Francis Marion Plan Revision: Proposed Management Strategies

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1.0 Introduction

The following sections include brief narratives on proposed management strategies that respond to the preliminary need to change statements. These proposed management strategies describe our potential priorities and expectations for future program direction. Partnerships and collaborative arrangements also are included as part of the strategy for accomplishing desired conditions, especially those that are dependent on cooperative efforts.

Generally, the Forest Service has managed forest activities through a variety of separate resource programs. However, as we develop the forest plan, desired conditions and objectives would be integrated across multiple program areas. Many of the resource programs would share similar objectives and contribute to multiple desired conditions. For example, ecosystem diversity objectives and watershed condition improvement are connected to the program strategies for species diversity, fire, soils, water and healthy forest conditions, while recreation objectives are linked to management approaches for infrastructure and economic strategies.

Two examples of where we need to integrate and partner on protecting and managing resources and providing benefits, such as recreation and revenue, are below:

1. The Wando area in the southeastern corner of the Francis Marion presents a number of challenges and opportunities. The Wando area is a block of national forest land closest to the urban development extending from North Charleston and Mount Pleasant; it also has the highest concentration of at-risk species. How can we balance the needs of these rare plants and animals with the impacts from our neighbors?
2. The Hwy.17 corridor provides social, recreational and historic values. How can we best manage this area to benefit the public while maintaining and enhancing these benefits and uses?

The 2012 Planning Rule provides guidance for ecological, social and economic sustainability, but leaves the how, where and how much to the discretion of each national forest. This document discusses the broad proposed management strategies on the how, where and how much.

2.0 Proposed Management Strategies

The proposed management strategies convey the present thinking about how to revise the forest plan, which is a work in progress. Both the assessment and the preliminary need to change documents provide the background information for these ideas. For more detailed information, review of both documents is encouraged and can be found at www.fs.usda.gov/goto/scnfs/fmplan.

This process recommends a preliminary need to change the existing forest plan and proposed management strategies that address the preliminary need to change; however, it does not include every topic that would be addressed in the final forest plan.

2.1 Ecosystem Diversity

Restoring and maintaining a variety of native ecosystems on suitable sites form the foundation of this plan. We plan to accomplish this primarily through vegetation management programs, such as prescribed controlled fire, that result in improved habitats for a variety of plants and animals (including threatened and endangered species and species of conservation concern) and increased resilience to potential effects from climate change. Restoration activities would mainly involve reducing loblolly pine densities to reestablish longleaf pine and hardwood communities.

Our proposed management strategy would focus on maintaining or restoring composition, structure, function and connectivity of ecosystems. We plan to accomplish this through vegetation and fire management programs that improve habitats for a variety of terrestrial plant and animal species and increase resilience to climate change. Opportunities to improve habitats for species dependent on wetlands and aquatic ecosystem groups involve improving aquatic passage or hydrologic function.

Current guidelines on managing these ecosystems require that we consider ecological integrity and diversity as follows:

1. What is needed to maintain or restore 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.
2. What is needed to maintain or restore the diversity of ecosystems and habitat types including:
    a) Key characteristics associated with terrestrial and aquatic ecosystem types;
    b) Rare aquatic and terrestrial plant and animal communities; and
    c) Native tree species diversity, similar to that which exists in the plan area.

Table 2.1.1 lists ten groups of terrestrial and aquatic ecosystems which have been tentatively identified for the Francis Marion. The “Ecosystem Group” would be used to focus our strategies for maintaining ecosystem integrity and diversity due to similar indicators, characteristics and function. The assessment provides a detailed description of each ecosystem and can be reviewed at www.fs.usda.gov/goto/scnfs/fmplan.

Table 2.1.1 Ecosystems on the Francis Marion National Forest

Ecosystem Group	NatureServe Ecological System
Upland Longleaf Pine Woodlands	Atlantic Coastal Plain Upland Longleaf Woodland
Wet Pine Savannas and Flatwoods	Southern Atlantic Coastal Plain Wet Pine Savanna and Flatwoods
Loblolly Pine Forests	Semi-natural/Altered Vegetation and Conifer Plantations
Oak Forests and Mesic Hardwood Forests	Southern Atlantic Coastal Plain Dry and Dry-Mesic Oak Southern Coastal Plain Mesic Slope Forest
Depressional Wetlands and Carolina Bays	Atlantic Coastal Plain Clay-Based Carolina Bay Wetland; Southern Atlantic Coastal Plain Depression Pondshore
Pocosins	Atlantic Coastal Plain Peatland Pocosin and Canebrake; Streamhead Seepage Swamp, Pocosin and Baygall
Forested Swamps and Floodplain Forests	Southern Atlantic Coastal Plain Nonriverine Swamp and Wet Hardwood Forest; Southern Coastal Nonriverine Basin Swamp; Atlantic Coastal Plain Blackwater Stream Floodplain Forest; Small Blackwater River Floodplain Forest; Southern Atlantic Coastal Plain Large River Floodplain Forest; Tidal Wooded Swamp
Maritime Forests and Salt Marsh	Central Atlantic Coastal Plain Maritime Forest; Southern Atlantic Coastal Plain Salt and Brackish Marsh
Streams and Rivers	
Lentic Systems (ponds)	

Many ecosystem drivers have created a variety of ecosystem groups that are mixed across the forest. This section focuses primarily on two drivers that we can influence: fire and water. The ecological systems listed in Table 2.1.1 include the following conditions:

1. Upland longleaf pine woodlands located on dry sandy soil with a frequent fire return interval of one to three years that would rarely, if ever, flood;
2. Moist sites with a mix of pine and hardwood forest;
3. Maintaining and restoring historic fire regimes at frequent, one-to-three year natural fire return intervals (for restoration burns), and a growing season burns at least every third burn; natural fire regimes may be less frequent in xeric to dry upland longleaf woodlands; and
4. Aquatic ecosystems that consist of mostly blackwater rivers, streams and ponds.

We propose to develop a description of forestwide desired conditions for each of the nine ecosystem groups on the Francis Marion that would guide the types of projects and activities needed to maintain or restore those systems. To follow is an overview of these ecosystems.

2.1.1 Upland Longleaf Pine Woodlands

Longleaf pine-dominated woodlands would be favored on appropriate sites within management areas where we can accomplish frequent prescribed burning. An area tentatively identified for restoration of fire-adapted ecosystems contains 33,000 acres in upland longleaf woodlands. Within this area, 16,000 acres are dominated by longleaf pine or mixtures with loblolly/slash pine and 13,000 acres are dominated by loblolly pine and mixtures with hardwood (no oak listed). The potential exists to maintain or restore all 33,000 acres in the upland longleaf ecosystem.

We have identified key characteristics and indicators of upland longleaf woodland ecosystem integrity. In addition to the dominance of longleaf pine forest types, we expect to:

1. Maintain and/or restore the frequency and seasonality of natural fire return intervals;
2. Open woodland structure, abundant native herbaceous groundcover and small/medium patches of old growth; and
3. Favor a low incidence to absence of non-native invasive species (NNIS).

Proposed management strategies include the following:

1. Reducing loblolly pine forests in favor of reestablishing longleaf pine-dominated woodlands on xeric, dry and mesic sites;
2. Thinning forests to favor longleaf pine, creating open pine woodlands with canopy closures less than 60% (10-70 ft^2 basal area);
3. Maintaining and restoring historic fire regimes at frequent, one-to-three year natural fire return intervals (for restoration burns), and a growing season burns at least every third burn; natural fire regimes may be less frequent in xeric to dry upland longleaf woodlands;
4. Promoting mid- to late- successional, open forests on 80% of the landscape in the long term, and regeneration age classes (0 to 10 years old) in the short term where we are replacing loblolly pine with longleaf pine forest types;
5. Preventing the introduction and spread of NNIS by collaborating with partners on education, native understory restoration, timely treatment and control, equipment cleaning and early detection and rapid response;
6. Encouraging practices which maintain and restore native forb communities and pollinator habitats; and
7. Restoring native landscapes to include high quality ecosystems and habitats for at-risk species.

2.1.2 Wet Pine Savannas and Flatwoods

Wet pine savannas and flatwoods would be favored on appropriate sites within an area where frequent prescribed burning can be accomplished. An area tentatively identified for restoration of fire-adapted ecosystems includes 55,000 acres in wet pine savannas and flatwoods. Within this area, 17,000 acres currently are dominated by longleaf pine or mixtures with loblolly/slash pine while 28,000 acres are dominated by loblolly pine and mixtures with hardwood (no oak listed).

We have identified key characteristics and indicators of wet pine savanna and flatwoods ecosystem integrity. In addition to the dominance of longleaf pine, key characteristics and indicators of sustainable wet pine savanna and flatwoods ecosystems include the following:

1. Maintenance and restoration of natural fire return intervals;
2. Open woodland or savanna structures;
3. Diverse and abundant native herbaceous groundcover;
4. Intact hydrology (a low incidence of recent rutting or disturbed soil); and
5. A relative absence of NNIS.

Proposed management strategies include the following:

1. Reducing loblolly pine densities to a range of 10 to 40 ft^2 basal area in favor of longleaf pine, pond pine or pondcypress savannas and flatwoods on mesic and wet sites;
2. Maintaining and restoring historic fire regimes to include frequent, one-to-three year fire return intervals for restoration burns including growing season burns at least every third burn;
3. Preventing and controlling the introduction and spread of NNIS by collaborating with partners on education, native understory restoration, timely treatment and control, equipment cleaning and early detection and rapid response;
4. Collaborating with others on practices which restore and maintain native forb communities and pollinator habitats;
5. Encouraging practices which minimize the displacement of soil, rutting and associated alteration of hydrology; and
6. Restoring native landscapes, to include high quality ecosystems and habitats for at-risk species.

2.1.3 Loblolly Pine Forests

Loblolly pine forests are widespread across the Francis Marion. Historically, loblolly pine was easily established, fast growing and valuable for producing timber products. As a result, loblolly pine has greater dominance than historically occurred. Loblolly pine dominated forests and mixtures with hardwoods occur on 112,000 acres, including 47,000 acres outside an area which can be maintained with frequent fire and 65,000 acres inside one. The majority of sites currently dominated by loblolly pine were once upland longleaf and wet pine savannas.

Loblolly pine forests may be promoted and sustained outside a management or geographic area where historic fire return intervals can be maintained. On other sites where ecosystem restoration is a goal, loblolly pine forest would be restored to a native ecosystem. Until we complete restoration to desired conditions, loblolly pine forests would be managed toward the appropriate ecological system.

2.1.4 Oak Forests and Mesic Hardwood Forests

Oak forests and mesic hardwood forests would be favored on appropriate sites but are relatively uncommon on the landscape (3.9% of the forested acres). Sixty three percent are dominated by loblolly pine or mixtures with non-mast producing hardwoods. Historic fire regimes are relatively infrequent (ranging from 2-35 years).

We have identified key characteristics and indicators of these ecosystems to include:

1. The restoration and maintenance of characteristic vegetation and dominant forest types;
2. A low incidence of non-native invasive species; and
3. Landscape structural diversity typical of reference conditions.

Proposed management strategies include the following:

1. Maintain and restore oak forests and mesic forests using characteristic, infrequent fire regimes;
2. Promote characteristic hardwood composition and structural diversity through forest and vegetation management activities;
3. Collaborate with the Santee Experimental Forest on the maintenance and restoration of calcareous hardwood forests supporting at risk plant species; and
4. Control and prevent the spread of NNIS (feral hogs, fire ants, non-native invasive plants) as needed to achieve desired conditions.

2.1.5 Depressional Wetlands and Carolina Bays

Depressional wetlands and Carolina bays contain a variety of vegetation types depending on size, depth, and frequency of fire. These ecosystems are predicted to occur on 8,594 acres (3.3% of forested acres), including 6,019 acres (70%) within a proposed fire-adapted management area. They would be maintained, improved, and restored where they occur but particularly in this area within which natural fire return intervals can be restored. Uncertainty regarding target vegetation types and long-term management of restored Carolina bays and depressional wetlands exists.

We have identified key characteristics and indicators of these ecosystems to include:

1. The maintenance and restoration of herbaceous groundcover vegetation - both within the wetlands and in the adjacent ecotones;
2. A low incidence of invasive species;
3. Intact hydrology (a low incidence of rutting or disturbed soil); and
4. Structural diversity which includes open canopies.

Proposed management strategies include the following:

1. Apply prescribed fire at natural fire return intervals, more frequent for restoration burns (1-3 year fire return intervals, including a growing season burn every third burn); ensure continuity of prescribed fire from adjacent longleaf uplands and savannas throughout the wetland ecotone;
2. Control loblolly pine, sweetbay, and sweetgum where competing with herbaceous vegetation-drop to 40% canopy closure;
3. Allow commercial logging or mechanical chipping in ecotones only during dry periods;
4. Control and prevent the spread of NNIS as needed to achieve desired conditions (feral hogs, fire ants, non-native invasive plants);
5. Prioritize the restoration of depressional wetlands and Carolina bays containing at risk species.

2.1.6 Pocosins

Pocosins are evergreen shrub-dominated systems. Although pocosin vegetation may be associated with forested wetlands that have been exposed to prescribed fire, true pocosins are relatively uncommon. True pocosins are predicted to occur on 9,322 acres (3.6% of forested acres) with 79% occurring in a proposed management area where frequent fire can be applied.

We have identified key characteristics and indicators of these ecosystems to include:

1. The maintenance and restoration of pocosin vegetation that includes pockets of herbaceous groundcover vegetation - both within the wetlands and in the adjacent ecotones;
2. A low incidence of invasive species, intact hydrology (a low incidence of rutting or disturbed soil); and
3. Structural diversity which includes open canopies.

Proposed management strategies include the following:

1. Apply prescribed fire at natural fire return intervals, more frequent for restoration burns (2-10 year fire return intervals, including a growing season burn every third burn); ensure continuity of prescribed fire from adjacent longleaf uplands and savannas throughout the wetland ecotone;
2. Allow commercial logging or mechanical chipping in ecotones only during dry periods; and
3. Control and prevent the spread of NNIS (feral hogs, fire ants, non-native invasive plants) as needed to achieve desired conditions.

2.1.7 Maritime Forests and Salt and Tidal Marshes

Maritime forests (1,195 acres) and salt marsh (2,786 acres) are relatively uncommon on the forest (1.5% of forested acres) and would be maintained, improved or restored where they occur.

We have identified key characteristics and indicators of these ecosystems to include:

1. The maintenance and restoration of characteristic vegetation;
2. A low incidence of invasive species; and
3. Structural diversity within the natural range of variation.

Proposed management strategies include the following:

1. Maintain and restore maritime forests using characteristic, infrequent natural fire regimes (2-52 years);
2. Promote characteristic hardwood composition and structural diversity through forest and vegetation management activities; and
3. Control and prevent the spread of NNIS (feral hogs, fire ants, non-native invasive plants) as needed to achieve desired conditions.

2.1.8 Forested Swamps and Floodplain Forests

Forested swamps and floodplain forests are common on the forest (93,488 acres or 36% of forested acres).

We have identified key characteristics and indicators of these ecosystems to include:

1. The maintenance and restoration of characteristic vegetation;
2. A low incidence of invasive species; and
3. Structural diversity within the natural range of variation.

Proposed management strategies include the following:

1. Maintain and restore forested swamps and floodplain forests using characteristic, infrequent natural fire regimes (2-218 years). Fire regimes may be variable depending on landscape position;
2. Promote characteristic hardwood composition and structural diversity through forest and vegetation management activities;
3. Control and prevent the spread of NNIS conditions (feral hogs, fire ants, non-native invasive plants) as needed to achieve desired.

2.1.9 Streams and Rivers

Streams and rivers consist of all lotic (flowing water) aquatic systems on the Francis Marion including ephemeral channels. These systems provide critical habitats for fish, mussels, crayfish, benthic macroinvertebrates/invertebrates, reptiles and amphibians.

The desired conditions for the aquatic ecosystems and the riparian areas have similar components. Riparian areas are a major influence on stream and river function and integrity.

Proposed management strategies include the following:

1. Address habitat and species diversity, stream and headwater protection and enhancement, riparian hardwood diversity, stream connectivity, aquatic organism passage and aquatic nuisance species;
2. Maintain or improve good water quality, channel stability, intact riparian vegetation and connectivity of habitats for riparian and aquatic dependent species;
3. Maintain or improve the movement of fish and other aquatic organisms obstructed by road crossings, culverts or other human-caused obstructions;
4. Provide high-quality sustainable angling opportunities;
5. Introduce large wood into stream systems;
6. Remove dams and obstructions in streams;
7. Replace stream culverts for passage of aquatic organisms; and
8. Outreach pertaining to aquatic nuisance species introduction and control.

2.1.10 Lentic Systems

Lentic systems consist of permanent ponds (still, impounded or otherwise non-flowing) aquatic systems, including the ecological system ephemeral ponds and emergent wetlands. Oxbow lakes are included within this system and consist of all waterbodies associated with floodplain aquatic ecosystems on the forest. These ponds provide critical habitats for fish, mussels, crayfish, benthic macroinvertebrates, reptiles and amphibians.

Proposed management strategies include the following:

1. Manage recreational fishing ponds for public use;
2. Provide good water quality and habitat for associated riparian and aquatic dependent species;
3. Control aquatic nuisance species; and

4. Improve water quality by liming, adding habitat structures to ponds and stocking desired fish species.

Other lentic systems such as swamps, wetlands, marshes, Carolina bays, sloughs and oxbows are nested within the terrestrial ecological systems. Aquatic desired conditions and objectives for these systems would be incorporated into those terrestrial ecological systems.

2.2 Species Diversity

The new forest planning regulations specify a focused coarse-filter/fine-filter approach to maintaining or restoring species diversity. This approach also takes into account the species rarity on the unit and the inherent capability of the plan area. At-risks species are associated with ecological system groups described in Section 2.1. In the coarse-filter/fine-filter approach, if the desired ecological conditions for the associated ecological system group are met, then habitat requirements for most of these species will be met. However, some species will have habitat needs above the management approach for their associated ecological groups described in Section 2.1.

Proposed management strategies for sustaining species diversity emphasize ecological conditions that:

1. Protect and promote improved habitat conditions for federally-listed species; and
2. Support a diversity of native plant and animal species in the long term.

Our overall approach for managing species diversity is achieved in cooperation with state, federal and private partners, and focuses on:

1. Maintaining and restoring composition, structure, fire regimes and connectivity;
2. Reducing non-native invasive species;
3. Returning native ecological systems to appropriate sites; and
4. Restoring historic fire regimes to the landscape.

2.2.1 Terrestrial Species

As of 10/30/2013, we have identified 75 at-risk plants that include three federally listed species and 72 potential species of conservation concern. Federally listed animal species include one amphibian, three birds, one reptile and one mammal. The potential species of conservation concern include eight mammals, 21 birds, 10 reptiles and three invertebrates.

At-risk terrestrial species mentioned include many fire-adapted and/or wetland-dependent birds, amphibians, reptiles and plants. We plan to use species groups as an evaluation and analysis tool to improve planning efficiency and to develop management strategies. Species would be grouped according to their habitat needs, limiting factors, threats and specific habitat elements (e.g., snags, cavity trees, underground refugia and woody debris).

The desired conditions of at-risks terrestrial species associated ecological groups should manage areas large enough to:

1. Avoid or overcome the adverse effects of habitat fragmentation; and
2. Reduce the risks involved with small populations.

Proposed management strategies would focus on:

1. Providing the continuity of habitat over a large area;
2. Allowing for dispersal of the various species across the landscape;
3. Appropriately managing their associated ecological systems;
4. Providing historic fire regimes and maintaining preferred habitats;
5. Reducing open road density or trail where roads and trail create barriers to movement of species and create continuous blocks of habitat; and
6. Reducing open road density to minimize effects on wildlife, especially those species which may be killed by vehicles traveling on an open roadway

Some examples of management strategies for species with needs beyond those provided by its associated ecological system are outlined in Table. 2.2.1.

Table 2.2.1 Threatened and Endangered Species, Associated Ecological System(s) and Management Strategy

Species	Ecosystem(s)	Management Strategy
Red-cockaded woodpecker	Upland Longleaf Woodlands; Wet Pine Savannas and Flatwoods	Sufficient old pine trees for nesting cavities and foraging with little midstory
Frosted flatwoods salamander	Upland Longleaf Woodlands; Wet Pine Savannas and Flatwoods; ; Carolina Bays and Depressional Wetlands	Time prescribed burning when individuals are less likely to be moving during a breeding season. This would minimize direct mortality
American chaffseed	Upland Longleaf Woodlands	Maintain and restore populations in existing and historic habitats
Pondberry	Carolina Bays and Depressional Wetlands	Maintain and restore populations in existing and historic habitats
Canby's dropwort	Carolina Bays and Depressional Wetlands	Maintain and restore populations in existing and historic habitats

2.2.2 Aquatic Species

Two federally endangered fish species (shortnose and Atlantic sturgeon), two fish candidate species (alewife and blueback herring) and one petitioned species (American eel) for federal listing are found on the Francis Marion. We have identified 19 species of potential conservation concern including nine fish, two crayfish and eight mussels.

Some examples of management strategies for aquatic species are outlined in Table. 2.2.2.

Table 2.2.2 Aquatic Species, Location, Threats and Management Strategy

Species	Location	Threats	Management Strategy
Shortnose sturgeon	Large river mainstreams and just off shore where species can access other river systems	Population decline due to dams which cut off upriver spawning areas; water quality; altered stream flow; temperature; habitat degradation; siltation, habitat disruption from dredging and overharvest	Desired Conditions and objective would manage forest lands in habitat watersheds to maintain or improve water quality and reduce impacts to instream habitat. These management strategies would contribute to the protection of large river habitats.
Atlantic sturgeon	The near shore ocean. Migrates to freshwater rivers for spawning.		
Alewife	Large river species		
Blueback herring	Large river species		
American eel	Larger rivers and streams		See Section 2.1.8
19 aquatic potential species of conservation concern	The majority occur in stream and river ecosystems as well as lentic ecosystems		Desired conditions and objectives would address habitat and species diversity, stream and headwater protection and enhancement, stream connectivity, aquatic organism passage and aquatic nuisance species.

2.3 Physical Environment

We propose to develop desired conditions and objectives for maintaining, restoring and monitoring the soil, water and air resources on the Francis Marion. More detail is in the assessment posted on our web site at http://www.fs.usda.gov/goto/scnfs/fmplan. Our management options vary with the resource and our ability to manage. Two examples are listed below:

1. National forest lands encompass only a small percentage of the streams and associated drainage areas within the state. In addition, much of the impacts to water resources are due to activities upstream or downstream from the areas the Forest Service manages. Our proposed management strategy is to provide clean water runoff from national forest land. We propose to develop a desired condition that ground-disturbing activities do not contribute to a stream listed by SC Department of Health and Environmental Control as a 303(d) impaired waterbody.

2. Groundwater and air quality issues cross national forest boundaries and are affected by multiple region-wide impacts such as increased agricultural use, growing urban development, cumulative effects from regional emissions and discharge sources and slow recovery from past actions. Therefore, our proposed strategy is to focus on sustaining and improving watershed areas within national forest control while working cooperatively with other agencies and landowners to improve statewide watershed health.

2.3.1 Healthy Watersheds

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.

Fifteen sub-watersheds with major public ownership are on the Francis Marion. Using the criteria for Watershed Condition Framework, we could determine if one or more watersheds may be recommended as priority for restoration. Detailed information about the Watershed Condition Frame can be found at http://www.fs.fed.us/publications/watershed.

Using this watershed evaluation, we propose to develop a desired condition to improve watershed conditions by addressing the above indicators or attributes that are in poor condition and to develop management strategies for how the watersheds may be improved or restored. This information would be used in the future to guide projects, such as the Environmental Mitigation Compensatory program. The most viable opportunity to address these indicators may be along the Cooper River, as our partners address the impacts from dredging the Charleston harbor.

Watershed management and restoration strategies include those ecosystem diversity objectives described in section 2.1 for ecological communities.

2.3.1.1 Floodplains

We propose to develop the desired condition of improving the hydrologic functions of floodplains. Unidentified opportunities may exist to plug ditches to maintain flow permanence.

2.3.1.2 Wetlands

Some wetlands are isolated and not connected to stream systems but may be fed by contributing surface or groundwater areas. Many of these have been modified to some degree. Some former isolated wetlands

have ditches that connect them to stream systems. We propose to develop a desired condition to restore their isolation and desired vegetative conditions. These potential restoration areas have not been identified, but restoration could involve plugging ditches to re-isolate them.

2.3.1.3 Riparian Areas

Management requirements for the riparian management zone must consider at least 100 feet along stream margins unless site-specific recommendations have been developed. Desired conditions for small stream and associated riparian characteristics would be included in the forest-wide desired conditions where appropriate. In addition, riparian area desired conditions and objectives would address ecosystem protection, riparian hardwood diversity and the natural recruitment of large wood from mature forests.

2.3.1.4 Aquatic Ecosystems (rivers, streams and ponds):

We propose to develop monitoring questions and/or indicators to help measure our progress toward desired conditions, as well as meeting any legal or regulatory compliance direction such as the following:

1. Aquatic community diversity;
2. Aquatic habitat components and riparian conditions; and
3. Management effectiveness of aquatic ecosystems

2.3.1.5 Soil, Water, Riparian, Wetlands and Watersheds (monitoring and assessment):

We propose to develop monitoring questions and/or indicators to help measure our progress toward desired conditions as well as meeting any legal or regulatory compliance direction such as the following:

1. Status of select watershed conditions;
2. Progress toward meeting desired conditions and objectives;
3. Compliance checks, inspections and consistency to BMPs/Mitigation Measures (MMs and partnership work with others;
4. Soil quality monitoring;
5. Air quality monitoring including partnership work of others;
6. Outside influences to national forest watersheds; and
7. Monitoring of improvement of restoration actions or activities.

2.3.2 Water Quality and Quantity

Management strategies for water quality and quantity require an integrated approach to move toward our vision for healthy watersheds. The watercourses within the Francis Marion provide many beneficial uses including recreation, fish and wildlife maintenance and instream flow or water level protection. We propose to develop a desired condition that continues to:

1. Provide these beneficial uses;
2. Maintain water quality on water runoff from national forest lands; and
3. Provide for watershed protection.

To achieve this desired condition, mitigation measures for ground-disturbing activities on the Francis Marion would meet or exceed South Carolina Forestry Commission's best management practices (BMPs). Use of BMPs crosses resource program areas and includes such practices as establishing streamside buffer zones, restricting vegetation management activities in riparian zones and employing erosion control measures.

Our proposed management strategy is to work with other federal and state agencies, research institutions and interested partners to collect data, monitor conditions and collectively address solutions on maintaining and improving water quality and flow. The forest maintains consistency with multiple regulations and requirements. If we feel that local refinements are needed, we would identify those

specifically as standards or guidelines. We also may include some plans for monitoring sea level rise and associated changes.

2.3.3 Soils

Soil condition on the Francis Marion can be affected by activities that disturb the soil surface such as vegetation management projects, prescribed burning and recreation use of trails and roads. Each national forest also has distinct soil characteristics that must be managed appropriately to avoid erosion, compaction, rutting and drainage issues.

Our management strategy for improving and/or protecting soil condition includes the following:

1. Match national forest activities with specific soil types and topography to minimize erosion, as well as use appropriate BMPs.(e.g., buffers to protect wetland communities, restrictions on mechanical equipment operation, filter strips to protect perennial and intermittent streams, installation of water diversions and careful designing and engineering of roads and firelines);
2. Maintain updated soil inventories and conducting site-specific soil surveys prior to restoration activities;
3. Conduct targeted watershed restoration projects; and
4. Close and restore undesignated trails.

2.3.4 Geology

Some areas on the Francis Marion have karst influence with local indicators of sinkhole terrain and at least one spring complex. Karst is a landscape formed from the dissolution of soluble rocks including limestone, dolomite and gypsum. It is characterized by sinkholes, caves, and underground drainage systems. The karst influence along the northern edge of the forest has created the potential for mining limestone. Our management strategy is to develop a desired condition on mining limestone and identify areas of the forest where limestone mining maybe suitable.

2.3.5 Air Quality

On the Francis Marion, prescribed burning is the activity most likely to contribute to air emissions. Smoke management procedures and best management practices are currently used to comply with air quality standards and protect health and safety. Our proposed management strategy includes continuing these practices as well as cooperating with state and federal agencies to improve regional air quality. We also would coordinate with regional air planners to incorporate projected management activities into state and regional emissions inventory projections. This would ensure that air emissions from forest's activities do not cause or contribute to a National Ambient Air Quality Standards exceedance nor cause nearby Class I Areas to not meet reasonable progress per the Regional Haze Rule.

Sixty-four percent of the forest has acidic deposition levels below a level to maintain the long-term health of the ecosystem. About 24% of the lands within the proclamation boundary may have excessive acidic deposition. Our proposed management strategy for acidic deposition includes:

1. Continue soil sampling, ecosystem modeling and gathering additional information before a final determination can be made on how much more acidic deposition needs to decrease to protect the long-term health of the ecosystems; and
2. Monitor acid deposition at broad and local scales.

2.4 Healthy Forests

Our overall strategy for achieving healthy forests is to use a combination of vegetation management practices including prescribed burning to restore and maintain resilient native ecosystems. Desired conditions for the different ecological systems are the primary context for the health of forests on the Francis Marion. The emphases in this plan would include:

1. Maintaining and restoring fire adapted ecosystems and longleaf pine;
2. Maintaining moderate stand densities in pine and pine-hardwood stands;
3. Regenerating stands to either restore more desired species such as longleaf pine and/or to create young age forest stands for ecological sustainability; and
4. Controlling non-native invasive plant species and insect and disease outbreaks.

2.4.1 Vegetation Management

Vegetation management on the Francis Marion is focused on the following elements:

1. Using prescribed fire to control fuels, restore fire-adapted ecosystems and provide desired wildlife habitat conditions;
2. Using tree harvest in restoring ecosystems, providing wildlife habitats and creating new young age forest;
3. Providing a flow of wood products from the forest; and
4. Controlling plant NNIS.

Desired conditions and objectives would address forest health needs through improved species composition and structural and age diversity. Forest management practices are the means for carrying out restoration goals while sustaining healthy forests that are resilient to extreme natural events and supply desired goods and services. Vegetation management with prescribed fire is discussed in more detail in section 2.4.3.

Resilient forest conditions are also the key to the Francis Marion strategy for climate change. In much of the Southeast, climate variability and extreme weather events have long been part of the natural environment.

The priority order for tree harvest is:

1. Flatwoods and uplands within the areas that are maintained with frequent prescribed fire;
2. Flatwoods and uplands outside the areas maintained with frequent prescribed fire with the Wildland Urban Interface (WUI);
3. Flatwoods and uplands outside the areas maintained with frequent prescribed fire outside Wild UI; and
4. Wetter areas, such as swamps and floodplains across the Francis Marion.

This does not mean that all priority 1 tree harvest above would precede the second or third priority items mentioned, but these are the general priorities for harvest.

Over the life of the plan, priorities may shift to respond to changing conditions such as expansion of NNIS, southern pine beetle outbreaks, disease infestations or storm events. Minimizing tree mortality caused by southern pine beetle outbreaks would be an important priority during the plan period. By aggressively treating southern pine beetle spots as they occur, reducing risks by thinning and establishing less susceptible species on appropriate sites, we expect damage from outbreaks to be reduced.

2.4.2 Old Growth

The Francis Marion and Sumter National Forest recognizes old-growth forests as a valuable natural resource worthy of protection, restoration and management (USDA, 2007). Since very little old growth

exists, we would emphasize areas for developing or restoring old growth on the forests, to include representation across our diversity of ecosystem types. Our goal would be to identify 10 percent of all forested ecosystems to manage for old growth conditions.

We would develop a desired condition and objectives to establish a network of old growth areas of small (less than 100 acres) and medium (100-2500 acres) sizes to provide for adequate distribution, linkages and representation.

2.4.3 Wildland Fire and Fuels

Wildland fire and fuels management support desired conditions and objectives for a variety of resource areas across the Francis Marion. Desired conditions and objectives for hazardous fuels management would focus on reducing the intensity and severity of wildland fire and improving vegetation composition and structure, response to wildfire, and community preparedness and resiliency. In turn, all influence the goods and services received from forests, improve firefighter and public safety, and protect homes and property from fire.

Proposed management strategies work toward these conditions:

1. Restoring and maintaining resilient landscapes: Management strategies move fire regimes within the systems of the Francis Marion toward historical ranges. Management activities encourage the restoration and maintenance of native vegetation patterns, species composition, and structure and function within natural limits. The risk of losing key ecosystems is low. Fire is allowed to operate as close as possible to its historic, ecological role. Refer to sections 2.2 and 2.3.

2. Creating fire-adapted human communities: Management strategies lessen the risk to developments, private property, and Forest Service infrastructure due to reduced levels of forest fuels along interface and intermix areas. We work with local government on land development and zoning laws that encourage creating a defensible space and implementing and adhering to wildland fire risk reduction practices. Smoke impact is lessened through public education and acceptance with new land development and zoning laws written with smoke acceptance guidelines.

3. Effectively responding to wildfire: We recognize that wildland fire can be an essential ecological process and natural change agent and should be incorporated into the planning process and wildfire response. Management strategies to wildland fire are based on ecological, social, and legal consequences of the fire, but reduce the risks to firefighters and the public.

Proposed management strategies focus on a combination of three primary means of managing fuels on national forest lands:
1. Prescribed fire;
2. Managing wildfire for resource objectives; and
3. Fuels treatments using mechanical, biological or other non-fire methods.

Additional methods of managing fuels and reducing the risk of wildland fires involve partnerships across national forests' boundaries.

Proposed management strategies would focus on working with our neighbors to reduce the risk of the ignition of wildfires and to reduce the spread of wildfires once a wildfire occurs by:
1. Managing human ignitions;
2. Offering advice about home and community actions; and
3. Initializing and extending responses to wildfires.

2.4.3.1. Prescribed Fire

Proposed management strategies recognize that prescribed fire is one of the most effective and cost-efficient means of managing vegetation, which enhances hazard reduction, ecosystem restoration or maintenance, silviculture, and others. In general, prescribed fire is an effective tool in areas for maintaining and restoring habitat for fire-adapted or fire-dependent plants and animals (See sections 2.1 and 2.2).

Objectives for prescribed fire include a realistic number of acres treated by prescribed burning annually. Tentative estimates are that approximately 30,000 to 50,000 acres would be annually treated by prescribed burning, with an estimated average of 40,000 acres per year. Objectives for prescribed fire must balance factors such as weather conditions, fire danger conditions, budget, landowners' willingness and availability of local staff. Changes in any of these factors or unexpected events can dramatically affect the ability to achieve prescribed burning from year to year.

Proposed management strategies also allow an increase in acres burned with favorable weather conditions, additional agency capacity and/or opportunities for joint efforts with cooperating agencies. When the above opportunities are present, our proposed strategy is to take advantage of those occurrences to accelerate goals and make improvements toward desired conditions.

2.4.3.2 Managing Wildfire for Resource Objectives

Desired conditions would be developed to recognize opportunities to manage wildfire to meet resource objectives and ecological desired conditions. Strategic choices would use unplanned ignitions to achieve forest plan desired conditions and objectives. Forest plan components balance risks with the potential benefits on an individual basis.

Proposed management strategies would consider managing wildfires to meet resource objectives and ecological purposes and can be a useful tool to restore fire-adapted ecosystems, reduce fuels, and achieve fire resilient landscapes. Our proposed management strategies must also balance the use of wildfires to meet resource objectives because of its inherent risks, due to the mix of ownerships and populated lands across the Francis Marion.

2.4.3.3 Fuels Treatments using Mechanical, Biological, or Other Non-Fire Methods

Our proposed management approach to fuels management must consider alternatives to prescribed fire, such as mechanical treatments, herbicide applications or biological methods. Examples of these non-fire options include: mechanical thinning and clearing debris in forests, the use of herbicides to change vegetation composition or livestock grazing to reduce fine fuels. The referenced methods would be used wherever they are economically viable, especially where using fire as a management tool is undesirable or carries high risks.

The advantages of these non-fire methods are that they do not create fire risk and can often be applied with a greater level of control over the location, timing and desired outcome of the treatment. Mechanical treatments are particularly suited for fuels management following natural disturbances such as storms or insect outbreaks that radically change forest structure. An additional consideration is that mechanical treatments generally are not wholly adequate substitutes for fire in terms of ecological effects which affects their suitability in many circumstances.

2.4.3.4 Managing Human Ignitions

Human ignitions are the predominant cause of wildfires throughout the Francis Marion. Ninety-eight percent of all wildland fires from 1992 through 2012 in the assessment area were caused by humans. While there are many different types of human-caused ignitions, they are primarily lumped into two

categories: accidental and incendiary. Accidental causes include debris burning, fireworks, equipment, campfires and others. Incendiary fires include malicious arson events or other incidents where fires were set intentionally using inflammable devices. Approximately 71% of all wildland fires in the assessment analysis area were incendiary or arson.

For more details, please review the Wildland Fire and Fuels section of the assessment at www.fs.usda.gov/goto/scnfs/fmplan.

2.4.3.5 Home and Community Actions

Proposed management strategies focus on maintaining and developing additional partnerships that would reduce losses to homes and communities from wildfires. Many actions can be taken by the individual homeowner, but other efforts require community level involvement to be effective. Similarly, community efforts without commensurate attention by local home and business owners are unlikely to succeed.

Working with local communities and homeowners can reduce the likelihood that a wildfire burning in adjoining vegetation would ignite homes or other structures and is one of the most effective avenues to reducing losses from wildfires. Using existing programs, such as community wildfire protection plans and firewise education can be effective tools to encourage homeowners and local governments to create fire resistant neighborhoods and communities.

Management strategies that target the prevention of human caused ignitions have the potential to substantively affect wildfire occurrences. Proposed management strategies would focus on the underlying causes of these human-caused ignitions and tailor the prevention programs to specific causal factors and community dynamics.

2.4.3.6 Initial and Extended Response to Wildfires

Wildland fires are managed according to the Federal Wildland Fire Management Policy, which is a unified and cohesive federal fire management policy codified in agency, interagency and departmental manuals, guidebooks and other documents through clear, concise, and uniform language across all agencies. All wildland fires managed for resource benefits follow appropriate reference guides for wildland fire use implementation procedures and are assessed using a decision support process that examines the appropriate range of responses for a given situation or circumstance.

Wildland fire response in the Coastal Plain of South Carolina, including the Francis Marion, is a complex, multi-faceted and continual process. We work closely with the various agencies responsible for suppressing wildland fires. Agencies that have initial and extended attack authority on and around the Francis Marion are extremely proficient at fire suppression. Less than 2 percent of all wildland fires occurring between 1992 and 2012 have grown beyond 99 acres.

Over the last few years, wildfire risks have escalated due to changing conditions in and around communities and may impact response effectiveness in the future. As part of the Wildland Fire and Fuels assessment, an analysis identified areas in and around the Francis Marion that could observe increased fire behavior and spread rates due to fuels conditions. These increases in fire behavior and spread rates limit resource effectiveness while also increasing hazards to both community members and wildland fire responders.

Our proposed management strategies are to work closely with responsible agencies to respond quickly to wildland fires and to apply effective control measures to limit the spread of wildland fires.

2.4.4 Lands and Special Uses

The lands and special uses program manages the real estate-related activities associated with National Forest System (NFS) lands. The overall strategy for the program is to consolidate NFS lands through acquisitions and exchanges while providing appropriate access to federal property for public services and other special uses. For land ownership adjustments, our proposed management strategy focuses on land parcels within or adjacent to national forest boundaries; however, isolated tracts that have special values or contribute to the mission of the Forest Service are also included.

Main concerns for consolidating and expanding land holdings include the following:

1. Acquiring high-value ecosystems;
2. Threatened and endangered species habitat;
3. Critical water corridors; and
4. Desirable adjoining or infill tracts.

Our proposed management strategy for continued land ownership adjustments is to give priority to lands that:

1. Help consolidate large blocks of existing NFS lands (as opposed to adding onto small or isolated blocks);
2. Protect resource values on adjacent, existing NFS land;
3. Contribute to the recovery of threatened or endangered species or aid in the protection of diverse species;
4. Enhance recreation, public access and protection of aesthetic values, especially those that provide public access to waterways; and
5. Complement a designated special area such as a wilderness area or Wild and Scenic River.

Priority would also be given to lands that are:

1. Needed for the protection of important cultural resources;
2. Needed for new administrative or recreational sites and/or protection of existing improvements; and
3. Environmentally sensitive lands such as those containing unusual geographic features, wetlands or floodplains, rare plant or animal communities or other attributes of uncommon or striking character.

Our proposed management strategy for maintaining desired conditions on the Francis Marion is to continue to include and enforce appropriate environmental protection controls in leases, easements, right-of-way grants, licenses and other special use permits.

Currently, the Francis Marion holds 20 permanent easements and several temporary easements to access national forests utilizing routes across private holdings. This low level easement activity is expected to continue as most of the Francis Marion is already well-served by an existing road network. Therefore, the need to access additional areas is minimal. Newly acquired tracts generally have an established system of roads and outstanding easements for access or to adjoin existing NFS lands.

Special use authorizations provide for necessary private uses of NFS lands that serve the public's interests and those that cannot be accommodated on non-federal land (e.g., lands used for utility corridors and transmission lines, communication sites, military training activities, driveways and special events).

2.4.5 Climate Change

Resilient forest conditions and adaptive management are imperative to the Francis Marion's strategy for responding to natural disturbances, changing climate or other changes in the existing conditions. In much

of the southeastern United States, climate variability and weather events such as hurricanes, heat waves, droughts, tornadoes, floods and lightning storms have long been part of the natural environment. Projections of climate change impacts for the region indicate that over the coming decades, there is expected to be an increase in extreme weather events and other climate related natural disturbances affecting the Francis Marion. While disturbance events represent potential for rapid change, changing climate is also characterized by long-term trends in temperature, precipitation and resulting secondary effects on physical and biological systems. Our response to changing climate through adaptive management requires detection of both disturbance driven and long-term change at multiple scales including at the forest level and broad-scale.

We intend to use climate change strategies that focus on:

1. Reducing vulnerability by maintaining and restoring resilient native ecosystems;
2. Providing carbon sinks and sequestration;
3. Reducing existing stresses; and
4. Engaging in partnerships across landscapes and ownerships.

Some of our proposed management strategies for addressing climate-related disturbances over the life of the plan would be to:

1. Reduce vulnerability by maintaining and restoring resilient native ecosystems, including streams and longleaf pine;
2. Enhance adaptation of species by reducing the effects of serious disturbances where possible and taking advantage of disruptions to convert to more resilient and desirable ecosystems;
3. Use preventive measures for reducing opportunities for forest's pests;
4. Lessen greenhouse gas emissions by reducing carbon loss from hurricanes and restoring species such as longleaf pine that have higher carbon sequestration rates;
5. Maintain, improve and restore the diversity within stands to be ecologically sustainable;
6. Increase resilience of forests to both climate change and hurricane damage through landscape structural diversity;
7. Plant new trees and improve forest health through thinnings and prescribed burning to increase carbon for the future;
8. Address ecological systems that are in the margin of change due to rising waters, as well as, recreation developments and the risks associated with potential new development in the margin of change;
9. Address speedy salvage, road repairs or other ecological damages after major disturbances by tornados, hurricanes, wildfire, floods or drought; and
10. Collaborate with partners and local municipalities to monitor the loss of marshlands, the effects of sea level rise on vegetation, saltwater intrusion, stream water temperatures and flows, and tidal forests and baldcypress for effects of increasing salinity.

Although research is still evolving, these proposed management strategies are consistent with achieving future desired conditions in the plan as well as improving resiliency to changing climate and weather conditions.

2.5 Infrastructure

Focusing on safety and maintenance of existing infrastructure (roads and facilities) is the proposed management strategy for the Francis Marion, which includes backlogged repairs and upgrades, improvements for environmental protection, disposal of facilities that are no longer needed and rehabilitation of user-created roads.

2.5.1 Roads

Our proposed primary focus for the future would be on maintenance and rehabilitation of our existing road system. Maintenance priorities would include bridge safety, adequate signage, suitable stream crossings and any resurfacing or reconstruction needed to provide an overall road system that is useable and safe. To promote ecological sustainability, wetlands and unique or common communities would be given priority when considering closing or obliterating existing roads. Unauthorized travelways would either be decommissioned or left to naturally re-vegetate. Decommissioning would focus on reducing resource impacts and management costs.

The Francis Marion has a substantial backlog of road maintenance needs. A proposed management strategy is to reduce the maintenance level for some roads, as well as decommissioning unauthorized roads.

2.5.2 Facilities

The facilities program consists primarily of maintaining a variety of structures and associated utilities across the Francis Marion that are used for recreation, administration, research, maintenance, storage, fire operations and other general management purposes.

Proposed management strategies would be directed toward the following:

1. Reducing the backlog of accrued facility deferred maintenance, particularly those items associated with health and safety;
2. Matching the facility inventory with current management needs, including decommissioning and disposing of facilities which are no longer required (i.e., unmanned work centers and unused ranger houses) to support management objectives; and
3. Reducing the operating and maintenance costs associated with the facility portfolio.

Limited new facility construction in the future is expected; new construction would be limited to improvements. As improvements are made to the work center and recreation facilities, bringing them into compliance with applicable accessibility and environmental requirements would be a priority. Buildings that are in use are safe and structurally sound but may lack preventive maintenance and aesthetics.

2.6 Recreation, Cultural Resources and Forest Setting

Management strategies for providing outdoor recreation opportunities, protecting heritage sites and maintaining a natural forest setting require balancing the increasing demand for more uses while protecting and maintaining existing desirable conditions.

2.6.1 Recreation

The Francis Marion provides a diverse range of quality natural and recreation opportunities in partnership with people and communities. The forest's niche is showcasing the diverse ecosystems that abound on the coastal plain through dispersed recreation opportunities.

Proposed management strategies for all recreation experiences on the Francis Marion include:

1. Improving the racial and gender composition of forest visitors;
2. Considering impacts from sea level rise and other climate change; and
3. Working with partners and the public to alleviate conflicts between user groups.

2.6.1.1 Dispersed Recreation

The forest's current strategy for managing dispersed recreation includes a focus on trail networks near larger urban population centers, such as the rapidly growing Mount Pleasant and Moncks Corner areas. Increasing loop trails when opportunities arise, the work associated with the current management strategy would bring existing trails up to sustainable standards through redesign and reconstruction. Proposed management strategies would continue this work, as well as reduce off-trail impacts, especially from motorized trails.

Additionally, proposed management strategies are to:

1. Connect the rapidly growing communities of Mount Pleasant and Moncks Corner to the forest's trails system in an effort to "connect people to nature" with opportunities for healthy lifestyles and an improved quality of life;
2. Seek new partnerships and maintain existing partnerships to offer better opportunities and support services for recreation, facilities and trails. Achieving trail maintenance, resources protection, user education and various inventory and monitoring activities would be achieved primarily through partnerships with various organizations; and
3. Continue traditional use of the forest such as hunting, fishing and wildlife watching. Approaches would be developed to improve traditional use of the forest that would provide revenue for the local economy.

2.6.1.2 Developed Recreation

The forest's priority for the developed recreation infrastructure would be to continue to reduce maintenance backlogs and improve accessibility as needed. Please refer to Section 2.5.2 for more details.

Proposed management strategies are to:

1. Continue to reduce our environmental footprint and decrease the greenhouse gases emitted through day-to-day operations, including making developed facilities more energy efficient;
2. Continue to use the Sewee Visitor Center as a conduit to connect people to nature and promote healthy lifestyles by use of the forest; and
3. Develop better visitor information for trip planning and onsite recreation areas as wells more opportunities to learn about the natural environment in conjunction with partners and volunteers.

2.6.1.3 Scenic Character

Continued restoration of fire-adapted ecosystems would allow for more open, longer viewsheds along roads and trails that would become evident and reveal mid-distance views of attractive environments. Viewsheds are often spaces that are readily visible from public areas such as from public roadways. Although disturbances would be temporary, changes would be visible as forest stands transition from existing conditions to restored native ecosystems.

The proposed management strategy is to:

1. Carefully manage the transition to more native ecosystems using mitigation techniques that maintain scenic integrity

The existing forest setting is generally naturally appearing and rural. Use of prescribed burning to sustain historic fire regimes would also have a generally positive visual effect on the landscape with longer viewsheds. The "Scenery Treatment Guide for the Southern Region" (issued April 23, 2008) and scenic integrity objectives provide guidance for mitigating scenery impacts for management activities and would be incorporated into project planning and implementation. The "Scenery Treatment Guide for the Southern Region" may be viewed online at www.fs.usda.gov/goto/scnfs/fmplan.

2.6.1.4 Settings

The semi-primitive settings classes are characterized by predominantly natural or natural-appearing landscapes. The proposed management strategy for providing semi-primitive motorized (SPM) and non-motorized (SPNM) recreation opportunities would be maintained by the use of management prescription areas that restrict certain activities such as road construction and timber harvest.

2.6.2 Wilderness and Wild and Scenic Rivers

Wilderness and wild and scenic river designations must meet additional federal guidelines contained in the Wilderness Act and the Wild and Scenic River Act.

Wilderness would be managed in accordance with the 1964 Wilderness Act. Tools, such as the Minimum Requirements Decision Guide, are used when considering if a project is appropriate in wilderness. The Minimum Requirements Decision Guide can be viewed online at www.fs.usda.gov/goto/scnfs/fmplan.

Proposed management strategies are to:

1. Manage areas recommended for wilderness study to preserve the character of the area that led to its consideration for designation. Additional actions may occur if needed to maintain and restore the wilderness character from impacts of recreation use; historical exclusion of fire; non-native invasive plants and animals; air pollution; aquatic habitat degradation; unmanaged illegal use; motorized boat use; and climate change;
2. Manage any rivers identified as eligible for designation as wild, scenic or recreational rivers; and under the Wild and Scenic Rivers Act to preserve their outstandingly remarkable values.

2.6.3 Cultural Resources

We have a significant public stewardship responsibility for cultural resources in our care. The forest's Heritage Resources Program has three key components:

1. Stewardship, which includes identifying cultural resources, protecting them and preserving them;
2. Public service; and
3. Providing context for natural resource management.

Through public service, we provide opportunities to enhance cultural resources in our care and to learn about the past. The Heritage Resources Program seeks to provide interpretive, educational and other

experiential programs and encourages scientific research. Providing cultural resources for current and future public enjoyment allows people to connect with their cultural heritage and creates a vital thread in the fabric of society. By providing this context for natural resource management, the forest promotes an understanding of the role human beings in past and present ecosystems and provides a context for understanding contemporary landscapes and natural resource issues.

Existing management strategies to conserve heritage resources include:

1. Identifying, stabilizing and monitoring cultural resources to protect their significant values;
2. Implementing. law enforcement protocols to prevent damage or loss due to illegal activities; and
3. Identifying and addressing deferred maintenance needs for National Register listed or eligible cultural resources.

Existing management strategies also provide quality heritage experiences; fascination with the past is transformed into understanding and appreciation. Those experiences come in a variety of forms including:

1. On-site interpretation;
2. Educational tours;
3. Partnership and volunteer opportunities to assist with research and management; and
4. Special events.

Proposed management strategies include the following:

1. Develop stewardship opportunities to identify, preserve and enhance cultural resources;
2. Preserve and curate collections (e.g. artifacts, historic documents and records, maps, photographs, reports and program records) which are available to scholars and the public for research and interpretation;
3. Develop stewardship opportunities to identify, preserve and enhance cultural resources;
4. Evaluate cultural resources for their eligibility for listing in the National Register of Historic Places or as National Historic Landmarks and eligible properties are listed;
5. Use public outreach and education about cultural resources and historic preservation to contribute to their protection;
6. Use interpretation and education to share cultural resource findings with the scientific community, tribes and the general public;
7. Encourage partnership opportunities to meet cultural resource needs;
8. Use law enforcement protocols to prevent damage or loss due to illegal activities by forest users;
9. Identify and address deferred maintenance for National Register listed or eligible cultural resources; and
10. Utilize density mapping of cultural resource sites to identify opportunities for interpretation and protection.

2.7 Economic Benefits

The management strategies for the Francis Marion are to produce a steady flow of benefits which are essential to sustaining life and fulfilling basic human needs and desires. These benefits stem from a number of provisioning, regulating, cultural and supporting services produced by biophysical and ecological processes within the forest. Collectively known as ecosystem services, these environmental goods and services are complexly linked to the health and vitality of human and ecological communities. While it is difficult to quantify the benefits people obtain from ecosystem services, their consideration should not be precluded from the collective vision for the forest.

Our management strategy on ecosystem services promotes human health and well-being at local, regional, and global scales. Although several key ecosystems provided by the forest were identified during the assessment phase, we continue to work towards identifying important ecosystem services provided by the forest and assess how resource conditions affect their provision. Since many services are interlinked, we would identify positive and negative relationships between provisioning, regulating, cultural and supporting services and consider trade-offs between key ecosystem services when developing desired conditions for the forest. Although the Francis Marion would not be managed for predetermined levels of ecosystem services, the revised forest plan would be developed to sustain and promote the production of previously identified ecosystem services. In doing so, the revised forest plan would ensure the Francis Marion continues to contribute to long-term health and sustainability of social, economic, and natural environments locally and globally.

The proposed management strategies are to:

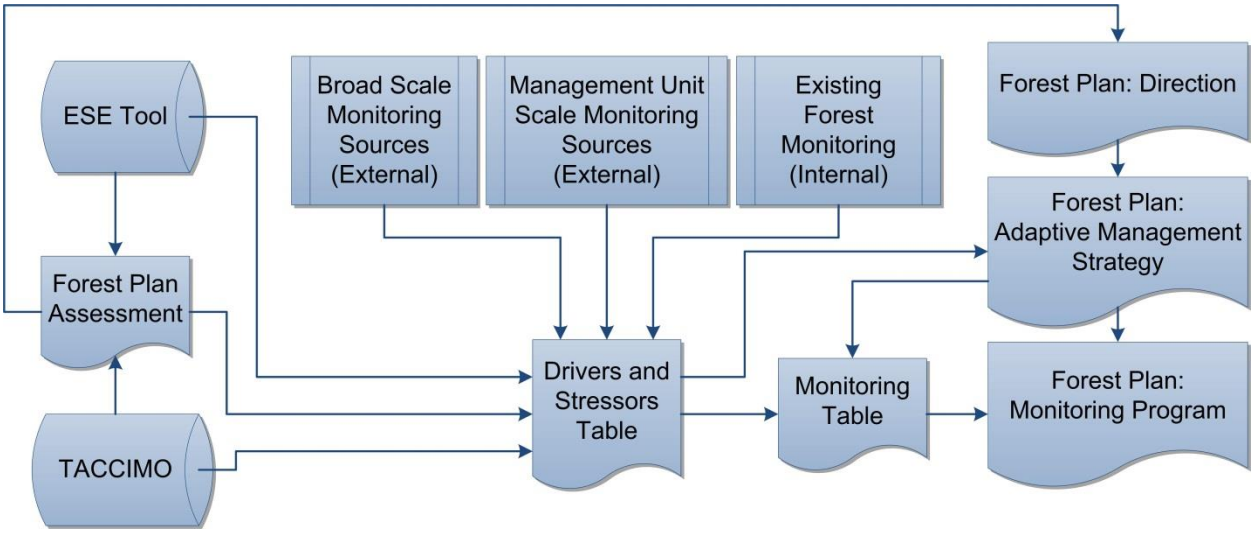
1. Strive to foster inclusion and strengthen the connection between people and the National Forest in its planning process;
2. Design a forest plan to meet desired ecological conditions, while continuing to support the social, cultural, and economic linkages between communities of interest, and communities of place, and the Francis Marion;
3. Coordinate public outreach, involvement, and collaborative activities to elicit values, attitude, and beliefs associated with these lands from current forest users, and identify social and economic trends which may affect the values and uses of future forest users.
4. Incorporate changing values and demand for forest’s resources into management actions to better meet the changing interests and needs of stakeholders.

2.8 Adaptive Management and Monitoring

The concept of adaptive management connects the national forest's ability to assess existing information, apply that information through management activities to achieve desired conditions, and monitoring to detect progress toward or away from those desired conditions. Monitoring is particularly important to adaptive management in practice, as it occurs alongside plan implementation and helps the national forest detect a need for change, which may warrant modifications to the monitoring program, a new assessment, or changes to the plan itself.

Designing an effective monitoring plan is informed by the understanding of focal resource system drivers and stressors to potential changes, as developed during the assessment and forest plan revision phases. Measures and indicators for each focal resource are identified at broad- and management-scales for key characteristics including source (partner), frequency, geographic scale, information quality, and alert. The alert characteristic is particularly important, as it identifies conditions that merit further evaluation. Finally, alerts are linked with possibilities for change, or potential adaptive management strategies. Figure 2.1 is a monitoring flow diagram that outlines this process.

Figure 2.1 Monitoring Flow Diagram



The goal of the process outlined in Figure 2.1 is to inform the Forest Plan's Adaptive Management Strategies and Monitoring Program. We begin with the best available scientific information (BASI), which is extracted from The Template for Assessing Climate Change Impacts and Management Options (TACCIMO) and the Ecological Sustainability Evaluation (ESE Tool). This science informs the Forest Plan Assessment and the Drivers and Stressors Table, in order to support the most scientifically sound plan direction possible. Additionally, monitoring at the broad scale, management unit scale, and in the existing forest monitoring is suggested and related to each driver and focal resource. Alerts are applied at each level of monitoring, in order to incite further evaluation if conditions change and eventually require adaptive management. The Drivers and Stressors Table in conjunction with the desired conditions and objectives from the Forest Plan is used to develop the Monitoring Table. This monitoring table will outline the monitoring program in the Forest Plan, which is informed by the Forest Plan's Assessment, Direction, and Adaptive Management Strategy.

The drivers and stressors table will be used as an interim product to help address the eight monitoring items required under the new planning regulations (36CFR 219.12(a)(5).

(i) The status of select watershed conditions.

(ii) The status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.

(iii) The status of focal species to assess the ecological conditions required under § 219.9.

(iv) The status of a select set of the 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.

(v) The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.

(vi) Measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.

(vii) Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities.

(viii) 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)).

Included are a few examples of how the Forest is presently thinking of defining possibilities for change, or potential adaptive management strategies. The drivers and stressors table will be updated to include strategies for all resources as the monitoring plan gets developed. For the complete table and latest updates, refer to our website at *http://www.fs.usda.gov/goto/scnfs/fmplan.*

To inform monitoring practices and adaptive management strategies using best available scientific information (BASI), Tables 2.8.1, 2.8.2 and 2.8.3 displayed on pages 27, 28 and 29 incorporates the following:

- **System Drivers** for each forest are identified as system drivers as exposures relative to trends. A few examples are natural succession, human disturbance, drought, temperature shifts, and sea level rise associated with climate change.
- **Stressors** for each resource are identified. This includes a summary of information from the scientific literature describing each resource's sensitivity to a particular system driver as well as important public concerns and values. Probability and risk of system driver may be included. Substantial uncertainty exists in trying to predict frequency and intensity of system driver.
- **Coarse and fine filter resources** are listed under the system drivers to which they are vulnerable, and their sensitivity is described, which is informed by the assessment findings. Coarse filter resources include systems (i.e. ecological, physical and social), while fine filter resources include species and assemblages.
- **Broad scale measures** are externally monitored indicators. Information is collected by sources such as National Oceanic and Atmospheric Agency (NOAA) or United States Geologic Survey (USGS), and this information is periodically examined to determine if trends exist, and if those

trends are approaching trigger points (described below). If that trigger point is reached, management unit measures can be examined. For broad scale measures, we identify:

- *Sources (S)* – a potential or established source of the monitoring that is external to the forest
- *Frequency (F)* – the frequency with at which monitoring occurs, or the event initiating monitoring
- *Scale (Sc)* – the geographic scale at which the monitoring occurs
- *Information Quality (IQ)* – Includes measures of the accuracy, reliability, and relevance to the planning issue considered; if relevance is omitted, it is synonymous with scale for that example
- *Alert (A)* – the condition that the monitoring measure or indicator passes (including measures of uncertainty) that may incite additional assessment, modifications to the monitoring, or need for change in the plan.

- **Management unit measures** are monitored at or near the forest, but still through an external source, such as an experimental forest if one exists. These measures may be incited by a trigger identified from broad scale monitoring, or done in conjunction with broad scale monitoring. If these measures reach the trigger point, then the resource is examined by means of the current forest monitoring. The same measures are identified for management unit measures and broad scale measures.
- **Current forest monitoring** ties these measures back to the forest. As the forests already engage in monitoring activities, we utilize the information gathered from these activities to inform whether or not the trigger has led to detectable changes within the forest. If negative changes have occurred and reached some critical threshold, then the need for change is assessed. If a need for change is identified, then possibilities for change are considered.
- **Possibilities for change** are strategies to address the disturbances or negative shifts in forest health. These options are expected to create a forest ecosystem that is more resistant to future environmental threats. Given that these threats are often variable and unpredictable, forest managers should use both BASI and local knowledge of the forest to inform these decisions.

Table 2.8.1 System Driver – Natural Succession

Focal Resource	Stressor	Broad Scale Measures; Indicators	Management Unit Measures; Indicators	Current Forest Monitoring	Possibilities for Change
Northern bobwhite Quail (*Colinus virginianus*)	Natural succession reduces habitat availability and suitability for northern bobwhite quail.	<u>Population Levels</u> **(S)** North American Breeding Bird Survey **(F)** Annual **(Sc)** South Carolina **(IQ)** Accuracy –no guarantee of accuracy, not all of the data on the website meets criteria for inclusion in annual BBS analysis (Run Type 1 data does) **(A)** Significant decrease in bobwhite counts <u>Habitat Distribution</u> **(S)** Climate Change Bird Atlas **(F)** Annual **(Sc)** South Carolina **(IQ)** Accuracy - high model reliability **(A)** Significant decrease	<u>Hunter Success</u> **(S)** SCDNR **(F)** Annual **(Sc)** State – Northern Coastal Plain; Southern Coastal Plain; Midlands; and Piedmont **(IQ)** Accuracy – uses Breeding Bird Survey data (see previous column) and call count data **(A)** Significant decrease in bobwhite counts <u>Habitat Suitability</u> **(S)** Quail Forever (Q) **(F)** Annual **(Sc)** Forest **(IQ)** Accuracy – currently unknown; will follow up with source **(A)** Habitat Suitability has	<u>Bobwhite Population</u> **(S)** Quail call counts **(F)** Annual **(Sc)** Forest **(IQ)** Accuracy and reliability – quail call counts taken from four routes within FMNF **(A)** Significant decrease in bobwhite counts <u>Prescribed Burning</u> **(S)** Burning records **(F)** Annual **(Sc)** Forest **(IQ)** Accuracy based on data input into records **(A)** Significant decrease in acres	Increase the amount of thinnings conducted on the FMNF and implement ecological restoration, especially longleaf pine restoration. Pine thinnings should try to reduce densely stocked pine stands to a residual basal area of 50-60 square feet per acre or less. Prescribed burning on more frequent intervals and in such a way as to burn in a

		in bobwhite counts	declined	burned	mosaic pattern.

Table 2.8.2 System Driver – Human Disturbance

Focal Resource	Stressor	Broad Scale Measures; Indicators	Management Unit Measures; Indicators	Current Forest Monitoring	Possibilities for Change
Recreation	Increased human traffic from recreation, as well as population increases and consequent urban and suburban expansion, can negatively impact the forest's resources.	Population Levels **(S)** Census data **(F)** Every 3-5 years **(Sc)** Berkeley and Charleston counties **(IQ)** Accuracy - unknown based on sampling techniques **(A)** Significant increase in population	Housing Developments **(S)** County data **(F)** Every 3-5 years **(Sc)** Berkeley and Charleston Counties (IQ) Accuracy – unknown based on court house records **(A)** Significant increase in proposed or built housing developments; housing developments shifting towards the forest	Visitor use **(S)** Visitation data from NVUM Report **(F)** 5 years **(Sc)** Forest **(IQ)** Accuracy and reliability – unknown based on sampling techniques **(A)** Significant increase in visitation	Improve buffers on edge of forest; if appropriate, control visitor access to sensitive parts of the forest (i.e. trail development in the Wando area)

Table 2.8.3 System driver – Drought and Precipitation Changes

Focal Resource	Stressor	Broad Scale Measures; Indicators	Management Unit Measures; Indicators	Current Forest Monitoring	Possibilities for Change
Pine Forests	Radial growth in longleaf pine has been found to respond to either February precipitation or spring and summer precipitation (Bhuta et al., 2009). Longleaf pine (*Pinus palustris*) has greater drought tolerance than loblolly pine (*Pinus taeda*) and slash pine (*Pinus elliotii*), particularly on well-drained, sandy soils (Samuelson et al., 2012). The potential of drought to lead to more frequent or intense fires also favors longleaf over loblolly (Bhuta et al., 2009). Low soil moisture due to decreased precipitation is likely to be the most important factor limiting growth of loblolly pine, even if it responds favorably to increases in temperature and CO2. However, increases in precipitation could improve growing conditions (Wertin et al., 2012a).	Precipitation **(S)** NOAA **(F)** Every 3-5 years (monthly data) **(IQ)** Accuracy – accurate within a scientifically appropriate degree of imprecision or error; reliability – real-time; relevance – near the forest **(Sc)** Sullivan's Island, SC, and/or Charleston International (nearest current temperature data) **(A)** Precipitation below **XX** mm per month Drought **(S)** NIDIS – Current and historical drought data **(F)** Annual **(IQ)** Current data: Accuracy – some data is provisional and could be inaccurate; reliability – updated daily to weekly; relevance – county level data Historical data: Accuracy –some data is provisional and could be inaccurate; reliability – no more than a 2-month consecutive gap in 40+ years of data; relevance – several stations near the forest **(Sc)** Berkeley and Charleston Counties **(A)** Significant increase in frequency and/or severity of droughts	Precipitation **(S)** Santee Experimental Forest (SEF) **(F)** Every 3-5 years (monthly data) **(IQ)** Accuracy - observed and well documented; reliability – well documented including periods of missing data; relevance – on the forest **(Sc)** Forest **(A)** Precipitation below **XX** mm per month Water Table **(S)** SEF **(F)** Every 3-5 years (monthly data) **(IQ)** Accuracy - observed and well documented; reliability – well documented including periods of missing data; relevance – on the forest **(Sc)** Forest **(A)** Soil moisture below **XX** on pine forest sites	Acreage of forest type/tree species **(S)** GIS database **(F)** Annual **(IQ)** Currently unknown - based on accuracy and reliability of GIS database **(Sc)** Forest **(A)** Decline in longleaf pine Forest and range health **(S)** Location and population trends of pests and diseases **(F)** Annual **(IQ)** Currently unknown-based on accuracy and reliability of forest monitoring **(Sc)** Forest **(A)** Increases in forest pests and diseases	Shift towards longleaf over loblolly, particularly following a drought disturbance event.

Citations for Information Quality

Carolinas Integrated Sciences and Assessments (CISA) Dynamic Drought Index Tool
http://www.cisa.sc.edu/DDIT.html

EDDMaps
http://www.eddmaps.org/about/appropriate_data.html

Forest Inventory Analysis (FIA)
http://www.fia.fs.fed.us/library/database-documentation/current/ver6.0/FIADB_user%20guide_6-0_p2_5-6-2014.pdf

National Visitor Use Monitoring
http://www.fs.fed.us/nrm/nvum/results/WebHelp/#Single_Forest_Tab.htm

National Integrated Drought Information System (NIDIS) Current Data
http://www.drought.gov/drought/content/site-disclaimers

National Integrated Drought Information System (NIDIS) Historical Data
http://droughtatlas.unl.edu/Methodology/StationCriteria.aspx

National Oceanic and Atmospheric Administration (NOAA)
http://www.cio.noaa.gov/services_programs/info_quality.html

North American Breeding Bird Survey
https://www.pwrc.usgs.gov/bbs/RawData/FTPdisclaim.cfm

SC Department of Natural Resources Northern Bobwhite
http://www.dnr.sc.gov/cwcs/pdf/Northernbobwhite.pdf

Santee Experimental Forest Climate Data
http://cybergis.uncc.edu/santee/TurkeyCr_halfhourly_data_2005_2011.html#Data_Quality_Information

United States Geological Survey (USGS) Water Alerts
http://water.usgs.gov/wateralert/provisional.html