.73; Very Good	1; Good	94.2; Very Good
French Quarter Creek	85.6; Very Good	No Impact; Very Good	1.51; Good	3.27; Poor	11; Fair	Present; Poor	103.0; Fair	1.44; Good	4; Fair	85.6; Very Good
Gough Creek	87.8; Very Good	No Impact; Very Good	1.56; Fair	3.19; Poor	34; Poor	Present; Poor	97.0: Good	0.34; Very Good	1; Good	87.8; Very Good
Guerin Creek	65.5; Good	No Impact; Very Good	2.00; Fair	2.48; Fair	71; Poor	Present; Poor	40.5; Very Good	3.06; Fair	13; Poor	65.5; Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Headwaters Wambaw Creek	95.0; Very Good	Indirect Impact; Fair	0.90; Very Good	1.20; Good	34; Poor	Present; Poor	40.8; Very Good	0.11; Very Good	0; Very Good	95.0; Very Good
Lower Wando River	23.6; Poor	Indirect Impact; Fair	2.36; Poor	3.91; Poor	4: Fair	Present; Poor	85.9; Good	16.0; Poor	22; Poor	23.6; Poor
Nicholson Creek	99.4; Very Good	No Impact; Very Good	1.29; Good	1.60; Good	92; Poor	Present; Poor	24.0; Very Good	0.04; Very Good	0; Very Good	99.4; Very Good
Outlet Wambaw Creek	91.9; Very Good	Indirect Impact; Fair	1.35; Good	3.02; Poor	73; Poor	Present; Poor	48.3; Very Good	0.30; Very Good	1; Good	91.9; Very Good
Penn Branch, Santee River	34.7 Fair	Direct Impact; Poor	1.19; Good	1.60; Good	8; Fair	Present; Poor	101.3; Fair	6.80; Fair	2; Good	34.7; Fair
Quinby Creek	92.9; Very Good	No Impact; Very Good	1.10; Good	3.14: Poor	50; Poor	Present; Poor	60.2; Good	0.54; Very Good	7; Fair	92.9; Very Good
Rediversion Canal, Santee River	63.9; Good	Direct Impact; Poor	2.41; Poor	4.08; Poor	30; Poor	Present; Poor	189.0 Poor	9.66; Poor	17; Poor	63.9; Good
Savanna Creek	94.8; Very Good	Indirect Impact; Fair	1.10; Good	1.95; Good	41; Poor	Present; Poor	72.8; Good	1.10; Good	0; Very Good	94.8; Very Good
South Santee River	62.5; Good	Direct Impact; Poor	2.33; Poor	2.08; Good	33; Poor	Present; Poor	28.7; Very Good	0.22 Very Good	4; Fair	62.5; Good
Turkey Creek, East Branch Cooper River	93.1; Very Good	No Impact; Very Good	1.00; Good	2.20; Fair	86; Poor	Present; Poor	74.4; Good	0.12; Very Good	1; Good	93.1; Very Good
Upper Cooper River	38.6; Fair	Direct Impact; Poor	0.96; Very Good	1.65; Good	3; Fair	Present; Poor	51.4; Good	6.35; Fair	25; Poor	38.6; Fair
Wadboo Creek	92.0;	No Impact; Very Good	1.40; Good	2.61; Fair	84; Poor	Present; Poor	36.5; Very Good	1.17; Good	3; Fair	92.0; Very Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
	Very Good									
Walker Swamp	83.4; Very Good	No Impact; Very Good	2.7; Poor	4.7; Poor	65; Poor	Present; Poor	95.6; Good	6.33; Fair	8; Fair	83.4; Very Good
Wedboo Creek	89.9; Very Good	No Impact; Very Good	1.68; Fair	3.96; Poor	47; Poor	Present; Poor	136.0; Fair	2.66; Good	0; Very Good	89.9; Very Good
West Branch Cooper River	65.0; Good	Direct Impact; Poor	2.15; Poor	4.60; Poor	6; Fair	Present; Poor	76.2; Good	7.75; Poor	18; Poor	65.0; Good
Wittee Lake, Santee River	70.7; Very Good	Direct Impact; Poor	0.73; Very Good	0.34; Very Good	3; Fair	Present; Poor	97.5; Good	4.00; Fair	0; Very Good	70.7; Very Good

Table E-42. Ecological sustainability potential of sub-watersheds on the Francis Marion National Forest for alternative 2, 50 Years

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Awendaw Creek	94.7; Very Good	No Impact; Very Good	1.26; Good	2.32; Fair	48; Poor	Present; Poor	32.1; Very Good	0.31; Very Good	1; Good	95.0; Very Good
Bull Bay	62.3; Good	No Impact; Very Good	2.8; Poor	2.64; Fair	42; Poor	Present; Poor	31.8; Very Good	0.84; Very Good	25; Poor	62.3; Good
Cane Pond Branch	99.6; Very Good	No Impact; Very Good	1.32; Good	3.10 Poor	6; Fair	Present; Poor	99.7; Fair	0.36; Very Good	1; Good	99.6; Very Good
Cape Romain	38.4; Fair	No Impact; Very Good	3.24; Poor	0.60; Very Good	2 Fair	Present; Poor	43.2; Very Good	0.04; Very Good	7; Fair	38.4; Fair
Copahee Sound	25.5; Fair	No Impact; Very Good	4.03; Poor	2.48; Fair	1 Fair	Present; Poor	69.2; Good	5.70; Fair	24; Poor	25.5; Fair
Dutart Creek, Santee River	75.7; Very Good	Direct Impact; Poor	0.86; Very Good	1.48; Good	21; Poor	Present; Poor	54.0 Good	0.66; Very Good	3; Fair	75.7 Very Good
East Branch Cooper River	69.2; Good	Indirect Impact; Fair	1.63; Fair	3.66; Poor	14; Fair	Present; Poor	104.0; Fair	0.58; Very Good	2; Good	69.2; Good
Echaw Creek	97.5; Very Good	Indirect Impact; Fair	1.29; Good	2.54; Fair	57; Poor	Present; Poor	47.4 Very Good	0.73; Very Good	1; Good	97.5; Very Good
French Quarter Creek	82.4; Very Good	No Impact; Very Good	1.57; Good	3.27; Poor	10; Fair	Present; Poor	107.0; Fair	1.47; Good	4; Fair	82.4; Very Good
Gough Creek	88.9; Very Good	No Impact; Very Good	1.54; Fair	3.14; Poor	26; Poor	Present; Poor	95.0: Good	0.33; Very Good	1; Good	88.9; Very Good
Guerin Creek	64.7; Good	No Impact; Very Good	2.00; Fair	2.00; Good	63; Poor	Present; Poor	41.0; Very Good	3.10; Fair	13; Poor	64.7; Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Headwaters Wambaw Creek	100.0; Very Good	Indirect Impact; Fair	0.90; Very Good	1.00; Very Good	26; Poor	Present; Poor	37.8; Very Good	0.10; Very Good	0; Very Good	100.0; Very Good
Lower Wando River	21.8; Poor	Indirect Impact; Fair	2.54; Poor	4.20; Poor	4: Fair	Present; Poor	92.2; Good	17.2; Poor	24; Poor	21.8; Poor
Nicholson Creek	100.0; Very Good	No Impact; Very Good	1.29; Good	1.40; Good	85; Poor	Present; Poor	22.2; Very Good	0; Very Good	0; Very Good	100.0; Very Good
Outlet Wambaw Creek	97.7; Very Good	Indirect Impact; Fair	1.26; Good	2.82; Fair	65; Poor	Present; Poor	45.2; Very Good	0.30; Very Good	1; Good	97.7; Very Good
Penn Branch, Santee River	31.8; Fair	Direct Impact; Poor	1.29; Good	1.77; Good	8; Fair	Present; Poor	109.2; Fair	7.40; Poor	2; Good	31.8; Fair
Quinby Creek	94.8; Very Good	No Impact; Very Good	1.10; Good	3.08: Poor	42; Poor	Present; Poor	59.0; Good	0.54; Very Good	7; Fair	94.8; Very Good
Rediversion Canal, Santee River	59.0; Good	Direct Impact; Poor	2.59; Poor	4.39; Poor	26; Poor	Present; Poor	203.0 Poor	10.37; Poor	19; Poor	59.0; Good
Savanna Creek	98.6; Very Good	Indirect Impact; Fair	1.05; Good	1.87; Good	33; Poor	Present; Poor	69.8; Good	1.08; Good	0; Very Good	98.6; Very Good
South Santee River	62.0; Good	Direct Impact; Poor	2.35; Poor	2.10; Fair	25; Poor	Present; Poor	28.9; Very Good	0.22 Very Good	4; Fair	62.0; Good
Turkey Creek, East Branch Cooper River	100.0; Very Good	No Impact; Very Good	0.90; Very Good	2.00; Good	78; Poor	Present; Poor	68.6; Good	0.12; Very Good	1; Good	100.0; Very Good
Upper Cooper River	35.8; Fair	Direct Impact; Poor	1.02; Good	1.77; Good	3; Fair	Present; Poor	55.0; Good	6.80; Fair	27; Poor	35.8; Fair
Wadboo Creek	94.1; Very Good	No Impact; Very Good	1.40; Good	2.54; Fair	76; Poor	Present; Poor	35.6; Very Good	1.14; Good	3; Fair	94.1; Very Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Walker Swamp	79.8; Very Good	No Impact; Very Good	2.8; Poor	4.9; Poor	57; Poor	Present; Poor	99.5; Good	6.60; Fair	8; Fair	79.8; Very Good
Wedboo Creek	90.8; Very Good	No Impact; Very Good	1.66; Fair	3.92; Poor	39; Poor	Present; Poor	134.0; Fair	2.66; Good	0; Very Good	90.8; Very Good
West Branch Cooper River	60.0; Good	Direct Impact; Poor	2.31; Poor	4.90; Poor	6; Fair	Present; Poor	81.8; Good	8.30; Poor	20; Poor	60.0; Good
Wittee Lake, Santee River	67.6; Very Good	Direct Impact; Poor	0.76; Very Good	0.36; Very Good	3; Fair	Present; Poor	101.6; Fair	4.17; Fair	0; Very Good	67.6; Very Good

Table E-43. Ecological sustainability potential of sub-watersheds on the Francis Marion National Forest for alternative 3, 10 Years

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Awendaw Creek	89.7; Very Good	No Impact; Very Good	1.34; Good	2.36; Fair	56; Poor	Present; Poor	34.1; Very Good	0.31; Very Good	1; Good	90.0; Very Good
Bull Bay	63.7; Good	No Impact; Very Good	2.70; Poor	2.58; Fair	42; Poor	Present; Poor	31.1; Very Good	0.82; Very Good	24; Poor	63.7; Good
Cane Pond Branch	96.7; Very Good	No Impact; Very Good	1.36; Good	3.20 Poor	7; Fair	Present; Poor	102.8; Fair	0.36; Very Good	1; Good	96.7; Very Good
Cape Romain	39.3; Fair	No Impact; Very Good	3.17; Poor	0.60; Very Good	2 Fair	Present; Poor	42.2; Very Good	0.04; Very Good	7; Fair	39.3; Fair
Copahee Sound	27.5; Fair	No Impact; Very Good	3.77; Poor	2.32; Fair	1 Fair	Present; Poor	64.7; Good	5.31; Fair	22; Poor	27.5; Fair
Dutart Creek, Santee River	77.0; Very Good	Direct Impact; Poor	0.84; Very Good	1.46; Good	25; Poor	Present; Poor	53.1; Good	0.66; Very Good	3; Fair	77.0 Very Good
East Branch Cooper River	70.7; Good	Indirect Impact; Fair	1.60; Fair	3.58; Poor	16; Fair	Present; Poor	101.0; Fair	0.58; Very Good	2; Good	70.7; Good
Echaw Creek	94.2; Very Good	Indirect Impact; Fair	1.34; Good	2.64; Fair	65; Poor	Present; Poor	49.2; Very Good	0.73; Very Good	1; Good	94.2; Very Good
French Quarter Creek	85.6; Very Good	No Impact; Very Good	1.51; Good	3.27; Poor	11; Fair	Present; Poor	103.0; Fair	1.44; Good	4; Fair	85.6; Very Good
Gough Creek	87.8; Very Good	No Impact; Very Good	1.56; Fair	3.19; Poor	34; Poor	Present; Poor	97.0: Good	0.34; Very Good	1; Good	87.8; Very Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Guerin Creek	65.5; Good	No Impact; Very Good	2.00; Fair	2.48; Fair	71; Poor	Present; Poor	40.5; Very Good	3.06; Fair	13; Poor	65.5; Good
Headwaters Wambaw Creek	95.0; Very Good	Indirect Impact; Fair	0.90; Very Good	1.20; Good	34; Poor	Present; Poor	40.8; Very Good	0.11; Very Good	0; Very Good	95.0; Very Good
Lower Wando River	23.6; Poor	Indirect Impact; Fair	2.36; Poor	3.91; Poor	4: Fair	Present; Poor	85.9; Good	16.00; Poor	22; Poor	23.6; Poor
Nicholson Creek	99.4; Very Good	No Impact; Very Good	1.29; Good	1.60; Good	92; Poor	Present; Poor	24.0; Very Good	0.04; Very Good	0; Very Good	99.4; Very Good
Outlet Wambaw Creek	91.9; Very Good	Indirect Impact; Fair	1.35; Good	3.02; Poor	73; Poor	Present; Poor	48.3; Very Good	0.30; Very Good	1; Good	91.9; Very Good
Penn Branch, Santee River	34.7; Fair	Direct Impact; Poor	1.19; Good	1.60; Good	8; Fair	Present; Poor	101.3; Fair	6.80; Fair	2; Good	34.7; Fair
Quinby Creek	92.9; Very Good	No Impact; Very Good	1.10; Good	3.14; Poor	50; Poor	Present; Poor	60.2; Good	0.54; Very Good	7; Fair	92.9; Very Good
Rediversion Canal, Santee River	63.9; Good	Direct Impact; Poor	2.41; Poor	4.08; Poor	30; Poor	Present; Poor	189.0 Poor	9.66; Poor	17; Poor	63.9; Good
Savanna Creek	94.8; Very Good	Indirect Impact; Fair	1.10; Good	1.95; Good	41; Poor	Present; Poor	72.8; Good	1.10; Good	0; Very Good	94.8; Very Good
South Santee River	62.5; Good	Direct Impact; Poor	2.33; Poor	2.08; Good	33; Poor	Present; Poor	28.7; Very Good	0.22 Very Good	4; Fair	62.5; Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Turkey Creek, East Branch Cooper River	93.1; Very Good	No Impact; Very Good	1.00; Good	2.20; Fair	86; Poor	Present; Poor	74.4; Good	0.12; Very Good	1; Good	93.1; Very Good
Upper Cooper River	38.6; Fair	Direct Impact; Poor	0.96; Very Good	1.65; Good	3; Fair	Present; Poor	51.4; Good	6.35; Fair	25; Poor	38.6; Fair
Wadboo Creek	92.0; Very Good	No Impact; Very Good	1.40; Good	2.61; Fair	84; Poor	Present; Poor	36.5; Very Good	1.17; Good	3; Fair	92.0; Very Good
Walker Swamp	83.3; Very Good	No Impact; Very Good	2.7; Poor	4.7; Poor	65; Poor	Present; Poor	95.6; Good	6.33; Fair	8; Fair	83.3; Very Good
Wedboo Creek	89.8; Very Good	No Impact; Very Good	1.68; Fair	3.96; Poor	47; Poor	Present; Poor	136.0; Fair	2.66; Good	0; Very Good	89.8; Very Good
West Branch Cooper River	65.0; Good	Direct Impact; Poor	2.15; Poor	4.60; Poor	6; Fair	Present; Poor	76.2; Good	7.75; Poor	18; Poor	65.0; Good
Wittee Lake, Santee River	70.7; Very Good	Direct Impact; Poor	0.73; Very Good	0.34; Very Good	3; Fair	Present; Poor	97.5; Good	4.00; Fair	0; Very Good	70.7; Very Good

Table E-44. Ecological sustainability potential of sub-watersheds on the Francis Marion National Forest for alternative 3, 50 Years

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Awendaw Creek	94.7; Very Good	No Impact; Very Good	1.26; Good	2.22; Fair	48; Poor	Present; Poor	32.1; Very Good	0.29; Very Good	1; Good	95.0; Very Good
Bull Bay	62.3; Good	No Impact; Very Good	2.8; Poor	2.64; Fair	42; Poor	Present; Poor	31.8; Very Good	0.84; Very Good	25; Poor	62.3; Good
Cane Pond Branch	99.6; Very Good	No Impact; Very Good	1.32; Good	3.10 Poor	6; Fair	Present; Poor	99.7; Fair	0.36; Very Good	1; Good	99.6; Very Good
Cape Romain	38.4; Fair	No Impact; Very Good	3.24; Poor	0.60; Very Good	2 Fair	Present; Poor	43.2; Very Good	0.04; Very Good	7; Fair	38.4; Fair
Copahee Sound	25.5; Fair	No Impact; Very Good	4.03; Poor	2.48; Fair	1 Fair	Present; Poor	69.2; Good	5.70; Fair	24; Poor	25.5; Fair
Dutart Creek, Santee River	75.7; Very Good	Direct Impact; Poor	0.86; Very Good	1.48; Good	21; Poor	Present; Poor	54.0; Good	0.66; Very Good	3; Fair	75.7 Very Good
East Branch Cooper River	69.2; Good	Indirect Impact; Fair	1.63; Fair	3.66; Poor	14; Fair	Present; Poor	104.0; Fair	0.58; Very Good	2; Good	69.2; Good
Echaw Creek	97.5; Very Good	Indirect Impact; Fair	1.29; Good	2.54; Fair	57; Poor	Present; Poor	47.4; Very Good	0.73; Very Good	1; Good	97.5; Very Good
French Quarter Creek	82.4; Very Good	No Impact; Very Good	1.57; Good	3.27; Poor	10; Fair	Present; Poor	107.0; Fair	1.47; Good	4; Fair	82.4; Very Good
Gough Creek	88.9; Very Good	No Impact; Very Good	1.54; Fair	3.14; Poor	26; Poor	Present; Poor	95.0: Good	0.33; Very Good	1; Good	88.9; Very Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Guerin Creek	64.7; Good	No Impact; Very Good	2.00; Fair	2.00; Good	63; Poor	Present; Poor	41.0; Very Good	3.10; Fair	13; Poor	64.7; Good
Headwaters Wambaw Creek	100.0; Very Good	Indirect Impact; Fair	0.90; Very Good	1.00; Very Good	26; Poor	Present; Poor	37.8; Very Good	0.10; Very Good	0; Very Good	100.0; Very Good
Lower Wando River	21.8; Poor	Indirect Impact; Fair	2.54; Poor	4.20; Poor	4: Fair	Present; Poor	92.2; Good	17.2; Poor	24; Poor	21.8; Poor
Nicholson Creek	100.0; Very Good	No Impact; Very Good	1.17; Good	1.40; Good	85; Poor	Present; Poor	22.2; Very Good	0; Very Good	0; Very Good	100.0; Very Good
Outlet Wambaw Creek	97.7; Very Good	Indirect Impact; Fair	1.26; Good	2.82; Fair	65; Poor	Present; Poor	45.2; Very Good	0.30; Very Good	1; Good	97.7; Very Good
Penn Branch, Santee River	31.8; Fair	Direct Impact; Poor	1.29; Good	1.77; Good	8; Fair	Present; Poor	109.2; Fair	7.40; Poor	2; Good	31.8; Fair
Quinby Creek	94.8; Very Good	No Impact; Very Good	1.10; Good	3.08: Poor	42; Poor	Present; Poor	59.0; Good	0.54; Very Good	7; Fair	94.8; Very Good
Rediversion Canal, Santee River	59.0; Good	Direct Impact; Poor	2.59; Poor	4.39; Poor	26; Poor	Present; Poor	203.0 Poor	10.37; Poor	19; Poor	59.0; Good
Savanna Creek	98.6; Very Good	Indirect Impact; Fair	1.05; Good	1.87; Good	33; Poor	Present; Poor	69.8; Good	1.08; Good	0; Very Good	98.6; Very Good
South Santee River	62.0; Good	Direct Impact; Poor	2.35; Poor	2.10; Fair	25; Poor	Present; Poor	28.9; Very Good	0.22 Very Good	4; Fair	62.0; Good

Sub-Watershed Name	% Riparian Forested	Major Hydrologic Electric Dam Proximity/Influence	Riparian Road Density	Road Crossing Rating	Severity of Hydrologic Control Structures	Presence/Absence of Non-Native Invasive Species in the Watershed	Sediment Risk Rating	Point Source Rating	Non-Point Source Rating	Riparian Land Use Rating
Turkey Creek, East Branch Cooper River	100.0; Very Good	No Impact; Very Good	0.90; Very Good	2.00; Good	78; Poor	Present; Poor	68.6; Good	0.12; Very Good	1; Good	100.0; Very Good
Upper Cooper River	35.8; Fair	Direct Impact; Poor	1.02; Good	1.77; Good	3; Fair	Present; Poor	55.0; Good	6.80; Fair	27; Poor	35.8; Fair
Wadboo Creek	94.1; Very Good	No Impact; Very Good	1.40; Good	2.54; Fair	76; Poor	Present; Poor	35.6; Very Good	1.14; Good	3; Fair	94.1; Very Good
Walker Swamp	79.8; Very Good	No Impact; Very Good	2.8; Poor	4.9; Poor	57; Poor	Present; Poor	99.5; Good	6.60; Fair	8; Fair	79.8; Very Good
Wedboo Creek	90.8; Very Good	No Impact; Very Good	1.66; Fair	3.92; Poor	39; Poor	Present; Poor	134.0; Fair	2.66; Good	0; Very Good	90.8; Very Good
West Branch Cooper River	60.0; Good	Direct Impact; Poor	2.31; Poor	4.90; Poor	6; Fair	Present; Poor	81.8; Good	8.30; Poor	20; Poor	60.0; Good
Wittee Lake, Santee River	67.6; Very Good	Direct Impact; Poor	0.76; Very Good	0.36; Very Good	3; Fair	Present; Poor	101.6; Fair	4.17; Fair	0; Very Good	67.6; Very Good

Overall Ecological Sustainability Ratings

Based on the indicator values presented in the tables above, we calculated overall condition scores for each ecosystem group for each alternative. These scores are the basis for assessing ecological sustainability under the alternatives. These scores were calculated by multiplying indicator values (1 to 4) by indicator weights (1 to 4) then averaging. Table E-45 below summarizes these results.

Table E-45. Overall ecological sustainability ratings

Ecosystem group	Current	Alt 1 – 10 yr	Alt 1 – 50 yr	Alt 2 – 10 yr	Alt 2 – 50 yr	Alt 3 – 10 yr	Alt 3 – 50 yr
Upland longleaf pine woodland	1.81	1.81	1.72	2.53	2.97	2.53	2.97
Wet pine savannas and flatwoods	2.14	2.19	2.19	2.97	3.35	2.97	3.35
Depression ponds and Carolina bays	2.38	2.25	2.13	3.44	3.66	2.84	2.94
Pocosins	2.93	2.93	2.52	3.72	3.72	3.31	3.31
Oak forests and mesic hardwood forests	2.83	2.50	2.21	3.00	3.33	3.00	3.33
Narrow forested swamps and blackwater streams	3.52	3.45	3.24	3.59	3.59	3.52	3.41
Broad forested swamps and river floodplains	3.64	3.48	3.44	3.48	3.56	3.48	3.56
Maritime forests and salt marsh	3.35	3.27	2.88	3.54	3.38	3.54	3.38
Rivers and streams	2.24	2.24	2.20	2.24	2.20	2.24	2.20

Forest Plan Components and Strategies

We evaluated plan area conditions needed for all species using a coarse-filter/fine-filter approach. Desired conditions, objectives, and design criteria for maintaining and restoring ecosystem integrity provide coarse filter habitat provisions for all species. Fine-filter strategies for species were developed where needed to contribute to the recovery of threatened and endangered species, conserve proposed and candidate species, and maintain or restore ecological conditions for sustaining a viable population of each species of conservation concern where possible and ecologically feasible, given the capabilities of our land base. See Table E-46 for a summary of forest plan components.

The following fine-scale provisions to address uncertainties in regard to at-risk species:

Federally Threatened and Endangered Species Population Provisions – We included additional fine-filter provisions to ensure the conservation of federally-listed species and any associated critical habitat. Section 7 of the Endangered Species Act requires that Federal land management agencies do not jeopardize the continued existence of federally-listed species.

At-Risk Species Population Provisions – We included additional fine-filter and monitoring provisions to ensure the conservation of at-risk species populations. Over 50 percent (41) of our at-risk species have only 1 or 2 known occurrences on the Francis Marion, and 66 percent have less than 5 known occurrences. In some cases, little is known about the distribution and the species is not well surveyed.

Species associated with the following habitat characteristics are listed above:

- Stump and Root Mound Associates
- Wildlife Species Sensitive to Road Use Associates
- Wildlife Snag and Large Diameter Hollow Tree Associates
- Forest Opening Associates

Forest plan standards and guidelines were developed to address these fine-filter needs to ensure that the plan promotes species diversity and ecosystem sustainability.

Rare Community Provisions. The 1996 Francis Marion National Forest Revised Land and Resource Management Plan included 2,056 acres in designated botanical areas, comprised of a combination of rare plant populations, rare and high quality plant communities and areas of high public interest. This information was evaluated and a rare community coverage (including existing and documented high-quality plant communities only) was created in 2014 consisting of 97 areas and 4,690 acres. Numerous rare plant associations have been documented from the Francis Marion by NatureServe (2012). Existing high-quality plant communities provide habitats for rare plant species at a finer scale than ecosystems but at a larger scale than plant populations. These areas are often imbedded within the larger ecosystem-level direction, and are also compatible with the desired composition, structure, function and processes of the associated native ecosystems at the coarse filter scale. See Appendix E of the revised forest plan for a map of rare plant communities.

A final list of all at-risk species identified on the Francis Marion and their associated coarse- and fine-filter management strategies are in Appendix D of the revised forest plan.

Riparian Management Zones are used as buffers at the project level to protect watersheds from detrimental effects. These buffers provide critical habitats for fish, mussels, invertebrates, reptiles, and amphibians. There is extensive acreage of this buffers on the Francis Marion National Forest as they occur throughout the area along rivers and streams.

Riparian areas are inseparably associated with upland forests and break up the upland areas with networks of bottomland forests (both pine and hardwoods). These riparian areas serve multiple ecological purposes. Riparian areas serve as natural filters for water borne sediments moving from the uplands and into the rivers and streams of the Francis Marion. Some species of plants and animals use riparian areas for completion of at least some phase of their life cycles, and aquatic species such as fish, some crayfish, and mussels are restricted to riparian areas.

In 2011, all national forests began a process to evaluate and begin to address watershed condition within the national forests using the newly developed protocols (USDA Forest Service 2011a, 2011b). Detailed information about the watershed condition frame can be found at http://www.fs.fed.us/publications/watershed.

The watershed condition framework uses watershed conditions and characteristics to evaluate and rate various attributes and indictors including air, soil, water, streams, aquatic and riparian habitats, non-native invasive species, roads, fuels and forest health. When these factors are considered together, it helps us to evaluate whether watersheds are functioning properly, at-risk or not functioning properly on the national forests. An evaluation of the watersheds using this framework was completed in 2011, but it needs to be updated based on new information, such as the updated soil inventory and streams layer.

The Francis Marion interdisciplinary resource team used existing information and national guidance to evaluate watershed condition indicators and attributes to help rate the watershed conditions for the 22 Francis Marion subwatersheds (6th-level hydrologic unit code [HUC]) with over 5 percent National Forest ownership. The results of this analysis are presented in the watershed condition framework supporting documentation posted on the Francis Marion Forest Plan Revision website under Supplemental Materials. Using the criteria for watershed condition framework, we could determine if one or more watersheds may be recommended as priority for restoration.

The subwatersheds on the Francis Marion identified in 2012 for potential consideration for improvement were Turkey Creek of East Fork Cooper River and Headwaters of Wambaw Creek, tributary to the Santee River.

- Turkey Creek was recommended as a potential priority subwatershed because of additional funding opportunity with approximately 20 timber sales tied to the Hellhole and Honey Hill EAs, probably the most available information with ongoing hydrological and ecological research, and portions are inside the core burning area with associated proposed, endangered, threatened, and sensitive species including red-cockaded woodpecker.

- Headwaters of Wambaw Creek was recommended due to its presence in wilderness with intermittent dam effects from salt water entry, ongoing small craft motorized boating, substantial soil and water restoration potential given the amount of land and stream

alteration, portions are contained within core burn area, abundant unique proposed, endangered, threatened, and sensitive species, and threat from wild hogs.

- Guerin Creek Sub-watershed (along with portions of French Quarter Creek) was added later as a priority watershed for the Francis Marion forest plan due to the presence of designated critical habitat for frosted flatwoods salamander.

Within the watershed condition framework and analysis, a variety of issues were identified in interdisciplinary analysis in the effort to help estimate and rate watershed conditions using the national protocol. The system used a numerical rating system based on poor to good categories for a number of watershed indicators and associated attributes that contribute to the rating of these indicators. The ratings of the indicators were weighted on watershed importance, and are compiled numerically into an overall watershed score, that can fall into one of three categories. Good watershed condition with a score between 1.0 and 1.6 is considered properly functioning, as these watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition (USDA Forest Service 2011a). Fair watershed condition with a score of 1.7 to 2.2 is declining or functioning at-risk, and these watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Poor watershed conditions with scores of 2.3 to 3.0 are not functional, with watersheds that exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. There are a variety of resource issues that were compiled within the watershed condition analysis, and readily available information and knowledge was used (USDA Forest Service 2011c). The Francis Marion evaluation of watershed condition was primarily internal, using existing information with limited public involvement in this process. However, future watershed condition evaluations will be more collaborative with public input and involvement. The plan has increased level of public involvement and collaboration, so added awareness, attention and review of watershed condition and evaluation is intended. Efforts should take advantage of key agency contacts, partnerships or other agreements, awareness education and technology transfer of watershed conditions, including discussion of techniques used, identifying resource areas needing improvement and opportunities to improve them.

Table E-46. At-Risk Species and associated ecological conditions, key characteristics, and forest plan components, Francis Marion National Forest

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Ambystoma cingulatum	Wet Pine Savanna and Flatwoods Pond Cypress Savannas Sensitive to Road Use	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species	DC-ECO-3 Wet Pine Savanna and Flatwoods DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems OBJ-ECO-4. Pond Cypress Savannas and Carolina bays	DC-T&E-2 Frosted Flatwoods Salamander DC-SCC-2. Wildlife Species Sensitive to Road Use Associates DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-SCC-6. Pond Cypress Savanna Associates	OBJ-T&E-1. Frosted Flatwoods Salamander OBJ-SCC-3. At-Risk Species	S30, S36, S41; G8, G9, G32, G33, G35, G40, G41, G45, G46 Appendix J.1.

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Lithobates capito	Wet Pine Savanna and Flatwoods Pond Cypress Savannas Sensitive to Road Use Stumps and Root Mounds	Same as above.	DC-ECO-3 Wet Pine Savanna and Flatwoods DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems OBJ-ECO-4. Pond Cypress Savannas and Carolina bays	DC-SCC-1. Wildlife Stump and Root Mound Associates DC-SCC-2. Wildlife Species Sensitive to Road Use Associates DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-SCC-6. Pond Cypress Savanna Associates	OBJ-SCC-1. Carolina Gopher Frog OBJ-SCC-3. At-Risk Species	S30, S41; G8, G9, G32
Pseudobranchus striatus	Depressional Wetlands and Carolina Bays	Same as above.	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem	DC-SCC-5. Mesic to Wet Pine Savanna	OBJ-SCC-3. At-Risk Species	S41; G8, G9

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
	Wet Pine Savanna and Flatwoods		DC-ECO-4 Depressional Wetlands and Carolina Bays	Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems OBJ-ECO-4. Pond Cypress Savannas and Carolina bays	and Flatwoods Associates DC-SCC-6. Pond Cypress Savanna Associates		
Aimophila aestivalis	Upland Pine Woodlands	Same as above.	DC-ECO-2 Upland Longleaf and Loblolly Pine Woodlands	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-7. Upland Pine Woodlands Associates	OBJ-SCC-3. At-Risk Species	S36, S41; G40, G41
Elanoides forficatus	Forested Wetlands Pocosins	Same as above.	DC-ECO-5 Pocosins DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-5. Pocosins	DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-2. Swallow-tailed Kite OBJ-SCC-3. At-Risk Species	S22, S31, S41; G8, G9, G34

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
			DC-ECO-8 Broad Forested Swamps and Large River Floodplain Forests				
Haliaeetus leucocephalus	Forested Wetlands	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species	DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests DC-ECO-8 Broad Forested Swamps and Large River Floodplain Forests		DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-3. At-Risk Species	S22, S25, S41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Mycteria americana	Forested Wetlands	Same as above.	ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests DC-ECO-8 Broad Forested Swamps and Large River Floodplain Forests		DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-3. At-Risk Species	S22, S41
Picoides borealis	Upland Pine Woodlands Wet Pine Savannas and Flatwoods	Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2)	DC-ECO-2 Upland Longleaf and Loblolly Pine Woodlands DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems OBJ-SCC-3. At-Risk Species	DC-T&E-3 Red-Cockaded Woodpecker DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-SCC-7. Upland Pine Woodlands Associates	OBJ-T&E-2. Red-Cockaded Woodpecker OBJ-SCC-3. At-Risk Species	S27, S32, S33, S34, S36, S37, S38, S41; G35, G36, G40, G42, G44 Appendix J.2.

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Acipenser brevirostrum	Rivers and Streams	Course Woody Debris Abundance - % Riparian Forested Hydrologic Function - Major Hydrologic Electric Dam Proximity/Influence Hydrologic Function - Riparian Road Density Hydrologic Function - Road Crossing Rating	DC-ECO-10 Rivers and Streams	OBJ-SCC-3. At-Risk Species	DC-SCC-10. River and Stream Associates		S13-S22; G19-G26; G28, G35

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Hydrologic Function - Severity of Hydrologic Control Structures Non-Native Invasive Species - Presence/Absence of Non-Native Invasive Species in the Watershed Water Quality - Sediment Risk Rating Water Quality - Point Source Rating Water Quality - Non-Point Source Rating Water Temperature Regime - Riparian Land Use Rating					
Acipenser oxyrinchus	Rivers and Streams	Same as above	DC-ECO-10 Rivers and Streams		DC-SCC-10. River and Stream Associates		S13-S22; G19-G26; G28, G35
Anguilla rostrata	Rivers and Streams	Same as above	DC-ECO-10 Rivers and Streams		DC-SCC-10. River and Stream Associates		S13-S22; G19-G26; G28, G35
Amblyscirtes alternata	Narrow Forested Swamps and Blackwater Stream Floodplain Forests Pocosins	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland,	DC-ECO-5 Pocosins DC-ECO-7 Narrow Forested Swamps and Blackwater	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration		OBJ-SCC-3. At-Risk Species	S36, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
	Upland Pine Woodlands	Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval	Stream Floodplain Forests				
Danaus plexippus	Narrow Forested Swamps and	Same as above	DC-ECO-2 Upland Longleaf	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem	DC-SCC-3. Pine Upland/Wetland	OBJ-SCC-3. At-Risk Species	S35, S36, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
	Blackwater Stream Floodplain Forests Pocosins Upland Pine Woodlands		and Loblolly Pine Woodlands DC-ECO-5 Pocosins DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests	Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	Ecotones Associates DC-SCC-7. Upland Pine Woodland Associates		
Euphyes berryi	Narrow Forested Swamps and Blackwater Stream Floodplain Forests Pocosins	Same as above	DC-ECO-5 Pocosins DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-3. Pine Upland/Wetland Ecotones Associates	OBJ-SCC-3. At-Risk Species	S35, S36; G40, G41
Zale perculta	Forested Wetlands	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.)	DC-ECO-7 Narrow Forested Swamps and Blackwater Stream		DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-3. At-Risk Species	S35; G35

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species	Floodplain Forests DC-ECO-8 Broad Forested Swamps and Large River Floodplain Forests				
Corynorhinus rafinesquii	Forested Wetlands Pine Upland/Wetland Ecotones Snags and Large Diameter Trees Forest Openings Rivers and Streams	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV	DC-ECO-5 Pocosins DC-ECO 7 Narrow Forested Swamps and Blackwater Stream Forests DC-ECO 8 Broad Forested Swamps and Large River	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-3. Pine Upland/Wetland Ecotones Associates DC-SCC-8. Forested Wetlands Associates DC-SCC-9. Wildlife Snag and Large Diameter	OBJ-SCC-3. At-Risk Species	S28; G31

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval	Floodplain Forests		Hollow Tree Associates SCC-11. Forest Opening Associates		
Myotis austroriparius	Forested Wetlands Pine Upland/Wetland Ecotones Snags and Large Diameter Trees Forest Openings	Same as above.	DC-ECO-5 Pocosins DC-ECO 7 Narrow Forested Swamps and Blackwater Stream Forests	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-SCC-3. At-Risk Species	DC-SCC-3. Pine Upland/Wetland Ecotones Associates DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-3. At-Risk Species	S28, S37; G31

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
			DC-ECO 8 Broad Forested Swamps and Large River Floodplain Forests		DC-SCC-9. Wildlife Snag and Large Diameter Hollow Tree Associates SCC-11. Forest Opening Associates		
Trichechus manatus	Rivers and Streams	Course Woody Debris Abundance - % Riparian Forested Hydrologic Function - Major Hydrologic Electric Dam Proximity/Influence Hydrologic Function - Riparian Road Density Hydrologic Function - Road Crossing Rating Hydrologic Function - Severity of Hydrologic Control Structures Non-Native Invasive Species - Presence/Absence of Non-Native Invasive Species in the Watershed Water Quality - Sediment Risk Rating			DC-SCC-10. River and Stream Associates		G35

			Coarse-filter Components		Fine-filter Components		
Scientific Name	Ecological Conditions	Key Characteristics and Indicators	Desired Conditions	Objectives & Mgmt. Strategies	Desired Conditions	Objectives & Mgmt. Strategies	Standards & Guidelines
		Water Quality - Point Source Rating Water Quality - Non-Point Source Rating Water Temperature Regime - Riparian Land Use Rating					
Clemmys guttata	Forested Wetlands Pond Cypress Savannas Rivers and Streams Sensitive to Road Use	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	DC-ECO-4 Depressional Wetlands and Carolina Bays DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Forests DC-ECO-8 Broad Forested Swamps and Large River Floodplain Forests	OBJ-SCC-3. At-Risk Species	DC-SCC-2. Wildlife Species Sensitive to Road Use Associates DC-SCC-6. Pond Cypress Savannas Associates DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-3. At-Risk Species	S35; G32, G35

			Coarse-filter Components		Fine-filter Components		
Scientific Name	Ecological Conditions	Key Characteristics and Indicators	Desired Conditions	Objectives & Mgmt. Strategies	Desired Conditions	Objectives & Mgmt. Strategies	Standards & Guidelines
		Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval Course Woody Debris Abundance - % Riparian Forested Hydrologic Function - Major Hydrologic Electric Dam Proximity/Influence Hydrologic Function - Riparian Road Density Hydrologic Function - Road Crossing Rating Hydrologic Function - Severity of Hydrologic Control Structures Non-Native Invasive Species - Presence/Absence of Non-Native Invasive Species in the Watershed Water Quality - Sediment Risk Rating					

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Water Quality - Point Source Rating Water Quality - Non-Point Source Rating Water Temperature Regime - Riparian Land Use Rating					
Crotalus adamanteus	Narrow Forested Swamps and Blackwater Stream Forests Pocosins Upland Pine Woodlands Wet Pine Savannas and Flatwoods Stump and Root Mounds Sensitive to Road Use	Same as above.	DC-ECO-2 Upland Longleaf and Loblolly Pine Woodlands DC-ECO-3 Wet Pine Savanna and Flatwoods DC-ECO-4 Pocosins	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-SCC-3. At-Risk Species	DC-SCC-1. Wildlife Stump and Root Mound Associates DC-SCC-2. Wildlife Species Sensitive to Road Use Associates DC-SCC-3. Pine Upland/Wetland Ecotones Associates DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S37; G31, G32, G35
Heterodon simus	Upland Pine Woodlands	Same as above	DC-ECO-2 Upland Longleaf	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem	DC-SCC-2. Wildlife Species Sensitive to	OBJ-SCC-3. At-Risk Species	G32

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
	Sensitive to Road Use		and Loblolly Pine Woodlands	Maintenance or Restoration	Road Use Associates DC-SCC-7. Upland Pine Woodland Associates		
Agalinis aphylla	Wet Pine Savannas and Flatwoods	Same as above	DC-ECO3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-SCC-3. At-Risk Species	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-RIZ-S Santee Rare Plants	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Andropogon gyrans var. stenophyllus	Pond Cypress Savannas Wet Pine Savannas and Flatwoods	Same as above	DC-ECO3 Wet Pine Savanna and Flatwoods DC-ECO-4 Depressional Wetlands and Carolina Bays		DC 6. Pond Cypress Savannas Associates DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-RiZ-Wambaw-S-9 rare plant communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Andropogon mohrii	Upland/Wetland Ecotones	Same as above	DC-ECO-4 Pocosins	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem	DC-SCC-3. Pine Upland/Wetland Ecotones	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39,

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
			DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Forests	Maintenance or Restoration OBJ-SCC-3. At-Risk Species	Associates DC-SCC- DC-RiZ-Wambaw-S-9 rare plant communities		S40, S41; G40, G41
Anthaenantia rufa	Wet Pine Savannas and Flatwoods	Same as above	DC-ECO3 Wet Pine Savanna and Flatwoods		DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Asclepias pedicillata	Pine/Wetland Ecotones	Same as above		OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-SCC-3. At-Risk Species	DC-SCC-3. Pine Upland/Wetland Ecotones Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Asplenium resiliens	Calcareous Mesic Hardwoods	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV	DC-ECO-6 Oak and Mesic Hardwood Forest	OBJ-ECO-6. Oak Forests and Mesic Hardwoods	DC-SCC-4. Calcareous Mesic Hardwood Forest Associates DC-Z-Wambaw-S-5 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species					
Burmannia biflora	Pond Cypress Savannas	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2)	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates RIZ-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Calopogon barbatus	Mesic to Wet Pine Savannas and Flatwoods	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41
Calopogon multiflorus	Mesic to Wet Pine Savannas and Flatwoods	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem	DC-SCC-5. Mesic to Wet Pine Savanna	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
				Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	and Flatwoods Associates		
Carex basiantha	Calcareous Mesic Hardwoods	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	DC-ECO-6 Oak and Mesic Hardwood Forest		DC-SCC-4. Calcareous Mesic Forests Associates DC-RIZ-Santee-S-2 Rare Plant Communities DC-RIZ-Santee-S-3 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Carex crus-corvi	Forested Wetlands	Same as above.	DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests DC-ECO 8 Broad Forested Swamps and Large River Floodplain Forests		DC-Z-Wambaw-S-9 Rare Plant Communities DC-RIZ-Wambaw-S-3 Eligible Wild and Scenic River	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Carex elliottii	Pine Upland/Wetland Ecotone	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2)	DC-ECO-4 Pocosins DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration Flatwoods Ecosystems	DC-SCC-3. Pine Upland/Wetland Ecotones Associates DC-Z-Wambaw-S-9 Rare Plant communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Carex granularis	Calcareous Mesic Hardwoods	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2)	DC-ECO-6 Oak and Mesic Hardwood Forest		DC-SCC-4. Calcareous Mesic Forests Associates DC-RIZ-Santee-S-3. Rare Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)					
Carex stricta	Mesic to Wet Pine Savannas and Flatwoods	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	DC-ECO-2 Upland Longleaf and Loblolly Pine Woodlands	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-Z-Wambaw-S-9 Rare Plant communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Stressor - % of Ecosystem Extent Impacted by Non-Native Invasive Species Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Carya myristiciformis	Calcareous Mesic Hardwoods	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2)	DC-ECO -6 Oak and Mesic Forest and		DC-SCC-4. Calcareous Mesic Forests Associates DC-RIZ-Santee-S-2; DC-RIZ-Santee-S-3	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)					
Chasmanthium nitidum	Mesic to Wet Pine Savannas and Flatwoods	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Process or Function - % of Ecosystem Acres Burned at Desired Return Interval	DC-ECO-3 Wet Pine Savanna and Flatwoods		DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-Z-Wambaw-S-9 Rare Plant communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Cladium mariscoides	Mesic to Wet Pine Savannas and Flatwoods	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-RIZ-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Coreopsis integrifolia	Pine Upland/Wetland Ecotones	Same as above	DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests		DC-SCC-3. Pine Upland/Wetland Ecotones Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Eryngium aquaticum var.ravenelii	Marl Mesic to Wet Pine Savannas and Flatwoods	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-RIZ-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Eupatorium anomalum	Pine Upland/Wetland Ecotones	Same as above	DC-ECO-5 Pocosins DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests		DC-SCC-3. Pine Upland/Wetland Ecotones Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Helenium pinnatifidum	Pond Cypress Savannas	Same as above	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates DC-Z-Wando-S-2 Rare Plant communities RIZ-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Lachnocaulon minus	Mesic to Wet Pine Savannas and Flatwoods	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Lindera melissifolia	Depressional Wetlands and Carolina Bays	Same as above	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-T&E-5 Pondberry DC-SCC-6. Pond Cypress Savannas Associates DC-Z-Wando-S-2 Rare Plant communities DC-Z-Wambaw-S-9 Rare Plant communities	OBJ-T&E-3. Threatened and Endangered Plant Species OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G35, G40, G41, G43
Listera australis	Calcareous Mesic Hardwood Forests	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2)	DC- ECO- 6 Oak and Mesic Hardwood Forest		DC-SCC-4. Calcareous Mesic Forests Associates DC-RIZ-Santee-S-3. Rare Communities	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)					
Lobelia boykinii	Pond Cypress Savannas	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Process or Function - % of Ecosystem Acres Burned at Desired Return Interval	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates DC-Z-Wambaw-S-9 Rare Plant communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Ludwigia lanceolata	Mesic to Wet Pine Savannas	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Lysimachia hybrida	Mesic to Wet Pine Savannas	Same as above	DC-ECO-2 Upland Longleaf and Loblolly Pine Woodlands	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Lysimachia loomisii	Pine Upland/Wetland Ecotone	Same as above	DC-ECO-5 Pocosins DC-ECO-7 Narrow Forested Swamps and Blackwater Stream		DC-SCC-3. Pine Upland/Wetland Ecotones Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
			Floodplain Forests				
Macbridea caroliniana	Forested Wetlands	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests DC-ECO 8 Broad Forested Swamps and Large River Floodplain Forests		DC-SCC-8. Forested Wetland Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Matelea flavidula	Calcareous Mesic Hardwood Forests	Same as above	DC- ECO-6 Oak and Mesic Hardwood Forest	OBJ-ECO-6. Oak Forests and Mesic Hardwoods	DC-SCC-4. Calcareous Mesic Forests Associates DC-RIZ-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Myriophyllum laxum	Depressional Wetlands and Carolina Bays	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Oxypolis canbyi	Pond Cypress Savannas	Same as above	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-T&E-6 Canby's Dropwort DC-SCC-6. Pond Cypress Savannas Associates	OBJ-T&E-3. Threatened and Endangered Plant Species OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G35, G40, G41, G43
Platanthera integra	Wet to Mesic Pine Savannas and Flatwoods	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Depressional Wetlands and Carolina Bays	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41
Ponthieva racemosa	Calcareous Mesic Hardwood Forests	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2)	DC- ECO-6 Oak and Mesic Hardwood Forest	OBJ-ECO-6. Oak Forests and Mesic Hardwoods	DC-SCC-4. Calcareous Mesic Forests Associates DC-Z-Santee-S-3 Rare Plant Communities DC-Z-Wambaw-S-9 Rare Plant communities	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)					
Pteroglossapsis ecristata	Upland Pine Woodlands	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	DC-ECO-2 Upland Longleaf and Loblolly Pine Woodlands	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-7. Upland Pine Woodland Associates DC-Z-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Quercus similis	Forested Wetlands	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests DC-ECO 8 Broad Forested Swamps and Large River Floodplain Forests		DC-SCC-8. Forested Wetland Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Rhynchospora breviseta	Wet to Mesic Pine Savannas and Flatwoods	Composition -% of Ecosystem Dominated by	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem	DC-SCC-5. Mesic to Wet Pine Savanna	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39,

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval		Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	and Flatwoods Associates		S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Rhynchospora globularis var. pinetorum	Mesic to Wet Pine Savannas and Flatwoods	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates RIZ-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Rhynchospora harperi	Pond Cypress Savannas	Same as above	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Rhynchospora oligantha	Mesic to Wet Pine Savannas and Flatwoods	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates RIZ-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Rhynchospora pleiantha	Pond Cypress Savannas	Same as above	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
				OBJ-ECO-4. Depressional Wetlands and Carolina Bays			
Rhynchospora scirpoides	Pond Cypress Savannas	Same as above	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Depressional Wetlands and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Rhynchospora stenophylla	Pine Upland/Wetland Ecotones	Same as above	DC-ECO-4 Pocosin DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests	OBJ-ECO-5. Pocosins	DC-SCC-3. Pine Upland/Wetland Ecotones Associates DC-RIZ-Wambaw-S-9 Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Ruellia strepens	Forested Wetlands	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV	DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Floodplain Forests DC-ECO 8 Broad Forested Swamps and Large River		DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	Floodplain Forests				
Schwalbea americana	Upland Longleaf Pine Woodlands	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2)	DC-ECO-2 Upland Longleaf and Loblolly Pine Woodlands	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-T&E-4 American Chaffseed DC-SCC-7. Upland Pine Woodlands Associates	OBJ-T&E-3. Threatened and Endangered Plant Species OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G35, G40, G41, G43

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2) Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Spiranthes laciniata	Pond Cypress Savannas	Same as above	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates DC-Z-Wambaw-S-9 Rare Plant communities	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41
Sporobolus curtisii	Mesic to Wet Pine Savannas	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-RIZ-Santee-S-3. Rare Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Sporobolus pinetorum	Mesic to Wet Pine Savannas	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem	DC-SCC-5. Mesic to Wet Pine Savanna	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
				Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	and Flatwoods Associates DC- RIZ-Wambaw-S-9 Rare Plant Communities		
Tridens chapmanii	Calcareous Mesic Hardwood Forests	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	DC-ECO-6- Oak and Mesic Hardwood Forest	OBJ-ECO-6. Oak Forests and Mesic Hardwoods	DC-SCC-4. Calcareous Mesic Forests Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Triphora trianthophora	Calcareous Mesic Hardwood Forests	Same as above	DC-ECO-6- Oak and Mesic Hardwood Forest	OBJ-ECO-6. Oak, Mesic Hardwood, and Maritime Forests	DC-SCC-4. Calcareous Mesic Forests Associates DC-Z-Santee-S-3;	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Utricularia macrorhiza	Pond Cypress Savannas	Composition -% of Ecosystem Dominated by characteristic Native Forest Types Structure - % Ecosystem Extent in Woodland, Savanna, Grassland, Structure - % of Ecosystem meeting age criteria for old growth (>=100yrs.) Structure - % Structural Departure from NRV Connectivity - ORV Trail Density w/in 0.5 miles (miles/mile2) Connectivity - Paved Open Road Density w/in 0.5 miles (miles/mile2) Connectivity - Unpaved Open Road Density w/in 0.5 miles (miles/miles2)	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
		Process or Function - % of Ecosystem Acres Burned at Desired Return Interval Process or Function - % of Ecosystem Acres Burned at Desired Growing Season Return Interval					
Xyris brevifolia	Mesic to Wet Pine Savannas	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Xyris difformis var. floridana	Pond Cypress Savannas	Same as above	DC-ECO-4 Depressional Wetlands and Carolina Bays	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Xyris flabelliformis	Mesic to Wet Pine Savannas	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5 Mesic to Wet Pine Savannas and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

			Coarse-filter Components		Fine-filter Components		
Scientific Name	**Ecological Conditions**	**Key Characteristics and Indicators**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Xyris stricta	Mesic to Wet Pine Savannas	Same as above	DC-ECO-3 Wet Pine Savanna and Flatwoods	OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5 Mesic to Wet Pine Savannas and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

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Appendix F: Supplement to Affected Environment Section of Social, Economic and Benefits to People

This appendix supplements information presented in Chapter 3 on the social and economic environment that is potentially affected under the alternatives.

Population and Demographics

Components of Population Change–Migration. Changes in a region's population can be attributed in part to natural increases (births minus deaths) and in part to net migration, which can affect the availability of housing, services, and jobs. Migration was the driving force behind much of the population change with the state (64 percent) and the study area (62 percent) between 1990 and 2010. Although migration accounted for more than half of net population change in the majority of the counties within the Francis Marion National Forest's study area, natural changes were still the leading cause of population change in Berkeley (56 percent), Charleston (79 percent) and Orangeburg (97 percent) (Table F-1) (U.S. Census 2011).

Table F-1. Components of population change between 1990 and 2010

	Natural Causes	Net Migration	Net Population Change 1990-2010	Percent Change from Natural Causes	Percent Change from Net Migration
South Carolina	412,067	726,987	1,139,054	36%	64%
8 County Area	116,625	192,025	308,650	38%	62%
Berkeley	27,699	21,486	49,185	56%	44%
Charleston	43,694	11,356	55,050	79%	21%
Clarendon	1,676	4,845	6,521	26%	74%
Dorchester	14,867	38,628	53,495	28%	72%
Georgetown	4,094	9,762	13,856	30%	70%
Horry	14,505	110,733	125,238	12%	88%
Orangeburg	7,447	250	7,697	97%	3%
Williamsburg	2,643	-5,035	-2,392	34%	66%

Source: U.S. Census Bureau 2011, Table 5.

Population Density. Population density measures the number of people living per square mile within a given area. This measure can serve as a valuable indicator of the socioeconomic and living conditions of a region, including: urbanization, availability of open space, socioeconomic diversity, and civic infrastructure (Horne and Haynes 1999). In general, more densely populated areas tend to be more urban, diverse, and offer more access to public infrastructure. In contrast, less densely populated areas provide greater access to open spaces and wildlands, which may offer natural amenity values to residents and visitors. Table F-2 displays the number of people per square mile at the county, state, and national levels (U.S. Census Bureau 2010).

South Carolina has experienced substantial population growth over the last thirty years, causing the state to become much more densely populated than the nation as a whole. In 2010, nearly half of the counties included in the Francis Marion National Forest study area had twice as many people per square miles relative to population density for the nation (Table F-2). While population densities surrounding the

Francis Marion are high relative to the nation, population densities for Clarendon, Georgetown, Orangeburg and Williamsburg remain low (U.S. Census Bureau 2010).

Table F-2. People per square mile

	2000	2010
United States	79.7	87.4
South Carolina	133.5	153.9
Berkeley	130.0	161.8
Charleston	337.5	382.3
Clarendon	53.5	57.6
Dorchester	167.8	238.2
Georgetown	68.5	73.9
Horry	173.4	237.5
Orangeburg	82.8	83.6
Williamsburg	39.9	36.8

Source: U.S. Census Bureau, 2010

Although population density may indicate whether a county is classified as urban or rural, it is not a measure of the concentration of urban and rural areas within a county. Large disparities between urban and rural areas remain in terms of economic conditions, access to infrastructure and services, including public transportation, opportunities for socioeconomic mobility, and control over natural resources. Disparities are caused by natural differences, political decisions, and social factors (Figure F-1 displays the distribution of urban and rural areas within study area counties).

Urban areas account for the majority of land surrounding the Francis Marion National Forest. In 2010 urban areas dominated five of the eight counties which make up the study area (Figure F-1). Though little human development exists within Francis Marion boundaries, urban growth has drastically altered the rural landscape of the region and caused growing concern over urban sprawl. Increasing residential and commercial development in Berkeley and Charleston counties has overrun many small, rural and unincorporated communities and has placed added pressure on the wildland-urban interface (WUI) which separates the natural terrain of the Francis Marion National Forest from developed lands. Rapid urban expansion of the Charleston area during the 1990s gained considerable attention after county officials concluded that the rate at which land was being developed was unsustainable (Johnson et.al 2009). According to a 1997 report published by the Berkeley-Charleston-Dorchester Council of Governments (BCD COG), residential and commercial development in Berkeley, Charleston, and Dorchester counties had outpaced population growth by a ratio of 6:1 between 1973 and 1994.

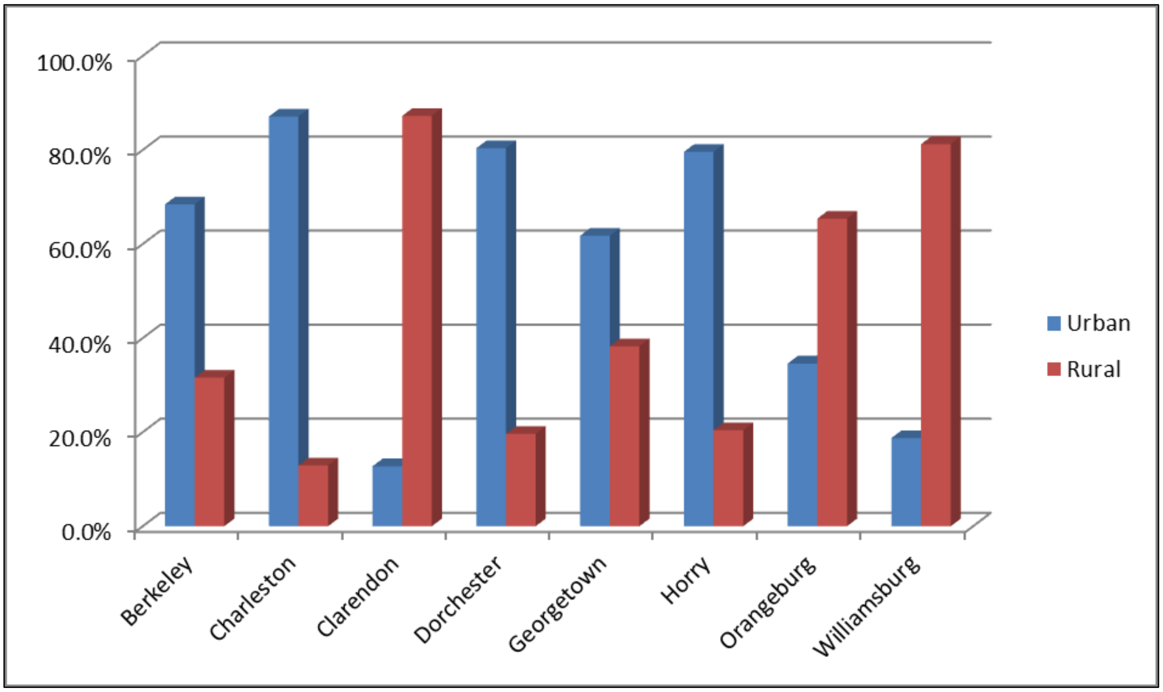

Figure F-1. Urban-rural distribution, 2010

Communities Interested in Francis Marion National Forest Management

Cultural communities of interest- protection and access to resources. Although the physical landscape of the Francis Marion has changed over time, the forest's uplands, swamps, and marshes still hold "memories" of its past prehistoric, colonial, and military significance. Today the Francis Marion National Forest serves as a reminder of the collective and individual roots of many Americans. The historic features which hold these memories possess heritage values which help people form attachments to places and provide an understanding of their place in the natural and cultural environment. Public comments highlighted the Francis Marion's importance to the culture and heritage of a large share of Francis Marion stakeholders. The Francis Marion is generally perceived as an important part of the cultural and heritage of the Lowcountry and attributed with protecting a number of historical sites. Many stakeholders believe that forest management of these sites increases public awareness of and access to opportunities to learn and interpret their cultural and historic significance. By preserving and facilitating the interpretation of these resources the Francis Marion National Forest ensures that the cultural legacy and heritage values of the Francis Marion's lands will be passed on to present and future generations.

In addition, management of forest resources, habitats and the integrity of ecosystems contributes to this community of interest's quality of life. For example, cultural practices depend on water from the Francis Marion National Forest. For example, indirectly cultural beneficiaries identify with cypress and habitats that depend on functioning waterways and water quality; they also directly utilize water for baptismal practices and fishing traditions.

Although comments received did not mention which cultures the Francis Marion contributed to, the Francis Marion National Forest is located almost entirely within a federally recognized heritage area known as the Gullah Geechee Corridor. This corridor was established in 2006 to protect and enhance resources associated with the Gullah Geechee people. The Gullah Geechee are American descendants of

enslaved immigrants brought over primarily from coastal West Africa. Years of captivity and relative isolation enabled various West African traditions, skills, and languages to fuse together, giving rise to the unique culture which has been passed down for generations. An inventory of the Corridor's historical, cultural, and natural resources, identified three forest dependent communities as having cultural landscapes[2] and ethnographic resources that increase the awareness and understanding of the culture and history of the Gullah Geechee people (Gullah Geechee Cultural Heritage Corridor Commission 2012). Located entirely within the Francis Marion National Forest, the communities of Awendaw, Huger, and McClellanville are recognized for helping the Gullah Geechee share their heritage by supporting six primary interpretive themes: origins and early development; the quest for freedom, equality, education, and recognition; global connections; connection with the land; cultural and spiritual expression; and Gullah Geechee language. Since the natural and cultural landscapes of these communities are synonymous with those of the Francis Marion, the management of forest resources for long-term sustainability contributes to the long-term viability of the cultures of the people living within them.

Contributions to sustainability for this community are reflected in indicators under MP6.3 and MP6.5. As described above, the Francis Marion National Forest is vitally important to this community and contributes to their resilience as a forest-dependent community. Ecologists have found that ecosystem resiliency is strongly correlated with ecological diversity. Social scientists have adapted these findings to develop the premise that more diverse communities generally adapt to and integrate change more rapidly and successfully than their less diverse counterparts. Community or socioeconomic resiliency relates to humans' ability to adapt to social and economic changes. Beckley et al (2002) define community resiliency as: "the capacity of humans to change their behavior, redefine economic relationships, and alter social institutions so that economic viability is maintained and social stresses are minimized."

In addition, the Francis Marion National Forest contributes to the range of cultural, social and spiritual needs and values; but there are no specific designated areas for management. This contribution to sustainability is decreasing as the region surrounding the Francis Marion National Forest is anticipated to become increasingly urban. Even assuming urban development would slow, the urban area surrounding the Charleston Metropolitan area is predicted to triple by 2030 (Allen and Lu 2003).

Educator, student and researcher community of interest. Educators, students and researchers depend upon a variety of goods and services from the Francis Marion National Forest such as water resources, wilderness, unique ecosystems and habitats to understand, communicate and educate. For example, the Francis Marion National Forest is highly valued by a large community interested natural plant and animal communities. Comments collected via Crowdbrite indicated that the Francis Marion National Forest was significant to them because it provided lands important to endangered species, neotropical migratory birds along the Atlantic Flyway, and to various populations displaced by extensive urban development in physical communities surrounding the Francis Marion National Forest. Several responses indicated that the Francis Marion National Forest was the only place to provide birders with an opportunity to see red

[2] Cultural Landscapes are areas that reflect how people adapt and use natural resources, as expressed by the land organization or use, settlement patterns, circulation, or types of structures, and how the area reflects cultural values and traditions. The National Park Service categorizes cultural landscapes into four types: historic designed landscapes, historic vernacular landscapes, historic sites, and ethnographic landscapes. Cultural landscapes associated with the Gullah Geechee corridor may not be previously identified as "cultural landscapes," but can include sites that fulfill the above definition of a cultural landscape. Examples might include plantations, village sites, or other important places with ties to long-established groups identified with Gullah Geechee cultural history.

Ethnographic resources are any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. These resources generally relate to folklife, religious traditions, foodways, anthropology, ethnomusicology, or the humanities.

cockaded woodpeckers or Bachman's warblers in their natural habitat, making the Francis Marion extremely important to birding communities.

Contributions to sustainability for this community are reflected in indicators under MP6.2. The Francis Marion National Forest contributes to opportunities for forest-related research, extension and development, and education by providing the opportunities described above to understand, communicate and educate. By managing areas suitable for wilderness designation and protecting habitats, the Francis Marion National Forest contributes to sustaining communities' interests for current generations and providing opportunities to pass knowledge down to future generations. Protection, enhancement and access to these goods and services support their livelihoods. The need for this contribution is increasing in demand with anticipated increases in population within the 8-county study area.

Government, municipal and residential community of interest. Local governments, municipalities and residential members of the community depend upon a variety of goods and services from the Francis Marion National Forest. Specific interests and benefits include flood control from rainwater, property values near natural amenities on the Francis Marion (such as bodies of water), opportunity for placement of infrastructure, and reduced risk of erosion, fire and pest infestation from properly managed ecosystems.

Contributions to sustainability for this community are reflected in indicators under MP6.3. The Francis Marion National Forest contributes to the resilience of local governments, municipalities and residents providing the benefits described above. This need for this contribution to sustainability is increasing in demand as the region surrounding the Francis Marion National Forest is anticipated to become increasingly more urban. Increased urbanization of areas surrounding the Francis Marion National Forest increases the region's need for infrastructure and places greater pressure on forest management to provide utility right-a-ways to meet the region's growing infrastructure needs. In addition, as urban and suburban populations grow, conflicts between local residents and Francis Marion visitors may increase.

In addition, local governments are supported by receipt-sharing of Federal land payments (see Forest Economic Contributions discussion below). The Payment in Lieu of Taxes (PILT) program may or may not continue to be funded, and Congress could initiate new discretionary or non-discretionary Federal land payment programs over the next twenty years. State and county Federal land payments, are essential to balancing tight local budgets. As these revenues are invested in the maintenance and improvement of local infrastructure and public services, they contribute to the sustainability and health of local communities by supporting a portion of the valuable services these local governments provide.

Non-use values community of interest (those who derive benefits from the existence and bequest values of resources, including wildlife, plant species, water bodies, landscapes, historical sites, and recreational trails). Non-use values are a type of non-market value. Non-market values can be broken down into two categories, use and non-use values. The use-value of a non-market good is the value individuals receive from the direct use of natural resource or non-market good. Within the Francis Marion National Forest use-values exists for recreational activities such as hunting, hiking, canoeing, and wildlife viewing. The use of non-market goods often requires consumption of associated market goods, such as food, gas and lodging expenditures incurred by Francis Marion visitors.

Non-use values of a non-market good reflect the value of an asset beyond its current use. These can be described as existence, option and bequest values. Existence values are the amount society is willing to pay to guarantee that an asset simply exists. An existence value for the Francis Marion National Forest might be the value of knowing that undisturbed native plant habitat exists or the value associated with undeveloped scenic landscapes. In addition to implicit existence values, society's willingness to pay to preserve resources for future use attaches additional non-use values. The potential benefits people would receive from future use are referred to as option values when future use is expected to occur within the

same generation and bequest values when preservation allows future generations to benefit from the resource use. Within the Francis Marion National Forest bequest and option values might exist for wildlife, plant species, water bodies, landscapes, historical sites, and recreational trails.

While non-use values may exist for many of the Francis Marion National Forest's natural resources, it is difficult to quantify and monetize. Since the methodologies for measuring these values can be controversial and difficult to apply, non-market goods tend to be undervalued. While it is not feasible to estimate non-market values during the planning process, it is important that Francis Marion management decision making recognizes that the value of forest resources include both market and non-market values. Many of these non-market values are discussed in other resource sections of the EIS.

Contributions to sustainability for this community are reflected in indicators under MP6.5. As described above, the Francis Marion National Forest is vitally important to this community and contributes to their sense of the importance of forests. In addition, the Francis Marion National Forest contributes to the range of cultural, social and spiritual needs imbedded in non-use values held by this community. In this manner contributions to their well-being and sustainability are maintained. For example, current management of wilderness contributes to the well-being of this community. The wilderness contribution to sustainability for this community is not changing but other non-use values associated with other resources are changing. For example, habitat for threatened and endangered species provided by the Francis Marion is becoming increasingly more important as the areas surrounding the Francis Marion National Forest become increasingly more urban. Even assuming urban development would slow, the urban area surrounding the Charleston Metropolitan area is predicted to triple by 2030 (Allen and Lu 2003).

Recreational community of interest (consumptive, including hunting, fishing and food pickers/gathers). Information received from the public during the assessment and public scoping revealed that recreationists highly valued the Francis Marion National Forest because of the opportunities for hunting, fishing and recreational food picking or gathering. Members of the public indicated they had developed strong personal bonds with the Francis Marion through years participating in these activities. Several comments highlighted that the Francis Marion supported multi-generation experiences where parents were given the opportunity to teach their children to appreciate and respect nature. Though conflicts arise over competing recreational uses, recreationists generally shared positive attitudes towards the Francis Marion National Forest and credited it as being as being an important recreational site in South Carolina's Lowcountry. By supporting unique recreational experiences the Francis Marion National Forest helps cultivate an appreciation for the outdoors that continues to be passed down to younger generations through recreational experiences thereby contributing to the longevity of recreational communities who use the Francis Marion.

The Francis Marion National Forest is one of the most biologically and ecologically diverse Francis Marion landscapes in the Southeast region. As discussed in the sections on Recreational Fisheries Management and Huntable and Fishable Species, the diverse natural landscapes of the Francis Marion provide habitat for many species of fish and wildlife. According to 2011 National Visitor Use Monitoring (NVUM) data, 23 percent of Francis Marion visitors participate in hunting, and 8 percent fished while recreating on the Francis Marion National Forest. NVUM data also indicated that hunting and fishing are two of the most popular recreational activities pursued on the Francis Marion National Forest, and were reported to be the primary purpose of 21 percent and 5 percent of annual Francis Marion visits respectively.

Contributions to sustainability for this community are reflected in indicators under MP6.4 and MP6.5. As described above, the Francis Marion National Forest is vitally important to this community and contributes to their sense of the importance of forests. In addition, the Francis Marion National Forest

contributes to the range of cultural and social needs and values of these recreationists by providing opportunities for hunting, fishing and food picking or gathering. These contributions to sustainability are not changing however, increased demand for recreational opportunities and these contributions to sustainability are anticipated with increases in population. In addition, increased urbanization in areas around the Francis Marion affects contributions to sustainability. While living proximate to public lands may provide local residents with amenities such as convenient access to recreation, increased forest congestion causes crowds, litter, and noise (Garber-Yonts 2004; Bolitzer and Netusil 2000; Moore et al. 1992).

Recreational community of interest (non-consumptive, including art (writing, painting, photography) connecting with history and wildlife viewing). Information received from the public during the assessment and public scoping revealed that people associated with this community of interest valued the Francis Marion National Forest because of the opportunities for trail running, hiking, biking, riding OHV, writing, painting, photography, birding, connecting with history and camping. Some recreationists had developed strong personal bonds with the Francis Marion through years of participating in these activities. Several comments highlighted that the Francis Marion provided multi-generation experiences where parents were given the opportunity to teach their children to appreciate and respect nature. The Francis Marion National Forest was also attributed with providing people with access to free forms of entertainment, like birding and various other types of wildlife viewing; access to these activities were attributed with increasing low-income residents' access to recreational experiences. Though conflicts arise over competing recreational uses, recreationists generally shared positive attitudes towards the Francis Marion National Forest and credited it as being as being an important recreational site in South Carolina's Lowcountry. By supporting unique recreational experiences the Francis Marion National Forest helps cultivate an appreciation for the outdoors that continues to be passed down to younger generations through recreational experiences thereby contributing to the longevity of recreational communities who use the Francis Marion.

Public comments highlighted a deep appreciation for the Francis Marion's wild landscape and scenic beauty. These Francis Marion stakeholders take great pleasure in using the Francis Marion National Forest as a source of inspiration for writing, painting, photography or other artistic pursuits. Others use the Francis Marion as a refuge away from the people, noise, and pollution of cities and credit the scenic, undeveloped landscapes of the Francis Marion with improving their quality of life. The nature enthusiast community attributes the Francis Marion National Forest with contributing to the overall beauty of South Carolina's Lowcountry and valued its scenic resources for cultivating mental clarity and spiritual renewal. People associated with this community of interest escape to the Francis Marion because the exploration and quiet enjoyment of its diverse landscapes provides relief from the stress of their daily lives and promotes self-reflection and inner peace. Community members who live in cities believed that the Francis Marion's natural beauty served as a reminder of the importance of incorporating nature in to their lives and enabled them to reconnect with a rural lifestyle.

Developed heritage sites on Francis Marion National Forest provide an opportunity for Francis Marion visitors to connect with history. As discussed other forest resource sections, the landscape of the Francis Marion National Forest has a rich history which dates back more than 15,000 years. Successive generations of native and early Americans have relied on the natural resources of the Francis Marion National Forest to foster social, economic, and spiritual growth and traces of past Francis Marion users and uses remain scattered across the modern forest landscape. As of today more than 4,000 archaeological sites, four historic buildings, and two historic fire lookout towers have been discovered on the Francis Marion National Forest. With the exception of interpretive areas, the Forest Service does not publicize the exact locations of culturally and historically significant resources to protect the integrity of Francis Marion heritage sites. Table F-3 lists the designated Interpretative Areas managed by the Francis

Marion National Forest and the reason for their cultural and historic significance. These developed heritage sites promote local heritage tourism which enables the public to enjoy our nation's heritage through greater knowledge and appreciation of local Francis Marion history.

Table F-3. Designated interpretive areas for Francis Marion National Forest's heritage resources

Interpretative Areas	Cultural & Historic Significance
Sewee Visitor and Environment Education Center	Jointly operated by the Forest Service and the Fish and Wildlife Service, this 9,000 square foot facility features hands-on interpretive displays exploring the heritage and natural history of the area.
Sewee Shell Interpretive Trail	The Sewee shell rig is the northernmost prehistoric coastal shell mound along the Florida, Georgia and South Carolina coasts. Today the shell ring serves as monument to prehistoric Native American Culture and providing five interpretive sites along the scenic trail.
Battery Warren	Named after Colonel Samuel Warren, the local Revolutionary War hero who previously owned the land, the Battery served as an earthen gunning fort built to blockade Union forces from moving up the Santee River during the Civil War.
I'on Swamp Interpretive Trail	This interpretive loop follows the remnants the elaborate grid of canals and dikes to remnants of the 200 year old Witheywood Planation which was once part of the state's lucrative "Carolina Gold" rice trade. Interpretive sites along the trail provides information on the agricultural history of the region and how slaves brought over from Africa contributed to success of southern plantations.

Wildlife related activities on the Francis Marion National Forest are an important attraction which draws visitors to the region. According to 2011 NVUM data, wildlife related activities accounted for approximately 21 percent of all Francis Marion visits each year and nearly 26 percent of Francis Marion visitors are estimated to participate in wildlife viewing. Comments collected indicated that the Francis Marion National Forest was significant to them because it provided critical habitat to a wide range of terrestrial, aquatic, and avian wildlife. While public comments suggested that community members may derive pleasure from knowing habitat provided by the Francis Marion National Forest contributes to sustaining healthy animal and bird populations, most of the value reflected in responses from these community members was derived from birding experiences on the Francis Marion. Although wildlife enthusiasts are attracted to the Francis Marion because it provides the opportunity to observe a wide variety of wildlife in a single visit, the Francis Marion National Forest is world renowned for the unique bird watching experiences it supports and is designated as an Important Bird Area by both the National Audubon Society and the American Bird Conservancy. Several responses indicated that the Francis Marion National Forest was the only place to provide birders with an opportunity to see red cockaded woodpeckers or Bachman's warblers in their natural habitat, making the Francis Marion extremely important to birding communities.

Contributions to sustainability from non-consumptive recreation opportunities are reflected in indicators under MP6.4 and MP6.5. The Francis Marion National Forest to contributes to the importance of forests to nature enthusiasts, wildlife viewers and heritage tourists; by managing the Francis Marion to protect the integrity of its resources so that it can continue to promote the mental, physical, and spiritual health of current and future generations. In addition, specific areas on the Francis Marion National Forest contribute to educational experiences and community sustainability.

Recreational community of interest (boaters, waders, swimmers and divers). Information received from the public during the assessment and public scoping revealed that people associated with this community of interest valued the Francis Marion National Forest because of opportunities for canoeing, kayaking, other boating, and swimming. Several comments highlighted that the Francis Marion provided children with access to nature and that the recreational experiences it supported facilitated multi-generation

Francis Marion experiences where parents were given the opportunity to teach their children to appreciate and respect nature. Though conflicts arise over competing recreational uses, recreationists generally shared positive attitudes towards the Francis Marion National Forest and credited it as being as being an important recreational site in South Carolina's Lowcountry. By supporting unique recreational experiences the Francis Marion National Forest helps cultivate an appreciation for the outdoors that continues to be passed down to younger generations through recreational experiences thereby contributing to the longevity of recreational communities who use the Francis Marion.

South Carolina benefits from an abundant supply of water in the form of lakes, streams, rivers, wetlands and aquifers and the state's water resources remain relatively clean (SCORP 2008). Francis Marion National Forest's watershed provides habitat for shellfish, fish and wildlife and supports recreational experiences on the Francis Marion. The diverse network of waterways, which connects slow moving blackwater creeks to the Atlantic Intracoastal Waterway, provides visitors with access to water for boating, visual aesthetics, desirable locations for picnicking, camping and other recreational activities.

According to 2011 NVUM data, approximately 9 percent of Francis Marion visitors participate in water activities while recreating on the Francis Marion National Forest each year. Although the Francis Marion supports motorized water activities, the Francis Marion National Forest's waterways and wetlands are more heavily used by non-motorized water recreationists. NVUM estimated that 8 percent of Francis Marion visitors participated in non-motorized water recreation and that these activities were reported to be the primary purpose of nearly 7 percent of Francis Marion visits each year.

Contributions to sustainability from water recreation opportunities are reflected in indicators under MP6.4 and MP6.5. The quality and quantity of Francis Marion water resources are maintained by Francis Marion management and contribute to opportunities for high quality non-motorized and motorized water recreation, on and off the Francis Marion. By supporting opportunities for unique water based recreation, the Francis Marion's water resources contribute to the quality of experience for kayakers, canoers, boaters, and swimmers. These unique waterways are a big part of how this community defines the importance of forests.

Recreational community of interest (regional and local contributions and effects). South Carolina's diverse geography and abundance of natural amenities have played an important role in making the state a retirement and recreational and tourist destination. Significant growth in services- related industries in recent years highlights the growing economic importance of the state's tourism industries and suggests that the economic drivers of the state have shifted away from agriculture related industries towards those related to tourism and recreation. According to South Carolina's 2008 State Comprehensive Outdoor Recreation Plan (SCORP), the state hosts approximately 29 million domestic visitors and nearly 1 million international visitors annually. In 2008 the state's tourism and travel industry was estimated to account for approximately 9 percent ($10.9 billion) of South Carolina's Gross State Product (GSP) and supported more than 216,000 jobs within the state, and forecasted that tourism would account for a growing share of the state's economic activity over the foreseeable future (SCORP 2008). Outdoor recreation is attributed with playing an integral role in South Carolina's flourishing tourist industry. More than 11 million South Carolina visitors annually are estimated to participate in some form of outdoor recreation during their trip. Coupled with heritage and cultural tourism, outdoor recreation is believed to provide significant economic benefits to all regions of the State, especially to rural communities (SCORP 2008). It's clear that outdoor recreation, contributes greatly to the economy by providing jobs and income throughout the local economy and the state. Communities within the study area acknowledged the important economic contributions attributable to recreation occurring on the Francis Marion National Forest.

Contributions to sustainability from regional economic activity associated with recreation on the Francis Marion are reflected in indicators under MP6.3. The discussion on contributions to sustainability is covered below in the section on Forest Economic Contributions from recreation.

Timber and forest products community of interest (regional and local contributions and effects). Although historic harvests far exceeded those in recent years, modern timber management enables the Francis Marion to provide a steady and reliable supply of forest products which contribute to sustaining communities interested in timber and wood products. Comments from the public indicated members of this community view timber harvesting in a positive light, but believe that the extraction of timber related goods needs to be done in ways which minimize adverse impacts to habitat and recreation. Recent restoration projects have provided timber and wood products for personal and commercial use and have been attributed with improving the health and function of the Francis Marion's diverse forest ecosystems. Although not all individuals interested in timber related forest products are in agreement over what the Francis Marion's annual yield should be, public comments indicated that there is a general consensus that the Francis Marion National Forest needs to continue to improve its timber management to ensure future Francis Marion users can rely on the these National Forest System lands to provide forest products for personal and commercial use.

Contributions to sustainability from regional economic activity associated with timber and wood products on the Francis Marion are reflected in indicators under MP6.1 and MP6.3. The discussion on contributions to sustainability is covered below in the section on Forest Economic Contributions from Timber &Forest Products.

Subsistence community of interest. Residents of Gullah Geechee communities maintain strong communal ties to the people and lands which make up South Carolina's Lowcountry. Although relative isolation has stifled modern economic development in the planning area's smaller communities; strong social, cultural, and economic ties to the natural environment have long sustained communities now thought to be economically suppressed. The Francis Marion National Forest has provided local residents with food, water, and forest products used for home heating and construction; and enabled generations of local residents to scratch out meager incomes through subsistence farming, fishing, hunting, bartering and small-scale marketing of subsistence.

Residents of these crossroad communities maintain strong communal ties to the people and lands which make up South Carolina's Lowcountry. Although relative isolation has stifled modern economic development in the planning area's smaller communities; strong social, cultural, and economic ties to the natural environment have long sustained communities now thought to be economically suppressed. The natural abundance of the lands which make up the Francis Marion National Forest has provided local residents with food, water, and forest products used for home heating and construction; and enabled generations of local residents to scratch out meager incomes through subsistence farming, fishing, hunting, bartering and small-scale marketing of subsistence.

Contributions to sustainability from subsistence uses on the Francis Marion are reflected in indicators under MP6.1 and MP 6.3. By managing the Francis Marion's ecosystems for ecological integrity, forest management promotes healthy, plant, fish and wildlife populations that contribute to the resilience of these forest-dependent communities. These contributions are a vital part of Gullah Geechee community needs and thus contribute to their sustainability.

Lands and natural resources administered as the Francis Marion National Forest enable current generations to reconnect with the values, traditions, and lifestyles of their ancestors. Although the Gullah Geechee are working hard to preserve and pass on the values, traditions, and lifestyles of their African ancestors, rapid coastal development and soaring coastal property values threaten the unique sense of

place of crossroad communities and push Gullah families off ancestral lands. In the presence of these changes lands managed by the Francis Marion National Forest act as a protective buffer and foster community sustainability.

Forest Economic Contributions

Recreation. The Francis Marion supports a wide range of outdoor experiences which attracts thousands of local and non-local visitor's to the Francis Marion each year. According to recent results from the NVUM survey the Francis Marion National Forest supports approximately 430,000 visits a year. People visit the National Forest to participate in activities such as fishing, hiking, boating, mountain biking, camping, horseback riding, canoeing, wildlife viewing, and interpretation of historical sites. Deer hunting with dogs, still deer hunting, small game hunting and turkey hunting are among the most popular activities on the Francis Marion with 21 percent of visitors reporting hunting as the primary reason for their Francis Marion visit.

Opportunities for recreational, cultural, and leisure activities provided by the Francis Marion are unique and attract local and non-local visitor spending in the local eight-county economy. Visitors traveling to the Francis Marion to recreate often eat in local restaurants, shop in local retailers, and purchase gas and lodging. If recreational opportunities on the Francis Marion National Forest did not exist, recreationists and their recreation-related spending would likely travel elsewhere. In this manner the recreational opportunities supported by National Forest System lands contribute to the local economy by attracting and maintaining visitor spending in communities surrounding the Francis Marion. In total spending by recreationists on the Francis Marion supports approximately 116 local jobs and nearly $3.7 million in labor income in the eight counties surrounding the National Forest. On an annual average basis approximately 93 of these jobs and $1.8 million of the labor income attributed to Francis Marion recreation is supported in the Accommodation & Food Services, Arts, Entertainment, and Recreation, and Retail Trade sectors (IMPLAN 2012).

Contributions to sustainability from regional economic activity associated with recreation on the Francis Marion are reflected in indicators under MP6.3. The tourism and recreation industry has become an increasingly more important sector within the Francis Marion National Forest's study area. Trends presented in the Social and Economic Affected Environment suggest that the economic base of nearby communities is shifting towards service businesses whom rely, in part, on outdoor recreation. In addition, public comments indicate the industry is a valued part of the local economy. As a result of its economic importance and continued presence the tourism industry contributes towards the resilience of forest-dependent communities; thus contributions from the Francis Marion National Forest contribute to economic sustainability.

Economic activity attributed to recreation on the Francis Marion National Forest also contributes to long-term viability and resilience of the local economy by attracting new money (money earned outside the local economy and spent by these non-local visitors) into communities surrounding the Francis Marion. The injection of non-local dollars through purchases of gas, food, lodging, and concessions opportunities for employment and income would not exist in if the unique opportunities on the Francis Marion National Forest did not exist. By managing visually appealing landscapes and healthy fish and wildlife populations; Francis Marion management contributes to economic sustainability by supporting a share of employment and income in the local tourism industry.

Timber and Forest Products. Forest products have played an important role in South Carolina's history and economy. Dating back to early Colonial America, the timber industry is one of the state's oldest and most successful industrial sectors. Timber continues to be the top ranked cash crop in 45 of the state's 46 counties. With more than 13 million acres of South Carolina's forest used for the production of

commercial wood products, the delivered value of products harvested from timberlands across the state was valued at nearly $679 million in 2009. Economic activity associated with timberlands can be attributed with making the state's forestry and wood products industry the state's largest manufacturing industry in 2010; employing approximately 90,624 people with a payroll of $4.1 million (S.C. Forestry Commission, 2014). Forestry, logging and wood processing also play an important role within the eight-county study area. Of the 5.2 million acres of land which make up the study area, approximately 3.1 million of these acres were timberlands (S.C. Forestry Commission, 2014) which are attributed with supporting more than 13,000 forestry and logging jobs within the Francis Marion National Forest study area in 2012 (IMPLAN, 2012).

In accordance with the MUSYA, the Francis Marion is managed to ensure that the Francis Marion continues to achieve and sustain a high level of timber production. In 2011 271 CCF of Sawtimber, 274 CCF of Pulpwood, 7,186 CCF of smaller Non-saw timber products (which include pulpwood and chip and saw), and 25 CCF of Fuelwood were harvested from the Francis Marion (USDA NRM 2012). While timber and wood products from National Forest System lands account for only a small share the region's timber, forest products from the Francis Marion National Forest directly supports employment in logging and wood manufacturing firms in the area and indirectly contributes to employment in a number of other industrial sectors. It is estimated that timber and wood products from the Francis Marion support a total of 57 local jobs and nearly $2.4 million in wages and proprietor's income across the eight-county study area (IMPLAN 2012). Approximately 35 of these jobs and $1.8 million of local labor income are supported in the Agriculture and Manufacturing sectors. These sectors include firms which specialize in forestry and logging and primary and secondary forest product processing.

Contributions to sustainability from regional economic activity associated with timber and forest products from the Francis Marion are reflected in indicators under MP6.1 and MP6.3. As noted above, the timber industry has been an important part South Carolina's economy for centuries and is anticipated to continue to play an important role in the Low Country's economy in the future. Public comments noted that the Francis Marion National Forest needs to continue to improve its timber management to ensure future Francis Marion users can rely on Francis Marion National Forest lands to provide forest products for personal and commercial use. Harvesting the Francis Marion National Forest's timber resources is done to maintain and restore ecosystem characteristics and improves the Francis Marions' resistance and resilience to stressors. In this way managing timber resources for ecosystem health increases the ability of area communities to adapt to changes in environment (such as fire, climate change, flood, insect and disease threats, etc.). As a result timber management on the Francis Marion National Forest can be attributed with increasing the resiliency of local communities and contributing to their socioeconomic sustainability. In addition to managing timber resources to improve stand health, management to ensure reliable future yields contributes to the continued viability, and thus sustainability, of communities dependent upon timber and forest products.

Forest Expenditures and Employment. Management of the Francis Marion National Forest directly contributes to the local economy by employing individuals living within the area and by spending federally appropriated dollars on goods and services to carry out management forest programs. In recent years expenditures on Francis Marion programs and personnel for the have averaged $10.4 million a year. Program related expenditures do not include expenditures associated with emergency fire suppression since these cannot be considered consistent contributions to the area economy.

Although field support for the Francis Marion comes from the District Ranger's Office in Huger, financial and administrative support for the Francis Marion is provided by the Francis Marion Supervisor's Office (SO) in Columbia, SC. On an average annual basis, expenditures associated with the management of the Francis Marion National Forest support 148 jobs (direct, indirect and induced) and approximately $9.8

million in local labor income in the eleven counties which surround the Francis Marion National Forest and SO. These counties include Berkeley, Calhoun, Charleston, Clarendon, Dorchester, Georgetown, Horry, Lexington, Orangeburg, Richland, and Williamsburg counties (IMPLAN 2012).

Payments to States and Counties. National Forest System lands account for 5 percent of all land within the eight-county study area, and make up 25 percent of Berkeley and 10 percent of Charleston counties. Although Berkeley and Charleston counties do not receive tax revenues from these lands, they provide public services (including law enforcement, road maintenance, and emergency services) that support activities on these public lands. As a result, Berkeley and Charleston counties are entitled to monies from land payment programs as compensation for the tax-exempt National Forest System land within their jurisdiction. These programs can be categorized into two types: receipt-sharing and per acre Federal land payments.

Receipt-sharing programs have been administered under the Secure Rural Schools and Community Self-Determination Act (SRSCS) and the Twenty Five Percent Fund Act of 1908. Congress recently reauthorized the SRSCS through 2016. In the absence of SRSCS reauthorization, the Twenty Five Percent Fund Act of 1908 mandates that states receive a 25-percent rolling average of revenues earned from timber sales, special use permit fees, grazing fees, and other programs that generate receipts on national forest lands. The payments are paid to South Carolina’s General Government based on a 7-year rolling average of receipts from national forests. While only a small portion of these funds are returned to Berkeley and Charleston counties, the payments help fund schools and roads across the state.

In addition to receipt-sharing, the PILT program provides payments to counties to offset losses in tax revenues due to the presence of tax-exempt Federal land in their jurisdictions. The authorized level of PILT payments is calculated under a complex formula. No precise dollar figure can be given in advance for each year’s PILT authorized level. Five factors affect the calculation of a payment to a given county: the number of acres eligible for PILT payments, the county’s population, payments in prior years from other specified Federal land payment programs, state laws directing payments to a particular government purpose, and the Consumer Price Index as calculated by the Bureau of Labor Statistics.

Receipt-sharing and per acre Federal land payments received by Berkeley and Charleston counties can be highly variable. Although rural communities in these counties rely on these funds to balance tight budgets, the PILT program has reverted back to a discretionary program which is highly susceptible to Federal funding shortages. It is fully funded through FY15, but there is a great deal of uncertainty whether and to what degree the Payment in Lieu of Taxes program will be funded in the future. If the program continues to be fully funded, Berkeley and Charleston could potentially see an increase in PILT payments as a result of reduced receipt-sharing payments.

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Appendix G: Biological Assessment and Biological Evaluations for the Francis Marion National Forest Land and Resource Management Plan

Note: The draft biological assessment used for consultation with the U.S. Fish and Wildlife Service and the biological evaluation used to address the Regional Forester's sensitive species list are stand-alone documents and they are included in their original form. The original documents will include the preparer's and concurrence signatures.

United States Department of Agriculture

Forest Service

Southern Region

Biological Assessment

for the

Francis Marion National Forest

Revised Land Management Plan

Prepared by:

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1. INTRODUCTION

This programmatic Biological Assessment (BA) assesses the effects of implementing the management activities proposed in the revised Francis Marion Land and Resource Management Plan (LRMP or Forest Plan). The planning area includes all Federal land managed or administered by the Francis Marion National Forest in Berkeley and Charleston Counties, South Carolina. The purpose of this analysis is to assess potential effects on federally listed threatened and endangered species, and critical habitat, which occur or may occur within the Francis Marion. No proposed species are known or expected to occur there. This document was prepared to meet the following specific objectives:

- Comply with requirements of the Endangered Species Act of 1973 (ESA), as amended, so that actions by Federal agencies do not jeopardize the existence of federally listed species, or destroy, or adversely modify their critical habitat;
- Assess the effects of the Francis Marion National Forest Revised Land Management Plan on federally-listed threatened, endangered, proposed species or designated critical habitat known or likely to occur on the Francis Marion National Forest in Charleston and Berkeley Counties, South Carolina, or that the Forest Plan potentially affects;
- Make full use of internal biological expertise and informal consultation with the USDI Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NOAA Fisheries) to reach supportable determinations of effect;
- Provide a process and standard by which to ensure that effects to federally-listed threatened, endangered, and proposed species, known or likely to occur on the Francis Marion National Forest in Charleston and Berkeley Counties, South Carolina, as well as designated critical habitat, receive full consideration in the decision making process consistent with Forest Service policy (FSM 2672.4).

National Forest Land and Resource Management Plans provide broad guidance and information for project and activity decision making for each National Forest over the next 15 years. The original Francis Marion National Forest Land and Resource Management Plan was adopted in 1985. The National Forest Management Act (NFMA) calls for plans to be revised every 10 to 15 years, to incorporate new information, to account for changed national policy and direction, and to address new issues and opportunities. This second revision of the Forest Plan incorporates new information, addresses evolving issues and trends, accounts for changes in national policies and direction, and includes updated views from public users and stakeholders.

This revised Forest Plan is the result of a multi-year planning process and collaboration with the public and other agencies, groups, and interested parties. It differs from the previous plan in focusing more on an integrated vision of how the national forest is to look and function in the future rather than how individual projects would be implemented. This plan uses a new format and emphasizes an adaptive management approach that will continue to include public input and technical adjustments as changes are needed. The revised Forest Plan direction strives to ensure ecological sustainability through time using a complementary ecosystem and species-specific approach. At the coarse filter scale, desired conditions for ecosystems are described in terms of desired composition, structure, ecological processes, landscape structure and connectivity, and response to anticipated stressors. We used a native ecosystem and terrestrial ecological unit framework because native vegetation and wildlife species evolved and adapted within the limits established by natural landforms, vegetation, and disturbance patterns which existed before extensive human alterations. We also included fine filter provisions, as needed, to ensure the persistence of federally-listed T&E species.

2. CONSULTATION HISTORY

Interagency cooperation between the Forest Service and FWS regarding proposed, endangered, or threatened species is required in Section 7 of the Endangered Species Act and Forest Service Manual Direction at FSM 2670.

On January 24, 2013 the then-acting Forest Supervisor Steven M. Lohr on the Francis Marion and Sumter National Forests submitted letters to David Bernhart - with the Protected Resources Division, NOAA Fisheries Service in S. Petersburg, Florida (NOAA), and to Jay B. Herrington, Field Supervisor, SC Ecological Services, USDI Fish and Wildlife Service (FWS), notifying them of the forest plan revision process, and requesting lists of federally listed threatened and endangered species, species proposed for Federal listing, and candidate species to be considered for further evaluation throughout the forest plan revision process. Both FWS and NOAA responded back to Robin Mackie with USFS by email (NOAA - 7/23/2013).

Biologists from the Forest including Mark Danaher, Robin Mackie, Danny Carlson, and Thomas Scott met with Section 7 Biologist Paula Sisson with the FWS on January 14, 2015, to review the most updated county lists, and to finalize the list of T&E species that would be addressed in the BA. The FWS commented on the Draft Revised Forest Plan and DEIS on November 10, 2015. Phone calls to discuss revised forest plan direction, determinations, and the process and timeframes for formal consultation were held between the Forest and FWS personnel, including on May 24 and May 27, 2016, and on July 5, 6, and 8, 2016. The most updated county lists of South Carolina At-Risk Candidate, Endangered, and Threatened Species dated 2/10/2015 for Berkeley and Counties (http://www.fws.gov/charleston/EndangeredSpecies_County.html) were reviewed again prior to submission of the BA to the Regional Office to initiate formal consultation.

3. RELEVANT FOREST PLAN DIRECTION

The proposed action is the implementation of a revised Forest Plan based upon the preferred alternative (alternative 2) analyzed in the Final Environmental Impact Statement for the Land Management Plan (referred to as a forest plan) for the Francis Marion National Forest. The Forest Plan and supporting documents are available on the Francis Marion National Forest website at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb5393142. Plan direction relevant for this analysis is provided below.

Language in this section that is quoted directly from the plan is noted with a vertical line on the left margin of quoted text. This document excludes some plan direction not relevant for the analysis of T&E species. Tables and figures retain their original numbering from the forest plan and are not included in the overall table of contents for this Biological Assessment.

a. Desired conditions

Chapter 2 of the revised plan includes coarse-filter desired conditions for forestwide distribution and quality of habitats and conditions for the two management areas and fine-filter desired conditions for rare or sensitive species:

2.1.1 Ecosystem Maintenance and Restoration meets the coarse-filter conditions. At the coarse-filter level, we used a native ecosystem and terrestrial ecological unit framework because native plants and wildlife evolved and adapted within the limits established by natural landforms (rivers, streams, marine terraces, floodplains, etc) and disturbance patterns (fires, extreme storm events, etc.) which existed before extensive human alterations. For more information on the ecological sustainability analysis, see Appendix A of this forest plan. Below is a terrestrial ecological inventory unit map (Figure 2-1) that displays the distribution of potential native ecosystem restoration on the forest (not existing conditions).
2.1.2 Management Areas provides additional direction on the coarse-filter conditions based on our ability to provide the desired fire return intervals in Table 2-1. While there are several important ecological processes (fires, storms, floods, insect outbreaks, etc.), the desired conditions focus on ones that we can actively manage notably fire through prescribed burning. The restoration of fire-adapted ecosystems (desired fire return interval of 5 years or less) is closely linked to our ability to apply frequent (1-3 years), low-intensity fire at a landscape level. To address the role of fire in restoration of these ecosystems, two management areas (See Figure 2-2 and Table 2-2 below and Appendix E for additional map) were developed based on our ability to apply frequent, low-intensity fire on a landscape level and how that would affect our ability to achieve desired conditions for these ecosystems.

- **Management Area 1** is the portion of the Francis Marion where frequent, low-intensity fire can be used at the desired fire return interval for various ecosystems including the fire-adapted ecosystems. These desired conditions are labeled as DC-ECO and are described in the Ecosystem Restoration and Maintenance section below.
- **Management Area 2** is the portion of the Francis Marion where management efforts will have to focus on providing wildlife habitats using herbicides, mechanical methods, etc. The desired conditions for the fire-adapted ecosystems in this portion of the Francis Marion are labeled DC-MA2 and are described in the Management Area section.

2.1.3 Species Diversity describes fine-filter desired conditions for At-Risk species. Additional fine-filter provisions can be found in the Objectives, Resource Integration Zones and Design Criteria sections. We developed fine filter scale provisions, as needed, to ensure the persistence of Francis Marion at-risk species including federally-listed T&E, proposed and candidate species and Species of Conservation Concern known to occur on the forest. See Appendix D for lists of Francis Marion at-risk species and the

relationships to forest plan components. These desired conditions are labeled DC-T&E for federally listed Threatened and Endangered Species and DC-SCC for species of conservation concern that occur on the Francis Marion.

Table 2-1. Forestwide Ecosystem Amount and Distribution and including Historic and Desired Fire Return Intervals on the Francis Marion National Forest

Potential Ecosystem [3]	Administrative Boundary (acres)	Proclamation Boundary (acres)[2]	Historic Fire Return Interval (years)	Desired Fire Return Interval (years)[1]
Upland Longleaf Ecosystems and Loblolly Pine Woodlands	51,500	100,400	1-3	2
Wet Pine Savanna and Flatwoods	85,500	128,400	1-3	2
Depressional Wetlands and Carolina Bay	8,500	11,800	1-6	3
Pocosins	9,300	11,000	2-10	5
Oak Forests and Mesic Hardwood Forests	5,800	10,000	2-35	8
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	43,900	75,200	1-25	5
Broad Forested Swamps and Large River Floodplain Forests	49,200	68,100	1-218	21
Maritime Forests and Salt Marsh	4,000	11,400	2-52	10
Rivers and Streams (*includes aquatic and riparian ecosystems and riparian management zones*)	2,499 miles	1,460 miles	N/A	N/A
Total	**257,700**	**416,300**		

[1] Represents the geometric mean; fire return intervals vary by landscape position and ecosystem type. Historic fire return intervals were developed with input from LandFire and Southeastern Fire Ecologists. Ecosystems with desired fire-return intervals of 5 years or less are referred to throughout the forest plan as fire-adapted ecosystems.
[2] includes other ownerships, such as private and other public lands
[3] Boundaries for ecosystems will be field verified

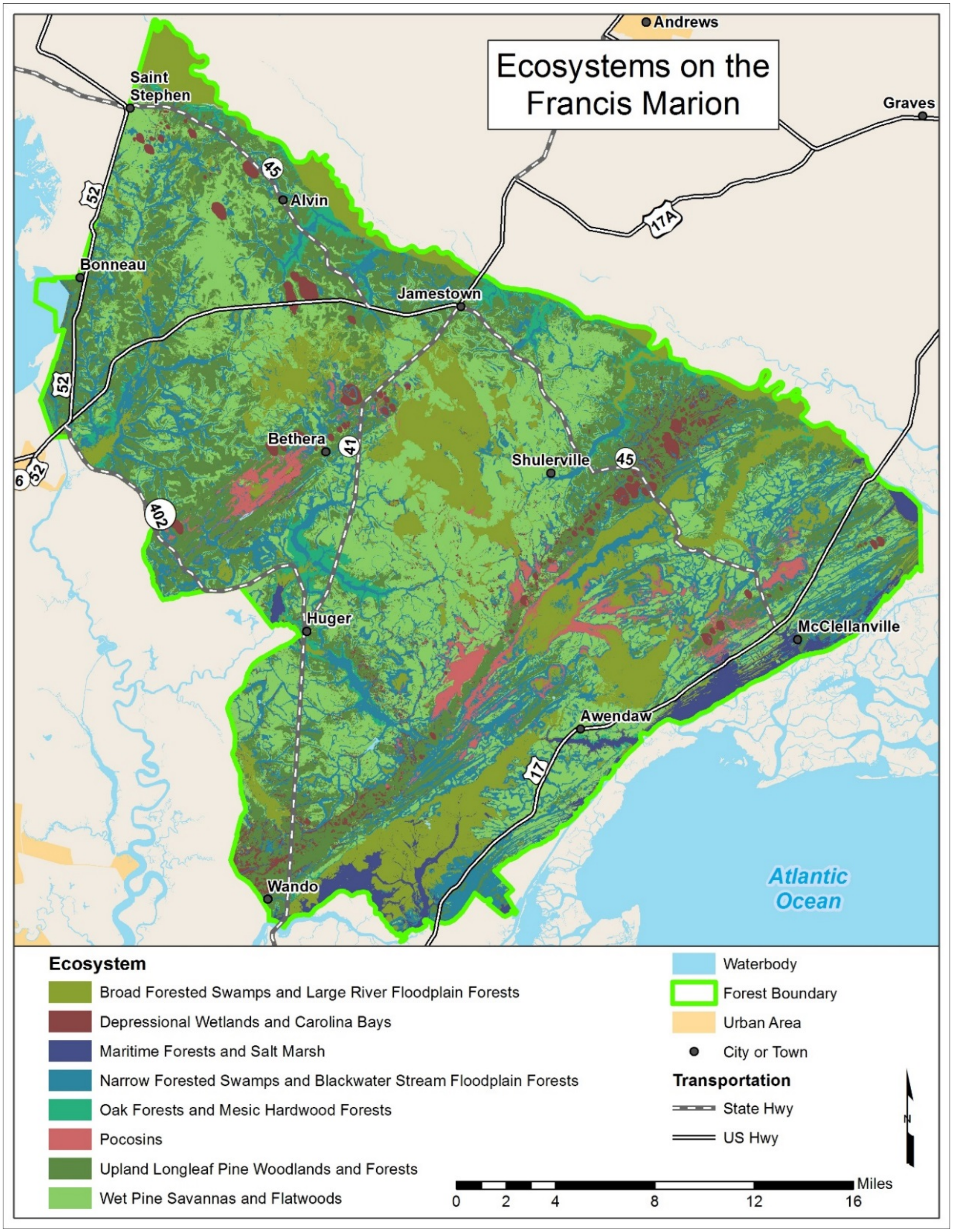

Figure 2-1. Ecosystems (not including Rivers and Streams) on the Francis Marion National Forest

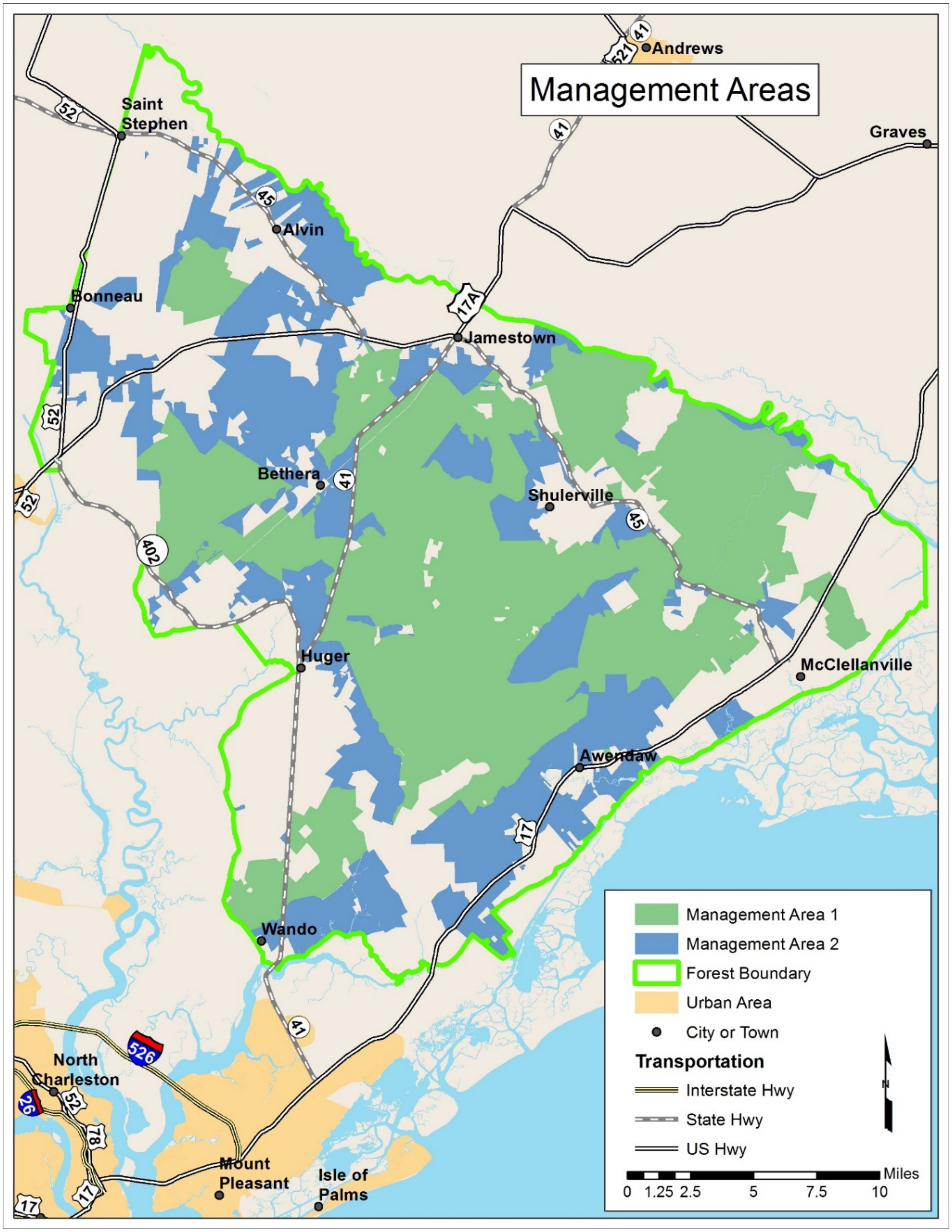

Figure 2-2. Management Areas on the Francis Marion National Forest

Table 2-2. Management Area 1 Ecosystem Acreage and Forestwide

Potential Ecosystem	Management Area 1	Forestwide
Upland Longleaf Pine Woodlands and Forests	33,407	51,990
Wet Pine Savannas and Flatwoods	58,062	86,178
Depressional Wetlands and Carolina Bays	6,385	8,738
Pocosins	7,239	9,177
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	26,073	44,209
Oak Forests and Mesic Hardwood Forests	1,929	5,809
Maritime Forests and Salt Marsh	43	3,978
Broad Forested Swamps and Large River Floodplain Forests	23,039	49,248
Grand Total	156,178	259,326

DC-ECO-2. Upland Longleaf and Loblolly Pine Woodlands

This ecosystem provides habitat for DC-T&E-1. Frosted Flatwoods Salamander, DC-T&E-2. Red-Cockaded Woodpecker, DC-T&E-3. American Chaffseed, and DC-SCC-7. Upland Pine Woodlands Associates. See Figure 2.1-2 for Desired Conditions of this ecosystem.

The upland longleaf pine woodland ecosystems occur on upland landforms of sandy flats with occasional low rolling hills. A key feature of this ecosystem is the drier, non-wetland sites with coarse, well-drained soils that naturally support frequent fire. The vegetation in this system is adapted to frequent, low intensity fires. The extent of this ecosystem within Management Area 1 is an estimated 33,500 acres. Open, loblolly pine-dominated woodlands, which support diverse plant and animal communities, will occur until conversion to longleaf pine can be completed. Where open loblolly pine woodlands provide high-functioning nesting and foraging habitat for red-cockaded woodpeckers and other plant and animal species, the conditions are maintained. In the long term, loblolly pine forest types are converted to longleaf pine.

Variations in upland longleaf plant communities within an ecosystem differ somewhat in composition on xeric to dry, dry-mesic to mesic, and dry to dry-mesic sites, but generally the overstory is dominated by longleaf pine. The mesic phase occurs on moderately well-drained soils, dry-mesic phase on well-drained soils and the xeric phase on excessively to somewhat excessively drained soils.

Composition. Vegetation is most often dominated by:

Overstory: Longleaf pine is the most common and dominant tree canopy species, but many associations have an understory of scrub oaks, including runner oak, blackjack oak, bluejack oak or turkey oak on the most xeric examples. Shortleaf pine may occur as a canopy species. Ericaceous shrubs, including dwarf and black huckleberry, dangleberry and deerberry, and runner oak or oak tree sprouts may be common in

these systems. Upland longleaf woodlands, along with loblolly woodlands and wet pine savanna, form a matrix of pine forests which support a primary core population of the federally endangered red-cockaded woodpecker and provide ecological conditions needed by many other wildlife species (e.g., Bachman's sparrow and Northern bobwhite quail) and at-risk species (e.g., American chaffseed).
Understory: Native grasses and forbs, including a ground cover dominated by bunchgrasses (such as little and big bluestem, and golden and slender Indian grass) and with abundant native legumes and forbs (e.g., grass-leaved golden aster, spurred butterfly pea, Maryland golden aster, bush clover, silvery lespedeza, downy trailing lespedeza, stiff coreopsis, goat's rue and black root).
Structure. The structure of these ecosystems is dominated by open-canopy woodland or savanna conditions.
Canopy: Mature components of upland longleaf pine woodlands are open, with canopy closure typically

Figure 2.1-2. Desired Conditions for Upland Longleaf Pine Ecosystem

less than 60 percent (40-70 square feet of basal area). Snags (dead pine and hardwood trees) occur throughout the forest as a result of abiotic and biotic forces. Scattered large flat-topped longleaf (minimum of 20 feet^{-2} of basal area per acre consisting of trees >= 14 inches in diameter at breast height) are present in the canopy.
Midstory: Shrub and mid-story cover are low, though advanced longleaf regeneration is present. Shrub or low tree cover averages < 30 percent cover and < 3 feet tall.

Groundcover. Groundcover is herbaceous and abundant (>65 percent cover) with diverse native wildflowers and legumes. Some areas have sparse herb layers due to excessively drained soils; the most xeric are dominated by scrub oaks. Scattered clumps of scrub oaks (turkey, bluejack, post scrub, upland laurel and runner oaks) form an understory in these associations.

Ecological Processes. Landscape-level; low-intensity fire averaging every 1 to 3 years is common during the dormant season, but growing prescribed burns occur periodically. Fires burn the parts of herbs and shrubs that are above ground, but have little effect on fire-tolerant trees. Vegetation recovers very quickly from fire, with live herbaceous biomass restored in just a few weeks. Flowering plants are encouraged by frequent burning and result in diverse pollinator habitat and foraging habitat and cover for a number of wildlife species. Longleaf pine colonizes sites over time due to its fire-adapted characteristics and is a relatively long-lived tree species. Prescribed burning mimics the spread of natural fire, beginning in the uplands and spreading into the wetlands.

Landscape Structure and Connectivity. Upland longleaf woodlands form a mosaic with wet pine savannas and flatwoods and other fire-adapted wetland and riparian systems (depressional wetlands and Carolina bays, pocosins and narrow forested swamps and blackwater stream floodplain forests, including canebrakes). Landscapes have a diversity of age classes, though 80 percent are in mid-to-late successional open woodland condition. Old growth Upland Longleaf Pine Woodlands and Forests occur as low density, park-like woodlands and savannas and harbor red-cockaded woodpeckers and a species-rich herbaceous layer.

Multiple age classes may occur within stands. In the long term, the young age component (0-10) of the forest comprises about 6-8.5 percent of the ecosystem. In the short term, this proportion is higher due to conversion to longleaf pine. Areas being converted to longleaf pine may exceed the normal opening size limitation of 80 acres. Open road densities are moderate over time.

Stressors. Longleaf pine-dominated woodlands, savannas and flatwoods are highly diverse and resilient to the effects of climate change, wildland fire and hurricanes. Occurrence of non-native invasive species is low.

DC-ECO-3. Wet Pine Savanna and Flatwoods

This ecosystem provides habitat for DC-T&E-1. Frosted Flatwoods Salamander, DC-T&E-2 Red-Cockaded Woodpecker, and DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates. See Figure 2.1-3 for a picture of the desired conditions.

The wet pine savanna and flatwoods system is abundant on the forest, occurring on seasonally wet mineral soils on low areas within beach ridge systems and aeolian sand deposits, and on poorly drained clayey, loamy or sandy flats, particularly across the Cainhoy ridge, where many high-quality examples

Figure 2.1-3 Desired Conditions in Wet Pine Savannas

may be found. The vegetation is adapted to frequent, low-intensity fire. The potential extent in Management Area 1 is approximately 58,100 acres. Variations in wet pine savanna and flatwoods communities occur on mesic and wet sites where they may differ somewhat in composition, structure and function.

Loblolly Pine on Mesic to Wet Sites. Open loblolly pine-dominated flatwoods and savannas may occur until conversion to longleaf pine can be completed. Where open loblolly pine woodlands provide high-functioning nesting and foraging habitat for endangered red-cockaded woodpeckers and other plant and animal species, existing overstory conditions are maintained. In the long term, the loblolly pine forest types are converted to longleaf pine on the mesic sites and pondcypress or pond pine on the wettest sites. Wet pine savannas and flatwoods fire-adapted ecosystems support a very high diversity of plant and animal species per unit area, including red-cockaded woodpecker, frosted flatwoods salamander, Carolina gopher frog and monarch butterfly. These areas are popular for wildflower viewing and include several species of orchid (grass pink, rosebud, fringed and fringeless) and carnivorous plants (yellow trumpet and hooded pitcher plants and yellow and purple butterworts), and several species of milkweed. Toothache grass is a common indicator plant. Many game species such as Northern bobwhite quail, Eastern wild turkey and white-tailed deer are common.

Composition. Variations in plant communities occur on wet, mineral, seasonally saturated, poorly drained soils, on mesic to wet somewhat poorly drained soils, and include imbedded wet marl savannas.

Canopy: Wet pine savannas and flatwoods are dominated by longleaf pine or pond pine and pondcypress on wetter sites, though loblolly pine may occur. Some of these wetter sites are wetlands.

Understory: With frequent burning (1 to 3-year fire return interval including a growing season burn every third burn), grasses and sedges, flowering plants and low shrubs dominate the ground cover Advanced longleaf regeneration is present, but is less common on the wettest sites of this ecosystem. Herbaceous species indicative of wet pine savanna conditions are common, including toothache grass, wetland white bluestem, savanna hairgrass, rattlesnake master, few-flower milkweed, Barbara's buttons, orange milkwort, hat pins, sunbonnets, foxtail clubmoss and yellow colicroot. Several at-risk species are dependent on these ecosystems (including bearded and many-flowered grass pinks; pineland and short-leaved yellow-eyed grass; frosted flatwoods salamander; pineland and Carolina dropseed; and red-cockaded woodpecker).

Structure. The structure of these ecosystems is dominated by open canopy woodland or savanna conditions. In the short-term when restoring these ecosystems, higher densities of trees may be needed to establish longleaf pine regeneration.

Canopy: The canopy is open and park like. In wet pine savannas, areas of mature trees typically have 30-60 square feet of basal area and may range down to 10 square feet of basal area. In the short term these densities may be higher to help achieve restoration objectives. In flatwoods, areas of mature trees typically have 40-70 square feet of basal area. Scattered large flat-topped longleaf (20 ft.^{2}/acre of trees >14 diameter at breast height) are present in the canopy on mesic sites.

Midstory: The midstory is low and sparse and consists of shrub species, including inkberry or scattered tree sprouts. Shrub or low tree cover averages <30 percent cover and <3 feet tall.

Groundcover: Groundcover is herbaceous and abundant (>65 percent cover), dominated by bunchgrasses with diverse native wildflowers and carnivorous plants, including pitcher plants and orchids.

Ecological Processes. Frequent, low intensity fire averaging every 1 to 3 years is common. Fires are low to moderate intensity resulting in topkill of woody midstory. Associated plants and animals, including longleaf pine, are long lived and colonize available sites over time. Flowering plants and associated pollinators are abundant, triggered by burning and provide foraging habitat and cover for a number of wildlife species. Prescribed burning mimics the spread of natural fire, beginning in the uplands and spreading into the wetlands. These ecosystems are seasonally wet, sometimes with a high water table. Flooding and fire may cause changes in vegetation, particularly at ecotones.

Landscape Structure and Connectivity. Wet pine savannas and flatwoods form a mosaic with upland longleaf and loblolly woodlands, and pond cypress savannas associated with depressional wetlands and Carolina bays; they form continuous blocks of fire-adapted habitat with intact native groundcover well distributed throughout the management area (particularly throughout the Cainhoy ridge, including Halfway Creek, Conifer and Steed Creek Roads).

Wet pine savanna and flatwoods ecosystems consist of various ages, but 70 percent is mid-late successional and open woodlands or savannas. Old growth Wet Pine Savannas and Flatwoods occur as low density, park-like woodlands and savannas and harbor red-cockaded woodpeckers and a species-rich herbaceous layer.

In the long term, the young age component (0-10 age class) of the forest comprises about 6 to 9 percent of the ecosystem. In the short term, this proportion may be higher due to conversions to longleaf pine. Areas being converted to longleaf pine may exceed the normal opening size limitation of 80 acres. Open road densities are moderate over time.

Stressors. Longleaf pine-dominated woodlands, savannas and flatwoods are highly diverse and resilient to the effects of climate change, such as hurricanes, alterations in rainfall and temperature patterns. Occurrence of non-native invasive species is low. Hydrologic patterns are restored where feasible to follow natural breaks between drainages. Few ruts are present.

DC-ECO-4. Depressional Wetlands and Carolina Bays

This ecosystem provides habitat for DC-T&E-1 Frosted Flatwoods Salamander, DC-T&E-4. Pondberry, and DC-T&E-5. Canby’s Dropwort, and DC-SCC-6. Pond Cypress Savannas Associates. See Figure 2.1-4 for a picture of the desired conditions.

Figure 2.1-4 Desired Conditions for depressional wetlands and known breeding wetlands for Carolina gopher frog and frosted flatwoods salamander

Carolina bays and depressional wetlands occur as isolated patches across the landscape, but generally occur in the sand ridges of the longleaf pine matrix and include an herbaceous ecotone or transition area between these and upland and wet-to-mesic longleaf pine ecosystems. Depressional wetlands and

Carolina bay ecosystems are characterized by soils that are semi-permanently or permanently saturated from processes such as groundwater seepage, perched water tables, rainfall or beaver activity. Some are contained within riparian areas as depressional features. The patch size ranges from 1 to 50 acres and the potential extent is approximately 6,400 acres within Management Area 1.

Some important examples of this ecosystem are dominated by pondcypress savannas or herbaceous meadows, and are included as designated critical habitat for the frosted flatwoods salamander including Old Railroad Pond and Sunset Pond. Because the basins are often isolated from larger water bodies and most dry out occasionally, their aquatic fauna does not include fish unless fish have been introduced through hydrologic modifications and flooding. Pondcypress savannas are important for a number of at-risk plants, including 2 federally listed plants, Canby's dropwort and pondberry. Notable high-quality pondcypress savannas on the Francis Marion include Florida Bay, Tibwin Bay, Echaw Road Bay, Halfway Creek Road pond cypress savanna, McConnell Sink and Honey Hill. Several at-risk plants are also associated with fire-maintained herbaceous ecotones occurring between depressional wetlands and Carolina bay ecosystems, and fire-maintained upland and wet to mesic wet pine savanna and flatwoods.

Many depressional wetlands were originally isolated from rivers and streams, but are now connected through ditching. Connecting ditches are removed and depressional wetlands are isolated from rivers and streams. The system is important as amphibian breeding habitat, may support a distinctive aquatic invertebrate community and generally does not support fish. The bays and wetlands provide breeding habitat for Carolina gopher frog and frosted flatwoods salamander. This system supports populations of amphibians and reptiles, including frogs such as the ornate chorus frog, tree frog species such as the barking tree frog, salamanders such as Mabee's salamander, turtles such as the chicken turtle, and snakes such as the crayfish snake.

Composition. A variety of vegetation types are present, depending on the size, depth and frequency of fire, but highest quality examples have an intact native herbaceous groundcover, both within ponds and in the adjacent upland ecotone. Vegetation composition often varies from year to year in response to differences in water levels and drawdown times. Seed banking plays an important role in component communities. The ecotone of these depressions is intact and predominantly herbaceous. Carolina bays have a sand rim often dominated by xeric upland longleaf pine. Wetland-associated species such as panic grasses, rushes, spikerushes, beak-rushes, meadow beauties and marsh-pinks are present and dominate the herbaceous layer. Incidents of non-native invasive species within these ecosystems are low.

Structure. Vegetation includes a series of primarily herbaceous and woodland associations, sometimes strongly zoned. The center or wettest area of these wetlands typically has open water and floating-leaved aquatic vegetation or marsh vegetation of tall grasses.

Canopy: Some trees or shrubs tolerant of standing water, especially baldcypress, pondcypress or tupelo, may grow in the basins, either as scattered individuals, or as a forested canopy over the whole basin. Drier, fire-maintained sites often have an open canopy of pondcypress, with a dense, often fairly species-rich herbaceous layer beneath.

Midstory: few occurrences are shrubby, but none contain the dense shrub layers of characteristic pocosin species that occur in the bays with organic soils.

Groundcover: The understory consists of herbaceous groundcover, including a wide variety of wildflowers, sedges, grasses and legumes.

Ecological Processes. Flooding and persistent saturation is dominant. Frequent, low-intensity fire is maintained at 3 year average fire return intervals. Hydrologic function remains intact; therefore, a diversity of native species, especially vascular plants and amphibians, are found here. During drought, woody species may invade into the depressional ponds and Carolina bays, altering hydrology and groundcover dynamics.

Landscape Structure and Connectivity. Depressional wetlands and Carolina bays are maintained and restored wherever they occur, which is on 3.4 percent of the Francis Marion's forested acres. Where they occur within a fire-maintained landscape (73 percent of which occurs in Management Area 1) frequent,

low-intensity fire is used to prevent encroachment from trees and encourage herbaceous ecotones and ground-cover, important to at-risk amphibians and vascular plants. Wetlands are connected to adjacent habitats, including the continuity of herbaceous understory and intact hydrology, to provide habitat for a number of plant and animal species.

Stressors. These systems and breeding habitats are resilient to the impacts of climate change, primarily alterations in hydrology. Few ruts are present. The incidence of non-native invasive species is low. Hydrologic patterns are intact and follow natural breaks between drainages. Open road and OHV trail densities within 0.5 miles of these systems are low to moderate.

DC-ECO-10. Rivers and Streams (aquatic lotic systems)

This ecosystem provides habitat for DC-SCC-10. River and Stream Associates. See Figure 2.1-10 for a picture of the desired conditions.

Rivers and streams consist of all lotic (flowing water) aquatic systems on the Francis Marion, including ephemeral channels. These systems provide habitat for fish, mussels, crayfish, benthic macroinvertebrates/ invertebrates, reptiles and amphibians. They also provide habitat for a variety of aquatic plants and fauna such as beavers and water birds, as well as periodic use by others such as raccoons.

Aquatic ecosystems occur across the forest and consist of fresh, brackish and tidal rivers and streams including ephemeral streams. Tannic stained blackwater streams are the most common stream type on the Francis Marion; they originate in the Coastal Plain, primarily on the forest itself. The Santee River is considered the only brownwater system as it originates in South Carolina’s mountain region.

Associated riparian areas are 3 dimensional ecotones of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near slopes that drain to the water, laterally into the terrestrial ecosystem and along the water course at variable widths. Riparian areas associated with open water wetlands and perennial and intermittent streams may occur imbedded within narrow forested swamps and blackwater stream floodplain forested ecosystems, broad forested swamps and large river floodplain forested ecosystems, and depressional wetlands and Carolina bays. They occur less commonly in wet pine savanna and flatwoods ecosystems and pocosins.

Riparian management zones are portions of a watershed where riparian-dependent resources receive primary emphasis to maintain or restore riparian and ecological functions. For the Francis Marion, these zones are defined as the area within 100 feet of perennial streams or open water wetlands, or within 50 feet of intermittent streams. Riparian management zones will help maintain the ecological integrity of rivers and streams and their associated aquatic systems.

Desired conditions for aquatic ecosystems and riparian management zones (biological, physical and chemical) are described in narrative form below. Desired conditions for riparian management zones will vary by ecosystem, landscape position, and management area.

Biological. Mature bottomland hardwood - or pond cypress and baldcypress on wetter sites - dominate vegetation in riparian management zones. A diversity of trees and shrubs including loblolly pine, pond pine, and sweet bay, and native cane may be present. Vegetation consists primarily of a diversity of mature hardwood trees and multiple canopy layers that will provide for present and future large wood recruitment and a variety of leaf litter for macroinvertebrates. Intermittent streams are often in close proximity to uplands and prescribed fire may more commonly enter the riparian management zones along them. For this reason, tree composition near intermittent streams may include a more significant pine component.

Aquatic species and community biological diversity, density and distribution are maintained, enhanced or restored. The amount, distribution and characteristics of aquatic habitats for all life stages are present to maintain populations of native species. Aquatic nuisance species are controlled and managed according to Forest Service national and regional guidance, as well as South Carolina state direction. Rivers and

streams provide spawning and rearing areas for aquatic species and influence downstream ecological conditions and processes.

Physical. Instream large wood (>10 cm diameter and >1 m length) is distributed throughout riparian management zones. Instream wood is large enough to create stable habitat diversity and drought resistance. Low intensity fire may occur when streams are used as natural firebreaks, as long as hardwood vegetation persists and soil humus is maintained.

Aquatic organism passage is not hindered as stream habitat connectivity and hydrologic function are maintained or restored. Past hydrologic modifications are restored to natural conditions. The natural range of instream flows is maintained to support channel function, floodplain function and aquatic biota habitat and movement. The physical integrity of aquatic systems, stream banks and substrate is intact and stable. New and replaced road and trail stream crossings are evaluated for aquatic organism passage.

Streams are in dynamic equilibrium (i.e.; stream systems function within natural ranges of flow, sediment movement, temperature and other variables). The geomorphic condition of some channels may reflect the process of long-term adjustment from historical watershed disturbances (e.g., past intensive farming practices and dike and ditching practices). The combination of geomorphic and hydrologic processes with land management activities within the watersheds creates a diverse physical environment, which maintains function and fosters biological sustainability and diversity. The physical integrity of aquatic systems, stream banks and substrate (including shorelines, flow permanence and other components of habitat) is intact and stable.

Canopy cover in riparian management zones provides shade and moisture that regulates stream temperatures. Riparian management zones function as filters to water bodies from sediments and pollutants. To maintain stream bank and channel integrity and water quality, livestock grazing in riparian management zones does not occur. Existing recreational areas, trails and facilities are maintained or improved to minimize impacts on stream banks and water quality.

Chemical. Water quality (e.g., water temperatures, sediment, turbidity, methyl mercury, fecal coliform, dissolved oxygen and pH) remains within a range that ensures survival, growth, reproduction and migration of aquatic and riparian-dependent species, and contributes to the biological, physical and chemical integrity of aquatic ecosystems. It meets or exceeds state and federal standards and is evaluated and improved where necessary and possible to benefit impaired waters and associated aquatic communities.

Figure 2.1-10 Desired Conditions for Rivers and Streams

2.1.2 Management Areas

Two management areas are established for the Francis Marion National Forest (see Figure 2-2 and Figure 2-3). The primary difference between the 2 management areas is the ability to safely apply landscape-level, low-intensity, frequent prescribed fire to maintain or restore fire-adapted ecosystems.

- **Management Area 1 (MA1) -** Management Area 1 encompasses ecosystems that include longleaf pine in the maintenance condition class and provides the most benefit to habitats for at-risk species and fire-adapted terrestrial ecosystems. Desired conditions for ecosystems in MA1 are described in subsection 2.1.1.
  The Forest Service is technically and fiscally capable to manage smoke and public safety associated with prescribed fire in this management area. Therefore natural fire regimes are mimicked, including frequent, low-intensity fire to provide historic fire return intervals across to restore fire-adapted terrestrial ecosystems. See Table 2.1-1 and Figure 2.1-11.
- **Management Area 2 (MA2)-** Most of the ecosystems in Management Area 2 are influenced by adjacent development and human activities; therefore, frequent, low-intensity fire is less likely to be practiced, even though it is desired to restore fire-adapted ecosystems where they have occurred historically. Forest Plan direction in Management Area 2 emphasizes the protection of human communities from wildfire and a flow of early- to late-successional habitats and a sustainable flow of timber for local economies. Use of herbicides, mechanical methods and other management tools will be used more often in MA2 to provide habitats for rare plants and animals. The desired conditions ecosystems in MA2 are described below. See Table 2.1-1 and Figure 2.1-11.

Because applying low-intensity frequent fire at a landscape level may not be feasible, deviation from the desired conditions for fire-adapted longleaf ecosystems would be likely to occur. As management strategies and partnerships are implemented, it may be possible to introduce fire in portions of MA2. *If conditions change such that frequent, low intensity fire can be used, then the desired conditions for the appropriate fire-adapted terrestrial ecosystem applies.*

Table 2.1-1. Fire-adapted ecosystems[1] by Management Area

	Management Area (acres)	
Potential Ecosystem	**MA1**	**MA2**
Upland longleaf and loblolly woodlands	33,500	18,000
Wet pine savannas and flatwoods	58,100	17,400
Carolina bays and depressional wetlands	6,400	2,100

[1] Field inventory is needed to verify the acreages

DC-MA2-1. Mixed Pine/Hardwood or Loblolly Pine Forests

Outside Red-cockaded Woodpecker Clusters: Loblolly pine or mixed pine-oak is the dominant species. To provide early successional habitat and a flow of habitats and forest products over time, 12-20 percent of the forest is young age component (0-10 years old). (Note: these systems would have occurred historically as either upland longleaf ecosystems (DC-ECO-1) or wet pine savanna and flatwoods ecosystems (DC-ECO-2)). Forest canopies are typically closed. Understories are typically woody vegetation with little herbaceous cover. Forests generally have densities of 50-100 feet^2 of basal area.

Within Red-cockaded Woodpecker Clusters: Guidelines for the management of cavity trees and clusters from the most recent species recovery plan are considered. All potential cavity trees (pines greater than 60 years in age) within clusters are retained, unless pine basal area is above 50 feet^2 and all trees are above 60 years in age. Hardwoods do not exceed 10 feet^2 of basal area on pine sites and do not occur within 50 feet of the cavity trees. Soil disturbance that negatively impacts native ground cover is avoided.

DC-MA2-2. Depressional Wetlands, Carolina Bays and Pocosins

Due to less frequent fire return intervals than in Management Area 1, depressional wetlands and Carolina bays are often forested and pocosins have a larger component of pond pine. Flooding continues to be a major driver within these ecosystems, though hydrology in isolated wetlands is driven by rainfall patterns, shallow groundwater, substrate patterns and the amount of forested vegetation, which influences evapotranspiration. While climate change impacts cannot be eliminated, corridors allow for migration of species. Embedded riparian areas, riparian management zones and aquatic habitats are maintained and restored.

Figure 2.1-11 Open pine forest after prescribed burning

Federally Listed Threatened and Endangered Species

Optimal ecological conditions and viable populations for the following federally-listed species will occur within Management Area 1, where the prescribed fire needed to maintain and restore them is most likely to occur. See the desired conditions in **DC-MA2-1. Mixed Pine/Hardwood or Loblolly Pine Forests** for more information on management of red-cockaded woodpecker clusters in Management Area 2.

DC-T&E-1. Frosted Flatwoods Salamander

Maintain and restore ecological conditions for the federally threatened Frosted Flatwoods Salamander within designated critical habitat on the forest (See Figure 2.1-14 below), which includes 1,175 acres on national forest land within the Wando Resource Integration Zone). Within this zone seasonally flooded isolated wetlands provide high quality breeding habitat, while surrounding fire-maintained longleaf-pine dominated woodlands and savannas provide migration routes. Restore continuous native herbaceous ground-cover and soil and hydrologic characteristics which support the natural function of these groundwater-dependent ecosystems. Information is obtained to ensure successful reproduction and recruitment of the frosted flatwoods salamander.

DC-T&E-2. Red-Cockaded Woodpecker

Upland longleaf and loblolly pine woodlands and wet pine savanna and flatwoods ecosystems within Management Area 1 support a recovered population for red-cockaded woodpecker of 350 potential breeding groups and 450 active clusters. See Figure 2.1-13. The Francis Marion supports the third largest population of the federally endangered red-cockaded woodpecker in the United States and is 1 of 13

designated primary core recovery populations identified in the Red-cockaded Woodpecker Recovery Plan posted on http://www.fws.gov/rcwrecovery/. High quality nesting and foraging habitat occurs as upland pine and wet pine savanna ecosystems within 0.5 miles of cluster centers and includes large, live old pines which provide cavity trees for nesting, low densities of small pines, little to no hardwood mid-story, and diverse and abundant herbaceous ground-cover. Guidelines in the most recent Recovery Plan in the management of cavities, clusters, foraging habitat, and monitoring are considered during project development.

DC-T&E-3. American Chaffseed

Upland longleaf pine ecosystems within Management Area 1 support viable populations for the federally-endangered American chaffseed at known and historic locations. High quality habitats for the species are maintained which have a very open forest canopy with a diverse native herbaceous component maintained with low intensity, 1-3 year prescribed fire desired return interval or mowing. Opportunities to expand populations are explored with the U.S. Fish and Wildlife Service. American chaffseed is maintained along roadsides in coordination with the South Carolina Department of Transportation.

DC-T&E-4. Pondberry

Depressional wetlands and Carolina Bays within Management Area 1 support viable populations for the federally-endangered pondberry at known existing and historic locations. High quality habitats are maintained and restored as pond cypress savannas and include an open canopy and an abundant herbaceous groundcover. Opportunities to expand populations are explored with the U.S. Fish and Wildlife Service.

Figure 2.1-13 A Red-cockaded Woodpecker flies toward a cavity tree

DC-T&E-5. Canby's Dropwort

Depressional wetlands and Carolina Bays within Management Area 1 support viable populations for the federally Canby's dropwort within pond cypress savannas at known existing and historic locations for the species. High quality habitats are maintained and restored as pond cypress savannas with an open canopy and an abundant herbaceous groundcover. Opportunities to expand populations are explored with the U.S. Fish and Wildlife Service.

b. Objectives and management strategies

Chapter 3 of the proposed plan describes the objectives and management strategies that will be used to achieve the desired conditions and objectives.

OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration
Prescribed Fire-Base level: Apply prescribed fire on at least 30,000 acres per year to maintain or restore fire-adapted ecosystems including longleaf pine woodlands, savannas and flatwoods, Carolina bays and depression ponds, and narrow river floodplains and swamps. Include at least 4,500 acres of those 30,000 acres (or approximately 15%) as growing season burns (April 1 – September 30) annually.
Prescribed Fire above base level: Within 3 years of plan approval, increase the amount of prescribed fire by 20,000 acres per year for a total of 50,000 acres per year of prescribed fire. Include approximately 16,500 acres of those 50,000 acres (or approximately 33 percent) as growing season burns annually. Check if any new burn blocks that are currently in Management Area 2 and should be converted to Management Area 1 conditions.
Management Strategy: The *Prescribed Fire-Base level* is based on the current prescribed burning program and that the fire program can be developed to achieve the *Prescribed Fire above base level.* Due to factors, such as weather conditions, it is anticipated that the prescribed burning program would typically vary annually between 30,000 to 50,000 acres total. Similarly, the amount growing season burning would vary between 10,500 to 16,500 acres annually of the total amount. Stewardship contracting has the potential to increase funding opportunities, while partnerships and Wyden amendments could create efficiencies, such as reducing the amount of bladed fireline needed, in order to increase the prescribed fire potential. Collaboration with adjacent landowners and regulatory agencies requires particular attention in areas that have not had prescribed fire.

OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems
Maintain or restore upland longleaf and mesic wet pine savanna and flatwoods ecosystems and loblolly pine forest on approximately 91,500 acres in MA 1 within 10 years of plan approval. Provide 68,500 acres in maintain condition class of the Upland Longleaf and Wet Pine Savanna Flatwoods ecosystems in MA 1 within ten years of plan approval. Maintain open pine woodlands or savannas with a canopy closure less than 60 percent (10-60 feet^2 basal area) in Management Area 1.
Longleaf Pine Base Levels: Maintain an existing 42,500 acres of longleaf pine by using the ecological processes of landscape-level, frequent, low-intensity prescribed fire, or by using other vegetation management practices to reach desired densities.

Loblolly Pine Base Levels: Maintain ecologically functioning loblolly pine woodlands on 49,000 acres by using the ecological processes of landscape-level, frequent, low-intensity prescribed fire or by using other vegetation management practices to reach desired densities.
Longleaf Pine above base level: Restore 26,000 acres of longleaf pine ecosystems by moving loblolly pine, mixed pine and longleaf pine forest-types to the desired structure and composition for longleaf pine ecosystems in Management Area 1 (15,000 acres of wet pine savanna longleaf and 11,000 acres of upland longleaf ecosystems) within 10 years of plan approval;

Management Strategy: Maintenance and restoration efforts can be achieved through a timber sale program and prescribed burning in Management Area 1. A priority is to maintain longleaf pine ecosystems in the maintain condition class and restore longleaf ecosystems improve condition class (as defined in the rangewide strategy for longleaf pine). To restore longleaf pine on xeric to mesic sites, different approaches are needed depending on the existing conditions:

- Open loblolly pine-dominated flatwoods and savannas would be maintained to provide suitable habitat conditions for at-risk species until conversion to longleaf pine can be completed in the long-term.

- Some longleaf pine stands have the desired overstory composition, but not the desired structure, due to lack of fire. Introducing prescribed fire back into these stands will create the desired structure and move toward meeting the desired conditions.
- Some stands consist of younger mixed loblolly-longleaf pine overstory that can be moved toward the desired overstory composition by favoring longleaf pine during thinning.

OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays
Maintain, improve, or restore Pond Cypress Savannas within Carolina bays and depressional wetlands on 6,400 acres within Management Area 1 within 10 years of plan approval.
Management Strategy: Provide desired conditions through frequent and growing season fire that controls the encroachment of woody species in and adjacent to wetlands within Management Area 1.

OBJ-MA2-2. Flow of Age Class

Provide at least 5,000-6,000 acres of young age component (0-10) forest in loblolly pine or mixed pine-hardwood forests within Management Area 2 within 10 years of plan approval.

Management Strategy: The strategy is to provide a flow of early to late-successional habitats; reducing hazardous fuels; and providing a sustainable amount of high-quality timber for local economies using primarily timber harvest.

3.2 Species Diversity

OBJ-T&E-1. Frosted Flatwoods Salamander
Restore 1 to 2 additional breeding sites for frosted flatwoods salamander breeding wetlands along the Talbot Terrace within 10 years of plan approval. Maintain the 6 known breeding wetlands.
Management Strategies: It is anticipated that the US Fish and Wildlife Service (FWS) will release a recovery plan for frosted flatwoods salamander. The Francis Marion will work toward meeting the recovery goals when a recovery plan is released and coordinate with partners to expand the population.

OBJ-T&E-2. Red-Cockaded Woodpecker
Provide open longleaf woodlands for a red-cockaded woodpecker population of at least 450 active clusters and 350 potential breeding groups with 10 years of plan approval. Support an average red-cockaded woodpecker group size greater than 3 birds per group and reproductive success averages greater than 2 fledglings per successful nest with 10 years of plan approval.
Management Strategy: The forest supports a recovered population for the red-cockaded woodpecker in upland longleaf and wet pine savanna ecosystems within Management Area 1 and contributes towards range-wide recovery efforts. Every project with the potential to affect red-cockaded woodpecker, will consider the terms and conditions of the biological opinion, and guidelines in the most recent species recovery plan.

OBJ-T&E-3. Threatened and Endangered Plant Species
Provide ecological conditions to support maintain and restore 9 stable to increasing populations for the federally endangered American chaffseed; 5 stable to increasing populations for the federally endangered pondberry; and 3 stable to increasing populations for the federally endangered Canby's dropwort within 10 years of plan approval.
Management Strategy: Management strategies for maintaining and restoring T&E Plants include frequent prescribed fire, open canopies, and population enhancement and propagation conducted in close coordination with the USFWS. The Forest will coordinate with SCDOT in the maintenance of American chaffseed along roadsides, and will manage habitats adjacent to roadsides to facilitate the management and movement of stable to increasing populations within natural stands.

OBJ-SCC-3. At-risk Species

Maintain or restore ecological conditions needed to provide stable to increasing populations for at-risk species on at least 25,000 acres per year. Prioritize habitat restoration for declining species (listed in order of priority): 1). Federally-listed T&E species; 2). Species of Conservation Concern with fewer than 5 known forest occurrences; 3) At-Risk Species of high public and external interest.

Maintain and restore ecological conditions for species of conservation concern as rare plant communities on 4600 acres identified across the RIZs and at-risk species associates. See Appendix D for At-risk species and Appendix E for map of rare plant communities.

Management Strategy: Collaborate with federal, state, non-government agencies (NGO's), and private partners to maintain and restore populations and associated habitats for At-risk Species using an all-lands approach.

- Collect and share inventory and monitoring information which documents locations, trends, habitat condition, threats, and management responses.
- Conduct propagation and population enhancement activities to maintain and enhance genetic diversity, encourage gene flow, and improve resistance to climate change and population resilience.
- Conduct widespread inventories for at-risk species populations to improve our understanding of distribution, habitat condition, threats and management needs.
- Maintain up-to-date digital databases of species occurrences and trends to share with State Wildlife and Heritage Programs, U.S. Fish and Wildlife Service, the South Atlantic Landscape Cooperative, Natureserve, and others.

OBJ-MUB-7. Wood Products

Wood Products Base Level: Within 10 years of plan approval, provide 60 MMCF of wood products from lands suitable for timber production. This level is established in recognition of current fiscal capability and organizational capacity.

Wood Products Desired level: Within 10 years of plan approval, provide a projected timber sale quantity (PTSQ) of 98 million cubic feet (MMCF) from lands suitable for timber production. In the second decade this quantity is 95 MMCF.

Management Strategy: The PTSQ is used to achieve desired conditions for ecological restoration and forest health objectives on national forest lands. Tree harvest is also used for other resource objectives, such as reducing hazardous fuels and establishing a sustainable flow of early and late seral habitats. The projected timber sale quantity is estimated using a variety of assumptions (see Appendix B for supplemental information).

Timber harvest priorities in the first decade are:

1. Convert loblolly pine to longleaf pine in Management Area 1; See OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems;
2. Thin 17,000 acres of pine stands to desired densities;
3. Regenerate pine stands in Management Area 2 to provide early-successional habitat; and
4. Improve composition of maritime forests and oak and mesic hardwood forests.

c. Standards and guidelines

Standards and guidelines are design criteria that constrain implementation of management activities. By providing additional direction, standards and guidelines help achieve desired conditions or objectives, resolve apparent conflicts among objectives, avoid or mitigate undesired effects and align forest management activities with legal requirements. Standards are considered mandatory and violation requires an elevated level of review, whereas actions may deviate from guidelines with appropriate documentation and analysis justifying the deviation.

The standards and guidelines below are those most applicable to federally listed species occurring on the Francis Marion National Forest and their habitat.

S1. Do not exceed 80 acres for even-aged openings for pine and pine-hardwood types and 40 acres for hardwood and hardwood-pine forest types except as follows:

- Where the forest type is being converted to longleaf pine or for other restoration activities
- Where areas are managed as permanent openings (e.g., meadows, pastures, food plots, rights-of-way, woodlands, savannas and grasslands) even when within or next to created openings.
- Where natural catastrophic conditions such as fire, insect or disease attack or windstorm have occurred.

Proposals to exceed the even-aged opening limitations stated above are subject to 60 days public notice and review by the regional forester. Even-age regeneration areas are no longer considered openings when the reestablished stand has reached an age of 5 years. Even-aged or two-aged regeneration cutting may be scheduled next to uneven-aged stands at any time. Uneven-age harvest areas have no size limitations or dispersion requirements.

S13. Use seed mixtures that contain genetically and ecologically appropriate native species. Use of non-native plants is allowed when it complies with Forest Service policy.

S14. Remove large wood added by harvest activities to streams unless it is compatible with native vegetation and aquatic habitat objectives and approved by a biologist. This is an exception to state BMPs.

S17. Do not use mechanical equipment on plastic soils when the water table is within 12 inches of the surface, or when soil moisture exceeds the plastic limit. Soil moisture exceeds the plastic limit if the soil can be rolled to pencil size without breaking or crumbling.

S19. Meet or exceed State Best Management Practices for water quality. See Standard S14 above.

S26. No firelines, temporary roads, or log landings in population sites for at-risk plant species, except as needed to protect facilities, private property, or public safety.

S27. Protect existing red-cockaded woodpecker cavity trees during prescribed burning operations. Only use low-intensity fire within the cluster and around cavity trees to keep hazardous fuels at acceptable levels. Prior to prescribed burning clear vegetation and fuels around cavity trees or mulch around cavity trees.

S30. Use only aquatically labeled herbicides and surfactants within designated critical habitat for frosted flatwoods salamander and known habitat for Carolina gopher frog.

S32. Retain at least 4 suitable cavities within each active red-cockaded woodpecker cluster on the forest.

S33. Retain all potential red-cockaded cavity trees (pines greater than 60 years in age) within red-cockaded woodpecker clusters, unless pine basal area is above 50 feet^2/acre and all trees are above 60 years within the clusters; protect red-cockaded woodpecker cavity trees by shielding cavities with restrictors, painting known cavity trees with highly visible paint, or replacing lost cavities with artificial ones.

S34. Require equipment cleaning practices on equipment, using equipment cleaning clauses in contracts, permits and agreements, when moving equipment from areas infested with non-native invasive plants (FSM 2903).
S35. No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species.
S36. Use plant materials that contain genetically appropriate native plant species when maintaining and restoring vegetation. Use of non-native plants is allowed only when in compliance with Forest Service native plant policy (FSM2070).
S38. Cutting of active red-cockaded woodpecker cavity trees is prohibited unless formally authorized by the FWS.
S39. Use low psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites.
S40. Do not use soil active herbicides (imazapyr, imazapic) in population sites for at-risk plant species.
S41. Maintain and restore viable populations and associated habitats for At-risk Species using an all-lands approach.

- Develop management practices which maintain and restore at-risk species populations and their habitats during project planning and implementation.
- Implement mitigating measures to minimize impacts of recreation use and restoration activities on populations for at-risk species where needed.
- Ensure that prescribed burning of fire-adapted at-risk species and rare communities occurs at desired seasons and intervals.
- Align land acquisition practices to result in improved connectivity among habitats for at-risk species where needed.
- Adapt our management of at-risk species and habitats in response to population and habitat monitoring information.

G4. Tree stands planned for regeneration harvest should generally have reached culmination of mean annual increment of growth. Typically, even-age regeneration harvests should not be made prior to age 35 for loblolly pine or age 50 for longleaf pine. However, plantations of loblolly pine on longleaf pine sites may be harvested for restoration purposes as soon as they are merchantable. Generally, hardwood regeneration harvests will not be made prior to age 50.
G33. Temporary or new system roads, log landings and firelines should be located outside primary (538 feet) and secondary zones (1,476 feet) from the edge of known breeding ponds for frosted flatwoods salamander.
G35. Guidelines and recovery objectives in the most up-to-date recovery plan should be considered for all federally-listed species, when available. Collaborate with U.S. Fish and Wildlife Service in the conservation of at-risk species.
G36. Do not allow any mechanical activities within active red-cockaded woodpecker clusters during the nesting season (April 1– July 31). Exceptions may be made at the project level with authorization from the U.S. Fish and Wildlife Service.
G40. Encourage the use of weed-free materials (including but not limited to gravel, mulch, seeds, plant materials) to limit the accidental introduction and spread of non-native invasive plant species (including but not limited to gravel, mulch, seeds, plant materials)(FSM 2900). If certified weed-free materials become available in SC, then the use of those certified weed-free materials would be required for use on national forest lands.
G41. Commercially-purchased seed mixes should be tested by a certified seed laboratory for purity, viability, and noxious weed seed.

4. SPECIES CONSIDERED AND EVALUATED

Following a review of county lists and additional consultation with FWS in November 2014, and a follow-up meeting on January 13, 2015, we determined that the following threatened or endangered species are known or likely to occur on the Francis Marion Ranger District in Charleston and Berkeley Counties (Table 1).

Table 1. Threatened or endangered species considered in this analysis.

Common Name	Scientific Name	Taxonomic group	Status	Associated Ecosystem(s) on the Forest
American chaffseed	*Schwalbea americana*	Vascular Plant	Endangered	Fire-maintained upland longleaf and loblolly pine-dominated woodlands
Atlantic sturgeon	*Acipenser oxyrinchus*	Fish	Endangered	Larger rivers on or adjacent to the Forest
Bachman's warbler	*Vermivora bachmanii*	Bird	Endangered	Broad and narrow forested wetlands
Canby's dropwort	*Oxypolis canbyi*	Vascular Plant	Endangered	Fire-maintained Carolina bays and depressional wetlands
Frosted flatwoods salamander	*Ambystoma cingulatum*	Amphibian	Threatened, Critical Habitat	Fire-maintained upland longleaf woodlands; wet pine savannas and flatwoods, Carolina bays and depressional wetlands in the Wando Area of the Forest
Pondberry	*Lindera melissifolia*	Vascular Plant	Endangered	Fire-maintained Carolina bays and depressional wetlands
Red-cockaded woodpecker	*Picoides borealis*	Bird	Endangered	Fire-maintained upland longleaf and loblolly pine woodlands and wet pine savannas and flatwoods
Shortnose sturgeon	*Acipenser brevirostrum*	Fish	Endangered	Larger rivers on or adjacent to the Forest
West Indian manatee	*Trichechus manatus*	Mammal	Endangered	Larger rivers on or adjacent to the Forest
Wood stork	*Mycteria americana*	Bird	Threatened	Foraging only in streams and rivers; and depressional wetlands

SPECIES NOT LIKELY TO OCCUR ON THE FRANCIS MARION

We determined, and USFWS agreed, that the following species were not likely to occur on the forest nor be impacted by Forest Service actions: piping plover, red knot, finback whale, humpback whale, right whale, seabeach amaranth, green sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle. The bald eagle will be treated as a species of conservation concern and will be protected under the Bald and Golden Eagle Protection Act.

5. EFFECTS OF FOREST PLAN ON FEDERALLY LISTED SPECIES

a. AMERICAN CHAFFSEED (*SCHWALBEA AMERICANA*)

American chaffseed is a perennial herbaceous plant in the figwort family (*Scrophulariaceae*). Recovery criteria include “[B]iennial monitoring shows that 50 protected populations are viable as well as stable or increasing over a 10-year period”, and “[L]ong-term protection is achieved for 50 geographically distinct, self-sustaining populations.” The FWS conducted a 5-year review for American chaffseed in 2010, and identified 1 site/each in Alabama, Florida, and Louisiana, 2 in New Jersey, 11 in North Carolina, and 33 in South Carolina. The Francis Marion National Forest supports 4 existing American chaffseed populations in 2014, of 9 populations and 20 occurrences once documented. Numbers of American chaffseed plants on the forest declined by 64% between 2001 and 2014, and three populations have likely become extirpated (Ballfield, Hwy. 41, and Cordesville). Two new experimental populations were established or enhanced with plants from an adjacent seed source in 2014. All recently documented populations are shown in Figure 7-1 below. There have been numerous plant surveys on the forest since 2000 documenting results of plant surveys for American chaffseed, as well as other rare and non-native invasive plants, particularly in proposed timber sale areas.

Several studies have documented the dependence of American chaffseed on frequent prescribed fire and on the Francis Marion National Forest declines are evident after two years without fire (Kirkman et.al., 1998; Streng and Glitzenstein, 2004). In addition, the species may benefit from late summer burns that expose mineral soil (Glitzenstein, personal observations). Additional threats to the species include destruction and adverse modification of habitat through development and incompatible agriculture and silviculture practices, illegal pine straw raking, incompatible right-of-way activities, non-native invasive plants, drought, genetic bottlenecks, and herbivory (USDI, 1995; 2010). Two of the existing four populations on the Forest include individuals which occur along state-maintained road rights-of-ways, sometimes threatened by inappropriate mowing regimes, though signs direct that mowing occur outside the timing of seed set. See Figure 7-1.

Optimal habitat for American chaffseed on the Francis Marion National Forest is upland longleaf or loblolly pine woodlands, which is abundant on the forest, maintained very open with frequent prescribed fire or mowing and a diverse herbaceous component. Fire-maintained upland woodland habitat for the plant is abundant on the Forest, and all known and historic populations for the species occurred in a longleaf restoration area in the 1996 Forest Plan. Nevertheless, stands containing American chaffseed on the forest would benefit from canopy or mid-story thinning and shrub reduction - and some have been proposed. Others would likely benefit from more growing season or late summer burning. Population monitoring also suggests that habitats are negatively impacted by bracken fern, which persists under a dormant season burning regime. Some individuals have been impacted by inappropriate mowing regimes along associated state maintained rights-of-ways, and several meetings to better coordinate appropriate mowing activities with the SCDOT.

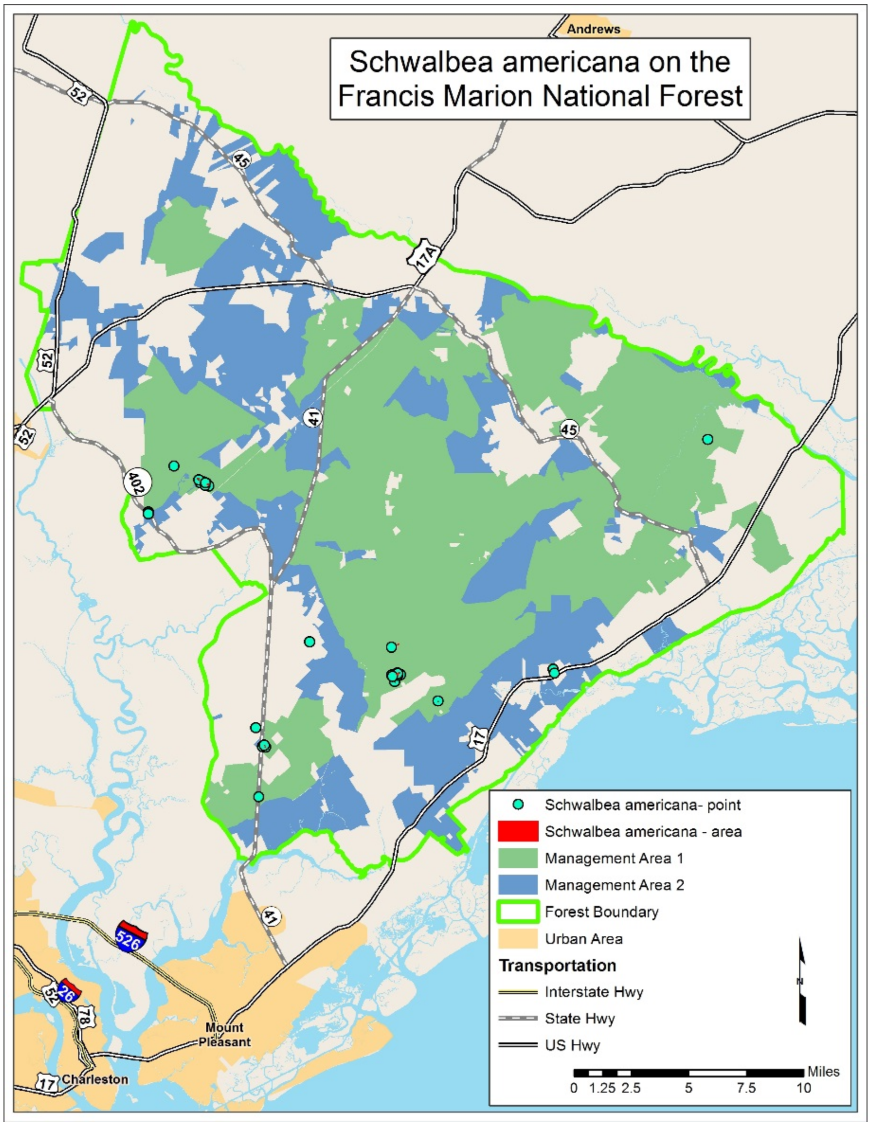

Figure 7-1. Locations of American Chaffseed on the Francis Marion National Forest

Effects of forest plan

Direct effects of the Revised Forest Plan to individual federally endangered American chaffseed plants are unlikely but could result as a result of habitat restoration activities within associated longleaf ecosystems, including timber harvest, mechanical chipping, non-native invasive species control, selective herbicide application, or fireline construction. Impacts to individuals will be minimized adherence to the following standards and guidelines:

> S34. Require equipment cleaning practices on equipment, using equipment cleaning clauses in contracts, permits and agreements, when moving equipment from areas infested with non-native invasive plants (FSM 2903).
> S35. No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species.
> S36. Use plant materials that contain genetically appropriate native plant species when maintaining and restoring vegetation. Use of non-native plants is allowed only when in compliance with Forest Service native plant policy (FSM2070).

S39. Use low psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites.
S40. Do not use soil active herbicides (imazapyr, imazapic) in population sites for at-risk plant species.
S41. Maintain and restore viable populations and associated habitats for At-risk Species using an all-lands approach.

- Develop management practices which maintain and restore at-risk species populations and their habitats during project planning and implementation.
- Implement mitigating measures to minimize impacts of recreation use and restoration activities on populations for at-risk species where needed.
- Ensure that prescribed burning of fire-adapted at-risk species and rare communities occurs at desired seasons and intervals.
- Align land acquisition practices to result in improved connectivity among habitats for at-risk species where needed.
- Adapt our management of at-risk species and habitats in response to population and habitat monitoring information.

Restoration activities to achieve desired conditions for upland longleaf woodlands are expected to benefit the plant in Management Area 1. Additional management actions that will benefit American chaffseed include population enhancement and propagation conducted in close coordination with the FWS, coordination with SCDOT in the maintenance of American chaffseed populations along roadsides, and management of habitats adjacent to roadsides to facilitate the management and movement of stable to increasing populations within natural stands. Although all attempts are made to survey and flag individuals prior to the onset of activities, due to the cryptic nature of this plant, individuals could go undetected, particularly if the species were to occur in MA 2. Therefore, although forestwide desired conditions, objectives and design criteria will benefit populations, management activities could result in the loss of individuals.

Public land plays a critical role in the conservation of federally listed plants, which receive no protection on private lands, and all T&E habitats, which receive no protection on private lands. During the next 10 to 50 years of forest plan implementation, human populations are likely to expand, affecting urbanization, roads and associated traffic, and prescribed burning and smoke management. This suggests that public land will play an increasingly important role in the conservation of threatened and endangered species in the future, but that management to ensure recovery and/or prevent federal listing of species will be an increasingly difficult challenge. Partnerships to facilitate introduction in known and historic habitats could lead to increased connectivity of these populations and enhanced genetic diversity.

Determination

Although Revised Plan implementation will primarily result in discountable, insignificant, or completely beneficial effects to American chaffseed, management activities **may affect, and are likely to adversely affect** individuals of American chaffseed on the Francis Marion National Forest. Despite implementing activities with protection measures to avoid impacts to this species, the active management required to maintain high-quality habitat conditions may harm individual plants over the 10-year period of plan implementation. This determination is a result, primarily, of management activities within Management Area 1 which maintain and restore associated upland longleaf woodland ecosystems and habitats with open mid-story, shrub, and tree canopies and desired 1-3 year fire regimes, including a growing season burn every third burn, where activities could include mastication, selective herbicide application, timber harvest, and fireline and road reconstruction. Despite potential effects to a small number of individual plants, implementing the plan will result in maintenance and restoration of at least nine viable populations for the federally endangered American chaffseed at known or historic locations.

b. SHORTNOSE STURGEON (*ACIPENSER BREVIROSTRUM*) AND ATLANTIC STURGEON (*ACIPENSER OXYRINCHUS*)

Shortnose sturgeon was once widely distributed throughout coastal river form St. John River, Canada to the St. Johns River, Florida. Occurring primarily in large river mainstreams and just off shore where the species can access other river systems. There are currently five distinct populations in South Carolina. The Santee and Cooper populations are adjacent to the Forest. This fish is anadromous, with adults spawning at or above head-of-tide in most rivers. Spawning occurs late winter/early spring based on water temperature rise and delayed by high flows (National Marine Fisheries Service 1998). Historically shortnose sturgeon would have migrated much further upstream in the spring to spawn. Migration is now hindered my major hydroelectric dams. However, besides seasonal migrations to estuarine waters these fish rarely occur in marine environment.

Of the two adjacent populations the Cooper River has an estimated population of 200 adult, spawning-run individuals (Cooke 2004). However, little is known about population size. There is an additional landlocked population in the lakes upstream. The Santee River does not allow for passage of sturgeon. Habitat management for large river species is not within the authority or capability of the Forest Service to maintain viable populations, but management of forest lands in those watersheds that maintain or restore biological, chemical and physical attributes would contribute to the protection of large river habitats.

Atlantic sturgeons occur from St. Croix, ME to the Saint Johns River, FL, primarily in the near shore ocean. During breeding season, it migrates to freshwater rivers for spawning. The Carolina distinct population segment ranges for the Santee-Cooper River to the Albemarle Sound and consist of seven extant subpopulations. Over 60% of the habitat available is impeded due to the presence of dams. Currently, the existing spawning populations in each of the rivers in the Carolina distinct population segment have less than 300 adults spawning each year (Cooke).

Habitat management for large river species is not within the authority or capability of the Forest Service to maintain viable populations, but management of forest lands in those watersheds that maintain or restore biological, chemical and physical attributes would contribute to the protection of large river habitats.

Pollution, loss of upstream habitat and over fishing are the primary causes of the species listing of the shortnose sturgeon in 1967 and the Atlantic in 1998. The Santee Dam hinders (some passage has been observed) migrations of native anadromous fish to their historic spawning grounds in the piedmont. These include shad, striped bass, and sturgeon (Francis Marion National Forest Draft Forest Plan Assessment 2013). Overall threat impact to these species includes population decline due to dams which cut off upriver spawning areas; altered stream flow; temperature; and water quality. Habitat degradation remains a threat. Other factors include siltation, habitat disruption from dredging, and overharvest.

The two federally listed sturgeon species occur only in the large rivers draining National Forest land and surrounding areas. Most of the lands immediately adjacent to these rivers are in private ownership. The Santee and Cooper Rivers are dammed and habitat within these two rivers is very dependent on the dam management. Habitat management for these large river species is not within the jurisdiction of the Forest Service, but management activities that reduce impacts to water quality and instream habitat would contribute to the protection of large river habitats in those watersheds.

Effects of forest plan

No direct or indirect effects from management are anticipated. All major hydrologic alterations on Francis Marion National Forest watersheds occur on privately owned adjacent lands and are outside of Forest

Service control. The Francis Marion National Forest is not expected to contribute negative impacts to hydrologic regimes. The Francis Marion National Forest does not contribute to nor manage for non-point source pollution therefore no effects to this species are anticipated. Forest activities, such as thinning, regeneration, prescribed fire, and maintenance may contribute temporary low levels of sediment but will not add significant measurable amount of sediment the large rivers.

In most watersheds, Francis Marion National Forest sediment contributions are minor when compared to neighboring land uses. Cumulatively, sedimentation and herbicide and pesticides from the Francis Marion National Forest are predicted to have no effects on shortnose and Atlantic sturgeon habitat due to forest-wide standards and guidelines designed to protect water quality and aquatic habitats. Watershed activities that are proposed as part of the Forest Plan (like head-cut remediation and bank stabilization) caused from historical land practices would help reduce the input of sediment into streams. In all cases, best management practices and guidelines intended to minimize sediment risk levels would minimize risks to these species.

Determination

With protective measures and guidelines implemented, the revised forest plan will have **no effects** on the shortnose and Atlantic sturgeons.

c. BACHMAN'S WARBLER (*VERMIVORA BACHMANII*)

Although suitable habitat for the Bachman's warbler can be found on the forest, the last confirmed sighting was in 1963 on private lands. Bachman's warbler (*Vermivora bachmanii*) was discovered in July 1832 in Cardin Bridge Swamp, South of Charleston on the Edisto River. In South Carolina, Bachman's warbler was not seen again until A. T. Wayne collected a specimen on May 15, 1901 near Mt. Pleasant in Charleston County (Wayne 1901; Forsythe 1991). On May 13, 1905, Wayne discovered and described the nest and young of Bachman's warbler (Wayne 1907; Forsythe). Wayne saw more than 70 individuals, collected 21 and located 35 nests between 1901 and 1919 (Wayne 1910; Hamel and Hooper 1979). Almost all of Wayne's field work was conducted in I'On Swamp, in Fairlawn Plantation and in the Francis Marion National Forest near the headwaters of the Wando River in Charleston County.

Since 1920, reported occurrences of Bachman's warbler have occurred erratically throughout coastal South Carolina. According to Forsythe (1991), the reports that have been recorded are reviewed in Burton (1970), Chamberlain (1958), Cutts (1964), Hamel (1986), Shuler (1977a) and Sprunt and Chamberlain (1949). The bulk of these sightings were reported between 1949 and 1962 from Charleston County mainly at Fairlawn Plantation, Moore's Landing (now known as Garris Landing), Orange Grove Road or near McClellanville.

During 1975-1977, several sightings of Bachman's warblers were reported in the I'On Swamp area of the Francis Marion National Forest (Shuler 1977b; Shuler et al. 1978; Forsythe). However, repeated attempts by Hamel and others to relocate these individuals failed (Forsythe). Hamel (1978) concluded that his inability to locate any of the birds reported in I'On Swamp, along with the lack of documentation on these sightings, makes these records questionable (Forsythe). Hamel (1978) considered the last documented Bachman's warbler sighting to be the single male from Moore's Landing Road (AKA Bulls Island Road, which leads to Garris Landing), which was seen by many in April 1962 (Forsythe).

Effects of forest plan

Historical accounts of Bachman's warbler habitat are neither plentiful nor specific, and there was considerable disagreement among experts as to what actually constituted preferred nesting habitat (Forsythe 1991). Hooper and Hamel (1977) stated, "The overstory of areas chosen for nesting appeared to have been subjected to disturbance, either natural or man caused, that stimulated development of a

relatively dense understory." Widmann (1897) found the birds nesting in areas that had been selectively harvested. Others have argued that the birds preferred habitat was "relatively mature, dense-canopied swamp forest" (Schulre, 1977) or dense thickets of cane under a relatively open canopy of large trees (Remsen, 1986). Hamel (1986) concludes the following, "A possible synthesis of the various opinions on breeding habitat may be that the birds' original habitats were secondary successional (i.e., gap-phase) openings in the swamp forest canopy, such as might be caused by storms or insect damage. However, we will never have a satisfactory explanation until breeding birds can be found and studied" (Forsythe 1991).

Regardless of which habitat the species truly prefers, all of the aforementioned conditions would be created and maintained under the proposed forest plan. Management activities proposed would create and/or maintain suitable habitat for Bachman's warbler based on the forested ecosystems where the species would be likely to occur. Direct and indirect effects to Bachman's warbler and its associated habitat would be unlikely since this species has not been confirmed on the forest in over a decade.

The Bachman's warbler is likely one of the rarest songbirds in the world. Based on the literature, Bachman's warbler has not been officially observed in Berkeley or Charleston counties in approximately 53 years. As previously mentioned, many species experts believe that the Bachman's warbler is now extinct in South Carolina. Extensive surveys conducted throughout the South Carolina Coastal Plain in 1991 also failed to document the species. Therefore, it is highly unlikely that the species occurs on the Francis Marion. However, the species is one of particular interest to the birding community, and is annually searched for by individual birders, particularly in the I'on Swamp area of the forest. Cumulative effects to Bachman's warbler and its associated habitat would be unlikely since this species has not been confirmed on the forest in over a decade and no direct or indirect effects are expected from the proposed forest plan.

Determination

From 1986 through 1991, the forest implemented experimental cuts and conducted surveys for the species during five nesting seasons in an agreement with the FWS. Systematic surveys on agreed upon sites were conducted by qualified personnel using tape recordings of the species. During these surveys, Bachman's warblers were neither seen nor heard. It is determined that the revised forest plan will have **no effect** on the Bachman's warbler.

d. CANBY'S DROPWORT (*OXYPOLIS CANBYI*)

Canby's dropwort is a perennial herbaceous plant in the carrot family (*Apiaceae*). In the 5-Year Species Review (2010a), the FWS concluded that eight sites for the species are currently managed and protected range wide, including 5 in South Carolina (Tibwin Savanna on the Francis Marion National Forest, Monkey Meadow Bay in Clarendon County, Crosby Oxypolis Heritage Preserve in Colleton County, Longleaf Pine Heritage Preserve in Lee County, and Lisa Mathews Bay in Bamberg County), 3 sites in Georgia, and 1 in Maryland. The recovery goal is that at least 14 sites are currently extant self-sustaining populations and that necessary management actions are being undertaken by landowners to ensure their continued survival. On the Francis Marion National Forest, one population containing ten plants for Canby's dropwort was confirmed from a depressional wetland pond dominated by pond cypress savanna in 2000. Only one plant was located there by Gaddy in 2006 (USDI, 2006), who described the habitat at that time (Tibwin cypress savanna) as excellent. No Canby's dropwort plants have been found at this site, nor at another unconfirmed, pond cypress depression, since 2006. Glitzenstein (2012) found that locations for the plant on the Francis Marion National Forest were impacted by succession, lack of prescribed fire, woody competition from red maple and loblolly pine, and feral hogs. However the Forest Service is working with FWS to enhance or establish an additional population at known or historic sites for the plant on the forest (see Figure 10-1 below).

One of the most significant threats to the species range wide is loss or alteration of rare wetland habitat (USDI, 2010). Optimal habitat for Canby's dropwort is depressional wetlands or Carolina bays maintained open and herbaceous with frequent prescribed fire (USDI, 2006). Climate change could jeopardize the existence of isolated populations and associated habitat in the future and are more likely to have low genetic diversity to adapt to change. Woody control to maintain and restore pond cypress competition in known ponds is likely to occur as a result of revised Forest Plan implementation. All known and historic populations and most potential habitat occur in Management Area 1, where associated depressional ponds and Carolina bay vegetation will be managed with frequent prescribed fire, including a growing season component.

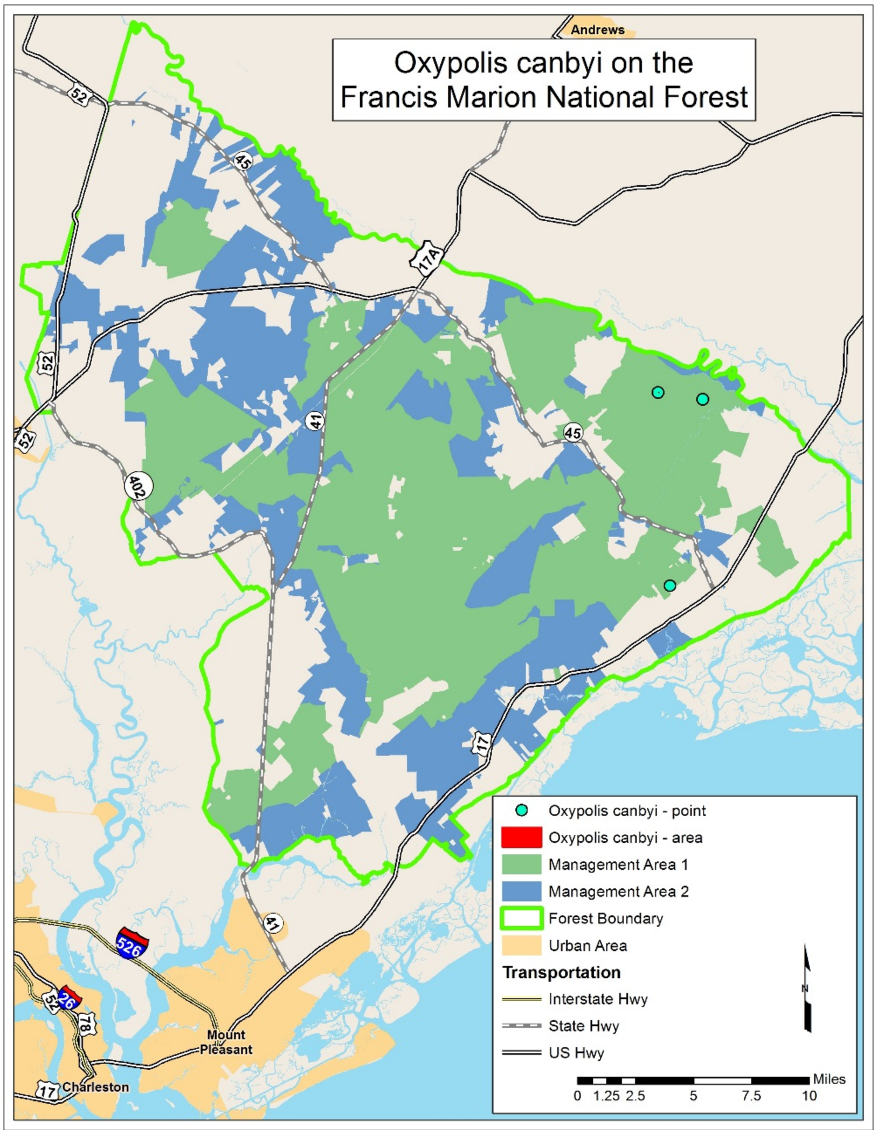

Figure 10-2. Locations of Canby's dropwort on the Francis Marion National Forest.

Effects of forest plan

Direct effects of the Revised Forest Plan to **Canby's dropwort** are unlikely, but could result in the loss of individuals as a result of habitat restoration activities in Carolina bays or depression ponds to possibly include wetland restoration, woody species control, mastication, or selective herbicide application. Although every effort is made to flag and avoid individuals in projects which have the potential to affect

them, there is a chance individuals could go undetected, as activities are typically conducted during the dormant season. The possibility for direct effects to known individuals will be minimized by adherence to the following design criteria:

S34. Require equipment cleaning practices on equipment, using equipment cleaning clauses in contracts, permits and agreements, when moving equipment from areas infested with non-native invasive plants (FSM 2903).

S35. No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species.

S36. Use plant materials that contain genetically appropriate native plant species when maintaining and restoring vegetation. Use of non-native plants is allowed only when in compliance with Forest Service native plant policy (FSM 2070).

S39. Use low psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites.

S40. Do not use soil active herbicides (imazapyr, imazapic) in population sites for at-risk plant species.

S41. Maintain and restore viable populations and associated habitats for At-risk Species using an all-lands approach.

- Develop management practices which maintain and restore at-risk species populations and their habitats during project planning and implementation.
- Implement mitigating measures to minimize impacts of recreation use and restoration activities on populations for at-risk species where needed.
- Ensure that prescribed burning of fire-adapted at-risk species and rare communities occurs at desired seasons and intervals.
- Align land acquisition practices to result in improved connectivity among habitats for at-risk species where needed.
- Adapt our management of at-risk species and habitats in response to population and habitat monitoring information.

Indirectly, the desired conditions and standards associated with depressional ponds and Carolina bay ecosystems in Management Area 1 will facilitate the restoration of habitat for Canby's dropwort, by creating open conditions in depressional wetlands and Carolina bays, including the ecotones maintained with frequent prescribed fire. Although all attempts are made to survey and flag individuals prior to the onset of activities, individuals could go undetected, particularly in areas where the species has not been known to occur. Therefore, although forestwide desired conditions, objectives and design criteria will benefit Canby's dropwort, management activities could result in the loss of individuals.

Public land plays a critical role in the conservation of federally listed plants, which receive no protection on private lands, and all T&E habitats, which receive no protection on private lands. During the next 10 to 50 years of forest plan implementation, human populations are likely to expand, affecting urbanization, roads and associated traffic, and prescribed burning and smoke management. This suggests that public land will play an increasingly important role in the conservation of threatened and endangered species in the future, but that management to ensure recovery and/or prevent federal listing of species will be an increasingly difficult challenge.

Climate change could jeopardize the existence of isolated populations in the future as they are more likely to have low genetic diversity to adapt to change. Partnerships to facilitate introduction in known and historic habitats could lead to increased connectivity of these populations and enhanced genetic diversity.

Determination

Although the Revised Plan implementation will primarily result in discountable, insignificant, or completely beneficial effects to habitat conditions and populations for Canby's dropwort, implementation

may affect, is likely to adversely affect individuals. Despite implementing activities with protection measures to avoid impacts to this species, the active management required to maintain high-quality habitat conditions may harm individual plants over the 10-year period of plan implementation. This determination is a result, primarily, of landscape-level management activities associated with the restoration of depressional wetland and Carolina Bay ecosystems and associated habitats, which could include woody species control, selective herbicide application, wetland restoration, and prescribed fire to include a growing season burn every third burn. Overall ecosystem and species desired conditions and objectives will benefit populations and habitats resulting in the maintenance and restoration of at least three self-sustaining populations and associated habitat for the federally endangered Canby's dropwort at known or historic locations.

e. FROSTED FLATWOODS SALAMANDER (*AMBYSTOMA CINGULATUM*)

The frosted flatwoods salamander (*Ambystoma cingulatum*) was designated as a federally threatened species in 1999 (Federal Register Vol. 64, No. 62: 15691-15704). The frosted flatwoods salamander is a mole salamander which breeds within seasonally flooded isolated wetlands (SFIWs) embedded within fire-maintained pine woodlands and savannas. This salamander burrows near water or moves about under debris on the forest floor. It is carnivorous and an opportunistic feeder, primarily eating earthworms and arthropods. The species needs shallow winter flooded isolated wetlands to breed and for larvae to develop. It also needs fire maintained pine uplands for the remainder of its life cycle. As with most pond breeding amphibians, the species does not do well in wetlands that contain fish. The timing and frequency of rainfall is critical to the successful reproduction and recruitment of Flatwoods salamander (Final Rule for Listing, 1999). Surviving populations are currently threatened by habitat loss and degradation from agriculture, urbanization, and various silviculture practices (Final Rule for Listing, 1999). The Flatwoods salamander is extremely rare in South Carolina; the Francis Marion is home to one of only four known populations in the entire state.

Most known, historic and potential frosted flatwoods salamander breeding wetlands on the forest (as identified by Harrison in monitoring report dated 2004 and internal surveys since 2004) occur in designated critical habitat near the community of Wando located on the southwest corner of the Francis Marion (see Figure 11-1 below). The August 13, 2008 Federal Register (Volume 73, Number 157) designated critical habitat for *A. cingulatum*. Critical habitat on the Francis Marion was given the unique identifier of Unit FFS-6. The Federal Register stated the following for Unit FFS-6:

> Unit FFS-6 occupied at the time of listing, encompasses 1,300 ac (526 ha) on Federal and private land in Berkeley County, South Carolina. This unit is bisected by State Highway 41 approximately 10 mi (16 km) south of the town of Huger. Within this unit, 1,176 ac (476 ha) are in the Francis Marion National Forest and 124 ac (50 ha) are on private land.

The August 13, 2008 Federal Register provides the following, "Food, Water, Air, Light, or Other Nutritional or Physiological Requirements" within breeding wetlands, "An unpolluted wetland with water free of predaceous fish, sediment, pesticides, and the chemicals associated with road runoff, is important to maintain the aquatic invertebrate fauna eaten by larval salamanders." In breeding wetlands, developing larval frosted and reticulated Flatwoods salamanders hide in submerged herbaceous vegetation during the day (Palis and Means, 2005) as protection from predators. An abundant herbaceous understory within these breeding wetlands is extremely important.

Numerous isolated breeding wetlands have been severely altered by previous land management practices prior to establishment of the Francis Marion. Some of the best examples of frosted Flatwoods salamander breeding wetlands on the Francis Marion are bordered by a former tram bed that was used to transport

lumber in the early to mid-1900s (Figure 11-2). The Tuxbury Horse Trail in compartments 114, 115 and 116 is located on this historic tram bed. Some of the potential impacts created by the tram bed include the following:

- Since there are no culverts or bridges on this horse trail/tram bed, this artificial land feature could serve as a barrier to sheet flow impacting the hydrology of adjacent wetlands. The tram bed is ditched on both sides and was intentionally built up to traverse through wetlands.
- Additionally, the ditches on either side of the tram bed drain adjacent wetlands could serve as vectors for undesirable aquatic organisms such as predatory fish.

Generally, flatwoods salamander breeding ponds and upland habitats are separated by an ecotone (area of transitional habitat) through which salamanders must move during pre- and post-breeding events (Palis, 1997). The grass-like ecotone represents a distinct habitat type and is important for maintaining connectivity between aquatic and terrestrial habitats. When the ecotone provides cover and appropriate microclimatic conditions, survival of migratory salamanders is enhanced. Studies of migratory success in post-metamorphic salamanders have demonstrated the importance of high levels of survival of these individuals to population maintenance and persistence (Rothermel, 2004). Post-larval and adult frosted and reticulated flatwoods salamanders occupy upland flatwoods sites where they live underground in crayfish burrows, root channels, or burrows of their own making (Goin, 1950; Neill, 1951; Mount, 1975; Ashton and Ashton, 2005). The occurrence of these belowground habitats is dependent upon protection of the soil structure within Flatwoods salamander terrestrial sites."

Only eight adults and approximately 12 larvae have been captured on the Francis Marion in the past 20 years (Harrison, 2004; Harrison, 2005; Palis, 2009; Palis, 2010; and internal USFS records). Julian Harrison made the initial observations of Flatwoods salamanders on the Francis Marion in the early 1950s through 1970 (Harrison, 2003). Subsequent observations were made during Flatwoods salamander surveys by Moulis and Seyle (1987) and Moulis and Williamson (1998). John Fauth captured four adults in October 1995 and a single larva in 2003 (Harrison, 2003), William Resetarits encountered an adult on Hoover Road in June 1997 (internal Forest Service documentation) and a single adult was captured in Hoover Pond in 2002 (Harrison, 2003). Unsuccessful surveys for Flatwoods salamanders on Francis Marion were conducted by Forest Service employees (1991), Bennett (1995), Humphries (2000), Harrison (2001), Waldron (2001), Harrison (2003) and Palis (2009). The species was documented on the forest in 2010 (Palis, 2010). The majority of sampling on the forest is conducted via dip-netting and deployment of minnow traps for larval salamanders.

Since 2006, the Francis Marion has attempted monitoring of breeding ponds every year, but with the exception of 2009 and 2010 breeding ponds were dry. During 2010, John Palis and Joyce Marie Klaus conducted surveys on the Francis Marion. Nineteen wetlands were surveyed and *Ambystoma cingulatum* was documented on the forest for the first time since 2003. Six larvae were collected from a previously undocumented breeding wetland during March 2010. Three larvae were taken to Riverbanks Zoo in Columbia, S.C. where Scott Pfaff (Curator of Herpetology) successfully raised them to metamorphosis. At the time of collection, the larvae were too small to collect tail tissue, so the zoo reared them until they were big enough to collect tissue. DNA analysis was performed; results indicate that individuals from the Francis Marion do not represent a distinct species and are closely related to other populations of the frosted Flatwoods salamander. This was the first genetic material available from South Carolina. The individuals from the Francis Marion National Forest maintained at Riverbanks Zoo in Columbia have since died.

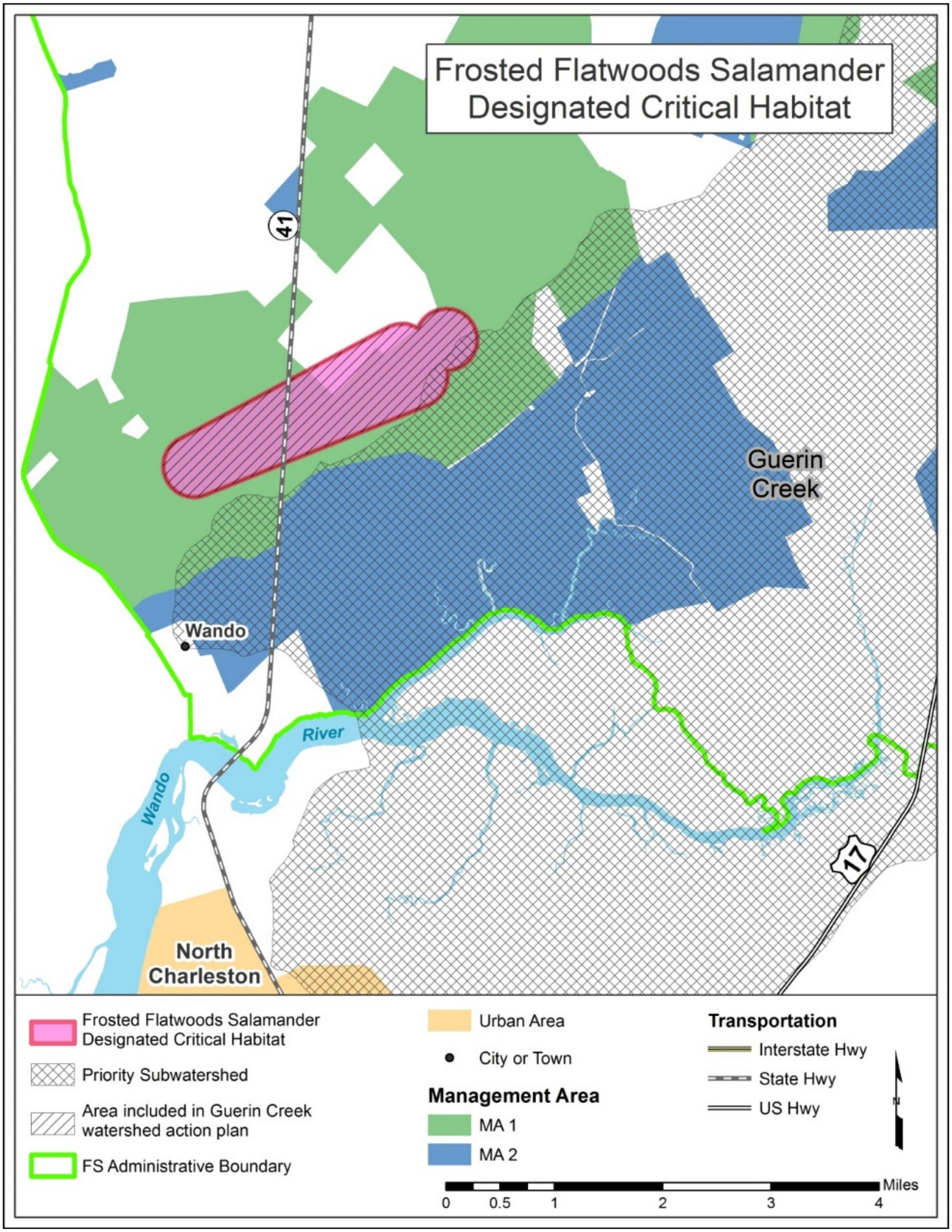

Figure 11 1. Designated critical habitat for the frosted flatwoods salamander on the Francis Marion National Forest

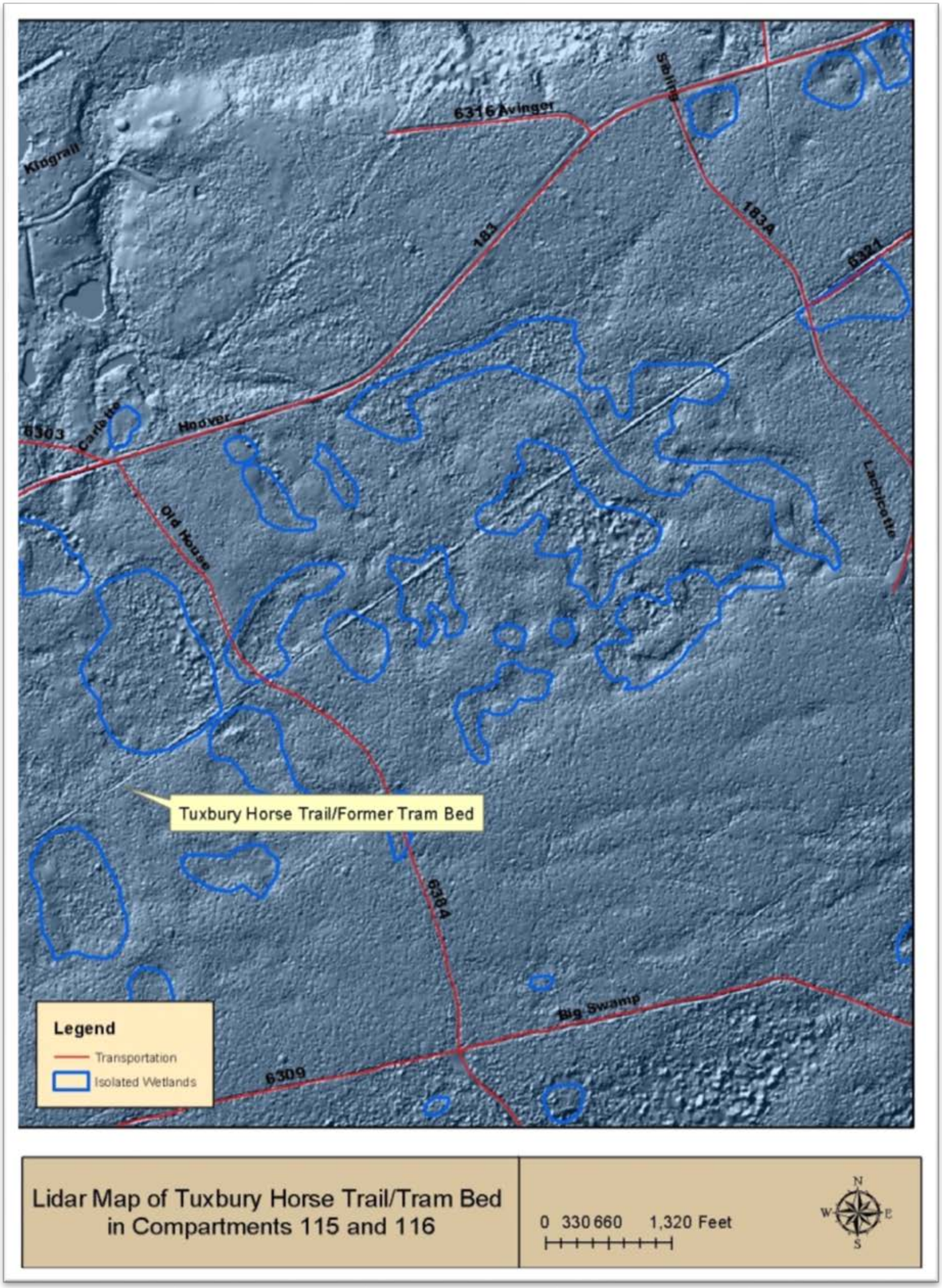

Figure 11 2. Hillshade map derived from LiDAR depicting tram bed impacts to breeding wetlands within the designated critical habitat for the frosted flatwoods salamander

Effects of Forest Plan

Since this species was not found in almost 20 years (6 surveys between 1991 and 2009) and only a small number of larvae were found in 2010, it is believed this species is close to being extinct on the Francis Marion National Forest. Direct effects of the Revised Forest Plan to frosted flatwoods salamander are unlikely, but because of the fossorial nature of the species habitat restoration activities in or around Carolina bays or depression ponds and associated critical habitat occurring in longleaf woodlands could result in the loss of individuals. Direct and indirect effects of the Revised Forest Plan to individuals of frosted flatwoods salamander and associated critical habitat would be minimized by adherence to the following design criteria:

> S30. Use only aquatically labeled herbicides and surfactants within designated critical habitat for frosted flatwoods salamander and known habitat for Carolina gopher frog.
>
> S39. Use low psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites. G16. Firelines should be avoided when possible in riparian management zones along lakes, perennial or intermittent streams, springs, wetlands or water-source seeps, or otherwise minimize the length of firelines in riparian management zones
>
> G33. Temporary or new system roads, log landings and firelines should be located outside primary (538 feet) and secondary zones (1,476 feet) from the edge of known breeding ponds for frosted flatwoods salamander.

Desired conditions for upland longleaf woodlands, wet pine savannas, and depressional wetlands and Carolina bays would benefit frosted flatwoods salamander and associated critical habitat are expected to benefit populations and critical habitat for the species within Management Area 1. Any management activities that could affect potential breeding ponds or adjacent upland habitat would be conducted in accordance with USFWS guidance for conservation of this species.

Public land plays a critical role in the conservation of habitat for federally listed species, particularly salamanders, for which distribution is largely unknown, particularly on private lands. During the next 10 to 50 years of forest plan implementation, human populations are likely to expand, affecting urbanization, roads and associated traffic, and prescribed burning and smoke management. This suggests that public land will play an increasingly important role in the conservation of threatened and endangered species benefitting from fire management in the future, and that management to ensure recovery and/or prevent federal listing of species will be an increasingly difficult challenge. Climate change could jeopardize the existence of isolated populations, including those associated with depressional wetlands, in the future as they are more likely to have low genetic diversity to adapt to change. Partnerships to facilitate introduction in known and historic habitats could lead to increased connectivity of these populations and enhanced genetic diversity.

Determination

Management direction addresses maintenance and restoration of both upland and breeding habitat used by flatwoods salamanders and should improve or maintain critical habitat for this species. Therefore, Revised Plan implementation will primarily result in discountable, insignificant, or completely beneficial effects to frosted flatwoods salamander designated critical habitat. This species has not been found on the Francis Marion National Forest since 2010, despite numerous attempts to find the species in the suitable habitat that occurs on the Forest. Additionally, forestwide standards and guidelines for at-risk species, wetlands, riparian and streamside management zones, should minimize the potential for harming individuals. However the species is difficult to detect, so its presence or absence cannot be completely confirmed with any level of inventory in Management Area 1. Potential harm to individuals, if present, could result from prescribed fire and heavy equipment use associated with typical forest management and restoration activities. Therefore, implementation of the plan **may affect, and is likely to adversely affect**

individuals of frosted flatwoods salamander. It is not possible to quantify the potential effects, but the Forest Service is actively participating in recovery planning with USFWS and will attempt to minimize the possibility of harming individuals of this species during implementation of the proposed plan.

f. PONDBERRY (LINDERA MELISSIFOLIA)

Pondberry is a woody shrub in the *Lauraceae* family. As of 2007, there were 54 potential populations for pondberry including Alabama (2), Arkansas (19), Georgia (7), Mississippi (16), Missouri (1), North Carolina (2), and South Carolina (7). According to the Recovery Plan (USDI 1993), pondberry may be downlisted to threatened when 15 self-sustaining populations are protected, and delisted with the permanent protection of 25 self-sustaining populations. Based on long-distance flight distances of ground-dwelling bees that pollinate pondberry, a more recent definition of a pondberry population is “colony or colonies separated by at least one mile from other colonies.” (Devall et al., 2001; USDI, 2007). Given this definition, the Francis Marion harbored 5 natural populations for pondberry in 2013, plus one introduced population (French Quarter Creek Road). Recovery plans emphasize that first priority be given to management and enhancement of populations at known and historic sites for the species, where possible. Since 1996, eleven new occurrences for the plant have been found and as of 2010, at least nine of those contained 200-1000 stems, though little fruit production has been observed (Gustafson, 2012; Glitzenstein, 2004). As of 2013, there were 24 documented occurrences on the forest (Forest GIS and Monitoring data). See Figure 12-1.

In South Carolina, pondberry may be easily outcompeted by woody vegetation (USDI, 2010b; Glitzenstein, 2007; Glitzenstein and Streng, 2004). The USFS has worked with the SC Native Plant Society to reverse pondberry declines at Honey Hill, as a result of drought and woody mid-story and canopy competition (Glitzenstein, 2007). Other threats to the species include a fungus which causes die back of stems, factors which draw down the hydrology of associated ponds, genetic bottlenecks associated with isolated populations (Gustafson, 2012), and lack of fire (USDI, 2010b), which may influence hydrology or light availability. Although laurel wilt occurs on the Forest and is a threat to species in the *Lauraceae* family, pondberry stems are typically too small to be infected (Fraedrich, 2011). The USFS working with FWS under the guidance of Gustafson (2012), enhanced two of our pondberry populations on the Forest, one with female plants (Hoover-Brick Church-Hwy. 41) and the other at Echaw Road with both males and females (this population had declined to less than ten stems).

Optimal habitat for pondberry on the Francis Marion National Forest is depressional wetlands – including limesinks and associated herbaceous ecotones. All known pondberry occurrences and populations occur in proposed Management Area 1 (Figure 12-1). Shrub cover is high at many associated pond ecotones, particularly at wildland-urban interfaces within the Wando area, where prescribed fire has been less frequent, and contain not only pondberry, but also frosted flatwoods salamander and Carolina gopher frog, and at Honey Hill.

Effects of forest plan

Direct effects of the Revised Forest Plan to individuals of pondberry could occur as a result of inappropriate fire regimes in unknown population locations and restoration activities such as mastication, selective herbicide application, wetland restoration, or timber harvest at pond ecotones. These impacts would be minimized by adherence to the following design criteria:

> S34. Require equipment cleaning practices on equipment, using equipment cleaning clauses in contracts, permits and agreements, when moving equipment from areas infested with non-native invasive plants (FSM 2903).

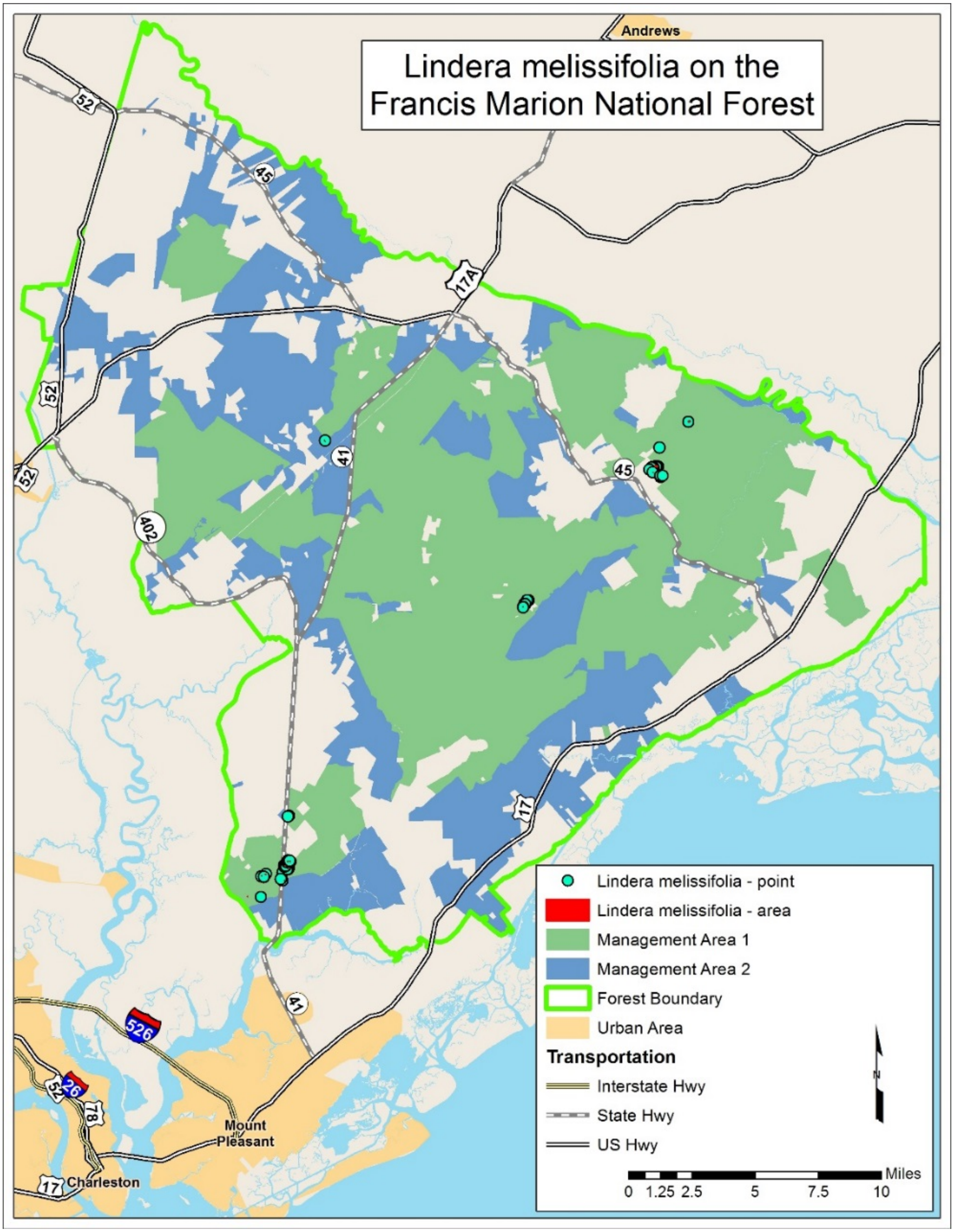

Figure 12-3. Locations of pondberry on the Francis Marion National Forest

S35. No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species.
S36. Use plant materials that contain genetically appropriate native plant species when maintaining and restoring vegetation. Use of non-native plants is allowed only when in compliance with Forest Service native plant policy (FSM 2070).
S39. Use low psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites.
S40. Do not use soil active herbicides (imazapyr, imazapic) in population sites for at-risk plant species.
S41. Maintain and restore viable populations and associated habitats for At-risk Species using an all-lands approach.

- Develop management practices which maintain and restore at-risk species populations and their habitats during project planning and implementation.
- Implement mitigating measures to minimize impacts of recreation use and restoration activities on populations for at-risk species where needed.
- Ensure that prescribed burning of fire-adapted at-risk species and rare communities occurs at desired seasons and intervals.
- Align land acquisition practices to result in improved connectivity among habitats for at-risk species where needed.
- Adapt our management of at-risk species and habitats in response to population and habitat monitoring information.

Indirectly, inappropriate prescribed fire regimes could affect reproductive success of populations. Maintenance and restoration of depressional wetlands and Carolina bays within Management Area 1 will indirectly benefit habitat for the species to include an open canopy and an abundant herbaceous groundcover, including 1-6 year burning regimes with a growing season burn every third burn on average. However, it is possible that implementing these activities could harm individual plants. Opportunities to expand populations are explored with the U.S. Fish and Wildlife Service and include the reduction of shrubs and identification of optimal hydrologic and prescribed fire regimes.

Public land plays a critical role in the conservation of federally listed plants, which receive no protection on private lands, and all T&E habitats, which receive no protection on private lands. During the next 10 to 50 years of forest plan implementation, human populations are likely to expand, affecting urbanization, roads and associated traffic, and prescribed burning and smoke management. This suggests that public land will play an increasingly important role in the conservation of threatened and endangered species in the future, particularly plants associated with fire-adapted ecosystems and depressional wetlands, but that management to ensure recovery and/or prevent federal listing of species will be an increasingly difficult challenge. Climate change could jeopardize the existence of isolated populations in the future which are more likely to have low genetic diversity to adapt to change. Partnerships to facilitate introduction in known and historic habitats could lead to increased connectivity of these populations and enhanced genetic diversity.

Determination

Although the Revised Plan is likely to benefit pondberry and associated habitats overall, implementation **may affect, and is likely to adversely affect** individuals of this species. This determination is a result of potential short-term impacts to individuals as a result of restoration activities, which indirectly improve structure or composition, or less than optimal prescribed burning regimes, particularly at undocumented locations, which could influence reproduction. Overall, forestwide objectives and Management Area 1 direction to maintain and restore associated depressional wetlands and Carolina Bay ecosystems and associated habitats with desired 1-6 year fire regimes, including a growing season burn every third burn, are likely to benefit the plant and associated ecological conditions. Forestwide objectives will result in

the maintenance and restoration of at least five viable populations for the federally endangered pondberry at known or historic locations, and potential expansion to suitable habitat in coordination with USFWS.

g. RED-COCKADED WOODPECKER (*PICOIDES BOREALIS*)

The Francis Marion supports the third largest population of the federally endangered red-cockaded woodpecker in the U.S. and is one of 13 designated core recovery populations. Prior to Hurricane Hugo in 1989, the red-cockaded woodpecker population consisted of approximately 477 groups and was one of the only known naturally expanding populations. In one night, Hurricane Hugo killed an estimated 63 percent of the red-cockaded woodpecker population, destroyed 87 percent of the cavity trees and 59 percent of the foraging habitat across the Francis Marion (Hooper et al. 1990; Hooper et al. 1991). Due to extensive habitat management and installation of more than 2,800 artificial cavities, the red-cockaded woodpecker population has rebounded to approximately 477 active clusters including 460 breeding groups, and 4,596 cavity trees in active foraging partitions (Forest GIS data as of May, 2016). See Figures 13-1 and 13-2.

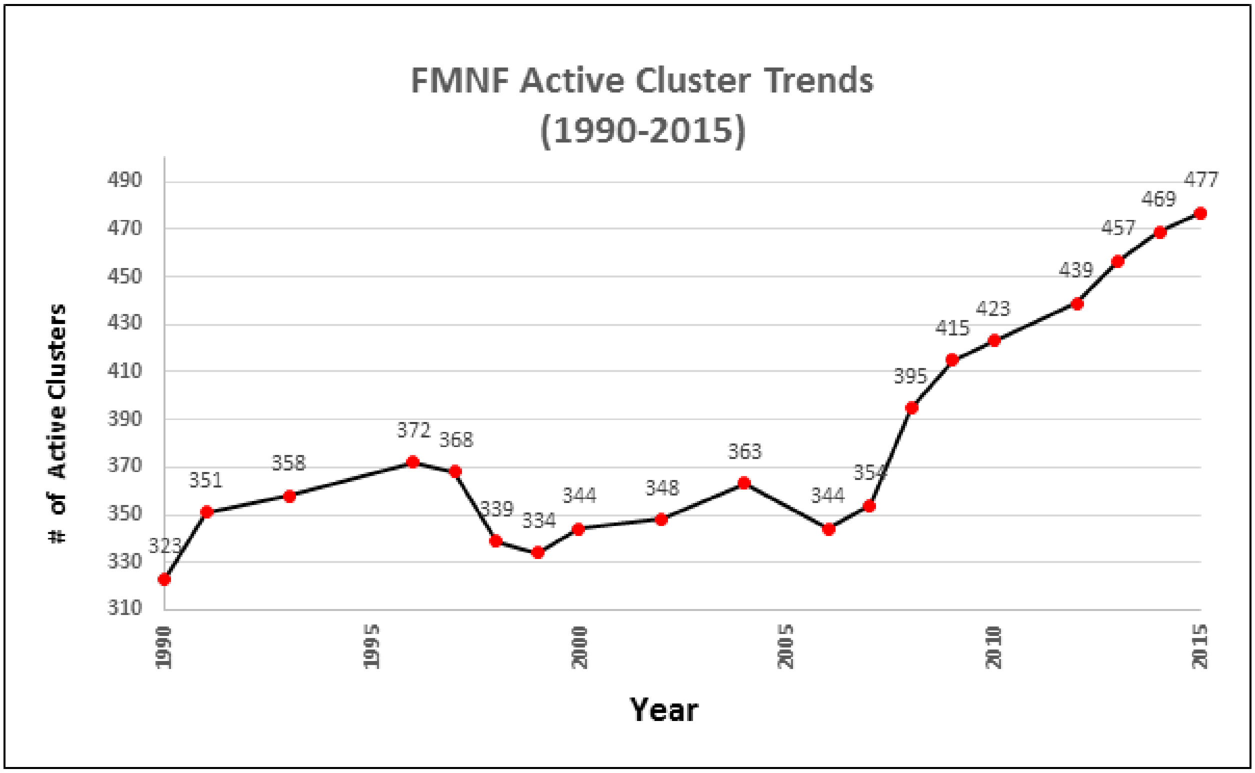

Figure 13-4. Active red-cockaded woodpecker clusters since Hurricane Hugo.

Since 2007, the Francis Marion National Forest's red-cockaded woodpecker population has exceeded the recovery goal of 350 potential breeding groups (PBGs) as described in the red-cockaded woodpecker recovery plan. Despite the fact that the majority of clusters on the forest have foraging habitat that does not meet standards described in the recovery plan, the Francis Marion supports one of the most robust populations in the country. Based on intensive monitoring conducted in 2009, the average group size on the Francis Marion is greater than 3 birds/group and reproductive success averages approximately 2.2 to 2.3 fledglings per successful nest.

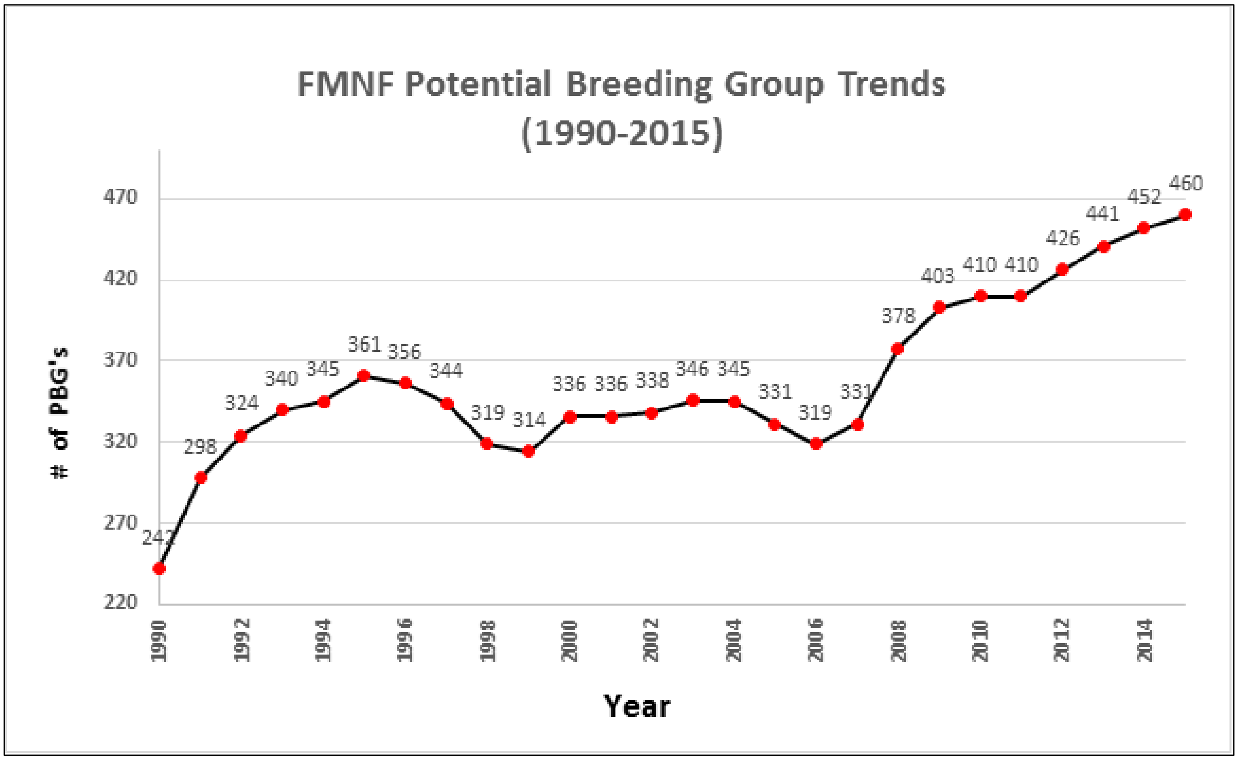

Figure 13-2. Active red-cockaded woodpecker clusters that are potential breeding groups

The Francis Marion red-cockaded woodpecker population is expanding in some areas of the forest, especially in those that are consistently burned on a 2-3 year return interval. Areas that have been consistently burned on a 2-3 year return interval are lumped together and called the "core burn" area. There are some areas on the Francis Marion where clusters are becoming inactive or reduced to single bird groups (SBGs). These clusters tend to be concentrated in the wildland/urban interface (WUI) and/or areas where minimal forest management has allowed undesirable mid-story succession to occur.

The highest densities of active red-cockaded woodpecker clusters are found within the portions of the forest that have been burned the most frequently. However, there are some exceptions to this trend. The southwest portion of the forest, in the vicinity of Mount Pleasant, supports some of the highest densities of red-cockaded woodpeckers. Unfortunately, this area, particularly along Highway 41, has numerous wildland urban interface issues, which have severely limited the Forest Service's ability to prescribed burn this area frequently.

The Revised Forest Plan would address the maintenance and restoration of nesting and foraging habitat in terms of upland longleaf, wet pine savanna and flatwoods ecosystem composition, structure, function and connectivity, particularly on ecological suitable areas within Management Area 1. The treatments used to accomplish the desired conditions would include prescribed burning, thinning, hydrologic restoration and non-native invasive species control. Restoration of longleaf pine forest types would occur on suitable upland and wet pine sites. To supplement burning and reduce fuels away from Management Area 1, the agency would rely on mechanical and chemical means of woody treatment at wildland-urban interfaces, and selective treatments with herbicides. Recreational uses would continue to increase but would be maintained at a sustainable and a dispersed level.

Upland pine woodlands would be maintained and restored on 33,500 acres (64 percent of the total extent) and wet pine savannas and Flatwoods would be maintained, improved and restored on 58,100 acres (67 percent of the total extent) within Management Area 1. Canopies would be open with canopy closure

typically less than 60 percent (40-70 $ft.^2$ basal area) and as low as 10 $ft.^2$ basal area in wet savannas. Groundcover would be predominantly native and herbaceous. Prescribed burning would mimic natural fire regimes within Management Area 1 and would include a one-3 year prescribed burning regime, as well as a growing season burn at least every third burn (approximately 360,000 acres of dormant season prescribed burning per decade and 100,000 acres of growing season burning).

The differences in management direction between Management Areas 1 and 2 are particularly relevant because red-cockaded woodpecker occur across the forest in a range of habitat conditions (Figures 13-3 to 13-5).

Effects of forest plan

Direct effects to red-cockaded woodpeckers from implementing the proposed forest plan include disturbance of individual red-cockaded woodpeckers from prescribed fire, restoration of upland longleaf, wet savanna and flatwoods ecosystems in MA 1 and loblolly pine silviculture in MA 2. Indirect effects to red-cockaded woodpecker resulting from plan implementation would result from habitat modification. The following design criteria will minimize adverse effects on this species:

S27. Protect existing red-cockaded woodpecker cavity trees during prescribed burning operations. Only use low-intensity fire within the cluster and around cavity trees to keep hazardous fuels at acceptable levels. Prior to prescribed burning clear vegetation and fuels around cavity trees or mulch around cavity trees.

S32. Retain at least 4 suitable cavities within each active red-cockaded woodpecker cluster on the forest.

S33. Retain all potential red-cockaded cavity trees (pines greater than 60 years in age) within red-cockaded woodpecker clusters, unless pine basal area is above 50 $feet^2$/acre and all trees are above 60 years within the clusters; protect red-cockaded woodpecker cavity trees by shielding cavities with restrictors, painting known cavity trees with highly visible paint, or replacing lost cavities with artificial ones.

S37. Maintain stands meeting age criteria for old growth during project planning using the criteria in the Region 8 Old Growth Guidance. Consider the contribution of old growth communities to the future network of small and medium-sized areas of old growth conditions including the full diversity of ecosystems across the landscape.

S38. Cutting of active red-cockaded woodpecker cavity trees is prohibited unless formally authorized by the FWS.

G36. Do not allow any mechanical activities within active red-cockaded woodpecker clusters during the nesting season (April 1– July 31). Exceptions may be made at the project level with authorization from the U.S. Fish and Wildlife Service.

Effects of fire - Although the Forest has managed to avoid accidental ignition of active cavity trees, at some point in our continued application of fire unintentional losses of active clusters or individual trees are likely. For the period of 1998-2002 all red-cockaded woodpecker properties managing their habitats with prescribed fire, burned 6195 active clusters with no losses of nests (Costa 2003). However, the Proposed Actions of continuing and increasing the prescribed burn program may result in the incidental take of red-cockaded woodpecker eggs or nestlings.

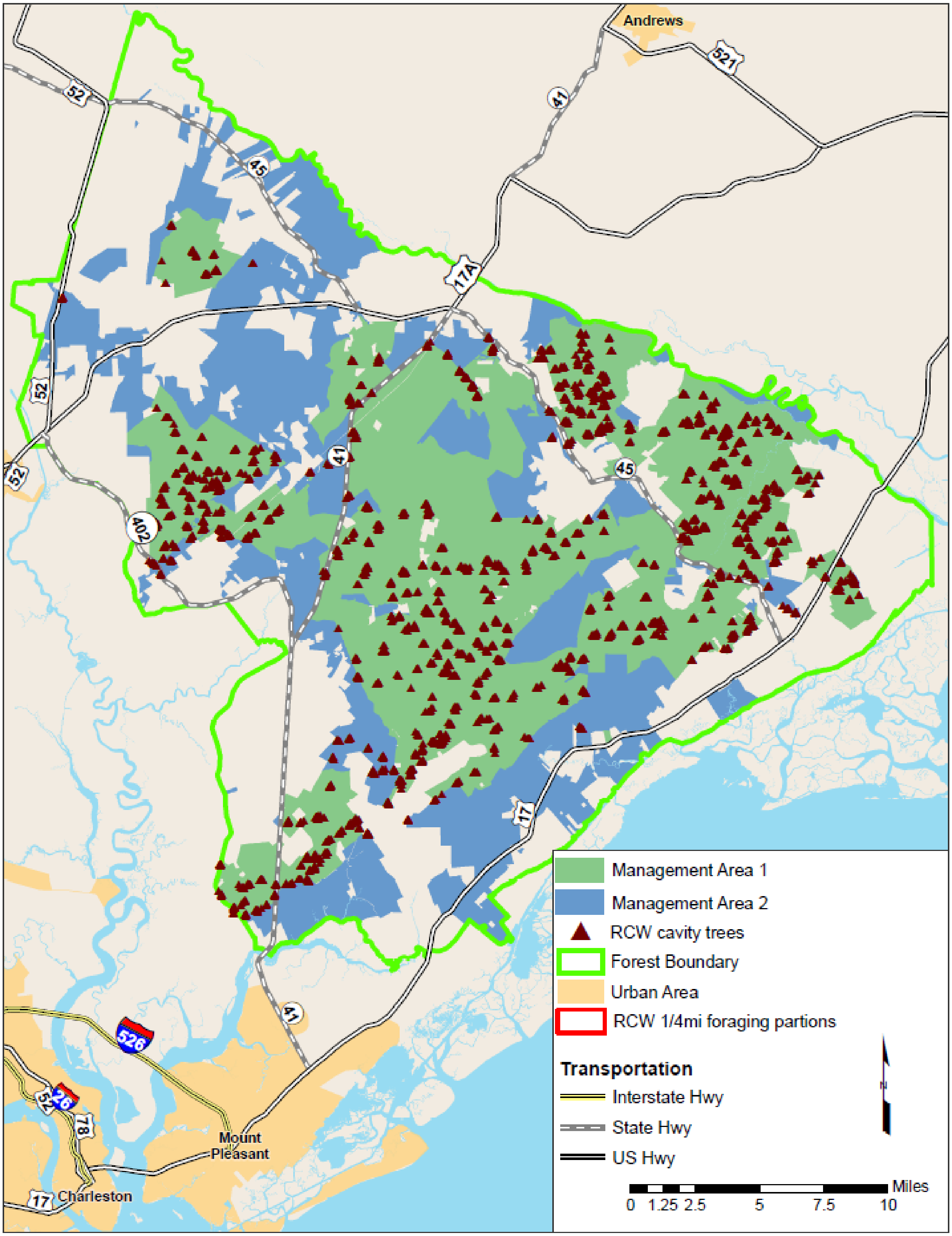

Figure 13-5. Locations of red-cockaded woodpecker cavity trees on the Francis Marion National Forest

Losses of individual cavity trees to fire can be compensated by installation of artificial cavities. Considering the various protection measures, there should be no negative effects on the overall viability of the red-cockaded woodpecker population on the Forest. Furthermore, the level of associated preparation should not significantly impact the burn program's capacity to manage and apply safe and effective fire. If active cavities are lost, inserts will be installed to replace them (if an additional cavity is not already available and confirmed to be usable and clean). This should negate any measurable take for adult red-cockaded woodpeckers which may be temporarily displaced. If nests are lost, red-cockaded woodpeckers are likely to re-nest after the event either in the same tree or another cavity. Avoidance of prescribed burning during the nesting season is not recommended, since nesting season coincides with timing favorable for other important ecological fire effects.

Effects of timber harvest - Evaluating the potential effects of forest management activities on red-cockaded woodpecker has two related components: indirect effects resulting from habitat modification and direct effects resulting from disturbance during the breeding season.

In the past, the forest has avoided timber harvest or hauling through active clusters during the red-cockaded woodpecker breeding season of April 1 – July 31. However, given the growth of the population and the ambitious restoration objectives in the forest plan, it is likely that some clusters would be disturbed by these activities. Many potential restoration sites have poorly drained, seasonally wet soils that can further limit timing of timber harvest, but after timber sales are sold and marked, prescribed fire is not applied to the area until the trees can be harvested. Therefore, allowing temporary disturbance to red-cockaded woodpecker from timber harvest during the breeding season when possible (i.e., soil conditions do not limit heavy equipment use) allows fire to be applied at the desired frequency habitat maintenance or restoration.

Assessing the foraging habitat criteria described in the red-cockaded woodpecker recovery plan requires detailed information on stand vegetation structure, including size and density of canopy trees as well as midstory and groundcover conditions. This information is generally collected through common stand exams, a standard forestry practice in which data on tree size and density are collected from multiple randomly placed plots within each stand. However, such data are not available for most of the over ~5200 stands on the Francis Marion National Forest. The FS Veg database included sufficient data to evaluate red-cockaded woodpecker foraging habitat criteria for 1,253 stands covering ~63,800 ac (~20% of stands covering ~25% of the Francis Marion National Forest). When the foraging habitat standards were evaluated separately, 158 stands (7,298 ac) met the Managed Stability Standard (MSS) criteria and 69 stands (3,287 ac) met the Recovery Standard criteria. Cumulatively, 178 stands (~14% of those with sufficient data for evaluation) totaling 8,480 ac (~13% of the area with data) met one or both of the habitat standards. Many stands did not meet the MSS criteria because the total basal area was too high (>80ft^2/ac) or because the basal area of trees <10 in dbh was too high (>20 ft^2/ac). However, in addition to the stands that currently meet the MSS, 407 stands totaling ~23,300 ac have sufficient area of >10 in dbh trees (>40 ft^2/ac) that they could potentially meet the MSS after a thinning.

The spatial relationship between ¼ mi foraging partitions and good foraging habitat (i.e., either meeting MSS or the Recovery Standard) is shown in Figure 9. Within ¼ mi foraging habitat partitions, only 10 clusters currently have at least 75 ac of stands with habitat either meets the MSS or Recovery Standard (given available data). In contrast, based on available information, the ¼ mi foraging partitions of 309 clusters had 0 acres of stands that met either the MSS or Recovery Standard criteria. It is likely that more stands and clusters would meet the MSS criteria for foraging habitat if complete stand data were available. However, based solely on total partition area and forest type, many clusters cannot meet the MSS within the ¼ mi foraging partition: 55 clusters have <75 ac total within their partition and 305 clusters have <75 ac of longleaf or loblolly pine stands within their ¼ mi partitions. Many partitions are small due to high density (in high-quality areas) or adjacency to private land (which cannot be included

for foraging habitat analyses). The recovery plan allows including suitable habitat within the ½ mi foraging partition under some circumstances, but missing stand data and challenges assessing the spatial

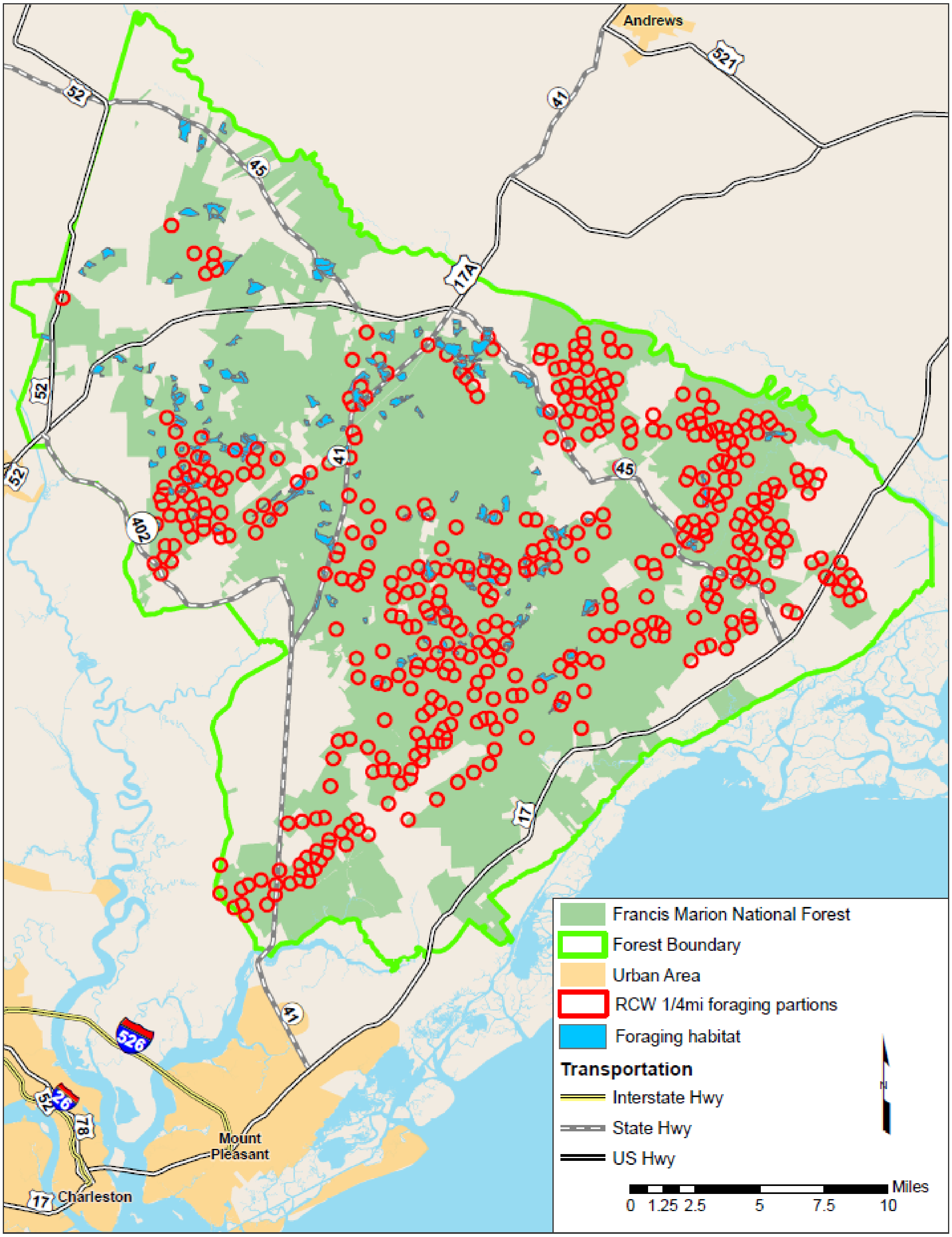

Figure 13-6. Red-cockaded woodpecker ¼ mile foraging partitions in relation to stands meeting the MSS or Recovery Standards for foraging habitat

connectivity of stands make such an evaluation prohibitive for a forest-wide analysis. Furthermore, the recovery plan and clarifying memo (USFWS 2003, 2005) clearly state that analysis of adverse effects should primarily consider conditions of stands within the ¼ mi foraging partition as is done here.

In summary, based on available data, most red-cockaded woodpecker clusters on the Francis Marion National Forest are deficient in foraging habitat according to the MSS criteria. As such, any further reduction of foraging habitat through stand modification or fragmentation would constitute an adverse effect. Due to the uncertainty of where activities could occur in the future and missing stand data, conducting a typical foraging habitat analysis is not possible. However, it is reasonable to estimate the number of clusters that could be adversely affected by activities implementing the plan based on the proximity of foraging partitions to areas likely to be harvested. This approach is described and analyzed below.

The activities analyzed below are used solely for the purpose of informing a robust, objective and quantitative analysis for how management activities described in the forest plan could affect red-cockaded woodpecker. The forest plan does not identify any site-specific management activities, and implementation of the management strategy described in the plan would require future analysis, public involvement and consultation with the USFWS on project-level actions and effects. However, the forest plan provides sufficient direction to conduct a programmatic analysis of actions that may affect red-cockaded woodpecker and the extent of those effects over the next 10 years as the plan is implemented. Because the precise timing, location and context of these activities is not known, the effects analysis is based on proportional relationships where the average annual number of red-cockaded woodpecker groups affected is based on the proportional annual area of a certain activity divided by the total area over which that activity could occur.

1. **Even-aged loblolly pine management in MA 2.**

   Types of effects:
   - Thinning stands (~10 year interval of entry) could reduce foraging habitat if pre-treatment stand conditions meet the MSS criteria.
   - Final harvest of stands could reduce foraging habitat if pre-treatment stand conditions meet the MSS criteria or if the harvest separates previously contiguous foraging habitat from the cluster by >200 ft.
   - Timber harvest or hauling through clusters during the April-July breeding season could disturb red-cockaded woodpecker and disrupt reproduction.

   Extent of effects:
   - The desired conditions for loblolly pine and loblolly-hardwood stands in MA 2 (DC-MA2-1) include 12-20% of young (0-10 year) forest resulting from final harvest on a 60-90 year silvicultural rotation. The objectives for timber harvest and successional diversity (OBJ-MA2-2) include harvesting at least 5,000-6,000 ac within 10 year of plan approval, resulting from 500-600 ac/year of loblolly pine final harvest. For this analysis a value of 600 ac/year is used to represent a maximum effect on red-cockaded woodpecker. Thinning stands would occur at ~10 year intervals until final harvest.
   - MA 2 encompasses ~103,000 ac, of which ~48,800 ac are in stands classified as loblolly or loblolly-hardwood forests. All of these stands would be subject to thinning on a ~10 year interval (=10% of stands per year). Additionally, the ~8,200 ac of older stands (currently >50 year or unknown age) are subject to final harvest (600 ac/yr).
   - The ¼ mi foraging partitions of 94 clusters contain at least some area in MA 2, mostly in loblolly pine stands. 23 of these partitions contain loblolly stands that are >50 year old or are of unknown age (Figure 13-5).

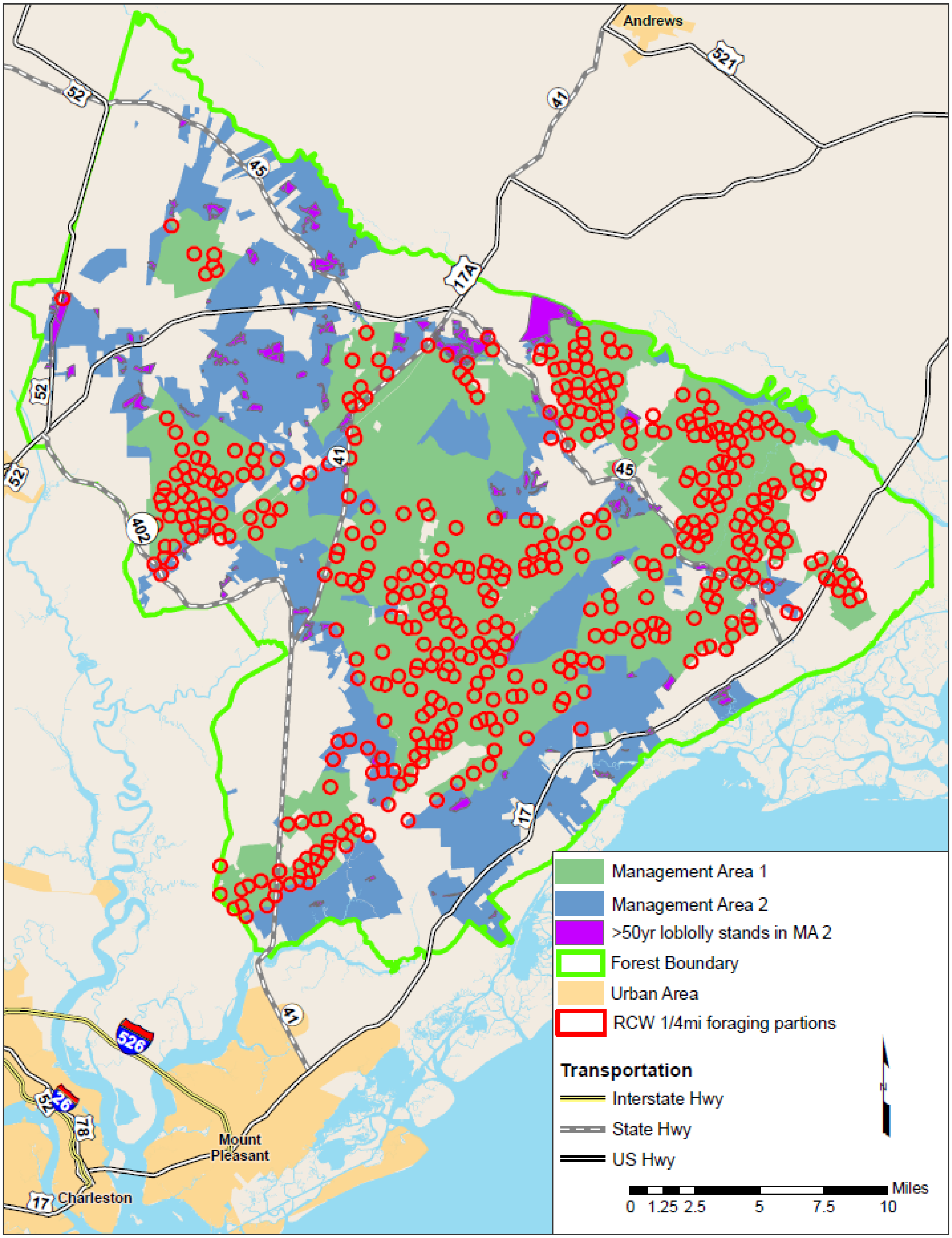

Figure 13-7. Red-cockaded woodpecker ¼ mile foraging partitions in relation to older loblolly pine stands in MA 2

  - o Proportion of MA 2 loblolly stands in ¼ mi red-cockaded woodpecker partitions subject to final harvest per year = 600 / 8,200 = 0.073
  - o Estimated number of red-cockaded woodpecker clusters affected per year = 0.073 * 23 = 1.7 ~ 2
- The cluster polygons (minimum convex polygons of cavity trees and a 200 ft buffer) of 45 clusters overlap loblolly stands in MA 2.
  - o Approximately 10% of loblolly stands would be thinned each year. These stands are unlikely to meet MSS criteria because they are young, they would not be thinned until they reach 80-100 ft^2/ac of basal area and they would be thinned to a target basal area of 50-80 ft^2/ac. Therefore, no adverse effects based on foraging habitat are expected from this activity. However, thinning of these stands and associated timber hauling could occur during red-cockaded woodpecker breeding season (April – July, or 1/3 of the year), which could disturb birds and reduce reproductive performance.
  - o Proportion of MA 2 loblolly stands that may be harvested during breeding season = 0.1 * 0.33 = 0.033
  - o Estimated number of red-cockaded woodpecker clusters affected per year = 0.033 * 45 = 1.5 ~ 2

2. Open wet savanna restoration in MA 1.

Types of effects:

- Thinning stands to desired tree density (10-60 ft^2/ac of tree basal area) could reduce foraging habitat if pre-treatment stand conditions meet the MSS.
- Removing loblolly pine to restore historical wet savanna sites could reduce foraging habitat if the harvest separates previously contiguous foraging habitat from the cluster by >200 ft.
- Timber harvest or hauling through clusters during the April-July breeding season could disturb red-cockaded woodpecker and disrupt reproduction.

Extent of effects:

- The plan objective (OBJ-ECO-3) for restoring open wet savannas with a sparse longleaf canopy is 15,000 ac, or 1,500 ac/yr.
- Open wet savannas and flatwoods historically comprised ~58,000 ac. in MA 1. The boundaries of current stands do not align with the historical ecosystem boundaries in many cases, so the latter were used to estimate effects of restoration on red-cockaded woodpecker. Because most historical savannas are not in the desired condition, this analysis assumes that all of these areas could be subject to restoration through timber harvest, primarily thinning but potentially clearcut of loblolly pine following by planting longleaf.
- The ¼ mi foraging partitions of 410 red-cockaded woodpecker groups contain historical wet savanna habitats, totaling ~19,000 ac (Figure 11).
  - o Estimated area of wet savanna sites that currently meet MSS criteria (based on forest-wide average above) = 14%
  - o Proportion of wet savanna sites that may be subject to restoration per year and also meet MSS criteria = (1,500 / 58,000) * 0.14 = 0.0036
  - o Estimated number of red-cockaded woodpecker clusters affected per year due to reduction of foraging habitat = 0.0036 * 410 = 1.5 ~ 2
- The cluster polygons of 357 red-cockaded woodpecker groups overlap historical wet savanna in MA 1.
  - o Proportion of MA 1 wet savanna areas that may be harvested during breeding season = (1,500 / 58,000) * 0.33 = 0.0085

  - o Estimated number of red-cockaded woodpecker clusters affected per year = 0.0085 * 347 = 2.96 ~ 3

3. Upland longleaf restoration.

Types of effects:

- Thinning stands to desired tree density could reduce foraging habitat if pre-treatment stand conditions meet the MSS criteria.
- Removing loblolly pine to restore historical upland longleaf sites could reduce foraging habitat if the harvest separates previously contiguous foraging habitat from the cluster by >200 ft.
- Timber harvest or hauling through clusters during the April-July breeding season could disturb red-cockaded woodpecker and disrupt reproduction.

Extent of effects:

- The plan objective (OBJ-ECO-3) for restoring upland longleaf habitats to a desired vegetation structure (meeting red-cockaded woodpecker foraging habitat criteria) and composition (longleaf canopy) is 11,000 ac, or 1,100 ac/yr.
- Stands in a range of current conditions could be appropriate for restoring upland longleaf systems. For this analysis, the stands considered most likely for restoration that could potentially affect red-cockaded woodpecker are loblolly or loblolly-hardwood stands in MA 1 with a desired condition of longleaf. Based on stand information in FS Veg, 603 stands totaling ~29,000 ac met these criteria.
- The ¼ mi foraging partitions of 302 red-cockaded woodpecker groups contain stands suitable for upland longleaf restoration (Figure 12).
  - o Proportion of stands that could be restored per year and also meet MSS criteria = (1,100 / 29,000) * 0.14 = 0.0053
  - o Estimated number of red-cockaded woodpecker clusters affected per year = 0.0053 * 302 = 1.6 ~ 2
- The cluster polygons of 247 red-cockaded woodpecker groups overlap stands suitable for upland longleaf restoration in MA 1.
  - o Proportion of MA 1 upland longleaf restoration areas that may be harvested during breeding season = (1,100 / 29,000) * 0.33 = 0.013
  - o Estimated number of red-cockaded woodpecker clusters affected per year = 0.013 * 247 = 3.21 ~ 4.

The analysis above suggests that implementing the forest plan could adversely affect up to 15 red-cockaded woodpecker clusters per year through reduction of foraging habitat or forest management activities conducted within cluster boundaries during the breeding season. This equals 3.3% of the 465 active clusters based on the 2015 red-cockaded woodpecker survey data. In the last 10 yr, as the post-Hurricane Hugo forest has grown into improved foraging habitat, the average annual red-cockaded woodpecker population growth has been 3.7%. Most of this growth has resulted from pioneering and budding; natural cavities and inserts have been maintained or replaced during this period but no new recruitment clusters have been established. Population growth rate varies from year to year but using the 10-year average of past growth is reasonable and constitutes the best available information.

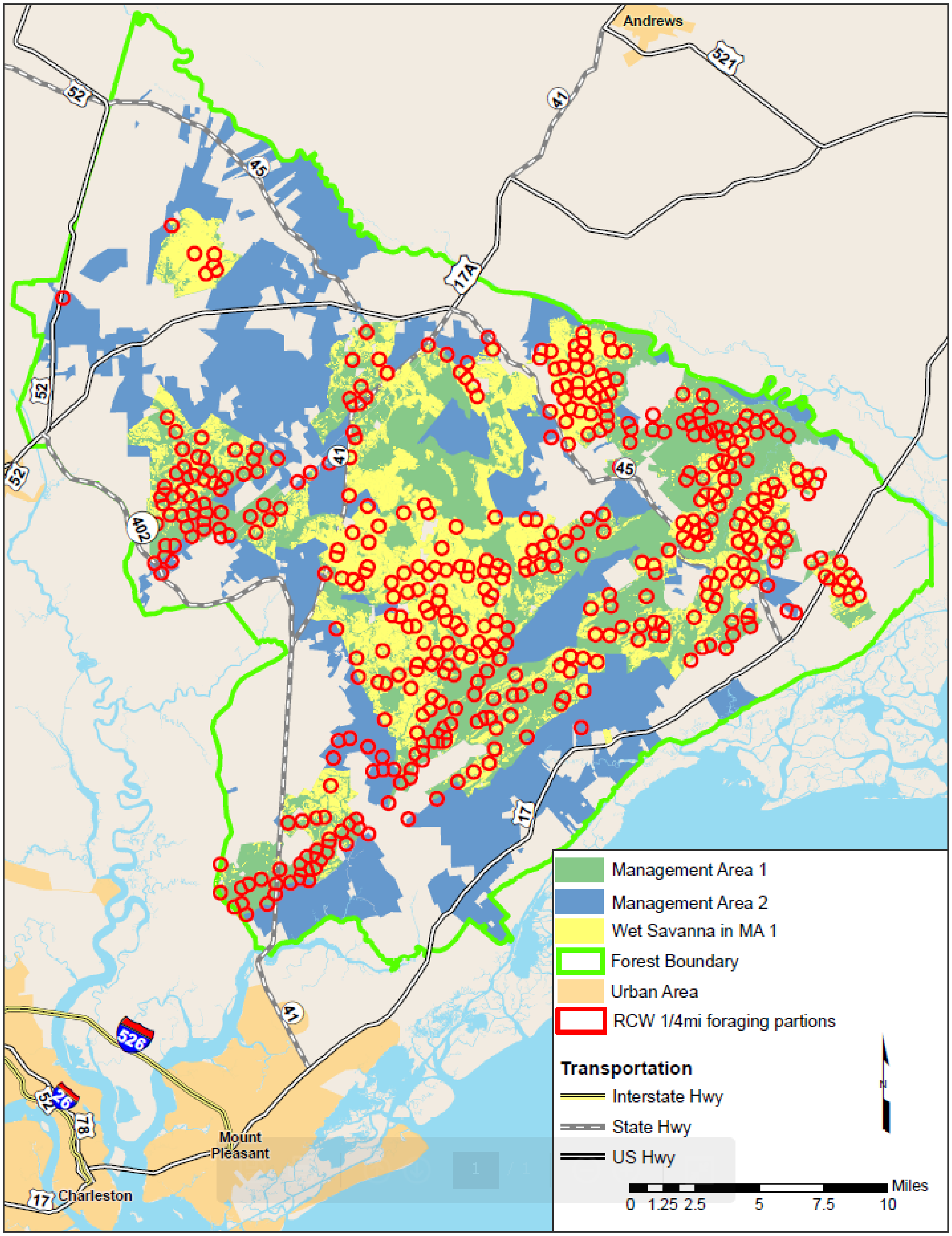

Figure 13-8. Red-cockaded woodpecker ¼ mile foraging partitions in relation to wet savanna ecosystems in MA 1

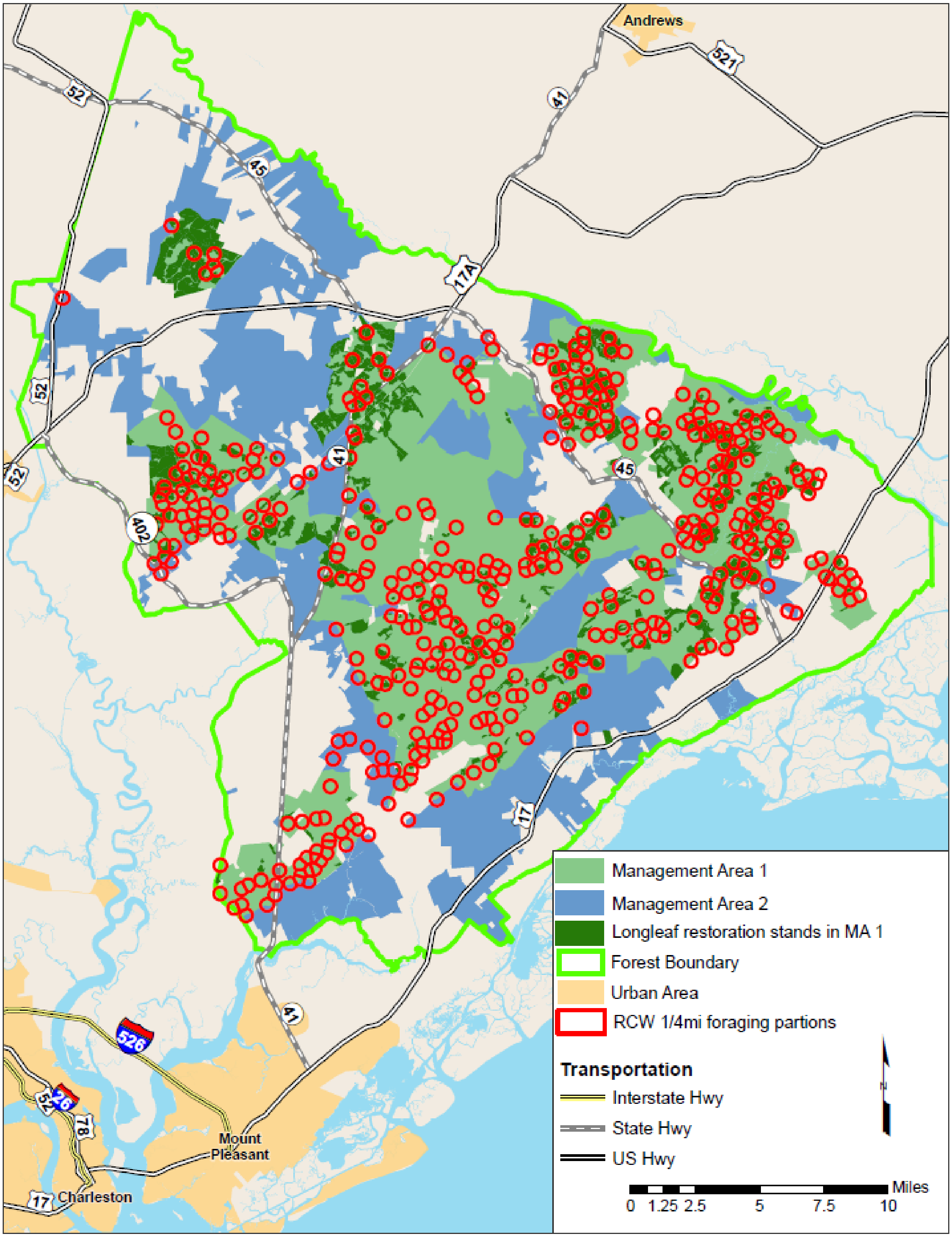

Figure 13-9. Red-cockaded woodpecker ¼ mile foraging partitions in relation to potential longleaf restoration stands

Based on the proportional effects and recent population growth rates, it is possible to estimate how cluster-level effects could influence population dynamics over the 10-yr life of the forest plan. The variables for calculating active cluster dynamics for each year are the following:

Cluster baseline = (previous year clusters – (previous year clusters * 0.033))

Cluster growth = 0.037 * cluster baseline

Current active clusters = cluster baseline + cluster growth

This simple population model produces the following results:

Table 2. Projected red-cockaded woodpecker population change during plan implementation.

Year	Active clusters	Maximum clusters affected
2016	477	16
2017	478	16
2018	480	16
2019	481	16
2020	482	16
2021	484	16
2022	485	17
2023	486	17
2024	488	17
2025	489	17
2026	490	17
2027	492	17
2028	493	17
2029	495	17
2030	496	17
2031	497	17

This deterministic model is very sensitive to variation in both the population growth rate and the number of clusters adversely affected. However, as shown above, even a worst case scenario is unlikely to adversely affect the Francis Marion National Forest red-cockaded woodpecker population.

An adaptive management approach could be used to better estimate the number of red-cockaded woodpecker clusters that could be adversely affected while still maintaining population growth or at least preventing unacceptable levels of population decrease. For example, if annual cluster monitoring shows that red-cockaded woodpecker are more sensitive than expected to some activity proposed in the plan, then the effects could either be avoided by modifying the action or mitigated by other habitat or cavity management. For situations when adverse effects are likely to result in cluster abandonment or cavity tree damage, those clusters could be moved to better habitat within the Francis Marion National Forest or translocated as part of the regional translocation program that has contributed to range-wide growth in red-cockaded woodpecker populations. Although this would not offset the adverse effects within the regulatory framework of the Endangered Species Act, it could nevertheless benefit the species.

There may be additional activities conducted within the greater area of the red-cockaded woodpecker clusters (i.e., county or state road maintenance), but it is unlikely that these activities would adversely affect red-cockaded woodpecker individuals, cavity trees or clusters. Adverse effects and incidental take due to ongoing management efforts (i.e., cavity restrictors, artificial cavity inserts, translocation, and red-cockaded woodpecker monitoring) are already covered in the Fish and Wildlife Service's 2003 intraservice programmatic biological opinion on issuance of section 10(a)(1)(A) permits (email from Will McDearman, Red-Cockaded Woodpecker Recovery Coordinator, dated 5/20/2016). Despite the potential for adverse effects to individuals and clusters shown in the analysis above, the cumulative effects of the forest plan, in the context of other reasonably foreseeable activities that may affect red-cockaded woodpecker, will likely be positive due to improved long-term red-cockaded woodpecker habitat resulting from achieving the desired conditions of the plan.

Determination

Forest management activities required to achieve desired conditions and objectives of the forest plan may affect, and are likely to adversely affect, red-cockaded woodpeckers. Prescribed fire may harm red-cockaded woodpecker through accidental ignition of cavity trees, though there is no basis to estimate the number of trees or birds that may be affected. Management for loblolly pine timber production in MA 2 may reduce foraging habitat for red-cockaded woodpecker clusters below the recovery plan guidelines or may disturb red-cockaded woodpecker during the breeding season (average of up to 4 clusters/yr). In MA 1, restoration of open wet savanna habitats and conversion of loblolly stands to longleaf are also likely to reduce short-term foraging habitat or disturb clusters during the breeding season (average of up to 11 clusters/yr). Together, these timber management activities may adversely affect up to 15 red-cockaded woodpecker clusters per year, but based on recent population growth the total number of active clusters would still likely increase (though more slowly) over the next 10 years. The number of active clusters and potential breeding groups would remain well above recovery goals for the population.

These estimates have two important caveats that suggest the actual number of clusters adversely affected would be much lower:

1. The analysis above assumes that all activities of certain types in stands that overlap red-cockaded woodpecker clusters or ¼ mile foraging partitions would reduce foraging habitat below the MSS. However, longleaf restoration and timber thinning can also modify stand structure to meet MSS criteria. For example, hardwood removal and thinning pines from below (i.e., selective removal of smaller diameter stems) could result in meeting the MSS criteria for many of the stands with sufficient >10 in dbh pine trees. As such, even if implementing the plan decreases habitat in some stands, project-level analysis could still show a net benefit in foraging habitat if other stands in the foraging partition are improved

2. Potential adverse effects to red-cockaded woodpecker would be limited to habitat modification and disturbance of birds during the breeding season. It is possible that these effects could result in cluster abandonment or mortality, but experience on the Francis Marion National Forest and other forests suggests that clusters affected by timber harvest activities may experience reduced breeding success or may move, but the adult birds generally are not killed.

Moreover, the restoration activities in the forest plan would contribute to achieving the cluster and foraging habitat guidelines in the recovery plan. The current dominance of even-aged loblolly pine stands on the Francis Marion National Forest is not considered compatible with long-term red-cockaded woodpecker population growth and maintenance. Although implementing the forest management activities described in the forest plan results in short-term, incidental disturbance to a small portion of the Francis Marion National Forest’s current red-cockaded woodpecker population, the long-term, net effects will be beneficial to the species.

h. WEST INDIAN MANATEE (*TRICHECHUS MANATUS*)

The West Indian Manatee (*Trichechus manatus*) is federally and state endangered in South Carolina. Manatees are protected under the Marine Mammal Protection Act, which prohibits the take (i.e., harass, hunt, capture or kill) of all marine mammals. Manatees are found in marine, estuarine and freshwater environments. The West Indian manatee, *Trichechus manatus*, includes 2 distinct subspecies, the Florida manatee (*Trichechus manatus latirostris*) and the Antillean manatee (*Trichechus manatus manatus*). Potential threats to the species include habitat loss and degradation, mortality from boat collisions, entanglement in fishing gear, entrapment in water control structures and exposure to cold temperatures. In South Carolina, the Florida manatee is known or believed to occur in the following counties: Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry and Jasper. Although Florida manatees are present throughout the year in Florida, they are migratory in South Carolina. Manatees begin migrating up the east coast of Florida, Georgia and South Carolina each spring when water temperatures begin to rise into the upper 60s. They can be found in tidal rivers, estuaries and near-shore marine waters throughout Georgia and the Carolinas throughout the summer months. Manatees return to Florida in September and October as water temperatures begin to cool.

Manatee sightings in Berkeley and Charleston County have been reported to SCDNR, most of which have come from the Cooper River. However, it would not be unexpected if the species occasionally swims in state waters on or adjacent to the forest such as Wambaw Creek, Tibwin Creek, Awendaw Creek, Guerin Creek and Huger Creek. The species was documented in the Santee River next to the forest in 1993 and has been repeatedly reported from the Cooper River and Wando River. Manatee sightings have been reported on the Cooper River as far north as Moncks Corner. During 2012 one manatee made it through locks on the Santee Cooper Lakes and wound up becoming trapped in Lake Marion. Unfortunately, this manatee was eventually found dead near Camp Bob Cooper on Lake Marion during November 2012.

Effects of forest plan

Management activities proposed in the Forest Plan are not expected to affect habitat for West Indian manatee as soil and water guidelines described for all alternatives are designed to minimize impacts to water quality; therefore, no direct or indirect effects are expected for all alternatives. Analysis and consultation with applicable state and federal entities would be conducted at the project level when projects have the potential to impact the West Indian manatee.

Because the forest plan is not expected to affect this species, there will be no cumulative effects to West Indian manatee resulting from implementing the forest plan.

Determination

This species has been documented as being sighted in streams within Berkeley and Charleston County, but this is on rare occasions. Based on the above information, the nature and locations of the proposed treatments of the Revised Forest Plan will have **no effect** to West Indian manatee.

i. WOOD STORK (MYCTERIA AMERICANA)

Since the 1996 Forest Plan was written, the wood stork has been down listed to threatened. The wood stork may be seen in swamps and wetlands across the Francis Marion, but is currently not known to nest on the forest. However, wood stork rookeries are known from adjacent private properties in Charleston County, including The Nature Conservancy’s Washoe Reserve. Due to the amount of ideal wetland habitat for rookeries, it is highly conceivable that wood stork rookeries may form on the forest within the next 10-50 years.

Effects of forest plan

Habitat for the wood stork would not vary greatly among the alternatives since their preferred nesting sites would not be actively managed. The greatest threat to habitat is draining wetlands and swamps. No alternatives propose to drain wetlands or swamps, but efforts are planned to restore hydrologic function to areas that may be suitable for rookeries or foraging habitat. Therefore, implementation of the forest plan would indirectly benefit wood storks by maintaining or improving wetland habitats. Because wood storks do not currently occur on the forest, and management actions would follow guidelines to avoid harm or harassment if rookeries were found, no direct effects would be expected due to the activities of the proposed alternative.

Cumulative effects to wood stork and associated habitat would be unlikely, since no known wood stork rookeries are documented on the forest and habitat would be expected to be maintained and improved as a result of the proposed alternative.

Determination

Wood storks may be seen in swamps and wetlands across the Francis Marion, but are currently not known to nest on the forest. Based on the above information, the nature and locations of the proposed treatments of the Revised Forest Plan may affect, but are not likely to adversely affect wood storks. If wood storks are found nesting on the forest, current USFWS guidance (citation) would be followed to avoid harm or harassment of individuals or disturbance to rookery sites.

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Biological Evaluation

Revised Francis Marion Forest Plan
Berkeley and Charleston Counties, South Carolina

July 2016

I. INTRODUCTION

This Biological Evaluation (BE) addresses the potential effects of the revised Francis Marion Forest Plan on Regional Forester sensitive species and their habitats. The sensitive species list for Region 08 of the Forest Service was last updated in August, 2001. Sensitive species are managed under the authority of the 1976 National Forest Management Act, and are designated by the Regional Forester. Sensitive species include species, which are not designated as federally threatened or endangered, but for which range-wide rarity is of concern. The effects of the revised Forest Plan on the subset of those species, which are known to occur on the Francis Marion National Forest, are evaluated below. The purpose of the Biological Evaluation is the following:

1. To ensure that the revised Francis Marion National Forest Plan does not contribute to loss of viability of any sensitive plant or animal species;
2. To provide a process and standard to ensure sensitive species receive full consideration in the decision making process.

II. MANAGEMENT ACTIONS

The proposed action is the implementation of a revised Forest Plan based upon the Preferred Alternative (Alternative 2) analyzed in the *Final Forest Plan and Final Environmental Impact for the Francis Marion National Forest* (available at http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=stelprdb5393142.

The planning area includes all federal land managed or administered by the Francis Marion National Forest in Berkeley and Charleston Counties, South Carolina. National Forest Land and Resource Management Plans provide broad guidance and information for project and activity decision making for each National Forest over the next 15 years. The original Francis Marion National Forest Land and Resource Management Plan (Forest Plan) was adopted in 1985. The National Forest Management Act (NFMA) calls for plans to be revised every 10 to 15 years, to incorporate new information, to account for changed national policy and direction, and to address new issues and opportunities. After Hurricane Hugo hit the Francis Marion in 1989, it became evident that the 1985 Forest Plan was not adequate, so the Francis Marion Forest Plan was revised in 1996. This second revision of the Forest Plan incorporates new information, addresses evolving

issues and trends, accounts for changes in national policies and direction, and includes updated views from public users and stakeholders.

The revised Forest Plan direction strives to ensure ecological sustainability through time using a complementary ecosystem and species-specific approach. At the coarse filter scale, desired conditions for ecosystems are described in terms of desired composition, structure, ecological processes, landscape structure and connectivity, and response to anticipated stressors. We used a native ecosystem and terrestrial ecological unit framework because native vegetation and wildlife species evolved and adapted within the limits established by natural landforms, vegetation, and disturbance patterns which existed before extensive human alterations. We also included fine filter provisions, as needed, to ensure the persistence of Francis Marion at-risk species including federally-listed T&E, proposed and candidate species and Species of Conservation Concern known to occur on the forest.

III. SPECIES CONSIDERED AND EVALUATED

Potentially affected species were identified by evaluating the location and nature of management direction associated with the revised Francis Marion National Forest Plan, along the with most updated known occurrences for Regional Forester's Sensitive Species (list last updated by the Regional Forester in August, 2001) on the Francis Marion National Forest. Table 1 lists the 2001 Regional Forester's Sensitive Species known to occur on the Francis Marion National Forest. Numerous surveys on the Forest have been conducted on the forest, including those for plants (Everett, Glitzenstein, and McMillan, 2002; Everett, 2002, 2009); and Glitzenstein and Streng (2000, 2003, 2010). Surveys have been conducted on the Forest for red-cockaded woodpeckers (Forest Service personnel and Larry Wood), Frosted Flatwoods Salamander and Carolina Gopher Frog (Fauth, Harrison, Klaus, and Palis), birds (FS personnel), and bats (Mary Kay Clark). The status of all threatened, endangered and sensitive species on the Forest is further summarized in the 2005-2011 Annual Monitoring Reports available at:

http://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=STELPRDB5261459.

The following Table 1 lists sensitive species on the FMNF, relationships of habitats to ecosystems addressed in the revised Forest Plan, whether the species were carried over as Species of Conservation Concern, and known occurrences by Management Area. Management Area 1 is the management area in the revised Forest Plan where ecosystem maintenance and restoration, to include natural fire regimes, is most likely to be practiced.

Table 1. Regional Forester Sensitive Species known from the Francis Marion National Forest

Sensitive Species				**# Known Occurrences**	
		SCC	**Ecosystem/Habitat**	**MA1**	**MA2**
AMPHIBIAN	GOPHER FROG *Rana capito*	Y	Pond Cypress Savannas Mesic and Wet Pine Savannas	16	0
BIRD	BACHMAN'S SPARROW *Aimophila aestivalis*	Y	Upland Pine Woodlands	Numerous	0
BIRD	BALD EAGLE *Haliaeetus leucocephalus*	Y	Forested Wetlands	0	7
MAMMAL	RAFINESQUE’S BIG-EARED BAT *Corynorhinus rafinesquii*	Y	Forested Wetlands Pine Upland/Wetland Ecotones	1	0
MAMMAL	SOUTHEASTERN MYOTIS *Myotis austroriparius*	Y	Forested Wetlands Pine Upland/Wetland Ecotones	1	0
PLANT	INCISED GROOVEBUR *Agrimonia incisa*	N	Upland Longleaf Woodlands	10	0
PLANT	SAVANNAH MILKWEED *Asclepias pedicellata*	Y	Pine Upland/Wetland Ecotones	1	0
PLANT	CAROLINA SPLEENWORT *Asplenium heteroresiliens*	N	Calcareous Mesic Hardwood Forests	0	1
PLANT	MANY-FLOWERED GRASS-PINK *Calopogon multiflorus*	Y	Wet Pine Savannas	2	0
PLANT	PONDSPICE *Litsea aestivalis*	N	Depressional Wetlands and Carolina Bays	36	20
PLANT	BOYKIN’S LOBELIA *Lobelia boykinia*	Y	Pond Cypress Savannas	13	0
PLANT	LOOMIS' LOOSESTRIFE *Lysimachia loomisii*	Y	Pine Upland/Wetland Ecotones	1	0
PLANT	LOOSE WATERMILFOIL *Myriophyllum laxum*	Y	Depressional Wetlands and Carolina Bays	3	0
PLANT	CLIMBING HEATH *Pieris phyllyreifolia*	N	Forested Wetlands	4	3
PLANT	PINELAND PLANTAIN *Plantago sparsiflora*	N	Mesic to Wet Pine Savannas	14	2
PLANT	YELLOW FRINGELESS ORCHID *Platanthera integra*	Y	Mesic to Wet Pine Savannas	10	3
PLANT	CRESTED FRINGED ORCHID	Y	Upland Pine Woodland	14	0

Sensitive Species				**# Known Occurrences**	
		SCC	**Ecosystem/Habitat**	**MA1**	**MA2**
	Pteroglossapsis ecristata				
PLANT	AWNED MEADOW BEAUTY *Rhexia aristosa*	N	Pond Cypress Savannas	22	0
PLANT	SHORTBRISTLE SEDGE *Rhynchospora breviseta*	Y	Wet Pine Savannas	3	0
PLANT	COASTAL BEAKSEDGE *Rhynchospora pleiantha*	Y	Pond Cypress Savannas	2	0
PLANT	PINELAND DROPSEED *Sporobolus curtisii*	Y	Mesic to Wet Pine Savannas	21	0
PLANT	CAROLINA DROPSEED *Sporobolus pinetorum*	Y	Mesic to Wet Pine Savannas	3	1
PLANT	CAROLINA FLUFFGRASS *Tridens carolinianus*	N	Upland Pine Woodland	8	0

IV. ENVIRONMENTAL BASELINE AND DIRECT, INDIRECT, AND CUMULATIVE EFFECTS OF THE REVISED FOREST PLAN

The following are coarse filter habitat/ecosystem acres addressed in the revised Francis Marion National Forest Plan, and associated acres.

Habitat	Ecosystem	Ecosystem Acres
Forested Wetlands	**Forestwide** - Narrow Forested Swamps and Blackwater Stream Floodplain Forested Ecosystems; Broad Forested Swamps and Large River Floodplain Forested Ecosystems	44,209 49,248 **93,100**
Pine/Wetland Ecotones	**Management Area 1** - Pocosins; Narrow Forested Swamps and Blackwater Stream Floodplain Forested Ecosystems	7,239 26,073 **33,312**
Wet Pine Savannas	**Management Area 1** - Wet Pine Savanna and Flatwoods Ecosystems	**58,062**
Pond Cypress Savannas	**Management Area 1** - Depressional Wetlands and Carolina Bay Ecosystems;	**6,385**
Upland Pine Woodlands	**Management Area 1** - Upland Longleaf Pine Woodland Ecosystems;	**33,407**
Calcareous Mesic Hardwood Forests	**Forestwide –** Mesic Slope Forests	**4,235**
Rivers and Streams	**Forestwide** - Rivers and Streams	**2499 miles**

Upland Pine Woodlands

Known occurrences and habitats for **Bachman's Sparrow, Incised Groovebur, Crested Fringed Orchid, and Carolina Fluffgrass occur** within upland pine woodland ecosystems in Management Area 1 which occurs on approximately 33,407 acres on the Francis Marion National Forest. Crested Fringed Orchid and Bachman's sparrow were designated as Species of Conservation Concern, whereas Incised Groovebur and Carolina Fluffgrass were not. Incised groovebur (11 documented occurrences) and Carolina fluffgrass (14 documented occurrences) are likely to be stable as substantial concern for persistence has not been not demonstrated through Forest monitoring of threats or population declines (Forest GIS data as of 7/21/2016).

Habitat for incised groovebur is less dependent on frequent fire and could occur in MA1 as well as MA2. Existing habitat condition for the upland woodland species is generally good, as known populations also occurred within areas managed for federally endangered red-cockaded woodpecker, which were maintained under the 1996 revised Forest Plan as open stands with herbaceous groundcover.

Directly, effects associated with restoration activities, including timber harvest, prescribed burning, and the possibility of selective herbicide application, could result in harm to individuals, but are unlikely to jeopardize populations. Directly, occurrences for sensitive species which are now Species of Conservation Concern (including crested fringed orchid and Bachman's sparrow), will be conserved through revised forest plan standards and guidelines, including **S35**, No new permanent roads, trails, or recreational sites are allowed in population sites for at-risk plant species; and **S41**. Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species associates and rare communities at desired seasons (growing vs. dormant) and fire return intervals for associated ecosystems (Table 2-1; DC-ECO-2; DC-ECO-3; DC-ECO-4; DC-ECO-5; DC-ECO-7). Indirectly, the desired conditions and associated fire regimes for upland longleaf woodlands within Management Area 1 and DC-SCC-7. Upland Pine Woodlands Associates will provide the desired ecosystem composition, structure, and function needed to benefit all sensitive species addressed.

Mesic to Wet Pine Savannas

Known occurrences and habitats for **Many-flowered Grass-Pink, Pineland Plantain, Yellow fringeless Orchid, Shortbristle Sedge, Pineland Dropseed, and Carolina Dropseed** are provided within fire-maintained wet pine flatwoods and savanna ecosystems in Management Area 1, which occurs on approximately 58,062 acres. Sensitive species which are now Species of Conservation Concern include Carolina gopher frog, many-flowered grass-pink, yellow fringeless orchid, shortbristle sedge, and pineland and Carolina dropseed. Only Pineland Plantain was not designated as a species of conservation concern. Existing habitat condition for many of these species is in fair condition, often threatened by competition from woody species, particularly along wildland-urban interfaces. Known locations for pineland plantain are extensive but known primarily to occur along roadsides, where they are considered to be stable, though some are in designated rare communities in the revised Forest Plan.

Directly, effects associated with restoration activities, including timber harvest, prescribed burning, and selective herbicide application, could result in harm to individuals, but are unlikely to jeopardize populations. Occurrences for sensitive species which are now Species of Conservation Concern (including Carolina gopher frog, many-flowered grass-pink, yellow fringeless orchid, shortbristle sedge, and pineland and Carolina dropseed, will be conserved through revised forest plan standards and guidelines, including **S35**, No new permanent roads, trails, or recreational sites are allowed in population sites for at-risk plant species, and **S41**. Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species

associates and rare communities at desired seasons (growing vs. dormant) and fire return intervals for associated ecosystems (Table 2-1; DC-ECO-2; DC-ECO-3; DC-ECO-4; DC-ECO-5; DC-ECO-7).

Indirectly, desired conditions to maintain, improve, and restore the desired composition, structure, function, and connectivity of wet pine savannas and flatwoods within Management Area 1 will benefit the species, along with DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates and DC-SCC-12. Rare Plant Communities.

Depressional Wetlands and Carolina Bays and Pond Cypress Savannas

Known occurrences and habitats for **Carolina Gopher Frog, Pondspice, Boykin's Lobelia, Loose Watermilfoil, Awned Meadow Beauty, and Coastal Beaksedge** are provided within fire-maintained pond cypress savannas within depressional wetlands and Carolina bays in Management Area 1, which occurs on 6,385 acres. Habitat for loose watermilfoil and pondspice can also be found outside Management Area 1, in open water and forested depressional wetlands and Carolina bays. Existing habitat condition for the majority of occurrences is good, though some are threatened by feral hogs or woody competition. Directly, effects associated with restoration activities, including prescribed burning, woody species control, wetland restoration, and selective herbicide application, could result in harm to individuals, but are unlikely to jeopardize populations. Occurrences for sensitive species which are now Species of Conservation Concern (including Carolina gopher frog, pondspice, Boykin's lobelia, loose watermilfoil, and coastal beaksedge will be conserved through revised forest plan standards and guidelines, including **S35**, No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species and **S S41**. Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species associates and rare communities at desired seasons (growing vs. dormant) and fire return intervals for associated ecosystems (Table 2-1; DC-ECO-2; DC-ECO-3; DC-ECO-4; DC-ECO-5; DC-ECO-7).

Project activities could directly impact individuals of awned meadow beauty, though concern for species persistence is not demonstrated through threats or population decline, and some occur within designated rare communities. Twenty-two records are documented, several populations large, and some of these populations occur in designated rare communities on the forest. Indirectly, desired conditions to maintain, improve, and restore the desired composition, structure, function, and connectivity of depressional wetlands and Carolina bays and DC-SCC-6. Pond Cypress Savannas Associates within Management Area 1 and DC-SCC-12. Rare Plant Communities will indirectly benefit all associated species.

Forested Wetlands

Known occurrences and habitats for **Bald Eagle, Rafinesque's Big-eared Bat, Southeastern Myotis, and Climbing Heath** are provided within forested wetlands on the forest, currently occupying 93,100 acres. Forested Wetland habitat condition including associated species is typically very good. Directly, effects

associated with restoration activities, including prescribed burning, woody species control, wetland restoration, and selective herbicide application, are not likely to occur, particularly in broad forested swamps and large river floodplain forests. Forested wetlands and associated occurrences for sensitive species which are now Species of Conservation Concern (including Rafinesque's Big-Eared Bat and Southeastern Myotis), will be conserved through forest plan standards and guidelines, desired conditions for riparian areas, rivers and streams, and eligible wild and scenic rivers. Through **S28**. Survey for at-risk bats before buildings, bridges, wells, cisterns and other man-made structures are structurally modified or demolished. If bats are found, then consider installing bat gates and/or erecting bat houses. Once the bat houses are being use, then demolish or replace structures. Habitat and populations for climbing heath are stable and persistence concerns are not demonstrated through population or habitat trends – as this is a species found in the canopy of bald cypress trees in broad non-riverine swamps which are not likely to be managed Desired conditions for Narrow Forested Swamps and Blackwater Stream Floodplain Forested Ecosystems and Broad Forested Swamps and Large River Floodplain Forested Ecosystems and DC-SCC-8. Forested Wetlands Associates will indirectly benefit all associated species.

Pine Upland/Wetland Ecotones

Known occurrences and habitats for Savannah Milkweed and Loomis' Loosestrife are provided within fire-maintained pine upland/wetland ecotones within Management Area 1 on the forest, currently occupying 33,407 acres. Directly, effects associated with restoration activities, including prescribed burning, woody species control, wetland restoration, and possible selective herbicide application, could result in harm to individuals, but are unlikely to jeopardize populations. Both species are Species of Conservation Concern and will receive additional conservation through forest plan standards and guidelines. Indirectly, desired conditions for DC-SCC-3. Pine Upland/Wetland Ecotones Associates, and landscape-level burning within Management 1, will benefit the species habitat.

Calcareous Mesic Hardwood Forests

Carolina Spleenwort has not been observed on the forest since 1981, therefore is was not recommended for inclusion as a species of conservation concern. Habitat within which the species was last seen is the Guilliard Lake Scenic Area, and will be conserved through desired conditions associated within the Scenic Area. There are expected to be no direct effects of forest plan implementation on the species, since it is unlikely to occur on the forest, and indirectly, the revised forest plan is expected to benefit habitat for the species through desired conditions for Mesic Hardwood Ecosystems and DC-SCC-4. Calcareous Mesic Forests Associates.

V. CUMULATIVE EFFECTS

Public land plays a critical role in the conservation of species prior to federal listing, which receive no protection on private or state lands. During the next 10 to 50 years of forest plan implementation, human populations are likely to expand, affecting urbanization, roads and associated traffic, and prescribed burning and smoke management. This suggests that public land will play an increasingly important role in the conservation of plant and animal diversity in the future, and that management to ensure the diversity of plant and animal species will be an increasingly difficult challenge. Our Management Strategy for dealing with these challenges is to strengthen our collaboration with federal, state, non-government agencies (NGO's), and private partners to maintain and restore populations and associated habitats for At-risk Species using an all-lands approach, including:

a. Collect and share inventory and monitoring information which documents locations, trends, habitat condition, threats, and management responses;
b. Conduct propagation and population enhancement activities to maintain and enhance genetic diversity, encourage gene flow, and improve resistance to climate change and population resilience.
c. Conduct widespread inventories for at-risk species populations to improve our understanding of distribution, habitat condition, threats and management needs.
d. Maintain up-to-date digital databases of species occurrences and trends to share with State Wildlife and Heritage Programs, U.S. Fish and Wildlife Service, the South Atlantic Landscape Cooperative, Natureserve, and others.

Partnerships to facilitate introduction in known and historic habitats could lead to increased connectivity of these populations and enhanced genetic diversity. The revised forest plan is likely to have cumulative benefits to populations and habitats for sensitive species through ecosystem level direction and improved collaboration to include an all-lands approach to conservation of plant and animal species.

VI. DETERMINATION OF EFFECT, ASSOCIATED MITIGATION, AND RATIONALE/SIGNATURE BLOCK

Based on this analysis, the following determinations can be made.

***For sensitive species*: May impact Individuals but not likely to cause a trend to federal listing or a loss of viability:**

All sensitive species addressed. Restoration activities could result in the loss of individuals, but are not likely to affect and may benefit populations and habitat, based on revised Forest Plan desired conditions which benefit habitats, standards and guidelines, and management strategies for populations of at-risk species, and because of information which suggests that the species does not occur on the forest, and that habitats and

populations are stable. In addition, an all-lands approach will be used to improve collaboration with partners in the sharing of information regarding species distributions, ecosystems, habitats, and management responses.

No impact: No sensitive species addressed.

SIGNATURES

/s/ *Robin Mackie* December 17, 2016

Forest Botanist/Ecologist Date

VII. References and Other Data Sources

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U.S. Department of Agriculture – Forest Service Southern Region. 1995. Record of decision final environmental impact statement for the management of the red-cockaded woodpecker in the Southern Region. USDA-FS Southern Region, Atlanta, GA.

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Appendix H: Concern Statements and Responses

Note: Public comment letters are included at the end of this section (see "Comment Letters Received on the Draft EIS."

Comment Letter Concerns and Agency Responses

No Response Needed

Concern: [Seq#1] These comments are supportive of forest plan direction, such as an all-lands approach, restoration of longleaf pine and increased prescribed burning. [ID#1]

Response: [Seq#1] No further response is needed. [ID#1]

Concern: [Seq#10] Technical edits to the Forest Plan and associated FEIS should correct typographical errors. [ID#10]

Response: [Seq#10] Errors will be corrected as needed. [ID#10]

Concern: [Seq#11] These comments are not specific or not relevant to changes in the Forest Plan Direction [ID#11]

Response: [Seq#11] No further response is needed. [ID#11]

Concern: [Seq#50] DC-F-2(n) under supporting information, any assessment of wind turbines should evaluate the effects on birds because of the potential for significant adverse effects. [ID#50]

Response: [Seq#50] This language will be removed from the revised forest plan. SC Department of Energy has identified that any potential development for wind energy is off-shore and there is no known potential on the Francis Marion National Forest. [ID#50]

Process, Policy, Laws, Partnerships

Santee Experimental Forest

Concern: [Seq#5] The Santee Experimental Forest should be put under a management strategy compatible with the surrounding national forest land because it is a degraded site in the heart of the Francis Marion National Forest. [ID#5]

Response: [Seq#5] While the Francis Marion coordinates with the Santee Experimental Forest on many projects (i.e. prescribed burning, conservation of natural areas), but our management strategies may not be completely compatible. The Santee Experimental Forest is a part of the U.S. Forest Service Southern Research Station's Center for Forested Wetlands Research and as such conducts studies and experiments consistent with this affiliation. This includes studies and experiments to develop needed information and tools to manage, restore and conserve the functions and values of the coastal plain forests. The Francis Marion collaborates with Santee Experimental Station in the conservation of wet marl hardwood and calcareous mesic forest associates on the Experimental Forest.

NFMA Concern

Concern: [Seq#6] Plan components should properly protect the ecological conditions and provide ecological integrity necessary for a viable population of at-risk species because delegating the protection of these species to project planning is not consistent with the planning rule and NFMA. [ID#6]

Response: [Seq#6] Protecting habitat of at-risk species is a priority in the planning regulations and in the Francis Marion forest plan. The planning regulations discuss a coarse/fine filter approach to managing habitat for at-risk species. Additional forest plan components are not needed if species needs can be met by providing suitable habitats by maintaining and restoring the appropriate ecosystems. A crosswalk of Threatened and Endangered and Species of Conservation Concern and relevant forest plan components are provided in Appendix D of the revised forest plan.

Concern: [Seq#25] Neither the final plan nor the FEIS acknowledge that the PTSQ for the plan represents a departure from non-declining even flow of timber (NDEF). An article by Wilkinson and Anderson which states that "the NFMA requires the Forest Service to follow NDEF policy, with some exceptions" is referenced. It is then further stated that NFMA requires that a decision to adopt a departure to be fully reviewed by the public. It is also stated that the record fails to identify "the projected long-term average sale quantity that would otherwise be established (without a departure), as required by NFMA. [ID#25]

Response: [Seq#25] The commenter interchanges NFMA with the 1982 planning regulations. This confusion likely stems from the referenced law review article's inadvertent conflation of NFMA and the 1982 implementing regulations. The National Forest Management Act (NFMA) (16 USC 1611(a)), states:

> The Secretary of Agriculture shall limit the sale of timber from each national forest to a quantity equal to or less than a quantity which can be removed from such forest annually in perpetuity on a sustained yield basis: Provided, That, in order to meet overall multiple use objectives, the Secretary may establish an allowable sale quantity for any decade which departs from the projected long term average sale quantity that would otherwise be established: Provided further, That any such planned departure must be consistent with the multiple use management objectives of the land management plan. Plans for variations in the allowable sale quantity must be made with public participation as required by section 6(d) of this Act. In addition, within any decade, the Secretary may sell a quantity in excess of the annual allowable sale quantity established pursuant to this section in the case of any national forest so long as the average sale quantity of timber from such national forest over the decade covered by the plan do not exceed such quantity limitation.

This is the only reference to "departure" in NFMA. The 2012 planning rule regulations, and accompanying directives, reflect this language taken directly from the National Forest Management Act itself.

The 2012 planning regulations fulfill NFMA's direction, stating that "the quantity of timber that may be sold from the national forest is limited to an amount equal to or less than that which can be removed from such forest annually in perpetuity on a sustained yield basis" (36 CFR 219.11(d)(6)), and then stating that the responsible official "may provide for departures from this limit as provided by the NFMA when departure would be consistent with the plan's desired conditions and objectives" (36 CFR 219.11(d)(6)(i)).

In contrast, the 1982 regulations did contain what was commonly referred to as a non-declining flow requirement (36 CFR 219.16(a)). The 1982 regulations called for planning alternatives to be formulated assessing long term sustained yield capacity and a base sale schedule. Further, the 1982 regulations required that in establishing base sale schedules, "the planned sale for any future decade shall be equal to, or greater than, the planned sale for the preceding decade, provided that the planned sale is not greater than the long-term sustained yield capacity consistent with the management objectives in the alternative" (219.16(a)(1)). Exceptions to this requirement were permissible and called "departure alternatives" and guidelines were provided for analysis and consideration when departing from the non-declining flow objective where doing so "will lead to better attaining the overall objectives of multiple-use management…" 219.16(a)(3). However, as noted above, the 1982 regulatory requirements were not carried forward into the 2012 planning regulations and are no longer applicable.

In the Francis Marion's Plan and FEIS, the Sustained Yield Limit is calculated to be 11.38 MMCF per year. The Planned Timber Sale Quantity (PTSQ) for the first decade is 9.83 MMCF per year and for the second decade, it is 9.51 MMCF per year. These Planned Timber Sale Quantities are both below the Sustained Yield Limit and do not "depart" from the limit (or in other words, do not exceed the limit) that has been established.

In terms of the PTSQ, the reasons for the variation between decades is discussed in more detail in Appendix B of the FEIS, but the foremost reasons are:

- In alternatives 2 and 3, the intent is to convert very large acreages of loblolly pine to longleaf pine in the first decade. This tends to create a large spike in harvest the first decade, and a large drop in the following few decades. This repeats when the acres regenerated to longleaf pine come of age for thinning in future decades.
- A second large factor is due to the effects of Hurricane Hugo. As a result of that event, the acreage in age 20-30 year old forest is quite large, comprising approximately 27% of the Francis Marion National Forest. Equally important is a following trough of very few acres 0 to 20 years of age.

Appendix B of the FEIS also discloses in more detail how the PTSQs for the alternatives were determined and how the Sustained Yield Limit (SYL) was calculated. These determinations, along with the forest plan standards for vegetation management, show how for the Francis Marion, the quantity of timber that may be sold from the national forest is limited to an amount equal to or less than that which can be removed from the Francis Marion annually in perpetuity on a sustained-yield basis.

Concern: [Seq#26e] Planners need to include plan components to address threats of nonnative invasive species on all the ecological systems because NFMA requirements for ecological integrity cannot be met without those plan components (29-17) [ID#26]

Response: [Seq#26e] The impacts of non-native invasive species (NNIS) are a serious threat to the ecological integrity of ecosystems and wildlife habitats on the Francis Marion National Forest. The Forest Service has no regulatory on items, such as hunting of NNIS game species or the sale or transport of NNIS plants and animals. Currently the Forest Service in cooperation with South Carolina Department of Natural Resources (SCDNR) and the USDA Animal and Plant Health and Inspection Service (APHIS) is aggressively trying to control the feral hog population on the Francis Marion. SCDNR has expanded the hog hunting opportunities to allow hunters to harvest hogs during any open hunting season and has

initiated “Special Hog Hunts” to help reduce/control hog populations across the Francis Marion. SCDNR and APHIS personnel actively trap feral hogs outside of the deer hunting season as well. The Forest Service has contracted with some hog hunters in the past and expects to pursue the possibility of continuing this activity. In 2015, 108 hogs were removed from the Francis Marion by SCDNR personnel, APHIS personnel and Forest Service contractors.

Forest plans components that are within the authority of the Forest Service that address this concern include desired conditions, objectives, and standards and guidelines on ecological sustainability and non-native invasive species.

Concern: [Seq#47] The FEIS should address the direct and indirect effects on private property and the associated private property rights because this is necessary to be in compliance with NFMA and NEPA. [ID#47]

Response: [Seq#47] Clarification that activities described in the forest plan apply only to national forest lands was added to chapter 1 of the final forest plan.

Range of Alternatives

Concern: [Seq#28] The range of alternatives in the DEIS should be expanded to consider more prescribed burning in order to maintain and restore habitats for at-risk species. [ID#28]

Response: [Seq#28] We interpret this request as wanting an alternative that does prescribed burning on all fire-adapted ecosystems within the appropriate fire return interval. Due to its importance and the amount of public concern, the restoration of native longleaf ecosystems and amount of prescribed burning needed was recognized as a significant issue in the Final Environmental Impact Statement, specifically, significant issues 1a and 1 b. Effects of alternatives on key characteristics including dormant and growing season prescribed burning of ecosystems associated with at-risk species habitats and ecosystems is disclosed in Chapter 3 of the FEIS.

The planning team considered a much higher amount of prescribed burning but eliminated it from further study because it is currently outside the “fiscal or technical capabilities of the unit”, as stipulated under the 2012 Planning Regulations. Another reason stated in the FEIS is that this alternative was only considered and not analyzed in detail. This alternative was not considered in detail because of potential impacts to human from prescribed burning in high-risk areas, particularly along major highways and near communities. However, the revised forest plan does direct managers to check if the fiscal or technical capabilities have changed that would allow a greater use of prescribed fire to maintain or restore ecosystems.

All Lands Approach

Concern: [Seq#7] The forest plan should prescribe more burning because there is substantial local support. [ID#7]

Response: [Seq#7] The Francis Marion acknowledges your concern related to local support for more prescribed burning. The Francis Marion agrees more burning is desirable within Management Area 2. The revised forest plan in chapter 2 within the management area section states the following: “Most of the lands in Management Area 2 are influenced by adjacent development and human activities; therefore, frequent, low-intensity fire is less likely to be practiced, ….” However, the plan goes on to say “As management strategies and partnerships are implemented, it may be possible to introduce fire in portions of MA2.”

Concern: [Seq#8] The Francis Marion National Forest should be coordinating with local governments and partners to: (1) Achieve prescribed burning objectives; (2) maintain infrastructure, such as roads and recreation facilities; and (3) identify specific areas where habitat connectivity can be developed to achieve desired conditions. [ID#8]

Response: [Seq#8] The Francis Marion agrees with the value in coordinating with local governments and partners to accomplish the above the tasks. As stated in Chapter 1 Theme 4 of the revised forest plan, "Share operational and planning resources among partners; keep ongoing collaborative efforts vibrant and develop new ones." The plan has a forest-wide desired conditions and objectives that further emphasizes the value of these partnerships.

Concern: [Seq#17] The Francis Marion Forest Plan should emphasize landscape level approach to planning management activities to reduce sedimentation, protect water quality, biodiversity and forest fragmentation. [ID#17]

Response [Seq#17]: We agree with using a landscape-level approach to planning management activities and believe our revised forest plan as disclosed in the FEIS meets this intent. Specifically, the revised forest plan has standards and guidelines to reduce sedimentation and protect water quality. One of the primary themes in the revised forest plan as discussed in Chapter 1 is to maintain or restore the Francis Marion's unique landscapes and features including ecosystems and associated species. The revised plan in Chapter 2 and 3 documents several desired conditions and objectives that ensure biodiversity by ecosystem and species. The FEIS discloses the effects of the action alternatives on biodiversity. All alternatives maintain the existing biodiversity of the area. Effects of alternatives on key characteristics including ecosystem-level connectivity – as it relates to biodiversity, fragmentation, and at-risk species populations and habitats is disclosed in Chapter 3 of the FEIS and in the BA/BE (See Appendix G).

Concern: [Seq#24] The Forest Plan should address the impacts of increasing urban development's adjacent to national forest lands, because developments will have direct and indirect impacts to wildlife habitats and water quality and affects the forest's ability to implement prescribed burning. [ID#24]

Response: [Seq#24] Nearby urban developments do have many direct and indirect impacts to resources on the Francis Marion. Increasing urban developments impact wildlife habitat and water quality and affect the Francis Marion's ability to implement prescribed burning. Increasing urbanization is discussed significant issue 2 discussed in detail in Chapter 1 of the FEIS. Thus these impacts are assessed throughout Chapter 3 of the FEIS.

Concern: [Seq#145] The forest plan should not allow any Forest Service system roads to be managed by the state or county unless mitigation measures are in place to protect natural resources and maintain ecosystem integrity. [ID#145]

Response: [Seq#145] We acknowledge your concern related to management of Forest Service roads by the state and county. We disagree with your assertion that we are giving the state and county the authority to manage our roads. Nothing in the revised forest plan under the desired condition DC-MUB-3 Road System allows this. As stated under the objective OBJ-MUB-6 Comprehensive Roads Planning and Maintenance in the strategy discussion, we will in some cases transfer forest roads to state and counties where the majority of the traffic is not related to forest use. Also we coordinate with state and county partners to reduce impacts to at-risk species and ecosystems.

Concern: [Seq#43] The burden of infrastructure development should be addressed by counties that border the Forest because this growth is degrading our ecosystems. [ID#43]

Response: [Seq#43] The Francis Marion understands your concern related to infrastructure development on the Francis Marion. However, the Francis Marion has no authority and it is outside the scope of this decision to have the counties who border the Francis Marion increase their construction of infrastructure. As stated in the forest plan under desired condition DC-REC-3. Developed Recreation Sites (Facilities and Infrastructure) new recreation sites are considered when they: support a niche opportunity, fulfill a need which cannot be realistically met elsewhere, and long-term partner support as well as alignment with demographic shifts, changing values and recreation demands

Sewee Visitors Center

Concern: [Seq#12] The Francis Marion Forest Plan should identify and commit to funding the Sewee Environmental Education and Visitors Center because of long-standing partnership agreements with the Cape Romain Wildlife Refuge. [ID#12]

Response: [Seq#12] The Francis Marion values the long-standing partnership with Cape Romain and expects this to continue in the future. However, future funding of the Sewee Environmental Education and Visitors Center is outside the scope of this decision.

Management Emphasis

Concern: [Seq#3] The FM NF should promote the importance of working forests because they provide multiple benefits to the public like reducing the risk of insect outbreaks that could affect adjacent private forests. [ID#3]

Response: [Seq#3] The development of promotional materials is outside the scope of a decision made by a forest plan. The FMS NFs work closely with state partners on programs, such as Wood Magic Forest Fair, SC Teachers' Tour, and Project Learning Tree that promote the importance of natural resources and their benefits to the public. [ID#3]

Concern: [Seq#9] The Forest Plan has some major faults, particularly silvicultural and financial costs of restoring longleaf pine because of an increasingly urban environment. [ID#9]

Response: [Seq#9] Comments are not specific to forest plan direction [ID#9]

Concern: [Seq#13] Lands managed for preservation and restoration of ecological elements should not be suitable for timber production because management for forest products compromises management for ecosystems throughout the longleaf system, whereas, lands suitable for timber production should only be managed to produce high quality forest products because this allows the Forest Service to fulfill its fiduciary obligation. [ID#13]

Response: [Seq#13] We acknowledge your concern related to designating lands suitable for timber production compromises management for other uses. We disagree with your assertion and note what is stated in the FEIS Appendix B within the section titled Suitability for Timber Production Step 2: "Lands classified as suitable for timber production does not mean that timber production is the primary purpose of management activities. When land is classified as suitable for timber production, it means that timber production is compatible with the achievement of desired conditions and objectives in the plan (36 CFR 219.11(a)(1)(iii)), and some regular flow of timber products may be expected."

Concern: [Seq#15] The Francis Marion Forest Plan should restrict hunting, herbicide use, prescribed burning and road work and manage for more wildernesses in order in order to protect the land, plants and animals for our children. [ID#15]

Response: [Seq#15] Conservation of natural resources involves a variety techniques, including maintenance and protection, as well as restoration, most notably the need to prescribed burn and maintain lower tree densities to provide red-cockaded woodpecker habitat. Wilderness designation was evaluated during the revision process. See Appendix D in the FEIS. The multiple use mandates in the National Forest Management Act require that national forests provide wood, water, wildlife, wilderness and recreation. [ID#15]

Concern: [Seq#38] The plan should emphasize timber production, including small diameter pine production, because of the significant role the Francis Marion has in supporting the state's economy, shortages of small diameter pine in the region, and the benefits of protection from wildfire and insect infestations [ID#38]

Response: [Seq#38] We appreciate your comments concerning the need to emphasize timber production in the forest plan, but disagree that timber production should be the only emphasis in the forest plan. The forest plan through alternatives 1, 2, and 3 does allow timber production in all alternatives but timber harvesting is used as a tool to help us achieve the desired conditions in the forest plan.

On national lands in Management Area 2, the forest plan does emphasize the protection of human communities from wildfire and a flow of early to late successional habitats and a flow of timber for local economies. In the revised forest plan, DC-MA2-1 Mixed Pine/Hardwood or Loblolly Pine Forests has a desired condition of providing early successional habitat and a flow of habitats and forest products over time.

Concern: [Seq#153] Forest plan direction should encourage the acquisition of inholdings to allow for more efficient management of national forest lands. [ID#153]

Response: [Seq#153] Acquiring inholding does increase the efficiency of management activities. Although there are no plan components that discuss the acquisition of inholdings, they are allowed in the forest plan. The forest plan does state in Chapter 1 under theme 6c "Common topics that are ripe and appropriate for coordination include transportation, land acquisition and high wildfire risks. As documented in the revised forest plan objective OBJ-COM-4. Consider the Broader Landscape, the Francis Marion does have a land exchange and in-holding strategy which does express the desire for acquisition of inholdings. This is accomplished through the development of a Land Ownership Adjustment Strategy that identifies and prioritizes lands for acquisition.

Concern: [Seq#142] The forest plan should emphasize the production of small diameter pine trees to meet statewide demands in the pulpwood market. [ID#142]

Response: [Seq#142] We appreciate your concern and agree with the need to harvest pine trees. While there are no plan components that specifically emphasize the production of small diameter pine trees, the forest plan does have an objective to reduce stand densities using commercial thinnings. "OBJ-THR-1. Reduce Forest Stand Densities. "Achieve low to moderate stand densities on approximately 17,000 acres of stands within 10 years of plan approval, in stands that are at densities higher than their desired." Material from these commercial thinnings can be used to meet the demands of the pulpwood market.

Concern: [Seq#48] The sustainability concepts of "green buildings", green parking, rain water harvesting, rain gardens, solar lighting and renewable energy should be included in the forest plan because they would enhance and protect diversity and ecosystems; improve air and water quality; and conserve and restore natural resources. [ID#48]

Response: [Seq#48] Forest plan desired conditions include the concept of “green building” as part of sustainable recreation and administrative use. Site specific changes are outside the scope of a forest plan.

Human Health and Safety

Concern: [Seq#19] The forest plan direction should address the control of mosquitos because mosquitos can spread diseases and impact human health and the quality of life for residents and visitors to the Francis Marion National Forest. The forest plan should allow a wider range of pesticides for aerial spraying to control mosquitos because the current pesticide restrictions increase the cost and effectiveness of the control program. [ID#19]

Response: [Seq#19] A site-specific decision on mosquito control is outside the scope of this forest plan decision. Language in the revised forest plan would allow for a site-specific analysis and subsequent decision for the control of mosquitos. The following wording changes were made in the revised forest plan to address this concern.

Added desired condition language under the label DC-COM-5 Human Health and Safety, “Health of citizens are improving as Charleston and Berkeley Counties lead efforts with cooperation from the Francis Marion. The transmission of vector-borne illnesses is low among residents. This coordination may include controlling the transmission of diseases that affect public health, such as diseases carried by feral hogs, rabies-vector species or mosquitos.”

Concern: [Seq#74] Planners should check the feasibility of conversion of loblolly plantations to longleaf which requires more burning and creates more smoke than encroaching urban and associated housing developments will allow because of the undesirable effects to human health. [ID#74]

Response: [Seq#74] Smoke can be a serious human health hazard, so numerous precautions are taken before there is an ignition of a prescribed burn. Prescribed burning operations must meet strict guidelines on weather conditions in order to limit smoke impacts to human health. In addition, prescribed burn plans must consider items, such as location of hospitals, schools, nursing homes and other known smoke sensitive areas. Prescribed burns comply with Federal guidelines and a permit is obtained from the SC Forestry Commission in order to limit smoke effects on any given day.

Forest Plan Direction

Chapter 1

Concern: [Seq#51] Chapter 1 of the forest plan should be shorter because: (1) Language about what a plan should do could be removed; (2) the six themes could be shorter since there are overlaps and redundancies; and (3) management strategies need to be identified as not being plan components and cannot be used to meet species diversity requirements. [ID#51]

Response: [Seq#51] We reviewed Chapter 1 of the Plan and agree that it should be concise. We have consolidated some of the themes and made sure that management strategies are identified as not being plan components. Although Chapter 1 has been consolidated, much of the content remains as many commenters appreciated the information provided.

Chapters 2 and 3

Concern: [Seq#52] The plan should clearly identify all areas with the same set of plan components because this information is not easily found. [ID#52]

Response: [Seq#52] To clarify where plan components apply, Chapter 2 was re-organized. Briefly, managers would check the location of a proposed project area with the appropriate Management Area and the Resource Integration Zone to determine the applicable plan components for the project.

Chapter 4 Standards and Guidelines

Concern: [Seq#21] The Forest Plan direction should not rely on best management practices, but use stricter guidelines to protect ecological integrity. [ID#21]

Response: [Seq#21] Both the Chief's National Best Management Practices and the South Carolina Best Management Practices were incorporated in the Plan. The planning team considers these as the minimum acceptable practices to maintain water quality. The desired conditions, objectives, standards and guidelines for terrestrial and aquatic systems (a total of nine ecosystems), and associated riparian areas, provide for the maintenance or restoration of ecological integrity. During project-level planning, additional guidelines maybe developed to protect ecological integrity. If a decision requires a variance from the BMPs, increased involvement with state and Federal agencies may be needed.

Concern: [Seq#54] The plan should include the following guideline "Herbicides will not generally be applied to roadside corridors to prevent invasive plant spread; instead herbicide use will be targeted to known invasive plant infestations." because of the need to protect diverse plant species. [ID#54]

Response: [Seq#54] The widespread applications of herbicides along roadsides should be carefully considered as herbicides can effect native species sensitive to that activity, especially species "at risk". A site-specific analysis of herbicide use is required before any herbicides are applied to national forest land.

Concern: [Seq#55] The forest plan should include an additional guideline "Discourage the movement or use of offsite firewood on the Francis Marion because ecosystem sustainability will be enhanced." [ID#55]

Response: [Seq#55] Firewood used in campfires can be a source of non-native invasive insects and the use of offsite firewood should be discouraged. The following guideline was added "Use of local firewood (firewood grown and cut within 50 miles of where it will be burned) should be encouraged on the Francis Marion to limit the spread of non-native, invasive insects and diseases."

Concern: [Seq#57] Guidelines for red-cockaded woodpecker should be standards and desired conditions should be based on natural range of variation and the red-cockaded woodpecker recovery plan. Red-cockaded woodpecker habitat should be its own management area because

then managers would know where applicable plan components for red-cockaded woodpecker would apply. [ID#57]

Response: [Seq#57] The Francis Marion contributes to the recovery of red-cockaded woodpecker and management activities must comply with forest plan desired conditions, objectives, standards and guidelines. We have considered guidelines and desired conditions from the red-cockaded woodpecker recovery plan as well as the historic range of variation expected for associated longleaf ecosystems, and incorporated them as desired conditions, guidelines, and standards as appropriate in the revised forest plan. See Response to Seq#126 and #128.

Concern: [Seq#58] Guideline G44 should be increased beyond the 5-meter buffer around historic properties because this seems inadequate. [ID#58]

Response: [Seq#58] We consult with SHPO (State Historic Preservation Officer) and Tribes on the appropriate method to protect historic properties from management activities. Based on past consultations, SHPO has often determined that a 5-meter buffer is adequate to protect historic properties from management activities, such as road construction, timber harvesting and prescribed burning. In some rare instances, SHPO may determine that additional buffering is needed or that a buffer is not the best method to avoid adverse effects.

Concern: [Seq#59] The plan should delete "desirable non-native" because using these exotics are not desirable, not necessary and pollutes the environment. [ID#59]

Response: [Seq#59] We agree that the term “desirable non-native” does not seem to fit with an ecosystem restoration or maintenance agenda nor Forest Service Native Plant Policy and have deleted that term. Non-native plants species may be used to meet management objectives when not in conflict with Forest Service policy.

Concern: [Seq#60] The plan should explain the difference between standards and guidelines because a purpose statement and criteria needs to drive whether a standard or guideline should be used. [ID#60]

Response: [Seq#60] We agree that the difference between standards and guidelines should be articulated clearly. We have edited the introduction to standards and guidelines to provide a clear explanation of the differences between them.

Concern: [Seq#61] In Standard S11 page 117. Better define what "within active red-cockaded woodpecker clusters" means. What distance is this from nest or roost trees? [ID#61]

Response: [Seq#61] The red-cockaded woodpecker recovery plan defines a cluster: “The cluster is the minimum convex polygon containing all cavity trees in use by a group of red-cockaded woodpeckers and a 200 ft. wide buffer of continuous forest surrounding the minimum convex polygon. The cluster must contain a minimum of 10 acres.” To put more simply: The cluster is the aggregate of cavity trees associated with a group of birds with a 200 ft. buffer. If the cluster within the 200 ft. buffer is less than 10 acres it must be expanded to be at least 10 acres.

Concern: [Seq#146] Standard S31 on requiring a permit for dispersed camping should be removed because it does not meet federal guidance. [ID#146]

Response: [Seq#146] We agree that dispersed camping is a desirable activity on the Francis Marion and national guidance does not require a permit. However, the Francis Marion National Forest has an extensive prescribed burning program and wants to minimize health and safety risks to visitors. Therefore, a permit for dispersed camping provides managers with information about the location of Francis Marion visitors and if additional steps are needed to ensure their safety during a prescribed burning operation.

Chapter 5 Monitoring

Concern: [Seq#20] The Monitoring Program should address habitat conditions in order to monitor progress toward meeting the desired conditions for restoration. [ID#20]

Response: [Seq#20] We agree with the need to monitor habitat conditions to achieve desired conditions for restoration. This is documented through numerous conditional monitoring questions in the monitoring table in Chapter 5 of the forest plan that address habitats such as longleaf pine ecosystems, depressional wetlands and Carolina bays, pocosins, maritime forests, and forested wetlands.

Concern: [Seq#62] At least 10 focal species should be listed for each plant habitat, because the existing list is not adequate. [ID#62]

Response: [Seq#62] Federal guidelines are specific on monitoring plant habitats through the use of focal species. We disagree with the need for 10 focal species for each plant habitat and believe the focal species we have listed comply with Federal guidelines. Relative abundance of native herbaceous groundcover was identified as a key characteristic and data gap in assessing ecological integrity of longleaf pine woodlands, wet pine savanna and flatwoods, Carolina bay and depression pond, and pocosin ecosystems and will be monitored in conjunction with ecosystem condition class. At-risk plant species are protected in the revised forest plan through numerous plan components, such as desired conditions and objectives on ecological sustainability, particularly those plan components related to species diversity. The monitoring program in Chapter 5 addresses this concern specifically through a monitoring question that states: To what extent are habitat conditions provided that support stable populations of at-risk plant species?

Concern: [Seq#149] The monitoring plan should include monitoring for water quality impacts because even with the implementation of the Best Management Practices there will be erosion and sedimentation impacts. [ID#149]

Response: [Seq#149] The revised forest plan does monitor compliance with BMPs and soil disturbance through monitoring questions 41 and 42. Water quality is monitored by SC DHEC as reflected in monitoring question 4. During project-level planning, water quality and sediment monitoring may be added on a site-specific basis.

Biological

Aquatic Habitats

Concern: [Seq#2] The FM NF should address Essential Fish Habitat because management activities on National Forest can have an indirect impact on these habitats that are critical to the production of oyster, shrimp, crabs, etc. [ID#2]

Response: [Seq#2] Activities on the national forest have a limited effect on the water quality characteristics that affect shellfish. Any project related activities that may influence fecal coliform will be addressed in a site-specific analysis and decision process. The feral hog removal program is a benefit to water quality concerns. Most of the water bird developments are contained with limited interchange with coastal waters. Essential Fish Habitat (EFH) was addressed in Chapter 3 of the Final Environmental Impact Statement (FEIS). A determination of No negative effects on EFH within the Francis Marion was made.

Concern: [Seq#4] The Francis Marion National Forest should restore the hydrologic function of freshwater wetlands because it improves habitats for freshwater aquatic species and at-risk amphibians. The Francis Marion National Forest should weigh the impacts of removing dikes because they may be limiting saltwater influx into freshwater habitats, such as those dikes within the lower Santee River. [ID#4]

Response: [Seq#4] Restoration of hydrologic function of freshwater wetlands is allowed under the Francis Marion Forest Plan. The tradeoffs of removing any dikes would be carefully considered in a site-specific analysis during the development of a project.

Concern: [Seq#32] The Forest Plan should restore hydrologic function because it can improve freshwater habitats and reduce migration of saltwater further inland. [ID#32]

Response: [Seq#32] Restoration of hydrologic function of freshwater wetlands is allowed under the Francis Marion Forest Plan. The potential effects of saltwater migration further inland will be carefully considered in a site-specific analysis during the development of a project.

Wildlife Habitat Management

Concern: [Seq#144] The forest plan should not allow the creation of wildlife openings in the Wambaw semi-primitive area, because it does not benefit wildlife, except feral hogs [ID#144]

Response: [Seq#144] Visitors choose from a variety of non-motorized recreation opportunities and this includes those opportunities provided by wildlife openings (i.e., wildlife viewing, hunting, and hiking). Furthermore, the Plan states wildlife openings are maintained in the Wambaw semi-primitive. There is no mention of wildlife openings being created.

Concern: [Seq#113] Permanent wildlife openings should be considered suitable for timber production. [ID#113]

Response: [Seq#113] Our Mission, as set forth by law, is to achieve quality land management under the sustainable multiple-use management concept to meet the diverse needs of people. The Francis Marion National Forest contains 259,625 acres of Berkeley and Charleston counties. In an attempt to fulfill Our Mission providing wildlife opening opportunities for our diverse users is an insignificant (379 openings totaling 650 acres) use of the extremely large land holding. The revised forest plan states wildlife openings will be maintained over time. This not compatible with a designation of suitable for timber production.

Concern: [Seq#114] DC-F-3(c). Climate Change in the Forest plan should identify the refugia that will be promoted to the extent feasible for climate sensitive species because this will further clarify this desired condition. (29-44) [ID#114]

Response: [Seq#114] The revised forest plan DC-THR-2. Climate Change—Ecosystem Resilience clearly lays out the parameters needed for the Francis Marion National Forest to combat the oncoming conditions of climate change. Desired Conditions for Rare plant communities does address the fine-scale habitats needed for plants with limited distribution. Specific refugia for specific species are further discussed in Chapter 4(Standards and Guidelines). For example, G28 states the following: "Dead and downed logs or other woody debris should be retained in riparian management zones unless its removal is deemed necessary for the protection of human life and property." In Chapter 3 of the FEIS, we evaluated effects of sea level rise associated with climate change as a key characteristic of ecosystems associated with at-risk species at the coarse filter.

Concern: [Seq#115] The DEIS should use the terminology "stable and not increasing" for turkey populations because statewide turkey population and harvest data do not support an increasing population. (37-1) [ID#115]

Response: [Seq#115] We agree and this language has been added to the FEIS. Wild turkey populations throughout the southeastern United States are on a trend of decreasing and state agencies are not sure why.

Concern: [Seq#116] The forest service should allow private individuals and organizations to plant wildlife plots because the SCDNR and USGS budget is inadequate to plant the many fields that are needed. (8-4) [ID#116]

Response: [Seq#116] The revised forest plan does permit this activity, but this decision is outside the scope of a forest plan. Other states and Federal/state agencies are being confronted by similar problems of limited personnel and funding. The Francis Marion National Forest will explore other opportunities to help us fulfill our mission, such as Stewardship Contracting. Contracting private individuals or organizations to help with wildlife opening maintenance is possible, but the trade-offs need to be carefully considered as problems have arisen in the past due to different expectations.

Concern: [Seq#117] The plan should emphasize timber harvests because early successional habitat will benefit numerous wildlife species and increase diversity across the Forest (17-5). [ID#117]

Response: [Seq#117] The plan does emphasize timber harvest as a means to promote early successional habitat. The plan also stresses the need for creating and maintaining open savannas and woodlands which provide early successional habitat for many wildlife species. For example DC-MUB-1. Fish and Wildlife Habitats states that "early successional habitat support white-tailed deer and northern bobwhite quail". Furthermore, DC-MUB-4. Wood Products "create new young forest to provide diverse habitats". DC-MA2-1. Mixed Pine/Hardwood or Loblolly Pine Forests discusses providing 12-20 percent of the forest over time in early successional habitat (0-10 years old) for areas outside of red-cockaded woodpecker clusters.

Concern: [Seq#118] DC –F-1(u) should clarify if the forest openings are for bats, wildlife or both. 24-4. [ID#118]

Response: [Seq#118] The commenter makes a good point and the language for desired conditions for forest opening associates has been updated in the revised forest plan. DC-SCC-11. Forest Opening Associates provide different opportunities for a wide range of

wildlife species. Bats benefit from these maintained openings for areas in which they can fly through and forage, but many other species both game and non-game do as well. Wild turkeys will likely use them for spring breeding displaying areas, bobwhite quail may use them as dusting areas, and rat snakes may use them as basking areas. These forest opening provide unique habitat components for many wildlife species.

Concern: [Seq#119] Top predator species including the red wolf should be reintroduced on the Francis Marion because they are necessary to have a healthy ecosystem and sustainable species of plants and animals. (7-1) [ID#119]

Response: [Seq#119] This revised forest plan is developed from the standpoint of maintaining and restoring the native ecosystems and their associated species. For example, please reference Chapter 1 Theme 1 in the revised forest plan. The Forest Service does manage larger land masses, but especially east of the Mississippi River these areas are greatly fragmented thus not conducive to re-introductions of larger wildlife species. This type of topic would have to be developed with a panel as a proposed action and presented to our public and other interested parties including US Fish and Wildlife Service in the scoping process. Many factors would have to be considered including; since coyotes have established themselves throughout the southeast including the Francis Marion National Forest the niche which the red wolf would fill is not available and many residential dwellings are encroaching on the Francis Marion National Forest would these families with young children and/or small pets be supportive of the re-introduction of a, “top predator”? All native species should be considered, but even though some species were once on the Francis Marion does not mean there is a place for them or efforts should be taken to restore them.

Concern: [Seq#73] The plan should address the scale of prescribed burning on recreationally important species, such as Eastern wild turkey because of the potential negative impacts on these species from prescribed burning during the growing season. [ID#73]

Response: [Seq#73] In the FEIS, there is discussion that some nests will be lost, but the habitat restored or maintained greatly outweighs that loss. In given areas individual nests may be lost, but not entire cohorts. Moreover, turkeys are documented to re-nest after being expose to similar disturbances or nest losses. We are held to very stringent prescribed burning parameters (i.e., fuel moisture, smoke dispersion), limited available days, limited personnel, equipment and funding prescribed burning plays an important role on the Francis Marion National Forest in maintenance and restoration.

Feral Hogs

Concern: [Seq#45] Current SC Department of Natural Resources should allow for hunting of feral hogs at night, year-round, and with any weapon because of the ecological degradation caused by these invasive species. [ID#45]

Response: [Seq#45] These activities are permitted in the forest plan, but the control of feral hogs is outside our technical capability. Hunting of feral hogs is regulated by the SC Department of Natural Resources (SCDNR). SCDNR has expanded the hog hunting opportunities to allow hunters to harvest hogs during any open hunting season and has initiated “Special Hog Hunts” to help reduce/control hog populations across the Francis Marion.

Currently the Forest Service in cooperation with SCDNR and the USDA Animal and Plant Health and Inspection Service (APHIS) is aggressively trying to control the feral hog

population on the Francis Marion. SCDNR and APHIS personnel actively trap feral hogs outside of the deer hunting season as well. The Forest Service has contracted with some hog hunters in the past and expects to pursue the possibility of continuing this activity. In 2015, 108 hogs were removed from the Francis Marion by SCDNR personnel, APHIS personnel and Forest Service contractors. [ID#45]

Concern: [Seq#120] The plan should address control of feral hogs with plan components because they are an important stressor for many at-risk species as stated in the DEIS. (29-26) [ID#120]

Response: [Seq#120] The revised forest plan does permit control of feral hogs, but specific actions to control feral hogs are outside the scope of a forest plan. The feral hogs are considered a non-native invasive species and despite recent control efforts, the population of feral hogs seems to be growing on the Francis Marion. Currently the Forest Service in cooperation with South Carolina Dept. of Natural Resources (SCDNR) and the USDA Animal and Plant Health and Inspection Service (APHIS) is aggressively trying to control the feral hog population on the Francis Marion. SCDNR has expanded the hog hunting opportunities to allow hunters to harvest hogs during any open hunting season and has initiated "Special Hog Hunts" to help reduce/control hog populations across the Francis Marion. SCDNR and APHIS personnel actively trap feral hogs outside of the deer hunting season as well. The Forest Service has contracted with some hog hunters in the past and expects to pursue the possibility of continuing this activity. In 2015, 108 hogs were removed from the Francis Marion by SCDNR personnel, APHIS personnel and Forest Service contractors.

Management for Bird Habitat

Concern: [Seq#121] The forest plan should include the recommendations for Bird-Friendly Forest Management Practices in bottomland hardwoods because these practices have been proven to work at our demonstration sites. (Need the attachment?) (23-4) [ID#121]

Response: [Seq#121] After reviewing the Bird-Friendly Forest Management Practices in bottomland hardwoods the principles of many of the recommendations are already incorporated throughout the forest plan and have been practiced for years. The Francis Marion National Forest contains nearly 260,000 acres within Berkeley and Charleston counties. Those treatments which may occur during the breeding season would be, "limited" and insignificant. Buffers of 25' (to each side) are assigned to our streams and all proposed treatments respect those zones. Larger trees, snag trees and hollow trees are left as wildlife habitat after treatments are carried out. We promote edge and ecotone to provide diverse habitats for many species. We have limited openings and linear strips (<700 acres of the total 259,625 acres) on the Francis Marion National Forest and relatively speaking there are larger road-less areas than elsewhere in South Carolina. Early successional forest are managed for and specified in the Plan and all this is carried out at the landscape scale. Principles within the Bird-Friendly Forest Management Practices in bottomland hardwoods seem to follow what the Forest Service is and has been doing for years. After all, the Francis Marion National Forest has been ranked in the top 10 percent for bird conservation within the Atlantic flyway (23-2).

Concern: [Seq#122] The forest plan should add a designation for "Continental Important Bird BCR27 Biome as part of Environmental Benefits (1.5.1) and a section for interior forest birds as

part of Species Diversity (2.2.2) because the FMNF has been ranked in the top 10 percent for bird conservation within the Atlantic flyway (23-2). [ID#122]

Response: [Seq#122] The Francis Marion National Forest has been known as a high ranking stop-over and residential location for many avian species and this includes common and listed species the Forest Service needs to continue with their past and current manage treatments. The revised forest plan will allow for the, "good management" to continue. Splitting out, "interior forest birds" is not necessary.

Concern: [Seq#123] Appendix D of the Forest Plan should be improved by adding birds that have greater than 5% of their global population in the Carolina because of the need to protect these species. (23-5) [ID#123]

Response: [Seq#123] We do agree that protection of birds is critical, but your recommended change would not improve the forest plan. The Francis Marion is very unique to the whole of South Carolina. There are many birds that occupy South Carolina, but do not spend much time or any time on the Francis Marion National Forest. We evaluated 8 birds for possible inclusion as species of conservation concern and 3 met the criteria for inclusion: Bachman's sparrow, American swallow-tailed kite, and bald eagle.

Species Sensitive to Road Mortality

Concern: [Seq#124] The forest plan should include the 5 actions identified in the DEIS to reduce impacts to species sensitive to road mortality as plan components because without these plan components the DEIS understates the effects on these species .Desired conditions for species sensitive to road use should identify locations where the conditions apply because it is not possible to adequately determine the effects on these species. 29-22 [ID#124]

Response: [Seq#124] Even though, the revised forest plan does not list the 5 components that were listed in the DEIS the revised forest plan does emphasize the negative impact roads have on wildlife species and especially the amphibian and reptile species. This is reflected in the desired condition DC-SCC-2. Wildlife Species Sensitive to Road Use Associates. The areas that support at-risk species that are sensitive to disturbance from road use are maintained without open roads and with a low level of recreational use, including off-highway vehicles (OHVs) and horses. Also, some roads are closed to provide habitat conditions for threatened or endangered species, or species of conservation concern.

Concern: [Seq#125] The plan should add spotted turtle to the supporting information because this species is also sensitive to road use. 25-2. [ID#125]

Response: [Seq#125] The spotted turtle is listed in Appendix D of the revised forest plan as a wildlife species sensitive to roads use.

Red-cockaded Woodpecker

Concern: [Seq#126] Planners should reanalyze the effects of the plan on red-cockaded woodpecker because: 1) the plan appears to deviate from the red-cockaded woodpecker Recovery Plan by allowing foraging sized pine trees to be harvested for the sake restoring natural systems; 2) the effects analysis uses the "managed sustainability standard" incorrectly as a point of reference, which is intended for private lands; 3) the effects analysis needs to project the amount of habitat and the number of individuals expected to utilize that habitat; and 4) establish criteria

for "silvicultural practices that minimize fragmentation" as called for in the Recovery Plan. 29-31; 29-32, 29-35. [ID#126]

Response: [Seq#126] Each comment is addressed individually:

1) The red-cockaded woodpecker recovery plan does not prohibit the harvest of foraging size pine trees. Reducing, the basal area of these discounted stands may in fact improve stand conditions whereby allowing these stand to be counted towards suitable foraging habitat for the red-cockaded woodpecker.

2) The managed stability standard is described as the minimum amount of foraging habitat necessary for maintaining a red-cockaded woodpecker cluster over time. The number of red-cockaded woodpecker clusters on Francis Marion presently exceed USFWS recovery goals of greater than 350 potential breeding groups and present Forest Service Land Management Goals of 450 active clusters. That being said, the red-cockaded woodpecker population on the Francis Marion is still dependent on the installation of artificial cavities to supplement the lack of available suitable cavity sized trees, resulting from Hurricane Hugo, to allow the red-cockaded woodpecker to be self-sufficient. Additionally, as the Francis Marion continues to recover from Hurricane Hugo suitable foraging habitat should increase over time as those stands established after Hurricane Hugo evolve into suitable foraging habitat.

3) Currently, the red-cockaded woodpecker has exceeded recovery goals established in the red-cockaded woodpecker recovery plan and continues to grow. The Francis Marion will continue to manage and provide good quality habitat for all red-cockaded woodpecker clusters on the Francis Marion.

4) The Forest Service presently describes fragmentation as a permanent loss of habitat and does not consider permanent wildlife openings or regeneration harvest as fragmentation. The plan standards for vegetation management discusses and limits even-aged opening size to 80 acres or less except for the purposes of longleaf restoration The final forest plan contains design criteria in Chapter 3, under the sections for Ecological Sustainability and At-risk Species to protect habitat for red-cockaded woodpecker.

   The forest plan also contains desired conditions to promote old growth conditions within ½ mile foraging partitions and mature open stands of longleaf with scattered large flat-topper longleaf present in the canopy, within associated longleaf ecosystems in Management Area 1. As stated, in regard to landscape structure and connectivity, 80 percent are in mid-to-late successional open woodland condition.

Concern: [Seq#127] The DEIS should address the effects of removing cavity-size pines in suitable habitat for the red-cockaded woodpecker because this is not presently disclosed. (29-27) [ID#127]

Response: [Seq#127] The impacts of removing cavity trees to red-cockaded woodpecker is an important consideration. A site-specific analysis and consultation with the US Fish and Wildlife Service must be completed before implementing a project proposing the removal of cavity-sized trees. The revised forest plan addresses this concern in a number of places: DC-T&E-2 Red-Cockaded Woodpecker; OBJ-T&E-2 Red-Cockaded Woodpecker.; and Standards and Guidelines for At-Risk Species and Ecological Sustainability

Concern: [Seq#128] The effects of converting loblolly forest types to longleaf pine should be compared to the ecological conditions recommended in the Recovery Plan because it is required to do so to be in compliance with NEPA. (29-29) [ID#128]

Response: [Seq#128] The impacts of conversion of loblolly pine to longleaf pine is carefully considered before implementing any management activities. A site-specific analysis and consultation with the US Fish and Wildlife Service must be completed before a project that would convert loblolly pine to longleaf pine would be implemented. The revised forest plan addresses this concern in a number of places:

- Chapter 2 Vision and Chapter 3 Objectives and Management Strategies: DC-T&E-2 Red-Cockaded Woodpecker; OBJ-T&E-2 Red-Cockaded Woodpecker and OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems;
- Chapter 4 Design Criteria: Standards and Guidelines for At-Risk Species and Ecological Sustainability; and
- Appendix D

Concern: [Seq#129] Lands in MA 2, within RCW foraging habitat should be unsuitable for timber production, and harvested only where ecologically beneficial because there is a desired condition that, "Recommended minimum rotation ages apply to all land managed as foraging habitat." Appendix B states that, "desired conditions typically express rotations as a range." However, plan components do not include rotation ages at all, nor do they establish how these rotation ages would be determined or who would recommend them (29-30) [ID#129]

Response: [Seq#129] The term “suitable for timber management” means that timber production could be compatible with the achievement of desired conditions and objectives established in the plan for those lands. Management area 2 was established as a result of the “Wildland Urban Interface” and Forest Service’s inability to prescribe burn on a desired fire return interval compatible with ecosystem restoration. In the revised forest plan, national forest lands within red-cockaded woodpecker clusters are unsuitable for timber production. Lands within red-cockaded woodpecker foraging partitions are comprised of a variety of ecosystems and within Management Area 1, will be managed for suitable foraging conditions on pine sites based on our ability to prescribed burn these areas.

The majority of pine-dominated ecosystems providing foraging habitat for red-cockaded woodpecker occur in Management Area 1. Management of pine stands within ½ mile foraging partitions will likely result in higher stocking of pine stands than desired for ecological restoration so as to shade out mid-story vegetation to maintain suitable foraging habitat for the red-cockaded woodpecker. Only a small portion of pine stands within MA 2 occur within ½ mile of a red-cockaded woodpecker cluster. As described in the red-cockaded woodpecker Recovery Plan foraging habitat must occur within ½ mile of the red-cockaded woodpecker Cluster. All pine stands within ½ mile of red-cockaded woodpecker clusters will be managed to provide suitable foraging habitat for the red-cockaded woodpecker. Those pine stands outside the ½ mile foraging partitions for clusters located in MA 2 could be managed as described in Appendix B without impacts to the red-cockaded woodpecker or available forage.

Frosted Flatwoods Salamander and Carolina Gopher Frogs

Concern: [Seq#130] The plan (pages 37 and 38) for Frosted Flatwoods salamander and Carolina Gopher Frog should clarify whether the 10-20% increase is sufficient to protect these species

since without knowing the potential number of these species that could be provided. (16-12) [ID#130]

Response: [Seq#130] Little is known about the Frosted Flatwoods Salamander and not much more is known about the Carolina Gopher Frog. Experts do not know much more about the Frosted Flatwoods Salamander than it is a species which uses differing layers of the soil strata at different times of the year and different periods of their life cycle. We know this species like to be hidden and very good at accomplishing this because experts have a very difficult time finding them. We know very little about these species including their abundance on the Forest even though experts are continually attempting to determine their abundance. Clarifying in the revised forest plan as to whether the 10-20 percent increase of breeding wetlands is sufficient to protect these species is not necessary because we do not know. Experts are unsure of anything when it pertains to these species; especially Frosted Flatwoods Salamander. We are currently involved in an attempt to better know of their existence on the Francis Marion. Currently experts debate on the abundance. Some say in 10 years the Frosted Flatwoods Salamander will no longer exist and others say they are difficult to find, but exist on the Francis Marion. As we are trying to determine these species abundance on the Francis Marion and as the US FWS is drafting a Frosted Flatwoods Salamander recovery plan we will not simply maintain those existing pools, we will increase their breeding pools by 10-20 percent. Furthermore, once the recovery plan is drafted we will make every attempt to fulfill its requirements which may or may not include the identified 10-20 percent.

Concern: [Seq#131] DC-F-1(g) should be changed to improve connectivity among meta-populations as specified in the management strategy because this would provide the basis for the objective OBJ-F-1(e) (29-25) [ID#131]

Response: [Seq#131] As we are trying to determine these species abundance on the Francis Marion and as the US FWS is drafting a Frosted Flatwoods Salamander recovery plan we will continue to maintain and restore habitats as the Forest Service, but we should not offset duties or invest in resources to improve connectivity among meta-populations while a solid assessment has not been completed. Experts do not know much about these species.

Wood Stork and Eastern Coral Snake

Concern: [Seq#132] Plan components should be included for wood stork and eastern coral snake because the individual analysis shows that only a “moderate proportion of the species requirements are met by the species group.” (29-24) [ID#132]

Response: [Seq#132] The planning regulations discuss a coarse/fine filter approach to managing habitat for at-risk species. Additional forest plan components are not needed if species needs can be met by providing suitable habitats by maintaining and restoring the appropriate ecosystems. A crosswalk of Threatened and Endangered and Species of Conservation Concern and relevant forest plan components are provided in Appendix D of the revised forest plan. No eastern coral snakes have been documented from the Francis Marion National Forest and therefore it did not meet our national criteria for inclusion as a Species of Conservation Concern. No roosts for wood stork occur on the Francis Marion. We feel that ecosystem desired conditions will maintain and restore habitats for both coral snakes and wood storks.

- Wood storks have been expanding their range and have been observed more often and in more locations in South Carolina in the last decade. Local Forest Service

biologists have documented them in locations well outside of what was once their known historic range. So it seems as though things are improving for them and in an attempt to moderately change conditions will be additional improvements to already changing or improving conditions.

- The eastern coral snake is an animal which is difficult to sample; highly secretive and spend most of their time under leaf litter and/or underground. They are documented as occupying a large area in South Carolina. Again, even though the forest plan reads, “a moderate proportion of the species requirements are met by the species group”, this species will benefit from the completion of this revised forest plan.

Swallow-tailed Kite

Concern: [Seq#133] The plan should prohibit logging in the critical nesting habitat for swallow-tailed kite. The old growth loblolly pine located just outside the Wambaw Creek wilderness boundary is critical nesting habitat for Swallow-tailed Kite. (28-2). [ID#133]

Response: [Seq#133] We are very much aware the old growth loblolly forest near the Wambaw creek wilderness plays a vital role in the nesting of the Swallow-tailed Kite. The revised forest plan addresses your concern in a number of places, specifically desired condition DC-MUB-1. Fish and Wildlife Habitats and objective OBJ-SCC-2 Swallow-tailed Kite. Please reference standards and guidelines for At-Risk Species and Ecological Sustainability in the revised forest plan. In particular, Standard S31 states all active nest sites are protected from timber treatments.

Concern: [Seq#134] The plan (p 25) should clarify why a single species is discussed here because the desired condition for swallow-tailed kite is not consistent with other ecosystem and habitat use desired conditions 16-9. [ID#134]

Response: [Seq#134] Based on the analysis in the FEIS and documented in the revised forest plan, swallow-tailed kite (a species of conservation concern) needed “fine-filter” forest plan components to meet habitat needs. Chapter 2 was reorganized to clarify the coarse-filter, fine-filter approach as outlined in the 2012 planning rule.

Restoration of Longleaf Pine

Concern: [Seq#14] The Francis Marion Forest Plan should recognize the longleaf pine ecosystems as fire-dependent rather than fire-adapted because identifying them as fire-adapted downplays the importance of fire in the longleaf pine ecosystems. [ID#14]

Response: [Seq#14] We acknowledge the importance frequent fire in maintaining and restoring longleaf pine ecosystems. We have chosen to consistently use the term “fire-adapted” in our planning documents consistent with the terminology used in the 2012 Final Forest Planning Rule, 36 CFR Part 219. In, “Protecting People and Sustaining Resources in Fire-Adapted Ecosystems-A Cohesive Strategy” (2000), the term fire-adapted is defined as, “An ecosystem with the ability to survive and regenerate in a fire-prone environment”.

Concern: [Seq#18] The Forest Plan direction should maximize the amount of longleaf pine restoration and prescribed burning where feasible, because these activities improve the diversity of the forest, habitats for numerous wildlife species [ID#18]

Response: [Seq#18] We considered our existing and historic conditions trends, and ecological and fiscal capability, to maximize longleaf pine restoration and prescribed burning

objectives within alternative 2 (proposed plan). The 2012 Final Forest Planning Rule, 36 CFR Part 219, p. 21261, states (g). “The responsible official shall ensure that the planning process, plan components, and other plan content are within Forest Service authority, the inherent capability of the plan area, and the fiscal capability of the unit.”

Concern: [Seq#26] The plan(page 51) should change the discussion about Calopogon multiflorus in the understory because it is not a wet savanna plant but occurs in mesic savannas similar to those that support the giant orchid as documented by Herrick Brown of USC herbarium.

Response: [Seq#26] We acknowledge your suggestion to remove many-flowered grass pink (*Calopogon multiflorus*) from the list of at-risk species dependent on “Wet Pine Savanna and Flatwoods Ecosystems” within the desired condition. This ecosystem “group” includes mesic savannas as well as wet savannas.

Concern: [Seq#94] The plan should not convert loblolly plantations to longleaf and continue managing for loblolly, hardwood and mixed stands because of the growth, composition and health of the forest they provide, the increased cost of herbicides’ and prescribed burning needed to convert to longleaf pine. [ID#94]

Response: [Seq#94]: We acknowledge your concerns with the conversion of loblolly plantations, and loblolly, hardwood, and mixed stands to longleaf. The revised forest plan encourages this conversion only on ecologically suitable sites where we have historically applying frequent prescribed fire - and feel we can do so in the future within Management Area 1. The need for herbicides for conversion purposes will be addressed on an as needed basis at the project level.

Concern: [Seq#95] Restoration of longleaf pine should be stated as a goal because no part of the Francis Marion has been truly restored [ID#95]

Response: [Seq#95]: We acknowledge your desire to include longleaf pine restoration as a goal. We believe using the components of desired conditions and objectives in the revised forest plan is a good approach for the restoration of longleaf pine.

Concern: [Seq#96] Upland Longleaf-. The forest plan (pp 49-50) should describe live herbaceous biomass are restored in months rather than weeks because a few weeks is a short time for recovery. [ID#96]

Response: [Seq#96]: It is true that live herbaceous biomass can take months for restoration - rather than weeks. We are unable to find the statement you mention on pp 49-50 of the draft forest plan.

Concern: [Seq#97] Wet Pine/savanna- Planners should consider a growing season burn every other burn because this treatment would be effective to restore the understory. [ID#97]

Response: [Seq#97] You are suggesting that we consider a growing season burn every other burn because this treatment would be effective to restore the understory. Our desired condition is to conduct a growing season burn every third burn which would be a significant increase our growing season burning compared to the 2006 forest plan (16,500 acres annually/ compared to 16,000 in the next ten years). This would not preclude conducting a growing season burn every other year on significant sites as warranted.

Concern: [Seq#98] The ground cover statement (p. 50) in the plan should be changed because the conversion of open loblolly pine stands to longleaf pine stands will not result in this ground cover. [ID#98]

Response: [Seq#98] We acknowledge your concerns that conversion of open loblolly pine stands to longleaf pine stands will not result in herbaceous and abundant groundcover (>65 percent cover) with diverse native wildflowers and legumes. As stated in the definitions in the glossary of the revised forest plan, desired conditions "are achievable", but do not "include completion dates". We feel this desired condition is achievable for longleaf ecosystems given reference conditions currently existing on the Francis Marion. Our forest and project monitoring elements will address progress towards meeting desired conditions and adapt our management accordingly.

Concern: [Seq#140] The amount of herbicides needed to manage for longleaf pine will have negative impacts to the environment [ID#140]

Response: [Seq#140] We acknowledge your concern regarding amount of herbicides needed to manage for longleaf pine and possible negative impacts to the environment. A site-specific analysis of potential impacts from herbicide use would be completed and documented in an environmental assessment before any project with a herbicide application is implemented.

Process for Identifying SCC and their Habitat Needs

Concern: [Seq#26a] The Forest Plan and DEIS should describe the coarse filter/fine filter approach used to identify habitat needs for at-risk species, so the public can understand the process used to create forest plan direction for species groups.

Response: [Seq#26a] We have addressed your request that the revised forest plan and FEIS describe the coarse filter/fine filter approach used to identify habitat needs for at-risk species, so the public could better understand the process used to create forest plan direction for species groups. We improved our description of the coarse/fine filter approach within the forest plan and within Appendix E of the FEIS.

Concern: [Seq#26b] The DEIS should display the values for each indicator by alternative that used to evaluate ecological integrity and how the indicators were affected by plan components because it is not possible to determine if the effects analysis is adequate.

Response: [Seq#26b] We added language to address your request that values for each indicator by alternative be used to evaluate ecological integrity and how the indicators were affected by plan components. We will display indicator values used to evaluate ecological integrity as affected by plan components within Appendix E of the Final Environmental Impact Statement (FEIS).

Concern: [Seq#26c] Planners should disclose in the DEIS how the best available scientific information was used to evaluate ecological integrity, including the sustainability scores, because this can be used to determine the probability of a species would persist in the plan area.

Response: [Seq#26c] We have addressed your concern that in the DEIS - the best available scientific information used to evaluate ecological integrity - including the sustainability scores used to determine the probability that a species would persist in the plan area, be disclosed. We will display final indicator values used to evaluate ecological integrity as affected by plan components within Appendix E of the FEIS.

Concern: [Seq#26d] Planners should disclose the rationale for determining “group weights” for SCC’s along with the plan components and locations used in the analysis and the “experts” who provided information, along with other relevant information contained in the “ecological sustainability evaluation tool” because the absence of this information negates the possibility of commenting on the adequacy of the analysis.

Response: [Seq#26d] We acknowledge your concern regarding further discloser of the rational for determining “group weights” for SCC’s along with the plan components and locations used in the analysis, and the “experts” who provided information. Our ecological sustainability sub-team comprised of a vegetation ecologist, wildlife biologist, hydrologist, and aquatic biologist contributed to the analysis of ecological sustainability and integrity. The species ‘group weights’ - which were defined, identified and listed in the DEIS, Section 3.3.3 Species Diversity - were considered in the qualitative analysis of how associated ecological system groups and other Plan components were providing for them. We have deleted the display of species group weights from the analysis in the FEIS. Further clarification of the process and indicators used for evaluating ecological sustainability is incorporated into Chapter 3 and Appendix E of the FEIS.

Concern: [Seq#88] Tables 2-1 and Table 2-2 in the plan should clarify the plan components needed for SCC species and how the components are accounted for in the effects analysis because it is not clear whether the plan is sufficient to support these species. [ID#88]

Response: [Seq#88] You suggest that further clarification is needed both in plan components for SCC (such as those addressed in Table 2-2), and for accounting addressing effects to SCC in the effects analysis. Further clarification of how the plan components for SCC species are developed - and the process for evaluating effects to SCC – will be incorporated into Appendix D of the revised forest plan and Chapter 3 and Appendix E of the FEIS.

Concern: [Seq#89] Plan components and the range of alternatives should be expanded because the discussion of effects common to all alternatives states: "Additional management may be needed for extremely rare species such as the frosted flatwoods salamander, Carolina gopher frog, pondberry and American chaffseed", which invalidates the range of alternatives with regard to these species and requires (per the 2012 Planning Regulations) additional measures needed to provide necessary ecological conditions for these at-risk species, [ID#89]

Response: [Seq#89] The revised forest plan’s components and alternatives in the FEIS sufficiently represent these species. We used a coarse-filter/fine-filter approach to managing habitats for “at-risk species” on the Francis Marion. The habitat requirement for many species are addressed by restoration of ecosystems, which serves as a coarse-filter. For some “at-risk species”, fine-filter forest plan components are needed. Desired Conditions, objectives, standards and guidelines were developed to address the fine-filter approach for “at-risk species” on the Francis Marion. Based on the analysis in the FEIS, we disclose effects of the range of alternatives which effect the amount and distribution of fire-adapted ecosystems providing habitat for these species within the FEIS, Chapter 3.3. Appendix D of the revised forest plan includes a crosswalk of forest plan components and at-risk species. Any future projects which may include areas occupying these species will not be implemented without the concurrence of the US Fish and Wildlife Service. Furthermore, many of these species have functioning US Fish and Wildlife recovery plans and the recovery plans are considered during all phases of planning.

Concern: [Seq#90] The Final Environmental Impact Statement should have included additional information as follows: 1) the basis for determining individual species of conservation concern; 2) the ecological sustainability analysis, including determinations of group weight; and 3) the relationship between plan components and timber yields because the absence of this information limited our ability to effectively analyze and comment on the draft plan and DEIS. ([ID#90]

Response: [Seq#90] In order to address your request for additional information on the processes that we used, we posted additional information on the public website and mailed you a more detailed process spreadsheet and white paper documenting our collaboration and our basis for determining individual species of conservation concern. The ecological sustainability analysis is further explained in the FEIS, Appendix E.

Concern: [Seq#91] The plan or DEIS should describe the ecological conditions needed by Species of Conservation Concern because it is not clear how or if they are actually used to develop plan components or in the effects analysis. [ID#91]

Response: [Seq#91] You suggest that the plan or DEIS should more clearly describe the ecological conditions needed by Species of Conservation Concern and how this was used to develop plan components and in the effects analysis. Appendix D of the revised forest plan will contain more detailed crosswalk of information to address this concern. The FEIS will describe the relationship between plan components and ecological conditions needed by Species of Conservation.

Concern: [Seq#92] Appendix E of the DEIS should have disclosed the rationale for identifying individual SCC because it is not possible to comment on why 32 of the potential 45 animal species were not carried forward without disclosure of the rationale. [ID#92]

Response: [Seq#92] In order to address your request for additional information on the processes that we used, we posted additional information on the public website and mailed you a more detailed process spreadsheet and white paper documenting our collaboration and our basis for determining individual species of conservation concern. The ecological sustainability analysis is further explained in the FEIS, Appendix E.

Concern: [Seq#87] The analysis in the DEIS should include “acres managed for at-risk species” because it is needed to properly evaluate how each alternative addresses Issue 1.c. [ID#87]

Response: [Seq#87] You suggest that the DEIS should include “acres managed for at-risk species”. We have displayed acres likely to be managed for at-risk species in Appendix E of the FEIS and in the BA/BE (Appendix G of the FEIS).

Concern: [Seq#29] The Forest Plan should clarify how the composition in Maritime Forest and Salt Marsh will be improved to avoid confusion over interpretation on how to maintain and restore these ecosystems [ID#29]

Response: [Seq#29] Due to the relative small acreage on the Francis Marion, and proximity to the coast, we grouped these two ecosystem types, but felt that we clearly differentiated their desired condition description within the text of the forest plan. Also see Concern [Seq#100] for additional information.

Concern: [Seq#76] Maritime Forest-Planners should clarify in the plan (p59) whether painted bunting is a species of conservation concern because this and other neotropical migratory birds play an important role in maritime and salt marsh ecosystems. [ID#76]

Response: [Seq#76] The list of species of conservation concern is in Appendix D and does not include painted bunting.

Concern: [Seq#77] Maritime Forest-the forest plan should include sable palmetto in the desired conditions for maritime communities because it is a defining species for those communities. [ID#77]

Response: [Seq#77] We have replaced dwarf palmetto with sabal palmetto in desired condition statements for the composition of maritime ecosystems.

Concern: [Seq#100] The Forest Plan should clarify how composition will be improved in maritime forests, especially clarify priority #4 [ID#100]

Response: [Seq#100] To clarify how composition of maritime forests will be improved on the Francis Marion, we added the following management strategy to the revised forest plan:

Management Strategies for Maritime Forests are similar to those for Oak Forests and Mesic Hardwoods, and include:

- Improve composition by removing loblolly pine and encouraging hardwood;
- Maintain with infrequent fire regimes;
- Treat non-native invasive species to encourage native composition;
- Encourage a predominance of late successional, closed canopy conditions. Only 12 percent or our maritime forests are in late succession, compared to 51 percent predicted in LANDFIRE PNV models, and none of our maritime forests meet age criteria for old growth.

Concern: [Seq#143] The forest plan should consider the migration of salt marsh and maritime forests further inland because sea-level rise creates a need for migration of species as salinity levels increase. [ID#143]

Response: [Seq#143] We acknowledge your suggestion the forest plan should consider the migration of salt marsh and maritime forests further inland because sea-level rise creates a need for migration of species as salinity levels increase. We evaluated effects of sea-level rise on applicable ecosystems and species groups in the FEIS and included associated indicator values in the Appendix E of the FEIS.

Mesic Hardwood Forests

Concern: [Seq#40] The forest plan should address the frequency of prescribed burning in hardwood forests, because it can impact rare plants within those communities. [ID#40]

Response: [Seq#40] We acknowledge your suggestion that the revised forest plan should address the frequency of prescribed burning in hardwood forests. Desired average fire return intervals are addressed for hardwood ecosystems within the revised forest plan, both in Table 2-5 and in the ecological process desired condition statements for individual ecosystems.

Concern: [Seq#81] Planners should check the description of mesic hardwoods because shortleaf pine is found primarily on dry sites while spruce pine is a component of mesic hardwoods. [ID#81]

Response: [Seq#81] We modified the desired condition statements for oak forests and mesic hardwood forests in the revised forest plan and it now includes shortleaf pine is found primarily on dry sites whereas spruce pine is a component of mesic hardwoods.

Concern: [Seq#82] The plan should incorporate Wadboo Swamp drainage to known areas of marl forest in DC-F-1(m) Wet Marl Hardwood and Calcareous Mesic Forests Associates forest because there is documented evidence of this in recent surveys of Cane Gully area. [ID#82]

Response: [Seq#82] We have incorporated Wadboo Swamp drainage into known areas of marl forest.

Pocosins, Wetlands and Carolina Bays

Concern: [Seq#78] The forest plan should emphasize the need for fire within and along the edges of ponds because many of the savanna edges have been lost to shrub conversion and can only be restored using intensive fire; for example Morgan Creek Seepage bog needs drastic restoration. [ID#78]

Response: [Seq#78] We have included desired condition direction for depressional wetlands and Carolina bays to include an herbaceous ecotone. The forest plan also includes desired conditions for a species group associated with upland/wetland ecotones.

Concern: [Seq#79] In the forest plan, the description of pocosin ecosystems (p55) should change “structure” to canopy because it implies that these systems have an open structure which they do not. [ID#79]

Response: [Seq#79] We acknowledge your suggestion that pocosin ecosystems do not have an open structure. Based on a number of publications including the NatureServe ecosystem classification ecosystems are typically shrub-dominated, given they are maintained with characteristic natural fire regimes.

Concern: [Seq#80] Landscape structure and connectivity should address the current problem of tree encroachment by hand thinning without chemicals and use of prescribed fire because this needs to be maintained [ID#80]

Response: [Seq#80] We acknowledge the concern that landscape structure and connectivity address tree encroachment. We have included restoration and maintenance of vegetative composition by thinning and prescribed burning to improve herbaceous vegetation as a management strategy for several fire-adapted ecosystems.

Rare Plants and Habitats

Concern: [Seq#84] The plan should address the importance of rare plants and rare habitats in MA2 and not abandon them due to the lack of fire because fire surrogates including canopy thinning, mulching and herbicides can be used to maintain these plant communities. [ID#84]

Response: [Seq#84] You express concern that rare plants and rare plant habitats would be abandoned in MA2 due to lack of fire because fire surrogates such as canopy thinning, mulching, and herbicides can also be used to maintain these plant communities. Most if not all known occurrences for At-risk species currently identified occur in Management Area 1. We have included standards and guidelines in Chapter 4, ecological sustainability and at-risk species subsections of the revised forest plan to protect rare plants and plant communities.

Concern: [Seq#85] OBJ-F-1(g) Threatened and Endangered Plant Species should be improved by explaining how cooperating agencies, including SCDOT, will manage appropriately so as to preserve and enhance chaffseed and other TES roadside populations because this will help to achieve the recovery goals. [ID#85]

Response: [Seq#85] We agree that management across jurisdictional boundaries will be critical to maintaining habitats of rare species. The management strategies have been updated in the revised forest plan to include collaboration with SCDOT and others on management for at-risk species, including American chaffseed.

Concern: [Seq#93] The plan on pages 88 and 92 concerning chaffseed should be checked because it seems contradictory. [ID#93]

Response: [Seq#93] We checked the language concerning American chaffseed on p.88 and p.92 and you are correct there was an error. We deleted language in the revised forest plan in both Wando and Wambaw RIZs that American chaffseed is found only within each zone (it is found in both zones).

Concern: [Seq#86] The plan (Table 2-5 Historic and desired average fire return interval by ecosystem (Table 2-1 in the final forest plan.) should change the fire return interval of 2 years to 3-5 years because both Lindera and Litsea would be eliminated due to their habitat needs. [ID#86]

Response: [Seq#86] We did change the fire return interval to 1-6 years in ponds and pond ecotones (average fire return interval 3) to address the greater possible variation in fire regimes for these ponds. We will continue to monitor effects of dormant and growing season fire frequencies and season of burn on pond ecotones containing pondberry. We have deleted reference to fire regimes needed for Endangered Plants and emphasized habitat outcomes in the revised forest plan.

Rivers and Streams

Concern: [Seq#83] Rivers and Stream: The description of rivers and streams should include cypress because these trees are not always considered as hardwoods. [ID#83]

Response: [Seq#83] Baldcypress was added to the description in the River and Streams ecosystem in the revised forest plan.

Timber Management/Timber Suitability

Concern: [Seq#108] Lands managed for ecological integrity should not be suitable for timber production because lands that have been designated as suitable for timber production where a “regulated crop of trees” is not likely to be compatible with desired conditions for the ecosystems or species [ID#108]

Response: [Seq#108] The 2012 planning rule does require that we address ecological integrity and timber suitability in forest plans. Suitability for timber production is discussed in Chapter 4 and Appendix B of the revised forest plan. As stated in Appendix B, Step 2: Lands Suited for Timber Production of the FEIS : “The status of land as suitable for timber production does not mean that timber production is the primary purpose of management on those lands. It means that timber production is compatible with the achievement of desired conditions and objectives established by the plan for those lands (36 CFR 219.11(a)(1)(iii)), and some regular flow of timber products may be expected.“ The planning team determined

that a flow of forest products is compatible with desired conditions and objectives of those lands identified as suitable in the revised forest plan.

Concern: [Seq#109] The plan should not allow timber harvest on the Wambaw because timber harvest will not benefit wildlife. ([ID#109]

Response: [Seq#109] We acknowledge your concern for wildlife, but do not agree with this recommended change. Timber harvest is one of the uses of National Forest Lands as described in the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C.528–531). The revised forest plan describes the benefits of timber harvest in managing the Francis Marion National Forest. The revised forest plan focuses on describing desired habitat conditions for the different ecosystems of the Francis Marion. Timber harvest is consistent with providing these desired habitat conditions, and is analyzed in the FEIS.

Concern: [Seq#110] The forest plan should increase timber efficiency to sustain the same income but on fewer acres suitable for timber production because these stands could be located in areas of lowest biological significance. (25-14)

Response: [Seq#110] To a degree, the forest plan does this with the desired conditions in Management Area 2. The timber aspects of vegetation management are more extensive (less intensive) in Management Area 1 where areas of highest biological significance are generally located.

Concern: [Seq#111] The plan should not convert loblolly pine plantations to longleaf pine which results in loss of productive acres, growth and revenue because managing existing loblolly pine plantations for loblolly pine is more prudent silviculture in the long term. (14-6, 14-10, 15-7, 15-10) [ID#111]

Response: [Seq#111] Your concern regarding the tradeoffs of restoring longleaf pine ecosystems and managing forest products and productivity is noted. However, threatened and endangered species and species of conservation concern are most common on the longleaf pine ecosystems referred to in this concern. As a Federal land management agency, providing these needed habitats must be one of our primary concerns. As discussed in the revised forest plan and FEIS, a main reason for revising the 1996 forest plan is because of the need to "Restore and maintain a variety of native ecosystems on suitable sites." The FEIS discusses the importance of fire maintained ecosystems on the Francis Marion, with longleaf pine ecosystems being one of them.

Concern: [Seq#112] The forest plan should emphasize a strategy to delay conversion of loblolly to longleaf pine until the end of the rotation because this would maximize the benefits to the public and provide a sustainable income to the FMNF. [ID#112]

Response: [Seq#112] Your recommended change would increase the economic benefits from timber harvest receipts. Please note that as described in revised forest plan, appendix B, loblolly pine over age 50 is not planned for conversion to longleaf pine where the fire maintained ecosystem is largely in place. On longleaf pine sites, however, younger stands of loblolly pine are planned for conversion to longleaf pine because of the benefit in changed habitat. The planning team considered this habitat benefit to outweigh increased economic benefits of additional timber harvest receipts.

Old Growth

Concern: [Seq#104] High quality longleaf stands should be designated as future old growth because these are some of the last strongholds in the south. [ID#104]

Response: [Seq#104] You suggest that high quality longleaf stands be designated as future old growth. We have modified the desired condition to state that old growth conditions for longleaf pine ecosystems are promoted within 0.5 mile foraging partitions for the endangered red-cockaded woodpecker in Management Area 1 (53 percent of the total ecosystem extent). Our old growth objective requires identification and locations of existing old growth conditions during project or activity planning.

Concern: [Seq#105] The plan should include plan components that are necessary for ecological integrity, until areas are designated for old growth [ID#105]

Response: [Seq#105] Forest plans do need to address ecological integrity. The desired conditions for the ecosystems that occur in Management Area 1 are old growth compatible. Additional management practices for red-cockaded woodpecker are also old growth compatible. Old growth conditions should be achieved and would be widespread across the Francis Marion. We have included plan components necessary for ensuring ecological integrity and disclosed this information in Chapter 3(Biological Environment as well as Physical Environment) and Appendix E and in the FEIS.

Concern: [Seq#106] Planners should consider that planning for old growth today will not be successful in the future because of climate change. [ID#106]

Response: [Seq#106] Changing climates will impact how forests of the future look, including old growth. Effects of climate change on ecosystems including sea level rise is disclosed in the FEIS.

Concern: [Seq#103] The plan should increase the desired condition (DC-F-1(d) and objective (Obj-F-1(b)) for old growth to more than 10% because old growth is needed to protect and maintain the longleaf and cypress tupelo systems. [ID#103]

Response: [Seq#103] We recognize the value of old growth, but we have modified desired condition and objective statements for old growth and removed the reference to 10 percent from both the revised forest plan and FEIS. The reason for this change is that the desired conditions for the ecosystems that occur in Management Area 1 are old growth compatible. Old growth reference conditions for longleaf pine ecosystems are maintained or restored within 0.5 mile foraging partitions for the endangered red-cockaded woodpecker in Management Area 1 (53 percent of the total ecosystem extent), wilderness and riparian areas and other unsuitable lands, pocosins and depressional ponds and Carolina bays within Management Area 1, and rare communities.

In the revised forest plan, we reworded and relabeled OBJ-f-1(b) into OBJ-ECO-1 Old Growth Conditions. The objective and corresponding strategy are as follows: Objective: “Identify locations of existing old growth conditions during project or activity planning.” Management Strategy: **“**Potential old growth conditions have been identified, but an inventory of existing old growth is needed. Old growth reference conditions for longleaf pine ecosystems are maintained or restored within 0.5 mile foraging partitions for the endangered red-cockaded woodpecker in Management Area 1 (53 percent of the total ecosystem extent), wilderness and riparian areas and

other unsuitable lands, pocosins and depressional ponds and Carolina bays within Management Area 1, and rare communities." This information is also displayed in the FEIS.

Concern: [Seq#151] Snags should be left because they benefit the environment [ID#151]

> **Response: [Seq#151]** Many species are dependent on dead and dying trees and/or large diameter hollow trees for cover, foraging, and roosting habitat. Our desired condition is that snags or hollow trees are maintained at a density of approximately 2 to 4 per acre. We anticipate that these attributes will be provided in abundance through desired conditions for ecosystem maintenance and restoration and old growth conditions.

Vegetation Management

Concern: [Seq#107] Chemicals, including herbicides as well as drum chopping should be prohibited as a vegetation management tool in Management Area 1 or 2 because of the potential environmental effects on waterways [ID#107]

> **Response: [Seq#107]** While herbicide applications and drum chopping can have environmental effects, compliance with Best Management Practices to buffer streams should limit impacts to water quality. A site-specific analysis of effects is documented in environmental assessment (EA) and is required before any project with herbicide application is implemented. One is also typically done for projects that would include drum chopping.

Concern: [Seq#102] The plan should prohibit the mowing or burning of Bahia grass along roadsides during the growing season because this will favor desirable native grasses. [ID#102]

> **Response: [Seq#1]** There are many miles of roads along and throughout the Francis Marion National Forest. Many of these roads have right-of-ways which are outside of the jurisdiction of the Forest Service. Therefore, we have no authority over the management (timing, season, or treatment) of these areas. Other roads, as Forest Service (FS) Roads are under the authority of the Forest Service. Our ecosystem desired conditions, native plant policies, and invasive plant policies encourage native species and discourage non-native invasive species including bahia grass where possible.

Concern: [Seq#56] The guidelines for vegetation management should be changed because these guidelines will result in overstocking. [ID#56]

> **Response: [Seq#56]** It appears that this concern is referring to guideline G6 in chapter 4 of the revised forest plan, but the Francis Marion does not think that it will result in overstocking. Note that G6 would only apply on final removal of remaining overstory, and that it would not apply to permanent openings such as savannas, woodlands or grasslands.

Invasive Plant Control

Concern: [Seq#99] Forest Plan OBJ-F-2(b) should be increased from 50% to 100% control of non-native invasive species in recreational areas and OBJ-F-3(c) should increase to more than 2,000 acres each year because the present objectives will result in re-infestations. [ID#99]

> **Response: [Seq#99]** You suggest that we increase both forest plan OBJ-F-2(b) from 50 percent to 100 percent control of non-native invasive species in recreational areas and OBJ-F-3(c) to more than 2,000 acres each year. We have decided to modify objective OBJ-F-2(b) to OBJ-REC-3 that states "Control non-native invasive species populations located at forest

priority developed recreation sites over the life of the plan." OBJ-F-3(c) was deleted with our efforts focused on the achievement of desired conditions.

Concern: [Seq#101] OBJ-F-3 (c) should clarify if invasive plant treatments will only occur in areas where at-risk species occur and how does increasing pond depth, limit invasive plant species because currently it is not clear what the rationale is for these statements [ID#101]

Response: [Seq#101] You suggest we clarify if invasive treatments will only occur in areas where at-risk species occur. OBJ-F-3(c) was deleted with our efforts focused on the achievement of desired conditions.

Physical

Climate Change

Concern: [Seq#16] The analysis in the DEIS should address the impacts of climate change, such as increase in extreme storm events, because the extreme weather events result in damage to timber, roads, recreational sites and increases the risk of a catastrophic fire. [ID#16]

Response: [Seq#16] The FEIS addresses climate change in Chapter 3 – Affected Environment and Environmental Consequences (section 3.2.4). In addition to the physical effects (i.e., changes in temperature and precipitation), this section includes a quantitative assessment of carbon effectives (i.e., the effects of the revised forest plan on climate) and a qualitative assessment based on peer reviewed literature of potential climate change effects on the plan area. Specific topics addressed in the qualitative assessment include: air quality, biological diversity, forest health, wildland fire and fuels, extreme weather, water resources, coastal ecosystems, terrestrial ecosystems, aquatic ecosystems, wildlife, and recreation. This information is summarized from an exhaustive literature review completed for the plan assessment.

Soil Productivity

Concern: [Seq#34] The Forest Plan should define "plastic soils" because it could be interpreted in different ways and lead to confusion over implementing the forest plan direction. [ID#34]

Response: [Seq#34] Plastic soils are any soil series/type that have the properties that would meet the following criteria. The following definition and table for "plasticity" will be added to the Glossary: The degree to which "puddled" or reworked soil can be permanently deformed without rupturing. The evaluation is made by forming a roll (wire) of soil at a water content where the maximum plasticity is expressed. Table and Definition source comes from: Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

Plasticity Class	Soil Science Conventional (Conv)	National Soil Information System (NASIS)	Criteria: make a roll of soil 4 cm long
Nonplastic	(w) po	PO	Will not form a roll 6 mm in diameter, or if a roll is formed, it can't support itself if held on end.
Slightly Plastic	(w) ps	SP	6 mm diameter roll supports itself; 4 mm diameter roll does not.
ModeratelyPlastic[1]	(w) p	MP	4 mm diameter roll supports itself; 2 mm diameter roll does not
Very Plastic	(w) vp	VP	2 mm diameter roll supports its weight.

[1] Historically, the Moderately Plastic class was simply call Plastic.

Fire and Fuel Management

Concern: [Seq#22] The Forest Plan should address construction and maintenance of fire lines because fire lines can cause resource impacts, such as erosion. [ID#22]

Response: [Seq#22] The need for fireline rehabilitation will be addressed site-specifically. Firelines that are rehabilitated can recover quickly when they accumulate litter from a forest canopy and/or are treated with erosion control measures to control concentrated flow and reduce soil exposure through revegetation efforts. Firelines needed for frequent or regular burning cycles are designed and maintained for long-term use through control of concentrated waterflow to limit soil erosion. The revised forest plan has specific Guidelines in chapter 4 under the heading Prescribed Burning and Wildfire Suppression pertinent to Firelines, Riparian Areas, and At-risk Species.

Concern: [Seq#23] The Forest Plan direction should address the ignition of prescribed fires on the Francis Marion National Forest, because ignition of prescribed fire using ATVs leaves more refugia for wildlife. [ID#23]

Response: [Seq#23] Forest Service Policy specific to the Southeastern States, restricts of the use of ATV/UTV ignition devices on prescribed fires. UTVs are utilized to patrol fire control lines, transport personnel and equipment, and modified UTVs with water sources are used to extinguish hot spots adjacent to the firelines. The majority of the prescribed burning is aerially ignited using a helicopter and specialized aerial ignition equipment. Ignition by Helicopter allows fire managers to burn larger areas in less time than by ground based ignition. By using helicopters for aerial ignition, risk to ground based firefighters is greatly reduced and resulting smoke from ignitions can be better managed utilizing aerial ignition techniques.

Concern: [Seq#36] The Forest Plan direction in the Coastal RIZ should be able to improve the FRCC by more than 50%, such as 2500 acres (FRCC 1), 1600 acres (FRCC2) and 3700 acres (FRCC3) because the use of Wyden Amendments and "all lands approach" will create new opportunities. [ID#36]

Response: [Seq#36] While we hope that Wyden Amendments and the “all lands approach” will create new opportunities to expand our burning program, we must face the fact that budgets and staffing are limited and restrictions that protect air quality and limit smoke will create more challenges as the area becomes more urbanized . The FEIS addresses the Direct, Indirect, and Cumulative Effects of increasing prescribe burn acreage from our current plan. Increased impacts of smoke production upon human populations in addition to managing

prescribed fire within a rapidly growing Wildland Urban Interface (WUI) are limiting factors in increasing prescribed fire within the Coastal RIZ.

Concern: [Seq#72] The forest plan should have a table showing the current FRCC and the 2026 acreage goals for the RIZs because it would be useful to compare these conditions among the zones. [ID#72]

Response: [Seq#72] The FEIS goes into considerable detail regarding FRCC, displaying not only current FRCC values, but also projected FRCC conditions across the Francis Marion.

Concern: [Seq#37] The Forest Plan direction should clarify the number of existing Wyden Amendments because it is not clear how many agreements are needed to achieve a 10% increase. [ID#37]

Response: [Seq#37] The number of existing Wyden Agreements should not be used as a benchmark indicator to be used in assessing the feasibility of a 10 percent increase in prescribed burning by itself. As the revised forest plan describes, in addition to establishing Wyden Agreements to create operational efficiencies on the ground, the use of stewardship authorities and partnerships will allow the Francis Marion to increase the number of burns implemented per day, number of prescribed burn days per year, and the number of acres per burn.

Concern: [Seq#39] The Francis Marion National Forest should post prescribed burn schedule because it will improve public safety [ID#39]

Response: [Seq#39] The revised forest plan broadly establishes prescribed burn implementation timeframes between dormant and growing season prescribed burns. Daily prescribed burn implementations requires fire managers to make decisions on where to burn each morning based on morning fire weather forecasts, and subsequent fire behavior modeling and smoke screening to pin point where burns will be conducted. Due to the complexity of weather variables on a given day, and the strict parameters needed for each individual prescribed burn, posting a schedule of where burns were to take place before hand would not provide accurate information. The Francis Marion is required to obtain a prescribed fire burn permit through the South Carolina Forestry Commission for each prescribed burn that is planned. Once the permit is approved, the location of our prescribed burns is available on the South Carolina Forestry Commission website available at the following link: http://www.trees.sc.gov/scnotifs.htm. Additionally, there is a robust notification process in place for each burn, whereas fire managers and fire dispatch notify emergency coordination centers for the county affected.

Concern: [Seq#53] Planners should correct the prescribed fire acres to 55K rather than 50k (p62) but also evaluate the feasibility of shifting burning to later in the season because winds and atmospheric conditions are less stable during that time of the year. [ID#53]

Response: [Seq#53] The Francis Marion must meet strict weather parameters in order to prescribed burn and those restrictions limit the number of available days for prescribed burning during the growing season. Considerations, such as air and the amount of ozone present limit the number of suitable prescribed burn days in the growing season. The FEIS addresses the Direct, Indirect, and Cumulative Effects of increasing prescribe burn acreage from our current plan. Increased impacts of smoke production upon human populations in

addition to managing prescribed fire within a rapidly growing Wildland Urban Interface (WUI) are limiting factors in increasing prescribed fire acreage above 50k.

Concern: [Seq#75] The analysis should disclose the feasibility of using grazing animals to control vegetation because the benefits could be useful for a number of practitioners. [ID#75]

Response: [Seq#75] The revised forest plan does allow for grazing to reduce hazardous fuels, but this is a site-specific decision that would have to go through a separate public involvement process and analysis of effects. The FEIS addresses the Direct, Indirect, and Cumulative of effects of using alternative vegetation treatment practices, such as grazing.

Air Quality

Concern: [Seq#33] The Francis Marion National Forest should comply with federal guidelines during prescribed burning operations to protect air quality. [ID#33]

Response: [Seq#33] Like all National Forests, the Francis Marion is required to comply with all Federal, state and local air quality rules and regulations. Each fire is designed, planned and implemented to protect air quality using the steps outlined in the FEIS. As stated in the FEIS, the planning and implementation of each burn complies with Regional Smoke Management Guidelines, which reference the USDA policy that prescribed fires will not cause or contribute to an air quality exceedance.

Concern: [Seq#64] The conversion of loblolly pine to longleaf pine should not occur because it will result in reduced air quality from increased burning regiments. [ID#64]

Response: [Seq#64] As stated in the DEIS, all prescribed burning is conducted to avoid smoke impacts to downwind areas. Duration of air quality impacts is generally short (less than one day) as smoke disperses within several hours. In addition, the DEIS states that other fuel reduction techniques such as mechanical, chemical and biological would be also used to mimic the historical role of fire without increased smoke production.

Concern: [Seq#65] The Fire Emissions Production Simulator (FEPS) model should be further evaluated because the projected emissions due to prescribed fire may be higher from this model than they actually are. [ID#65]

Response: [Seq#65] FEPS is currently being revised to address these and other concerns, with a new version expected in late 2016.

Water Quality

Concern: [Seq#63] Water Quality in Dutart Creek should monitored because past disturbance in this drainage may have an effect on ph. [ID#63]

Response: [Seq#63] Limestone mining does have a potential to impact water quality, but on private lands, the state is responsible for monitoring impacts. The Martin Marietta operation is permitted by SC DHEC with mine number SCG730059 and NPDES Permit number 0885-15 relative to mining of limestone. The monitoring of this activity is a responsibility of both Martin Marietta and SC DHEC. Any concerned about water quality, aquatic habitat or other concerns related to limestone mining near Dutart Creek should be brought forward to SC DHEC. If any declines in ecosystems, particularly limestone sinks, are noted in the vicinity of Dutart Creek, then Francis Marion personnel would investigate the cause and work with SC DHEC to address concerns as needed.

Groundwater and Geology

Concern: [Seq#66] The analysis in the DEIS should disclose the effects in changes in the water table because forest ecosystems are affected by small to moderate changes in the water table. [ID#66]

Response: [Seq#66] Forest ecosystems are affected by small to moderate changes in the water table; the FEIS has been updated to assess potential effects of changes in the water table. The FEIS discloses the potential for lowering of water tables due to groundwater withdrawals, and the resulting potential to affect groundwater dependent ecosystems. The FEIS also recognizes that the lowering of water tables in deeper aquifers that may not have connections to surface ecosystems still has impacts because 1) it affects the groundwater supply or reserves, 2) it may have cumulative effects of pumping-induced aquifer compression and ground-surface subsidence.

The process records include more detail on the likely increase in water yields by subwatershed by alternative over the decade. Increases in the water tables from timber harvesting, thinning and low density stand management for red-cockaded woodpecker and other species will occur. The action alternatives suggest small increases in water yield will occur and in most instances the increased will be in the growing season and help maintain streamflow.

Other direct and indirect effects on the water table were considered in water yield analysis in the process record include:

- Restoration of hydrology in wetlands and channelized streams, will locally also increase water tables and may approach more natural levels where these activities are concentrated.
- The recovery of beaver within some areas may also promote local water table increases.
- Roads and skid roads can also affect local water tables.

Project level analyses will address any site-specific changes as needed.

Concern: [Seq#67] Springs should be evaluated and protected because they are vulnerable to water-table lowering. [ID#67]

Response: [Seq#67] Springs are vulnerable to water-table lowering caused by management activities. Springs are protected from management activities due to restrictions provided by State and National Best Management Practices and guidance for the Riparian Management Zones and Riparian Areas in the revised forest plan. Management within the vicinity of springs, such as Blue Spring would have special considerations to determine if proposed actions could impact spring flow and the associated habitats and scenery in the vicinity and downstream. Project-level analyses would address any site-specific mitigation measures as needed.

Concern: [Seq#68] In DC-F-2(m). Clean Air and Public Drinking Water: The supporting information should disclose the value of buffering area residents from runoff during high rain events and serving as a reservoir to recharge area aquifers. [ID#68]

Response: [Seq#68] We agree and will update the Desired Conditions to disclose the value of buffering area residents from runoff during high rain events and serving as a reservoir to

recharge area aquifers. Activities to restore hydrology on the national forest should reconnect streams to their floodplains, which will slow the movement of floodwaters, delay flooding further downstream; promote increased water tables and recharge of area aquifers.

Projects that implement the revised forest plan, such as timber harvesting and prescribed burning that maintain low density savannas, may increase water tables and recharge local aquifers. Most increases in water yield would occur in the growing season and not necessarily connected to high rainfall events or flooding. Restoring wetlands which were drained will increase storage of water during rain events. Because these activities may result in some elevated local water tables, there could be some increases in storm hydrographs after storm events that occur within the growing season.

Flooding problems reported from local residents and believed to be connected to forest operations would be investigated. The Francis Marion has investigated activities, such as road construction or culvert installation, that may have captured and diverted water flows onto a neighbor’s property. Mitigations would be considered if appropriate.

Geology

Concern [Seq#69a]: The Affected Environment discussion in the DEIS should incorporate information related to phosphate potential, because this is presently missing.

Response: We agree to discuss potential for phosphate as well as other minerals, but it will be in the Minerals section rather than in the Geology section because minerals need to be considered as a resource and not just a source of potential impacts to other resources. The DEIS did discuss minerals in the Affected Environment and Environmental Consequences section for Geology, but mostly from the standpoint of potential impacts on geologic resources like groundwater. In contrast, the DEIS did not discuss phosphate or other minerals in the Affected Environment and Environmental Consequences section for Special Uses, Energy and Minerals. This section in the Economic and Social Environment of the FEIS is revised to meet the Planning Rule requirements to consider Mineral Resources as part of multiple use and as part of ecosystem services. The 2012 Planning Rule requires that “The plan must include plan components, including standards or guidelines, for integrated resource management to provide for ecosystem services and multiple uses in the plan area” (36 CFR 219.10a). It is important to recognize that supplying minerals is not only part of multiple use but also ecosystem services. The Rule defines “ecosystem services” as benefits people obtain from ecosystems, including “Provisioning services, such as clean air and fresh water, energy, fuel, forage, fiber, and minerals;…” (36 CFR 219.19).

The FEIS is revised to separate the Mineral Resources section from the Special Uses section. Mineral resources are not Special Uses of National Forest System lands. Congress established laws for the management of mineral resources, including energy resources like natural gas and geothermal. Mineral resources, including energy resources, are an integral part of the natural resources the forest plan needs to address. Some minerals like phosphate are leasable minerals. Some minerals like limestone or sand depending on their specific characteristics could be a leasable mineral (suitable for special technical uses) or a mineral material (common varieties of minerals used, for example, as road aggregate). Leasable minerals are authorized by Bureau of Land Management (BLM), and require Forest Service consent before prospecting permits or leasing and mining could occur. Mineral materials (36 CFR 228C) are authorized by the Forest Service. The FEIS is revised to display the potential

impact of the alternatives on access to exploration and development of mineral resources, with emphasis on potential use of mineral materials needed the implement the Plan.

Concern: [Seq#69b]: Is there documentation or guidance regarding suitability determinations for mineral development?

Response: In Chapter 3 of the forest plan, lands suitable for mineral materials development was identified per guidance in 36 CFR 228C. The Determinations of the Suitability of Lands for Various Uses is one of the required Plan components under the Planning Rule. The identifications of lands that are “suitable” and “not suitable” for timber production is mandatory. The suitability of lands need not be identified for every use or activity (36 CFR 219.7(e)(1)(v)) and 36 CFR 219.11, FSH 1909.12, chapter 20, section 22.15).

Concern: [Seq#69c]: The Affected Environment discussion in the DEIS should incorporate information about the hazard of earthquake-induced sand blows, because this is presently missing.

Response: We will add information about sand blows to the FEIS because this is one of the multiple geologic hazards associated with earthquakes in coastal plain of South Carolina. The DEIS did discuss earthquake-induced liquefaction. Sand blows are a prominent type of liquefaction associated with earthquakes in coastal plain of South Carolina.

Concern: [Seq#69d]: The Environmental Consequences in the DEIS should complete the assessment of Effects of Alternatives on Geologic Hazards because some words are missing.

Response: We will add the missing words to the FEIS.

Concern: [Seq#147] The forest plan should address permits for personal fossil collecting as fossil collecting could be a family-friendly activity to connect people to the Francis Marion. [ID#147]

Response: [Seq#147] We agree that the Plan should address personal fossil collecting as a family-friendly activity because the Paleontological Resources Preservation Act of 2009 (Public Law 111-11) and the 2015 Forest Service implementing regulation (36 CFR Parts 214, 261, and 291) provides for casual collecting by the public provides the basis for determining when a permit is or is not needed for fossil collecting. In response we have up-dated Plan component DC-F-2(o) Paleontological Resources and its Supplemental Information. Casual collecting is allowed without a permit on National Forest System lands where such collection is consistent with the laws governing the management of those lands, the land management plans, and where the lands in question are not closed to casual collection (36 CFR 291.11(a)). According to 36 CFR 291.11(b), National Forest System lands are open to casual collection unless otherwise closed, as described in 36 CFR 291.12. Research activities do not constitute casual collection, and therefore, research involving the collecting of paleontological resources requires a permit.

Concern: [Seq#70] The plan should incorporate the existing research and future research needs related to geology, paleoecological information and the relationship of natural communities to the water table regime because planning predictions and management decisions are highly dependent on a good understanding of these relationships. [ID#70]

Response: [Seq#70] The connections among geology, paleoecology, water tables and ecosystems are highly complex and that a good understanding of those connections is critical

to achieving desired conditions described in the forest plan. During the development of the assessment and the DEIS, state geologists were given opportunities to review and provide comments. Their comments were incorporated into both documents. In the assessment, we have additional information geology, groundwater and hydrology. Some research needs are identified related to climate change and sea level and their impacts on resources. See Appendix F of the revised forest plan for a list of research needs.

During project development, ecological connections to water table regimes and the potential for hydrological restoration are considered. In some instances, the existing plant and animal communities may be maintained where some hydrologic modification were made.

Concern: [Seq#71] The analysis related to ground water should disclose information about the existence of small caves, underwater caves, and repositories of archeological and environmental history because they could be affected by plan implementation. [ID#71]

Response: [Seq#71] We are not aware of any caves on the Francis Marion. If a cave is discovered, its values (archeological and environmental history; geologic, speleological, etc.) will be assessed prior to implementing any projects that may affect it.

Concern: [Seq#71a] Organic sediments (peat, muck, peaty or mucky clays or sands) deserve some special attention not only because of their ecological value (as specialized habitat) and paleoecological-research value, but also because they have special threats. They are combustible and can be lost in severe fires, especially when overdrained, and they can be economically valuable as a mined or extracted product, perhaps especially when misrepresented as a "renewable" material or a "mineral" material...The organic matter is not mineral (it has no regular crystalline structure, nor any set chemical composition). Renewal (replacement) times, if inferred from original emplacement (accretion) times, would be minimally a few thousand years for thicknesses worth the effort of mining. This is not truly renewable in the generally accepted sense… The argument that organic-sediment deposits are "renewable" (say, as a timber crop is) is inaccurate but its use has been attempted in the state for Carolina Bays. There have even been more extreme preliminary proposals and true-expert advice should be available to FMNF to evaluate any in the future.

Response: [Seq#71b] Organic sediments (peat, muck, peaty or mucky clays or sands) do warrant special attention because of their ecological value, paleoecological-research value, and in light of potential threats. The forest plan direction does provide special attention to such areas as Carolina Bays, Pocosins, and Wetlands.

Concern: [Seq#71b] The importance of sinkholes, including infilled sinkholes, should be recognized because there is much paleoenvironmental evidence, including paleoclimatic information, stored in these geologic features. Initial investigation of a representative few could help reinforce recognition of their importance. FMNF recognizes the special importance of sinks by official recognition of the Honey Hill Lime Sinks area of significant concentration. There are other elsewhere in FMNF, however, also deserving of recognition of their existence and importance. Not all are as conspicuous as at Honey Hill, where high-slope uppermost walls can protrude conspicuously above the level sediment and where surface water may be conspicuous most of the year. Limesinks just as valuable elsewhere can have infilled peaty sediment nearly to the level of the surrounding forest and thus appear similar to the common shallow sand-bottomed cypress "ponds" of far-lesser paleoenvironmental significance.

Response: [Seq#71b] Sinkholes are mapped and included within our forest plan direction for depressional wetlands and Carolina bays. Honey Hill is included as a rare community in the Wambaw RIZ and contains a significant population for the endangered pondberry.

Social

Cultural Resources

Concern: [Seq#27] The forest plan should recognize the designation of the Kings Highway as a historic site because of its location within the Francis Marion proclamation boundary. [ID#27]

Response: [Seq#27] The portion of the Kings Highway that was designated is not on national forest land and the forest plan focuses only on historic properties located on national forest land. Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effects of their undertakings on historic properties. The Forest Service would identify historic properties, such as the Old Georgetown Road, and consult with the South Carolina State Historic Preservation Office, federally recognized Indian tribes and other interested parties before carrying out any projects proposed in the vicinity of the Old Georgetown Road.

Concern: [Seq#31] The forest plan direction should protect the inland rice fields in the Huger Creek drainage basin, particularly Turkey Creek and the East Branch of the Cooper River because they are the last remnants of slave-based rice cultivation. [ID#31]

Response: [Seq#31] Under Section 106 of the National Historic Preservation Act the Forest Service would take into account the effects to any proposed activities on historic properties. The Forest Service would identify historic properties, including archaeological sites, manmade features and historic landscapes, and consult with the South Carolina State Historic Preservation Office, federally recognized Indian tribes local governments, and other interested parties before carrying out any projects proposed in the vicinity of Huger and Turkey Creek watersheds.

Concern: [Seq#49] In the Wambaw Resource Integration Zone S-5 Guillard Lake Scenic Area should be preserved because it has outstanding features, such as levees. [ID#49]

Response: [Seq#49] Under Section 106 of the National Historic Preservation Act the Forest Service would take into account the effects of any proposed activities on historic properties. The Forest Service would identify historic properties, including archaeological sites, manmade features and historic landscapes, and consult with the South Carolina State Historic Preservation Office, federally recognized Indian tribes local governments, and other interested parties before carrying out any projects proposed in the vicinity of Guillard Lake Scenic Area.

Concern: [Seq#152] The forest plan should protect the slave-built rice fields in the Huger Creek drainage basin and in the tidal portions of Wambaw Creek because they are priceless cultural artifacts that speak to much of the early history of the area. [ID#152]

Response: [Seq#152] Under Section 106 of the National Historic Preservation Act the Forest Service would take into account the effects of any proposed activities on historic properties. The Forest Service would identify historic properties, including archaeological sites, manmade features and historic landscapes, and consult with the South Carolina State Historic Preservation Office, federally recognized Indian tribes local governments, and other

interested parties before carrying out any projects proposed in the vicinity of Huger and Wambaw Creek watersheds.

Minerals

Concern: [Seq#35] The forest plan direction should address the potential mining of leasable minerals, including sand, phosphate, limestone and organic sediments; because as urbanization increases the demand for these resources will increase and mining operations could potentially impact groundwater and other natural resources on the Francis Marion National Forest. [ID#35]

Response: [Seq#35] Plan direction should address the potential for mining minerals because of the anticipated future demand for minerals. The Plan direction does apply to mining as well as to any other type of ground disturbance. Any proposal for mining would be subject to the Forest-wide Standards and Guidelines and other Plan direction to protect groundwater and other natural resources. Some minerals like phosphate are leasable minerals. Some minerals like limestone or sand depending on their specific characteristics could be a leasable mineral (suitable for special technical uses) or a mineral material (common varieties of minerals used, for example, as road aggregate). Leasable minerals are authorized by Bureau of Land Management (BLM), and require Forest Service consent before prospecting permits or leasing and mining could occur. Mineral materials (36 CFR 228C) are authorized by the Forest Service. The revised forest plan addresses both leasable minerals and minerals materials.

The assessment is conducted under the 2012 Planning Rule which requires that “The plan must include plan components, including standards or guidelines, for integrated resource management to provide for ecosystem services and multiple uses in the plan area”(36 CFR 219.10a). It is important to recognize that supplying minerals is not only part of multiple use but also ecosystem services. The Rule defines “ecosystem services” as benefits people obtain from ecosystems, including “Provisioning services, such as clean air and fresh water, energy, fuel, forage, fiber, and minerals;…” (36 CFR 219.19).

***Note:* See additional minerals-related comments/responses in Geology section.**

Scenery

Concern: [Seq#135] The DEIS should address the potential effects utilities right-of-way, towers and windmills will have on the view (i.e. scenery) because this is an important effect not disclosed in the DEIS. (36-4) [ID#135]

Response: [Seq#135] Utilities often have significant impacts to aesthetics of an area. Any potential projects, such as right-of-ways, windmills or electronic towers, would have a site specific public involvement process and an analysis that addresses the specific visual impacts of those actions at that time. There are standards for the scenery of the Francis Marion that every potential project must meet, See Chapter 4 of the revised forest plan under the heading Standards for Recreation and Scenic Character.

Concern: [Seq#136] The forest plan should emphasize conditions for visually stimulating scenery and a restored native forest along the Highway 17 corridor because the opportunity exists to use these zones as a living billboard of what South Carolina’s native forest should look like. (16-20) [ID#136]

Response: [Seq#136] The aesthetics of the Francis Marion National Forest are important to the sense of place and a benefit to neighboring communities. There are aesthetic standards for the Francis Marion that every potential project must meet, See Chapter 4 of the revised forest plan under the heading Standards for Recreation and Scenic Character. The scenic integrity objective for the Highway 17 corridor on National Forest is HIGH, which strives to maintain or enhance the view sheds of that corridor.

Environmental Justice

Concern: [Seq#139] The Environmental Justice (EJ) analysis in the EIS should indicate the efforts made to identify or quantify the amount of subsistence consumption within the planning area that involve low-income and minority populations. (38-7)

Response: [Seq#139] The FEIS has been edited to portray available information on subsistence consumption within the planning area that involve low-income and minority populations. This update is based on qualitative/anecdotal information, since there is no quantitative data

Concern: [Seq#139a] The Final EIS should summarize any EJ concerns raised during the public engagement process. (38-7)

Response: [Seq#139a] A brief summary has been added to the FEIS summarizing the EJ concerns raised during the public engagement process.

Concern: [Seq#139b] Planners should consider incorporating the EJ section as a subsection of the Social Demographics section in the Final EIS because understanding EJ issues is very heavily dependent on social demographics data. (38-7) [ID#139]

Response: [Seq#139b] The current EJ section references the demographic data. In addition information has been added summarizing the EJ concerns raised during the public engagement process and available information on subsistence consumption within the planning area that involve low-income and minority populations.

Recreation

Concern: [Seq#44] The forest plan should identify, protect and manage roadless areas because of their ecological and environmental value. [ID#44]

Response: [Seq#44] The two roadless areas on the Francis Marion are located in the Wambaw Semi-Primitive Area, which seeks to offer a higher degree of solitude for recreation visitors and restoration of native ecosystems. The roadless areas themselves are subject to the Roadless Area Conservation Rule, which limits the road-building and tree harvest without Regional Forester approval.

Concern: [Seq#137] The management plan should consider relocating the Wambaw Cycle Trail because this reduces user conflicts and better protect the ecosystems. (25-31) [ID#137]

Response: [Seq#137] Trails can impact ecosystems if they are not properly designed and maintained. A site-specific decision on the relocating the Wambaw Cycle Trail is outside the scope of this forest plan. The forest plan makes programmatic decisions that provide broad, strategic direction. The specific impacts such as user conflicts and ecosystem protection would be best addressed in a site-specific decision.

Concern: [Seq#138] Planners (p93) should modify the statement that the Wambaw Cycle Trail coexists with the diverse ecosystems through strong partnerships because there has been severe damage to adjacent ecosystems. (24-20) [ID#138]

Response: [Seq#138] The Francis Marion acknowledges that trails can impact ecosystems without proper design and maintenance. The statement is written as a desired condition statement, which identifies the desired condition of the area necessarily the current existing conditions. The intent of the statement in the plan is to acknowledge that there is an OHV trail in the Wambaw Resource Integration Zone and it is maintained through strong partnerships.

Concern: [Seq#110a] The forest plan should reallocate the location of ATV trails away from sensitive areas and closer to population centers of the users because uses of ATV trails is not suitable in sensitive areas. (25-14) [ID#110]

Response: [Seq#110] The revised forest plan makes programmatic decisions that are not site-specific. The specific impacts such as user conflicts and ecosystem protection would be best addressed in a site-specific decision and the forest plan does not preclude the re-location of the Wambaw Cycle Trail. Over the last several years, trail conditions have improved and impacts to continue to sensitive areas continue to decline.

Concern: [Seq#148] The forest plan should include direction on limiting any new developed recreation sites due to the existing maintenance backlog and declining budgets. [ID#148]

Response: [Seq#148] With declining budgets, any proposals for new recreation sites will receive close scrutiny. The forestwide desired condition states that new sites would consider life cycle costs as well as operational costs and maintenance costs. Also, the forest plan makes programmatic decisions that are not site-specific so any new recreation site would have to undergo a public involvement process and site-specific analysis before it could be constructed on the Francis Marion.

Concern: [Seq#150] The forest plan should allow more for OHV trails due to the public interest in riding OHV's on national forest trails. [ID#150]

Response: [Seq#150] During the public involvement process, there was a lot of interest from the public on increasing the number of trails. The desired condition of the forest plan states, "the forest provides a system of designated, sustainable trails that deliver safe motorized and non-motorized public access to the forest." The forest plan makes programmatic decisions that are not site-specific and does not preclude adding new trails.

Cost/Benefit

Concern: [Seq#141] The forest plan should consider the costs of conversion and the resulting loss of timber productivity because when these are considered restoration of longleaf pine is not economically feasible. [ID#141]

Response: [Seq#141] The cost of conversion is important and will be considered during project analysis when actual treatments are proposed. Adverse and beneficial consequences to communities in the area are considered in the social and economic effects section. Financial costs that may be incurred from management under the proposed plan need to be considered alongside benefits of treatments to improve forest health that include financial benefits and other non-market benefits to communities from improvements in ecosystem services. Forest

planning regulations in 36 CFR 219.9 9 (a) (2) direct the National Forests to: "maintain or restore the diversity of ecosystems and habitat types throughout the plan area." Economics are a consideration, but they are one of several factors considered during the planning process.

Government Agency Comment Letters Received on the Draft EIS

Note: Comment letters begin on the next page.

Date submitted (UTC): 10/13/2015 9:53:59 PM
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Comments:
I see nothing in the plan specifically about invasve species, either terrestrial or aquatic. I'm sure you well know that invasive species can decimate an ecosytem in many ways. Species like cogon grass and phragmites as well as some injurious diseases can move quite fast in and through areas and have devastating effects especially on threatened and endangered species. The estimate number one cause of species extinction may just be invasive species.
Those species which may currently exist within the boundaries and those which may be future invaders need an early detection and response system that could be built into the plan itself or in an accompanying document.

Letter ID# 12 (a)

Date submitted (UTC): 11/9/2015 5:58:43 PM
First name: Gene
Last name: Kodama
Organization: SC Forestry Commission
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Official Representative/Member Indicator:
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State: SC
Province/Region:
Zip/Postal Code: 29212
Country: United States
Email: kodama@scfc.gov
Phone: 803-896-8800
Comments:
Mr. Rick Lint
Forest Supervisor
National Forests in South Carolina
4931 Broad River Road
Columbia, SC 29212

Dear Rick:

The Francis Marion and Sumter NF's are prominent features in South Carolina and play a significant role in our state's economy, environment, and society. I am sure our citizens appreciate the opportunities that you have provided for all of us to be a part of the planning process.

As you are aware, private landowners own most of the state's forest land and provide around 96% of the wood supply that keeps the forest industry solvent and provides about 90,000 jobs for its citizens. State and federal government also play a significant role in the forestry community by supporting the forestry cycle from land ownership, timber production, and ecosystem services to wood product manufacturing and its many jobs. With that in mind, we suggest that timber production be a more deliberate emphasis in the Francis Marion forest management plan and also on the ground. We are encouraging private landowners to be more active forest managers to ensure forest economic and environmental health and their own financial success, and we as government landowners should do likewise.

Pine timber production is especially important right now in South Carolina because of a dramatically imbalanced pine age class structure that has created a scarcity of small diameter pine. Unfortunately, this condition will worsen before improving. We can help alleviate this problem by planting as many acres as we are able to on our own properties to increase timber production and by producing as much pulpwood as possible over the next 10 to 20 years. We can also ensure the public knows that we are working hard to help address this challenge and to support our share of the jobs in forestry while serving as responsible stewards of the environment. We should also remind them that our forests provide other values like recreational opportunities, wildlife habitat, clean water, and carbon sequestration while providing valuable fiber for our mills and providing employment.

Seeing that timber harvests are now being planned to exceed pre-Hugo levels is good news for the National Forests and for South Carolina. The Francis Marion contains some of the most productive timber growing land in the country, so it can produce significant additional wood volumes on just a portion of the total Forest area through tree planting and active timber management. This national forest also happens to be located in the part of the state with the highest scarcity of small diameter pines. Because of these factors, the Francis Marion National Forest is poised to provide significant relief to this wood supply problem.

Increased timber harvesting on the Forest will not only help support South Carolina's forest industry, but it will also provide other benefits. The South Carolina Forestry Commission and the USDA Forest Service are partners in wildfire prevention and control, so we are keenly aware of the high fire danger that results from over-stocked forests. The work that is planned on the Francis Marion to reduce fuel loadings will help mitigate this risk and is extremely important to citizens who live in this area as well as adjacent landowners.

Letter ID# 17 (a)

Timber sales, especially final harvests, help to break up an otherwise homogeneous forest. Additional early successional habitat in a mosaic pattern will be a positive result from harvesting and tree planting and is being promoted as a need by organizations like the Quality Deer Management Association and the National Wild Turkey Federation. This variety of habitat will benefit numerous wildlife species and will increase diversity across the Forest.

Active forest management through timber harvests can help reduce the incidence of forest pest outbreaks as well. Controlling stand density and replacing over mature stands with vigorously growing seedlings are two very effective strategies to help prevent attacks from southern pine beetles and other pathogens. Maintaining the health of stands of trees on the Francis Marion is important not only for the sake of this ownership, but it also helps ensure that pest outbreaks do not begin on the Forest and spread to adjacent private land.

Thank you for the opportunity to provide comments on this plan revision. We look forward to continuing our productive partnership as we serve as leaders in our South Carolina forestry community.

Sincerely,

Henry E. (Gene) Kodama
State Forester

Letter ID# 17 (b)

Date submitted (UTC): 11/10/2015 1:38:25 PM
First name: Frank
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Comments:
The work of the Charleston County Mosquito Control Program (CCMCP) is performed by the Mosquito Control Division of Charleston County Public Works. We appreciate the opportunity to offer the following comments in the hope that we can assist in achieving the stated theme to "Improve the quality of life and health for the public".
The CCMCP is prohibited by the South Carolina Department of Natural Resources (SCDNR) from conducting the basic, highly effective mosquito control practices of aquatic stage mosquito (larvae) surveillance and treatment (larviciding) on the Santee Coastal Reserve managed wetland impoundments (the Santee Coastal Reserve currently contains 1,000 acres of diked impoundments). A study conducted in 1981 and 1982 by researchers from The Citadel's Vector Biology Program found mosquito larvae production as high as 32,000 larvae per square meter in standing water on one sampled impoundment. Research conducted by the U.S. Navy on similar sites discovered that they can produce up to four million adult female mosquitoes per acre (on non-larvicided sites) after sufficient rainfall, tide, or man-made flooding event. These adult salt-marsh mosquitoes easily fly to and affect communities eight to ten miles from their impoundment breeding grounds, utilizing the Francis Marion National Forest (FMNF) and other adjacent natural zones as flight paths and resting areas.
Due to the adult mosquito populations generated by the Santee Coastal Reserve, grossly disproportionate amounts of CCMCP resources are devoted to controlling the adult mosquitoes that are infesting McClellanville, Germantown, Awendaw, and other local communities, all of which are located in or have relevant geographical proximity to the FMNF. As stated in the Citadel study, in 1983, the CCMCP determined that 20% of its total budget was expended to control salt-marsh mosquitoes in the McClellanville area alone. In 2010 a cost analysis was conducted by the CCMCP of the previous four years of the mosquito control carried out in the area bordered by Darrell Creek Trail northward to the South Santee River. 61% of the CCMCP's total budget for those four years was expended in this area, including 33% of the adult mosquito spraying by truck-mounted units. In 2013 from January through September, 11% (159) of the total CCMCP spray truck missions countywide were carried out in the McClellanville area, in addition to 9% (84,346) of the total County spray truck acreage.
Although spray truck missions can at times sufficiently control adult mosquito outbreaks, aerial spray missions are sometimes necessary in this and other regions due to the geographical spread, intensity, and duration of the outbreaks (adult mosquito "counts" of 10 to 100 per minute or more over several days). The aerial spray missions conducted in the McClellanville, Germantown, and Awendaw regions by necessity encompass much of the FMNF. The CCMCP has been prohibited by the USDA Forest Service (UFS) from using any other product except Malathion (active ingredient) by air in the FMNF for decades. As a result, a large percentage of the mosquito population is resistant to (will survive) the necessary aerial treatment; so much so that, at times, as little as 50% control is achieved per mission. Continued aerial spraying, utilizing Malathion as the sole pesticide, will soon increase the resistance factor until the point is reached that aerial spraying is ineffective, resulting in dire quality of life and potential public health consequences for the human population. Since the late 1990's, the UFS has required that an Environmental Impact Study (EIS) be conducted to determine whether other pesticides would be approved for aerial application for adult mosquito treatment over the FMNF. At that time the cost of the requisite EIS was estimated to be approximately $3 million. No agency at any level has decided to fund this EIS.
The CCMCP has also been prohibited by the UFS since the late 1990's from conducting larval mosquito surveillance and treatment by air at a known salt-marsh mosquito breeding impoundment (approximately 35 acres in area) in the Tibwin Forest section of the FMNF adjacent to the Atlantic Intracoastal Waterway (AIWW).

Letter ID# 19 (a)

In consideration of the Francis Marion Forest Draft Plan's stated goal of improving quality of life and health for stakeholders, the CCMCP requests that the Revised Forest Plan contain specific provisions and goals to address the aforementioned issues that are currently severely impacting residents living in and adjacent to the FMNF as well as visitors to the FMNF, in addition to straining the resources of the CCMCP and Charleston County taxpayers. Specifically:

1. That an Environmental Impact Study (EIS) be funded and carried out within five years of the finalization of the Revised Forest Management Plan with the goal of

approving the use of alternative aerial adult mosquito control products, or that the UFS grant the CCMCP an indefinite waiver immediately (beginning in 2016) for permission to utilize other products commonly used by CCMCP until such a time that an EIS is completed and alternative products are approved.

2. That the UFS immediately (by February 2016) allow the CCMCP to conduct larval mosquito surveillance and aerial treatment at the previously mentioned AIWW impoundment in the Tibwin section of the FMNF.

3. That the UFS partner with the CCMCP and other stakeholders to address the SCDNR prohibition against implementing the effective, well-established basic preventive mosquito control practices of larval surveillance and treatment in the Santee Coastal Reserve. The adult mosquito population generated by the Santee Coastal Reserve could be significantly reduced by these practices, resulting in greatly increased quality of life for the human population and significant cost savings to the County taxpayers.

All of the products used by the CCMCP for control of aquatic stage and adult mosquitoes are approved by the EPA and are utilized in accordance with Federal and State Law. The CCMCP also follows the guidelines established by the American Mosquito Control Association (AMCA) and the U.S. Center for Disease Control (USCDC) as Best Management Practices (BMP). Among the most important BMPs is the implementation of a high degree of surveillance to evaluate larval and adult mosquito populations to determine the most appropriate mosquito control methods to be used, if any.

The CCMCP currently conducts mosquito control BMP's in the Cape Romain Refuge, the ACE Basin, State and County Parks, and thousands of acres of freshwater wetlands, salt marshes, marsh estuaries, woodlands, and other natural areas and ecosystems across Charleston County. We are confident that their use in the FMNF would not pose an unreasonable risk and would improve the quality of life and health for the public.

Letter ID# 19 (b)

Date submitted (UTC): 11/10/2015 3:09:03 PM
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Comments:
Francis Marion National Forest

Groundwater

Groundwater in the several main aquifers beneath FMNF will almost certainly be a tempting target for pumping and use elsewhere as the Charleston metropolitan area and other nearby developed areas grow and water resources (both surface waters and groundwater) come into more demand and competition in use. Legitimate arguments will be made that the footprint of even a large wellfield can be small and minimally obtrusive (small fenced enclosures at the actual sites of the scattered wells) and with pipelines, and even electrical powerlines, buried unobtrusively along existing forest roads. Where there will be much more risk to the forest environment will be in easily made misunderstandings and inaccurate assumptions in hydrologic arguments and assessments. While it is possible and even probable that the deepest major aquifers beneath FMNF are sufficiently isolated hydraulically from the surface environment so that they might be pumped safely and even heavily without harm to the surface environment, it is the shallower aquifers that will be more coveted due to their lesser salt content (and possible other constituents, e.g., dissolved boron that can harm lawn and golf course grasses). FMNF is dominated almost exclusively by high-watertable forests and wetlands and thus is especially vulnerable ecologically (and in fire susceptibility, at least so far as the peaty wetlands are concerned: e.g., Wambaw Swamp, Hell Hole Swamp) to even very minor lowering of the watertable. A somewhat similar high-watertable forest mosaic at Green Swamp in west-central Florida decades ago showed the ecological effects of watertable lowering above heavy pumping of the principal limestone aquifer, it being closely related to the limestone and aquifer situation just beneath FMNF (studies at South Pasco well field by the USGS and SW Florida Water Management District). Reduced spring flow and stream flow is also to be expected from heavy pumping of a shallower aquifer (more directly affecting a spring) and from a decline in watertable (more directly affecting a stream). Groundwater extraction proposals will need to be examined extremely carefully and professionally and from an ecological as well as hydraulic and land-use "footprint" perspective.

There are also less-obvious risks or threats associated with any future proposal for groundwater extraction, revealed by similar situations occurring in the past elsewhere. There is much room for misinterpretation of the vulnerability of the surface ecosystem and hydrologic system to heavy and prolonged groundwater pumping. The simplest common misinterpretation is misconstrual of the conceptual model of the aquifer stratigraphy. Another common misinterpretation involves pumping-based hydraulic tests for vertical interconnection. Persons responsible for FMNF should at least know of the ways that hydrologic assessments may be faulty or biased. Extremely brief descriptions follow.

A geologic formation beneath the uppermost principal aquifer may have a different lithology (e.g. here, sand vs. limestone) and a different geologic formation name (e.g. here again, Black Mingo Fm. vs. Santee Limestone) and then be assumed to be a different aquifer, that is a different hydrologic or hydraulic unit (a hydraulic unit implying direct interconnection). This taxonomic "splitting" has been done intentionally by proponents of new pumping in other areas. A single aquifer or hydraulic unit, however, may consist of several stacked layers of geologic units of different names and lithologies, as has been shown for the Tertiary limestone (mainly Santee Fm. here) and the underlying Tertiary sand aquifer (mainly Black Mingo Fm. here) in other nearby areas of this combined system to the northwest of FMNF. It is a mistake to assume or propose that pumping from the deeper stratum does not involve extraction from that (or those) shallower one above it, and especially a

Letter ID# 20 (a)

mistake to conclude that the surface wetland or shallow-watertable environment will be unaffected. Hydraulics, not nomenclature or lithology, are the direct factors.

Technical evaluation of the interconnection of the water table, or else the uppermost principal aquifer, with deeper aquifers from which heavy pumping is proposed is notoriously difficult and chronically misinterpreted even with a hydraulic perspective. Estimation of permeability of intervening potential confining units (strata) has sampling difficulties for obtaining representative average samples (plus effective localized breaching can be missed). More typically, pumping-test data are misinterpreted. Even where heavy long-term pumping of an aquifer would in fact acutely affect (lower) the water table and greatly affect forest ecosystems, the interconnection of a deeper aquifer with the shallow watertable aquifer can be missed or misinterpreted despite the use of pumping tests thought (or purported) to be specifically designed to evidence such an interconnection. The key difficulty is often failure to differentiate the concepts of "evidence" and "test" (both used here as a verbs). Lack of evidence (noun) for interconnection in a pumping test is often misconstrued as direct evidence for some opposite condition, i.e., for a lack of effective interconnection, when in fact it is lack of evidence and does not indicate strongly one way or the other regarding interconnection.

The most common and dangerous error is in test pumping from the deeper aquifer and seeing no drawdown in observation wells in the water-table aquifer (or indeed, any shallower aquifer) and concluding a lack of effective interconnection. If one does see a concurrent drawdown, that then is very strong evidence for an effective interconnection. But when one does not detect any drawdown in the shallower aquifer that typically does not indicate or strongly suggest that there is no effective interconnection that could prove troublesome (up to disastrous) under future widespread, prolonged heavy pumping of the deeper aquifer. Judged by pumping test and wellfield experience worldwide those wellfield conditions (wide, pronounced, prolonged pumping) are the ones that eventually exhibit the clear interconnections where they exist. You may not see any effects in a medium-length pumping test (say, 72 hours) and far less likely in a short one (say 12-24 hours) but that does not mean that interconnection may not be ecologically substantial after a few years of heavy pumping. And wellfields are usually permanent. One main reason that such pumping tests are insensitive to actual interconnection and effective downward leakage and drainage of the surface environment is because shallow aquifers can readily replace leaked water by lateral flow under small hydraulic gradients. The critical item is long-term effect. The USFS should have expert technical advice in evaluating the acceptability of any proposed heavy prolonged pumping (short-term heavy pumping, say for temporary excavation dewatering in construction, may be perfectly acceptable and there one would be concerned more with where the pumped water was discharged, especially if muddy).

Another factor in any future groundwater use involves water chemistry (quality). If deep aquifers are demonstrated to be safely pumped for use by distant users, any salts-reduction treatments (e.g., reverse osmosis) should be done nearer the distant users (even if this is less efficient in terms of pumping) to avoid discharge of locally atypical saltier wastewater in FMNF itself.

The likely tight interconnection between biotic communities or ecosystems and the prevailing water-table regime (e.g., depth to water table or depth of water, and typical variation, both seasonal and among years) makes it very likely that small hydrologic changes, if persistent, will have appreciable ecological effects. A lowering of average watertable elevation may be more visually apparent by, say, pines colonizing into cypress forests than by any other observation save detailed water-level measurements and data analysis. Subtle changes in hydrology have the ready potential for significant to substantial changes in local biology in an ecosystem where the water table lies close to the surface, whether above or below, and small shifts in water levels can have large shifts in ecological forces, say especially from flooding.

There has been some concern among groundwater hydrologists and others that South Carolina may be susceptible to pumping-induced aquifer compression and ground-surface subsidence. In such a case, oddly, heavy pumping of a deep aquifer could cause the surface environment to become wetter by becoming physically lower. Thick major sand aquifers with appreciable clay content, say as interlayers, are most susceptible to this problem, and then only if heavily pumped to produce a large (broad and deep) drawdown. Careful attention should be paid to any targeted studies of these same aquifers where pumped heavily in other areas of southeastern United States (e.g., Grand Strand). Precise re-leveling of old monuments can sometimes detect a lowering of ground level. Any major wellfield planning or development of hydraulically low-risk deep aquifers should include rigorous assessment of this wide-acting factor as well, because this forest (vs., say, Sumter NF) would be so much more vulnerable to the effects.

Letter ID# 20 (b)

Environmental history

FMNF has several types of sites that can have special, up to unique, value as localized concentrated repositories of archeological and environmental-history (paleoecological and paleontological) evidence. Sinkholes (solution holes), substantial springs, peat- or muck-filled wetlands, and stream corridors are of obvious potential value here. Isolated drier sites that were former high-water-times focuses of animal and human (including historical) activity are also important in wetland environments. While streams are found throughout the state, the other mentioned features are not common elsewhere in the state but are found in important occurrences in FMNF.

Sedimentary charcoal evidencing past fire regimes and their possible shifting; pollen, spores, and other plant remains evidencing past flora directly and thus past ecology and climate and their shifts and changes; paleontological remains (bones, teeth, scales, and other remains) similarly evidencing past fauna and environments; and undoubtedly archaeological remains in or focused adjacent to these types of sites are invaluable scientifically and increasingly are valuable in assessing modern forest management practices (perhaps especially fire regime) and others under possible future shifts in rainfall and water table.

Sinkholes (solution holes) are unique repositories of remains from the sinkhole itself and surrounding former environments. Where peat or muck filled, as some (many?) are in FMNF, and thus with a stratigraphic sequence, the past changes or shifts can be shown and the stages or boundaries more easily dated (by 14C, 210Pb, optical luminescence). Wet sites in an unflooded general environment also attract animal and human activity and thus are still more important because they concentrate remains: they are focuses of activity. FMNF recognizes the special importance of sinks by official recognition of the Honey Hill Lime Sinks area of significant concentration. There are other elsewhere in FMNF, however, also deserving of recognition of their existence and importance. Not all are as conspicuous as at Honey Hill, where high-slope uppermost walls can protrude conspicuously above the level sediment and where surface water may be conspicuous most of the year. Limesinks just as valuable elsewhere can have infilled peaty sediment nearly to the level of the surrounding forest and thus appear similar to the common shallow sand-bottomed cypress "ponds" of far-lesser paleoenvironmental significance. One infilled sink, now for all appearances simply a shallow cypress "pond," was cored decades ago to almost 7-meter depth and 14C dated about half way down to ~11,000 BP (14C years "before present"): an infilled sinkhole of some sort. Sand/muck interlayering found at depth might evidence severe storms, severe fires, or conceivably even repeated earthquake shaking. There is much paleoenvironmental evidence, including paleoclimatic information, stored in infilled sinkholes and their importance should be recognized. Initial investigation of a representative few could help reinforce recognition of their importance.

Shallower but much larger depressions in the mineral (sand/limestone) general ground surface (and of yet unclear geologic origin) similarly can contain at least some organic sediment (peat or muck) of wetland origin, also having considerable usefulness in paleoecologic (e.g., paleohydrologic) reconstructions. Wambaw Swamp and Hell Hole Swamp are obvious examples. There are undoubtedly smaller less familiar ones.

Organic sediments (peat, muck, peaty or mucky clays or sands) deserve some special attention not only because of their ecological value (as specialized habitat) and paleoecological-research value, but also because they have special threats. They are combustible and can be lost in severe fires, especially when overdrained, and they can be economically valuable as a mined or extracted product, perhaps especially when misrepresented as a "renewable" material or a "mineral" material. The organic matter is not mineral (it has no regular crystalline structure, nor any set chemical composition). Renewal (replacement) times, if inferred from original emplacement (accretion) times, would be minimally a few thousand years for thicknesses worth the effort of mining. This is not truly renewable in the generally accepted sense. Special caution must be given to evidence for any supposed rapid accretion based on dating of shallow layers. For notable example, shallow samples (say, <0.5 m) of peat may give very young 14C dates by the effect of root intrusion, implying incorrectly that peat deposits can renew relatively quickly. Worse, mined deposits revert to ponds too deep to form peat. The original deposit formed over a long period of rising water table and was never deep. The textbook pond-filling sequence for peat-bog development is incorrect for most southeastern United States situations (it applies mostly to glaciated terrain of the upper Midwest) and should not be allowed to direct decisions here. The argument that organic-sediment deposits are "renewable" (say, as a timber crop is) is inaccurate but its use has been attempted in the state for Carolina Bays. There have even been more extreme preliminary proposals and true-expert advice should be available to FMNF to evaluate any in the future (flooding a Carolina Bay peat deposit with a lye solution to extract valuable humic acids while supposedly

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"leaving" the peat after the leaching and collection was one such proposal).

Substantial springs have special ecological functions of fairly wide recognition, but they also possibly existed and functioned as focuses of animal and human activity in the drier era before the widespread development of wetlands and perhaps streams (in southeastern United States generally before 5000-7000 BP, when the pineland also arrived). Ill-advised development (e.g., clearing, leveling, etc.) could readily destroy important deposits adjacent to (or even in) larger springs. Ill-advised groundwater pumping could eliminate springs of all sizes. Blue Spring on Echaw Creek is well known. Others likely exist (Tabor, 1939, mentioned their apparently common existence in the related limestone terrain of the nearby Santee-Cooper project). Blue Springs' likely high vulnerability to water-table lowering (i.e., by its not discharging from a separate and appreciably deeper aquifer) is suggested by its young groundwater age (apparent post-WWII recharging, based on 14C in dissolved inorganic carbon).

Streams and immediate stream corridors probably have similar values and vulnerabilities as the springs, and for similar hydrologic reasons.

The same Santee Limestone near the town of Santee (to the NW of FMNF) has small caves in it. These are known because parts lie above the water table and were noticed and explored. Underwater caves may exist in FMNF (Amataya n.d.)(springs and sinkholes also hint at this). Carbonate cave flowstone formed in former times of lower sea level and lower water table can possess important isotopic evidence of climate in these previous times. Underwater caves can possess endemic fauna as well.

Geologic Materials

Subsurface materials in addition to groundwater at FMNF are likely to have continued and perhaps increasing pressure for extraction, especially given the continued urban and industrial growth in the wider Charleston metropolitan area and especially if private entities hold any "mineral rights." Additionally, any low-elevation urban or urbanizing coast is going to have enormous eventual demands for fill or raised-pad material under conditions of rising sea level (which also defines freshwater drainage base level). Geological resources definitely include abundant limestone, sands, and some peat or muck deposits (and perhaps some geologically young marine shell deposits), even while common conceptions of "mineral resources" would be for more valuable and localized deposits (e.g., ores) and while peat and muck are not technically made of minerals dominantly. Florida successfully fought attempts to consider and mine the limestone bedrock of Everglades conservation areas as "minerals," which at the very least shows that such attempts will likely come eventually to similar FMNF and should be planned for. Additional South Florida wetland areas once slated for conservation have been extensively mined in recent decades (see NW of Miami on Google Maps or similar photographs). South Carolina has previously faced the threat of mining of peat and muck deposits (in Carolina Bays) on the pretext that these plant-origin geological materials were "renewable" and would "naturally grow or accrete back" in the deeper depressions the mining left behind. As noted above, FMNF officials should be aware (1) that such deposits took a few millennia to accrete, or to "renew," while true renewable are restored on time scales of a growing season up to a few decades. No higher-value (per mass) geologic material is known to be available in commercial abundance or concentration (e.g., phosphate, or titanium minerals in heavy sands).

Some Useful Initial Research

Research goals in the realm of geology include some that can be directly useful in the short terms, and those that need attention now mainly in terms of protecting their potential now for their future exploration.
It might be useful to have a survey sampling of basal organic sediments 14C dated to document about how long it would take to "renew" an organic sediment deposit under FMNF conditions, if it could be renewed at all.

It might also be useful to examine a few of the probable "data caches" of paleoecological information, including archaeological information, to (1) demonstrate their value in several sciences, and (2) obtain initial information of more-nearterm use to forest managers themselves, especially apparent fire-frequency (but including such items as mercury deposition) in the pre-modern and pre-historic past, plus other aspects of natural-era (or at least pre-European) forest ecology.

Documenting the relationship of the principal or notably important or present natural communities to the water-

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table regime (USDA, Forest Service, 2012) would go a long way toward being able to predict any negative impacts of proposed future modifications or activities, including ones that might be naively thought of as minor. It is assumed that an ecosystem above a high water table (i.e., shallow, to above-ground) is highly attuned to it, and that small changes in the annual procession of level will have a profound effect (even though a forest above a deep water table may not "feel" or respond at all to a similar or larger change). A tight interconnection would, of course, be far stronger evidence in future decision making regarding water resources if it is documented rather than inferred or assumed.

Ultimately, confident planning predictions and management decisions are also highly dependent upon a good understanding of the surface and shallow-zone physical (and to an extent, geochemical including pollutant) hydrology of the FMNF ecosystem. Continuing, and appropriately focusing and integrating, the growing body of information on the overall water budget of FMNF is essential here.

Summary for Hydrologic/Ecological Aspects

The FMNF ecosystem is almost undoubtedly very sensitive to even minor shifts in the water-table regime, including shallow surface flooding, and several obvious sources of such minor (or greater) shifting are apparent for this large and valuable area (e.g., wellfield development, climate change). Understanding and confident prediction are clearly needed for effective planning and management.

One can hardly overestimate the importance of understanding the controls on, and ecological functions of, the water table (i.e., the water-table aquifer and its upward extension into surface flooding) for a high-watertable and wetland ecosystem. In addition, the water-table system feeds most or nearly all of the streamflow (but with some deeper-origin springs at least possible) and all or nearly all of the innumerable wetland depressions.

Understanding both the hydrology and ecological effects of the water table are critically important for at least several main reasons. In a high-watertable ecosystem the near-surface position (whether below or above the ground) of the top of saturation exerts both favorable conditions (mainly water availability, but also dispersion route and aquatic habitat if flooded) and also stresses (including, anoxic soil conditions and outright drowning). It is obvious that an ecosystem with the water table near the ground surface is much more sensitive to small fluctuations in level than, say, ecosystems with the water table two meters above (a lake) or below the surface (e.g., a mesic forest). Small to moderate changes in surface hydrology can easily arise from human activities (e.g., wellfields, adjacent development drainage, mining dewatering) and of course any future climate changes in SE United States are as likely to be expressed in rainfall changes as in temperature. Understanding hydrology allows far better predictions of future ecosystem conditions under changes in hydrological factors. To that last point, it would be worthwhile to make some initial estimates as to how sensitive FMNF's surface hydrology is to rising drainage baselevel, that is, sea level. And of course, the critical other side of the 'impact" equation is the biological or ecological linkages between watertable regime (position and short term, say seasonal to decadal return-frequency shifting).

No attempt is made here to review what is known at present about water-table hydrology at FMNF or the related ecology. Extensive studies for the former (hydrology) are listed and briefly reviewed in Amatya et al. (2015). USDA Forest Service and local university hydrology and hydrogeology researchers have been extensively involved. These and other existing studies should be closely evaluated for the significance of their hydrologic findings in application to a high-water table resident ecosystem, particularly its management and its vulnerabilities to future hydrologic changes that may be proposed or imposed. An understanding of the "ecohydrology" is the needed ultimate goal (Amatya et al., 2015), though very basic hydrologic information is required as part (e.g., Callahan et al., 2012, on estimating recharge rates).

The water table itself and controls on its position (depth below or height above ground, seasonal fluctuations, extremes at different timescales, etc.). For technical reasons, a water-table aquifer often is mathematically more complex than a deeper confined aquifer (the saturated thickness of the tater-table aquifer often changes through short times) and less hydrogeologic emphasis seemingly has been paid to these types. Considerable attention has come instead from agronomy and forestry hydrologist researchers. Expertise and findings from both main disciplines (hydrogeology and agricultural/forestry hydrology) will be necessary to understand the main controls on water-table behavior (position and fluctuations) at FMNF. Amatya et al. (and references)(2015) show examples of the types of relevant research that can yield the needed hydrologic-regime understanding and how they can be built upon. Research often leads to answers that would not have been assumed without it. A potential example lies with the sinkholes. Are we sure that shallow ground water

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generally flows down in them, as we might be tempted to assume from many sinks elsewhere? It need not though, especially seasonally, and this would be straightforward to answer regarding these unique patchy wetlands.

On the ecosystem level and emphasizing now the biota, the effects of a high-watertable regime (mainly acting directly, presumably, on the autecology of individual taxa, but with a cumulative ecosystem influence), a critical overall question is "How sensitive, and in what ways, is the FMNF ecosystem susceptible to small to moderate changes in water-table hydrology?" This resolves itself into many individual questions, of course. The ecologies (for main examples, flooding or drying tolerances) of principal taxa are obvious examples, while shifts in habitat or prey taxa have repercussions farther in the ecosystem. USDA, Forest Service (2012) explores and shows ways to proceed with these basic and critical assessments.

"Forensic ecology" via a host of historical records to determine vegetational-landscape and surface-water conditions in early historical times, times unimpacted by modern technology, can yield important and unanticipated information and is an effort well worth considering (for outstanding example, McVoy et al., 2011).

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Letter ID# 20 (f)

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To who it concerns:
I am the Coastal Plain Region Geologist for the South Carolina Geological Survey (Part of the SC DNR). My attached submittal concerns mostly Chapter 3 of the Draft EIS.
Thank you for the opportunity to review the drafts.

Letter ID# 22 (a)

USFS Francis Marion NF Draft EIS Comments- WRD III

Draft Environmental Impact Statement (EIS)

Ch 3
3.2.2 Geology
3.2.2.1 Affected Environment- Minerals- Removal of minerals

p. 54- Sand- In this section the only current mention of sand mining is dredging in waterways. Other sources of sand exist within the Forest. For example, in areas outside the FM Nat. Forest, sand from former beach and terrace deposits above sea level is often mined for fill material (upland borrow sites). These deposits are often covered with pine forest since the soil is too poor for other agricultural uses (colloquially know as "pine-barrens"). Examples of these areas are the ridges the Bethera and Cordesville communities sit upon. Unless surface mining is expressly prohibited with the Forest boundaries, this possible surface-mined salable resource should be mentioned or addressed in some form before the limited mention of "upland borrow sites" in the fourth paragraph of this section (p. 57).

3.3.1 both .3, .4, .5, and .6-
Alternative 2 for restoration and preservation of Carolina Bays and Pocosins is a **critical goal** to allow ecosystem survival during climate changes. These areas, when not ditched for drainage by man, trap surface water and make it available for both ecosystem use and as a groundwater recharge location.

3.3.1 both .11, and .12-
Alternative 2 for restoration and preservation of the maritime forest and salt marshes, and allowances for them to inland migrate with a rising sea level, is a **critical goal** to allow the continued existence of these ecosystems during times of sea-level rise.

Letter ID# 22 (b)

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Please direct related correspondence to the attention of Ms. Jaclyn Daly-Fuchs at our Charleston Area Office.
She may be reached at (843) 762-8610 or by e-mail at Jaclyn.Daly@noaa.gov.

Letter ID# 31 (a)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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November 10, 2015 F/SER47:JD/pw

(Sent via Electronic Mail)

Rick Lint, Forest Supervisor
Francis Marion and Sumter National Forests
4931 Broad River Road
Columbia, South Carolina 29212

Attn: Francis Marion Forest Plan Revision

Dear Mr. Lint:

NOAA's National Marine Fisheries Service (NMFS) reviewed the *Francis Marion National Forest Draft Environmental Impact Statement for the Revised Land Management Plan* (EIS), dated August 2015, prepared by the U.S. Department of Agriculture (USDA) Forest Service. The Draft EIS describes and analyzes three alternatives for managing the 258,942 acres of land and associated resources within the Francis Marion National Forest in Charleston and Berkeley Counties. The Final Forest Plan resulting from the Final EIS analysis will guide all natural resource management activities, such as prescribed burning, habitat restoration, and public recreational use, in Francis Marion National Forest. While the Francis Marion Forest includes over six thousand acres of essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the Draft EIS does not include a determination by the USDA Forest Service on whether the proposed management plan would adversely affect EFH [50 CFR 600.920(e)(3)]. As the nation's federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, the NMFS provides the following comments and recommendations pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Act.

The Santee River, the Intracoastal Waterway, Lake Moultrie, and the Cooper River bound the Francis Marion National Forest. Because land use surrounding the forest is rapidly changing from a forested, rural landscape to an urban environment, the USDA Forest Service is revising the 1996 Land Management Plan, which focuses primarily on recovery from Hurricane Hugo. The Draft EIS presents three alternatives, each focused on achieving ecosystem restoration through vegetation management, prescribed burning, and enhancing wetland connectivity:

- Alternative 1 represents no change from the current forest plan enacted in 1996.
- Alternative 2 (Preferred Alternative) includes converting select loblolly pine stands to longleaf pine forests, improving hydrologic function of wetlands, and restoring rare communities and old growth forests.
- Alternative 3 is a variation of Alternative 2 and considers less prescribed burning near communities and major roads.

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Essential Fish Habitat in the Project Area
Portions of the Francis Marion national Forest include tidal freshwater palustrine forests, tidal freshwater wetlands, estuarine emergent wetlands (salt marsh), tidal creeks, intertidal and subtidal flats, and unconsolidated bottom. The South Atlantic Fishery Management Council (SAFMC) identifies these habitats as EFH for penaeid shrimp, including white shrimp (*Litopenaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*), and/or estuarine-dependent species of the snapper-grouper complex. Salt marshes are EFH because larvae and juveniles concentrate and feed extensively and shelter within these habitats. As a consequence, growth rates are high and predation rates are low, which make these habitats effective nursery areas. The SAFMC provides additional information on EFH and its support of federally managed species in Volume IV of the *Fishery Ecosystem Plan of the South Atlantic Region*[1].

Freshwater Wetlands
In addition to habitats designated as EFH, the Francis Marion National Forest is rich with freshwater wetlands providing nutrients and organic material to downstream estuaries and affecting the water quality of those estuaries. Past modifications, such as ditching and road construction, have altered water flows in and out of forested wetlands, riparian areas, and streams. To address these issues, the USDA Forest Service is proposing to restore hydrology in wetlands, which should benefit downstream EFH. Alternative 2 and 3 include restoration of wetlands, floodplains or riparian areas to benefit at-risk species within three target watersheds, Guerrin Creek, Turkey Creek, and the headwaters of Wambaw Creek. Specific activities include plugging ditches and adding culverts under dikes to restore water flows. However, existing dikes may be used to limit saltwater influx where hydrologic modifications are causing saltwater entry beyond recent historic conditions, such as those within the lower Santee River. Hydrologic restoration would improve habitats for freshwater aquatic species and at-risk amphibians.

Comments on Alternatives
Alternative 2 and 3 include measures to restore hydrology within freshwater wetlands, and the NMFS recommends this management strategy be carried over to tidally influenced wetlands. The Draft EIS states there are approximately 6,546 acres of tidal waters on the Francis Marion and 179 miles of intermittent and perennial streams receiving tidal influence. The designation of these habitats as EFH is not discussed within the Draft EIS and the actual amount of EFH within the Francis Marion is likely greater because these numbers are based on using SC Highway 17 as the saltwater/freshwater boundary and do not consider tidal freshwater wetlands designated EFH.

It is unclear if the use of existing dikes to control saltwater influx, as described above, would further impair EFH. The Magnuson-Stevens Act requires the USDA Forest Service to consult the NMFS should any of these projects adversely affect EFH. In addition, some projects could enhance EFH. For example, the Draft EIS discusses bridging portions of the Tuxbury Horse Trail (an old rail bed) to restore breeding habitat for salamanders; however, portions of the trail restrict flow within EFH. Restoring flow to EFH by bridging or culverting old rail and timber roads, such as the Tuxbury Trail, should also be a management strategy. In addition, restoring impounded salt marsh (e.g., old rice culture fields) would convert these impaired habitats back to free-flowing marsh habitat.

[1] Available at *http://safmc.net/EcosystemLibrary/FEPVolumeIV*

2

Letter ID# 31 (c)

In summary, the NMFS believes the Final EIS should include information regarding the designation and importance of EFH within the Francis Marion National Forest, the need to consult with the NMFS when any action may adversely affect EFH, and strategies for eliminating restrictions and impairments to EFH. With the exception of using dikes to limit saltwater flow, the restoration of freshwater wetlands within the Francis Marion National Forest would likely have indirect beneficial impacts to EFH by improving the flow of nutrients and organic matter; however, there are opportunities to directly restore and enhance EFH within and adjacent to the Francis Marion. The USDA Forest Service should include these goals in Alternative 2 and 3. The NMFS is available to assist the USDA Forest Service in identifying and designing EFH conservation and restoration projects.

NMFS appreciates the opportunity to provide these comments. Please direct related correspondence to the attention of Ms. Jaclyn Daly-Fuchs at our Charleston Area Office. She may be reached at (843) 762-8610 or by e-mail at Jaclyn.Daly@noaa.gov.

Sincerely,

Pace Wilber

/ for

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

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3

Letter ID# 31 (d)

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Letter ID# 32 (a)

United States Department of the Interior

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November 10, 2015

Cape Romain has had a long-standing partnership with the Francis Marion NF since the opening of the Sewee Visitor and Environmental Education Center in 1996. The Center, jointly operated by the Refuge and Forest, has been and continues to be the hub for visitor information and recreation opportunities for both agencies. Our concern is with future Forest Service representation at the Center.

We are puzzled by the Outdoor Recreation Themes/Goals stated in the Draft Management Plan. Nowhere in the plan is there any mention of the existing Partnership with Cape Romain NWR, specifically the Sewee Visitor & EE Center (SVEEC), and current successful public outreach programs. The Plan notes the Coastal Zone as being the "epicenter for interpretation and environmental education…contributing greatly to the region's tourism market through increased delivery of guided services and developed attractions where they can be accommodated."

Since its opening, the SVEEC has seen an average of 30,000 visitors annually. Environmental Education programming at the Center reaches 8,000 – 10,000 youth each year. Visitors frequent the SVEEC to obtain forest information and recreations guides for hiking, biking and water trails, purchaseFMNF permits and walk the Nebo Trail. The popular annual Youth Fishing Rodeo at Sewee Pond, coordinated by the FMNF, is staffed by both forest and refuge staff and volunteers. The hub for the community Bulls Bay Nature Festival is the SVEEC. Fifteen partners contribute to its success and, Francis Marion NF has played a significant role in all aspects of festival planning and delivery. Other activities at the SVEEC relevant to the Forest include the Longleaf Pine Restoration Summit, National Public Lands Day, and Firewise events. The Plan calls for partnerships that will promote and sustain recreation in the forest and, promotes engagement with communities and partners for marketing and delivery of visitor information. The SVEEC meets this and other themes as stated in the Plan.

The Plan notes that: New facilities will be considered only by taking into account facility life cycle costs, maintenance costs and when resources are available for long-term sustainability without comprising existing facilities. There is no mention for current and future plans for the existing Sewee Visitor and Environmental Education Center. Overhead costs for Center operations and maintenance average 50k annually. In past years, the Francis Marion has contributed 19k each year to Cape Romain NWR. For the past two years, the Francis Marion NF has not made contributions to operating costs at the SVEEC. The Forest staffs the Center with a permanent employee 32 hours during days of operation. Cape Romain NWR lost its park ranger

Letter ID# 32 (b)

position in 2012. The refuge Visitor Services Manager (VSM) oversees the daily operations of the SVEEC and staffs the Center with volunteers, interns and employees holding temporary positions. The VSM staffs the Center when necessary to fill in for the FS employee. With the anticipated retirement of the current employee at the Center, we would like to know whether this partnership will continue.

During the past two years, Cape Romain NWR and Francis Marion NF have explored bringing in an additional partner at the SVEEC to assist with overhead expenses and staff the information desk. The Charleston County Parks and Recreation (CCPR) expressed interest in having a presence at the Center. However, they had a need to collect revenue for education programs. The U.S. Fish & Wildlife Service currently do not charge entrance fees at visitor centers nor charge for environmental education programs at Centers. Hence, the CCPR dismissed any further plans to pursue the partnership.

As the focus of the Forest Plan is more semi-primitive dispersed recreation, there has been discussion to bring in an outfitter business to rent kayaks and bicycles at the Center. This for-profit business would also assist in staffing the information deck to promote forest recreation. Also mentioned has been the inclusion of organizations such as the Quail Forever. We see that these partnerships would support the Forest in their efforts and, there would be no forest service involvement at the Center – neither monetary to assist with overhead expenses or help with staffing needs. We would like to see the continuation of the Cape Romain NWR long-standing partnership with the Francis Marion NF. As such, we would like to see the continued representation for the Forest at the SVEEC by Forest personnel and a continued commitment for the strong partnership that we have shared since the Center's inception in 1996.

We thank you for the opportunity to comment on the Plan and we support your efforts in the ecological approach for management of the Francis Marion National Forest.

Sincerely,

Sarah Dawsey, Cape Romain NWR Manager

Patricia Midgett

Patricia Midgett, Co-Director, Sewee Visitor and Environmental Education Center

Letter ID# 32 (c)

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Letter ID# 33 (a)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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November 10, 2015

Mr. Rick Lint
Forest Supervisor
Francis Marion National Forest
4931 Broad River Road
Columbia, SC 29212

Re: Francis Marion National Forest Management Plan Revision
Charleston and Berkeley Counties, South Carolina
FWS Log No. 2013-R-0310

Dear Mr. Lint:

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Revised Land Management Plan for the Francis Marion National Forest, Berkeley and Charleston Counties, South Carolina. Our comments are provided in accordance with the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), and the National Environmental Policy Act of 1969 (42 United States Code 4321 *et seq.*).

The Draft Revised Land Management Plan (Forest Plan) will provide broad planning for the Francis Marion National Forest (FMNF) within the context of the greater landscape for the next 10-15 years. The last management plan focused on managing and restoring the FMNF post-Hurricane Hugo, which ravaged the forest in 1989. The new Forest Plan will be developed under the 2012 forest planning rule, which places greater emphasis on public involvement. Since the Forest Plan revision began in 2013, the FMNF has relied on collaboration with local partners, private landowners, Federal and State agencies, and other organizations.

According to Forest Plan, the Forest Service has developed a land management plan to guide the general management direction of the FMNF during the next 15 years. The document, developed under the 2012 Planning Regulations outlined in 36 CFR 291, is a second revision of the original Forest Plan prepared in 1985 under the National Forest Management Act. The purpose of the Forest Plan is to guide future projects, practices, uses and protection measures to assure sustainable multiple-use management of the FMNF. This plan supports an adaptive management approach, which emphasizes checking results as projects are implemented and making the plan more adaptable to changes in social, economic, and environmental conditions.

Letter ID# 33 (b)

The South Carolina Ecological Field Office and the FMNF have worked closely on many issues including threatened and endangered species management and prescribed fire. Many of the concepts within the Forest Plan are reflective of our shared objectives. While we support the Forest Plan as a comprehensive and practical management tool to sustain and restore the forest ecosystems, we are concerned about the lack of information regarding expanding human population growth and potential impacts on natural resources. The FMNF will be challenged to sustain the use of fire as part of their management tools within close proximity to developing communities. The indirect effects of road widening, traffic, and the inability to use prescribed fire in the most diverse area of the forest could potentially be a great burden for the FMNF. We recommend the Forest Plan develop criteria to evaluate and respond to future growth and its potential impacts.

Thank you for the opportunity to comment on the Forest Plan. We look forward to working with on this valuable management plan in the future. If you have any questions or comments or require additional information regarding this letter, please contact Ms. Paula Sisson at (843) 727-4707 ext. 226, and reference FWS Log No. 2013-R-0310.

Sincerely,

Thomas D. McCoy
Field Supervisor

TDM/PTS

Letter ID# 33 (c)

Date submitted (UTC): 11/10/2015 12:00:00 AM
First name: Billy
Last name: Dukes
Organization: SC Dept of Natural Resources
Title: Chief of Wildlife
Official Representative/Member Indicator:
Address1: 1000 Assembly St
Address2: P.O. Box 167
City: Coumbia
State: SC
Province/Region:
Zip/Postal Code: 29202
Country: United States
Email:
Phone: 803-734-3885
Comments:
Dear Rick:

The South Carolina Department of Natural Resources (SCDNR) appreciates the opportunity to comment on the Francis Marion National Forest Plan Revision. We concur that the Proposed Action (Alternative 2) is the Preferred Alternative to best manage the multiple habitats and activities that occur on the Francis Marion National Forest. We do have some concerns related to the scale of prescribed burning (thousands of acres at any one time) proposed to occur in Management Area 1. The Forest Service acknowledges that burns of this magnitude may negatively impact wildlife, especially ground nesting birds such as the wild turkey, yet the overall benefit is habitat improvement in the long run. SCDNR agrees that prescribed burning, including growing season burns, is essential for creation and maintenance of habitat for many species, including economically and recreationally important species like Eastern wild turkey and Northern bobwhite quail. We believe that by reducing the scale of
individual prescribed burns, especially during the growing season, negative impacts to certain vulnerable species can be avoided or mitigated.

In the Environmental Impact Statement under Huntable and Fishable Species {3.4.13) under the heading 11Environmental Consequences," the plan states that the wild turkey population on the Francis Marion is 11currently stable to increasing."
We suggest using the terminology of "stable" and not 11increasing" as statewide turkey population and harvest data do not support the idea of an increasing wild turkey population on the Forest or in surrounding areas.

Thank you for the opportunity to comment, and please contact me or any members of my staff if you have any questions regarding our comments.

Regards,

Billy
Chief of Wildlife SCDNR

Cc: Emily Cope
Sam Chappelear Will Carlisle

Letter ID# 37 (a)

South Carolina Department of

Natural Resources

DNR

Alvin A. Taylor
Director
Emily C. Cope
Deputy Director for
Wildlife and Freshwater Fisheries

November 10, 2015

Rick Lint, Forest Supervisor
Francis Marion & Sumter National Forests
Francis Marion Plan Revision
4931 Broad River Road
Columbia, SC 29212

Dear Rick:

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We suggest using the terminology of "stable" and not "increasing" as statewide turkey population and harvest data do not support the idea of an increasing wild turkey population on the Forest or in surrounding areas.

Thank you for the opportunity to comment, and please contact me or any members of my staff if you have any questions regarding our comments.

Regards,

Billy Dukes
Chief of Wildlife
SCDNR

Cc: Emily Cope
Sam Chappelear
Will Carlisle

Rembert C. Dennis Building • 1000 Assembly St • P.O. Box 167 • Columbia, S.C. 29202 • Telephone: 803/734-3886
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Letter ID# 37 (b)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

November 9, 2015

Rick Lint, Forest Supervisor
U.S. Forest Service
4931 Broad River Road
Columbia, SC 29212

RE: Francis Marion National Forest Draft Revised Land Management Plan and Draft Environmental Impact Statement, SC; CEQ Number: 20150215

Dear Mr. Lint:

Pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA) has reviewed the subject Francis Marion National Forest Draft Revised Land Management Plan and Revised Draft Environmental Impact Statement (DEIS). The U.S. Forest Service (USFS) is the lead Federal agency for the proposed action.

The proposed action by the USFS is to revise the 1996 Francis Marion National Forest Revised Land and Resource Management Plan ('forest plan'). The area affected by the proposal includes nearly 260,000 acres of Francis Marion National Forest ('Francis Marion'), which is located Berkeley and Charleston Counties north of Charleston, S.C. The forest plan guides all natural resource management activities on the Francis Marion to meet the objectives of Federal law, regulation, and policy. The proposed action would also effect a wide range of socioeconomic factors as they relate to natural resources. The attachment includes the EPA's DEIS detailed comments and recommendations pursuant to our review of the revised draft forest plan (Please see the attachment).

The EPA understands the need for multiple-use activities and supports the management of National Forests that place less emphasis on traditional harvesting and other consumptive uses and a greater emphasis on recreation and ecosystem enhancement. The EPA has rated this document 'EC-1', meaning that we have some Environmental Concerns for the proposed action and that some clarifying information is being requested for the Final EIS. We have some environmental concerns about the potential biological impacts from these actions including stream sedimentation, loss of habitat and reduction of biodiversity, and species impacts.

We appreciate the opportunity to review the proposed action and appreciate the revised agency review schedule based on the Regional receipt date of the document. Please feel free to contact

Letter ID# 38 (a)

me at (404) 562- 9512, if you have any questions on the attached detailed comments. When the Final EIS is available for review, please send one hard copy and one CD to the EPA Region 4 office for our review.

Sincerely,

Christopher A. Militscher
Chief, NEPA Program Office
Resource Conservation and Restoration Division

Attachment: EPA Detailed Comments and Recommendations

Letter ID# 38 (b)

Attachment
EPA's Detailed Comments and Recommendations
Francis Marion National Forest Draft Revised Land Management Plan and Draft Environmental Impact Statement, SC; CEQ Number: 20150215

Chapter 3. Affected Environment and Environmental Consequences

3.2.3 Air Quality (pages 57-60):

The land management activity most likely to affect air quality will be prescribed burning. The DEIS indicates that Alternative 1 presents no change in the number of acres burned per decade during the dormant and growing season; approximately 260,000 acres and 40,000 acres burned per decade, respectively. Alternative 2 will provide the highest level of hazardous fuels reduction and ecological restoration and maintenance with prescribed burnings, lasting less than 24 hours, of approximately 195,000 acres (dormant season) and 105,000 acres (growing season). Alternative 3 proposes the least amount of prescribed acres burned at 167,000 acres (dormant season) and 105,000 acres (growing season). Alternative 3 will also see the greatest increase in fuel loading due to increases in shrub growth.

Recommendation: The EPA recommends that the USFS continue to comply with the Federal and State guidelines associated with prescribed burns. While Alternative 2 will result in the greatest hazardous fuels reduction and ecological restoration and maintenance, it will also contribute to the greatest air quality impact of the three alternatives. Alternative 2 would also incorporate other fuels reduction treatments, such as mechanical, chemical, and biological activities that would mimic the historical role of a wildland fire without increased smoke and air pollutant production. However, the DEIS indicates that the increase in smoke from prescribed burning activities is not expected to affect the continued attainment of the Federal and State air quality standards.

3.2.4. Climate Change (pages 60-71)

According to the DEIS, the key factors expected to affect the Francis Marion include an increase in extreme weather events such as hurricanes, heat waves, droughts, tornadoes, floods, and lightning storms. These issues are expected to continue to grow over the life of the revised forest plan. Previous storms such as Hurricane Hugo resulted in damage to one-third of the Francis Marion forests, which included timber damage, high winds, downed trees, blocked roads, closed trails, closed facilities, recreational site damage, and a greater risk of catastrophic fire from increased shrub growth.

The DEIS includes strategies that address the effects of increasing weather disturbances and responding to anticipated climate changes. These strategies are incorporated into the alternatives and include the reduction of vulnerabilities by maintaining and restoring resilient native ecosystems and conducting prescribed burns.

National forests can play an important role in both mitigating and adapting to the effects of

Letter ID# 38 (c)

climate change. Mitigation measures focus on strategies such as carbon sequestration by natural systems, ways to increase carbon stored in wood products, ways to provide renewable energy from woody biomass to reduce fossil fuel consumption, and ways to reduce environmental footprints. Adaptation measures address ways to maintain forest health, diversity, productivity, and resilience under uncertain future conditions.

Recommendation: The DEIS indicates that the USFS's Best Management Practices (BMPs) will be used to maintain resilience and resistance to a changing climate. The EPA notes that under all three alternatives the Francis Marion remains a carbon sink.

3.2.3 Water Quality (pages 72-90):

According to the DEIS, under Alternative 2 (i.e., the 'preferred alternative') and Alternative 3, forest management activities are not anticipated to substantially or permanently impair water quality nor result in measurable changes to overall watershed condition ranking. The implementation of mitigation measures, such as the use of BMP's and adherence to forest standards and guidelines are being proposed by the USFS. Nevertheless, timber harvesting in forests will result in some soil and water impacts associated erosion, increased sedimentation, and potential degradation of water quality.

Recommendations: The EPA supports the effective use of BMPs and adherence to forest standards and guideline for water quality. We recommend reducing the nonpoint source pollution of surface and ground waters that can result from forestry activities, recreation, fire management, and roads. These activities include but are not limited to:

- Tracking the implementation of BMPs used to control nonpoint source pollution generated by forestry practices, recreation, fire management, and roads.
- Fully utilizing the USFS published guidelines for National Best Management Practices (USDA, 2012) to maintain and improve water quality.
- Developing water-quality monitoring plans to evaluate the effectiveness of forestry BMPs in meeting water-quality goals or standards.
- Design of monitoring projects and the selection of variables and methods to correlate BMP implementation with changes in stream water quality. Providing information on methods for sample site selection, sample size estimation, sampling, and result evaluation and presentation. The focus is to develop statistical approaches needed to collect and analyze data that are accurate and defensible.
- The EPA supports efforts to implement the nonpoint source (NPS) total maximum daily load (TMDL) program. Nonpoint source TMDLs and watershed-based plans designed to implement the NPS TMDLs, provide the necessary link between actions on the ground and the water quality results to be achieved.
- The EPA continues to support planning at the landscape level to address broader ecological concerns such as biodiversity, watershed maintenance and restoration, and forest fragmentation.
- The EPA recommends that ecological and other environmental values should be the primary driving factors in the identification, protection, and management of roadless areas in Francis Marion.

Letter ID# 38 (d)

3.4.14 Social Demographics (pages 275-298) & Environmental Justice (pages 299-301):

The EPA notes that the Environmental Justice (EJ) section is separate from the Social Demographic section regarding low-income and minority populations. The DEIS also indicates that the potential benefits of the proposed forest plan would accrue to all segments of the population and no disproportionate negative environmental or health impacts are anticipated under all of the alternatives. However, it is also noted that Gullah Geechee are working hard to pass on their traditions and values, but that rapid coastal development and soaring land costs will threaten the passing on of these traditions to future generations. Additionally, the DEIS also indicates in the EJ section that there is subsistence consumption of fish, wildlife, and/or vegetation within the planning area.

Recommendation: The EJ analysis should indicate the efforts made to identify or quantify the amount of subsistence consumption within the planning area that involve low-income and minority populations. The Final EIS should summarize any EJ concerns raised during the public engagement process. The EPA further suggests to the USFS consider incorporating the EJ section as a subsection of the Social Demographics section in the Final EIS because understanding EJ issues is very heavily dependent on social demographics data.

The EPA recommends some sustainability concepts which could be considered by the USFS in the final management plan and Final EIS:

'Green Building'

'Green building' is the practice of creating structures and using processes that are environmentally-responsible and resource-efficient throughout a building's life-cycle from design to construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also potentially known as a sustainable or high performance building. Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution, and environmental degradation

For example, green buildings may incorporate sustainable materials in their construction (e.g., reused, recycled-content, or made from renewable resources); create healthy indoor environments with minimal pollutants (e.g., reduced product emissions); and/or feature landscaping that reduces water usage (e.g., by using native plants that survive without extra watering).

In the United States, buildings account for:

Letter ID# 38 (e)

- 39 percent of total energy use
- 12 percent of the total water consumption
- 68 percent of total electricity consumption
- 38 percent of the carbon dioxide emissions

Potential benefits of green building can include:

Environmental benefits

Enhance and protect biodiversity and ecosystems
Improve air and water quality
Reduce waste streams
Conserve and restore natural resources

Economic benefits

Reduce operating costs
Create, expand, and shape markets for green product and services
Improve occupant productivity
Optimize life-cycle economic performance

Social benefits

Enhance occupant comfort and health
Heighten aesthetic qualities
Minimize strain on local infrastructure

Green Parking

Green parking refers to several techniques that when applied together reduce the contribution of parking lots to total impervious surfaces. From a storm water perspective, green parking techniques applied in the right combination can dramatically reduce impervious cover and, consequently, reduce the amount of storm water runoff. Green parking lot techniques include: setting minimums of permanent parking spaces; minimizing the dimensions of parking lot spaces; utilizing alternative pavers in overflow parking areas; using bioretention areas to treat storm water; and encouraging shared parking, wherever feasible.

Green parking lots can dramatically reduce the creation of new impervious cover. How much is reduced depends on the combination of techniques used to achieve the 'greenest parking'. While the pollutant removal rates of bioretention areas have not been directly measured, their capability is considered comparable to a dry swale, which removes approximately 91 percent of total suspended solids, 67 percent of total phosphorous, 92 percent of total nitrogen, and 80-90 percent of metals (Claytor and Schueler, 1996).

The North Carolina's Fort Bragg vehicle maintenance facility parking lot is an excellent example of the benefits of re-thinking parking lot design (NRDC, 1999). The redesign incorporated storm water management features, such as detention basins located within grassed islands, and an onsite drainage system that exploited existing sandy soils. The redesign reduced impervious

Letter ID# 38 (f)

surfaces by approximately 40 percent, increased parking by 20 percent, and saved 20 percent or $1.6 million on construction costs over the original, conventional parking lot design.

Briefly, three other sustainable activities which may applicable to the USFS' general management plan are as follows:

- **Green Detention Ponds**
- **Rain Water Harvesting**
- **Rain Gardens**
- **Solar lighting or other renewable energy sources for buildings and facilities**

The EPA asks that the USFS consider these recommendations in its development of its final land management plan and Final EIS.

Letter ID# 38 (g)

Date submitted (UTC): 11/9/2015 12:00:00 AM
First name: Christopher
Last name: Militscher
Organization: US Environmental Protection Agency, region 4
Title: Chef, NEPA Program Office,
Official Representative/Member Indicator:
Address1: Resource Conservation and Restoration Division
Address2: Atlanta Federal Center
City: Atlanat
State: GA
Province/Region:
Zip/Postal Code: 30303-8960
Country: United States
Email:
Phone:
Comments:
RE: Francis Marion National Forest Draft Revised Land Management Plan and Draft Environmental Impact Statement, SC; CEQ Number: 20150215

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We?appreciate the opportunity to review the proposed action and appreciate the revised agency review schedule based on the Regional receipt date of the document. Please feel free to contact

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me at (404) 562- 9512, if you have any questions on the attached detailed comments. When the Final EIS is available for review, please send one hard copy and one CD to the EPA Region 4 office for our review.

Sincerely,

1r?: :_

Letter ID# 38 (h)

Christopher A. Militscher Chief, NEPA Program Office
Resource Conservation and Restoration Division

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Letter ID# 38 (i)

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'Green Building'

Letter ID# 38 (j)

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- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution, and environmental degradation

For example, green buildings may incorporate sustainable materials in their construction (e.g., reused, recycled-content, or made from renewable resources); create healthy indoor environments with minimal pollutants (e.g., reduced product emissions); and/or feature landscaping that reduces water usage (e.g., by using native plants that survive without extra watering).

In the United States, buildings account for:

- 39 percent of total energy use
- 12 percent of the total water consumption
- 68 percent of total electricity consumption
- 38 percent of the carbon dioxide emissions Potential benefits of green building can include:

Environmental benefits
Enhance and protect biodiversity and ecosystems Improve air and water quality
Reduce waste streams ?
Conserve and restore natural resources

Economic benefits
Reduce operating costs
Create, expand, and shape markets for green product and services Improve occupant productivity
Optimize life-cycle economic performance

Social benefits
Enhance occupant comfort and health Heighten aesthetic qualities
Minimize strain on local infrastructure

Green Parking

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surfaces by approximately 40 percent, increased parking by 20 percent, and saved 20 percent or

Letter ID# 38 (k)

$1.6 million on construction costs over the original, conventional parking lot design.

Briefly, three other sustainable activities which may applicable to the USPS' general management plan are as follows:

o Green Detention Ponds o Rain Water Harvesting o Rain Gardens
o Solar lightig or other renewable energy sources for buildings and facilities

The EPA asks that the USPS consider these recommendations in its development of its final land management plan and Final EIS.

Letter ID# 38 (l)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Eastern States
20 M. St. S.E., Ste. 950
Washington, DC 20003
http://www.es.blm.gov

Thank you for the opportunity to review the Francis Marion National Forest Plan and Environmental Impact Statement. The BLM Eastern States Office has reviewed the documents and notes that a major focus of the Plan is to restore native ecological systems in the forest and there is no projected mineral removal, as summarized below:

(From the Plan):
Minerals. Removal of mineral materials is the only management activity that has the potential to affect the geology of the area, including groundwater supplies. Currently the Francis Marion has no mineral activity for the following reasons:

- No known potential for oil, coal or natural gas development exists on the forest, due in part to no Triassic basin, or its associated hydrocarbon resources, being identified; and
- No known deposits of gold, silver, or copper occur on the forest; therefore, there are no known outstanding mineral rights.

The potential exists for two salable mineral products: limestone and sand:

- Limestone. The Santee Formation has high enough quality limestone that mining is occurring on private lands near the northern edge of the Francis Marion. Currently Martin Marietta is mining limestone near Jamestown. The company is producing products for road base and agricultural fertilization, which are considerable salable mineral products. In the past, the forest has received proposals for mining limestone. Each proposal was turned down for various reasons. Since the agency could only give a five-year minerals material contract, and the area of interest contains a variety of rare or at-risk species, the inquirers have not pursued it further. While the Gulliard Lake Scenic Area has limestone, it is protected from mining as a forest-designated scenic area.
- Sand. There is questionable potential for dredging sand from rivers, but whether a special use permit from the Forest Service would be needed or not is determined by the actual ownership of the river bed. On larger rivers, the state owns the river bed and the South Carolina Department of Health and Environmental Control (SCDHEC) would process the sand dredging permit, typically with a public notice and comment period. On smaller rivers, where the river bed is national forest land, the permit would have to be approved by the Forest Service. The agency has not received any requests to develop sand dredging operations.

The BLM Eastern States Office has no official comments on the Plan, other than to note that the *Francis Marion National Forest, Draft Forest Plan Assessment* (referenced on page 8 of the EIS), incorrectly refers to the General Mining Law of 1872, which does not apply to acquired lands (see Section 10, Renewable and Nonrenewable Energy and Mineral Resources).

Again, thank you for the opportunity to review and comment on the documents. We look forward to continuing to work with the U.S. Forest Service.

Sincerely,
BLM Eastern States Office

Letter ID# 39 (a)

Date submitted (UTC): 10/15/2015 12:00:00 AM
First name: Randall
Last name: Mills
Organization: DOI BLM
Title: Mining Engineer/Geologist
Official Representative/Member Indicator:
Address1: Southeastern States district office
Address2:
City:
State:
Province/Region:
Zip/Postal Code:
Country: United States
Email: ramills@blm.gov
Phone:
Comments:
Comments on the draft Francis Marion EIS

Map of Francis Marion National Forest, page 9.
* Georgetown Co./Charleston Co. boundary mislabeled - Should be Georgetown Co./Berkeley Co.
3.3.2 Geology - Pages 50 to 51
* "?phosphate-rich Oligocene and Miocene-age deposits are found overlying the Santee Formation and underlying the Pleistocene formations?.The phosphate industry is no longer active in the state."
Comment - In time other phosphate deposits will decline and be worked out. These virgin phosphate-rich deposits could become exploration and mining targets.

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* Page 53 - Minerals - Phosphate potential not discussed, yet it was noted that "?phosphate-rich Oligocene and Miocene-age deposits are found?" to the south in the forest.
* Fossils - are there rules for collecting fossils? Should personal collecting be discussed here.?
* Earthquakes - Is there any evident of sand blows as have occurred in the Charleston area and southeast Missouri? Could they cause significant damage?
? Holocene And Late Pleistocene)?) Earthquake-Induced Sand Blows In Coastal South Carolina. Obermeier SF etc. "?discovered throughout coastal South Carolina?"
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* Utilities right-of-way, towers, windmills - What would be the effect on the view? Viewscape, is that the word used now?

3.4.6 Outdoor Recreation
* Recreation personal fossil collecting?

Page 252 - Minerals management and development activities can involve major landform alteration?."
* I agree, but mineral development as in a mine would extend downward and could be hidden by berms and evergreen trees. While utility lines, towers, windmills would extend upward and be hard to conceal. Fake pine trees just look fake.

Draft Francis Marion Forest Plan

Letter ID# 39 (b)

3.3.4 Minerals and Energy Suitability

* Look good. Mineral develop would also be on a case-by-case basis.

Outdoor recreation - General comment.

* Understandably mineral and fossil are not seen as significant items in the Francis Marion Forest. I know of no notable and collectable minerals located in your forest area that mineral collectors would be interested in. However, there would be fossils and there are noted sites in Berkeley and Charleston counties given on internet websites. Most fossil collecting is a surface activity with little or no real disturbance. Judging from the forest plan and a couple trips passing thought the Francis Marion, there is plentiful ground cover and fossil collecting usually needs open and/or disturbed ground locations. This limits opportunities to see or pick up fossils. However, where possible children/young people (young at heart) should be able to explore nature. Someone with an interest in nature picking up a shell should not be discouraged. I would hate to hear of an overzealous ranger handing out fines because there are no guidelines and he/she wants to discourage looting of the national forest.

Thank you for the opportunity to comment.

Randall A. Mills, LPG
Mining Engineer/Geologist
DOI-BLM-Southeastern States District Office
411 Briarwood Drive
Jackson MS 39206
601-977-5437

Letter ID# 39 (c)

Date submitted (UTC): 11/18/2015 12:00:00 AM
First name: Randall
Last name: Mills
Organization: DOI-BLM-Southeastern States District Office
Title: Mining Engineer/Geologist
Official Representative/Member Indicator:
Address1: 411 Briarwood Drive
Address2:
City: jackson
State: MS
Province/Region:
Zip/Postal Code: 39206
Country: United States
Email: ramills@blm.gov
Phone: 601-977-5437
Comments:
Comments on the
Francis Marion National Forest Plan (FMNG) Revision Documents

draft FMNG Forest Plan Assessment, December 2013.

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Page 405 - 10.1.1.1 (2) Minerals
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Page 408 - Locatable Minerals:
Are lands of the Francis Marion public domain or acquired? Since south Carolina was an original colony, I expect they are acquired and are not open to mineral claims. Minerals (normally locatable) on lands acquired (purchased or received) under the Acquired Lands Act of 1947 by the United States or found on American Indian reservations are subject to lease only (43 CFR Group 3500).

An aspect of acquired lands is that the mineral estate can be split with the minerals, oil and gas in private ownership. The owners have a right to access what they own, but must work with the Forest Service if they must disturb the surface.

Page 409 - No Triassic basin in South Carolina. Not entirely true.
Wendell M. etc, 1974, Buried Triassic Basin in the Central Savannah River Area, South Carolina and Georgia, Geological Society of America Bulletin, Feb. 1974, v.85, n.2, p.311-320.
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Letter ID# 39 (d)

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draft FMNG Environmental Impact Statement

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draft FMNG Forest Plan

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Letter ID# 39 (e)

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Thank you for the opportunity to comment.

Randall A. Mills, LPG

Jackson MS 39206

Letter ID# 39 (f)

Comments on the
Francis Marion National Forest Plan (FMNG) Revision Documents

draft FMNG Forest Plan Assessment, December 2013.

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Page 1 of 3

Letter ID# 39 (g)

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draft FMNG Environmental Impact Statement

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Page 2 of 3

Letter ID# 39 (h)

3.4.4 Special Uses, Energy, Minerals

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draft FMNG Forest Plan

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Thank you for the opportunity to comment.

Randall A. Mills, LPG
Mining Engineer/Geologist
DOI-BLM-Southeastern States District Office
411 Briarwood Drive
Jackson MS 39206
601-977-5437

Page 3 of 3

Letter ID# 39 (i)

Date submitted (UTC): 11/18/2015 12:00:00 AM
First name: Carol
Last name: Zurawski
Organization: Bureau of Land Management
Title: Planning and Environmental Coordinator
Official Representative/Member Indicator:
Address1: Eastern States Office
Address2: 20 M Street, SE
City: Washington
State: DC
Province/Region:
Zip/Postal Code: 20003
Country: United States
Email: czurawski@blm.gov
Phone: 202.912.7747
Comments:
Thank you for the opportunity to review the Francis Marion National Forest Plan and Environmental Impact Statement. The BLM Eastern States Office has reviewed the documents and notes that a major focus of the Plan is to restore native ecological systems in the forest and there is no projected mineral removal, as summarized below:

(From the Plan):
Minerals. Removal of mineral materials is the only management activity that has the potential to affect the geology of the area, including groundwater supplies. Currently the Francis Marion has no mineral activity for the following reasons:
* No known potential for oil, coal or natural gas development exists on the forest, due in part to no Triassic basin, or its associated hydrocarbon resources, being identified; and
* No known deposits of gold, silver, or copper occur on the forest; therefore, there are no known outstanding mineral rights.

The potential exists for two salable mineral products: limestone and sand:
* Limestone. The Santee Formation has high enough quality limestone that mining is occurring on private lands near the northern edge of the Francis Marion. Currently Martin Marietta is mining limestone near Jamestown. The company is producing products for road base and agricultural fertilization, which are considerable salable mineral products. In the past, the forest has received proposals for mining limestone. Each proposal was turned down for various reasons. Since the agency could only give a five-year minerals material contract, and the area of interest contains a variety of rare or at-risk species, the inquirers have not pursued it further. While the Gulliard Lake Scenic Area has limestone, it is protected from mining as a forest-designated scenic area.
* Sand. There is questionable potential for dredging sand from rivers, but whether a special use permit from the Forest Service would be needed or not is determined by the actual ownership of the river bed. On larger rivers, the state owns the river bed and the South Carolina Department of Health and Environmental Control (SCDHEC) would process the sand dredging permit, typically with a public notice and comment period. On smaller rivers, where the river bed is national forest land, the permit would have to be approved by the Forest Service. The agency has not received any requests to develop sand dredging operations.

The BLM Eastern States Office has no official comments on the Plan, other than to note that the Francis Marion National Forest, Draft Forest Plan Assessment (referenced on page 8 of the EIS), incorrectly refers to the General Mining Law of 1872, which does not apply to acquired lands (see Section 10, Renewable and Nonrenewable Energy and Mineral Resources).

Again, thank you for the opportunity to review and comment on the documents. We look forward to continuing to work with the U.S. Forest Service.

Sincerely,
BLM Eastern States Office

Letter ID# 40 (a)

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Richard B. Russell Federal Building
75 Ted Turner Drive S.W., Suite 1144
Atlanta, Georgia 30303

ER 15/0450
9043.1

November 9, 2015

Francis Marion
Forest Plan Revision
Sumter National Forests
4931 Broad River Road
Columbia, SC 29212

Attn: Francis Marion

Re: Comments on the Draft Environmental Impact Statement (DEIS) for the Land and Resource Management Plan for the Francis Marion National Forest, SC

Dear Mr. Marion:

The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement (DEIS) for the Land and Resource Management Plan for Francis Marion National Forest in South Carolina. We offer no comments at this time.

Thank you for the opportunity to provide comments. If you have questions, I can be reached at (404) 331-4524 or via email at joyce_stanley@ios.doi.gov.

Sincerely,

Joyce Stanley, MPA
Regional Environmental Protection Specialist

cc:
Anita Barnett – NPS
Gary Lecain – USGS
Christine Willis – FWS
OEPC

Letter ID# 40 (b)