DuPont State Forest
Land and Resource Management Plan

June, 2011

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This Land and Resource Management Plan (LRMP) for DuPont State Forest describes our framework for guiding on-the-ground projects and activities. We encourage your comments on all aspects of the plan.

E-mail comments to: **brian.schneider@ncdenr.gov**
Subject: **DuPont State Forest LRMP**

If email is not available, written comments can be submitted to the primary plan contact listed above.

Plan Development

This plan was developed through the combined effort of personnel within the North Carolina Division of Forest Resources, with direction and recommendations provided by the DuPont State Forest Interagency Planning Team as appointed by the Secretary of the North Carolina Department of Environment and Natural Resources. The intent of this plan is to provide the ecological context within which management will be conducted on DuPont State Forest, to describe the desired future condition of natural resources throughout the forest toward which management will be directed, and to outline appropriate management techniques to work towards those conditions.

The goals and objectives presented in this plan were developed to support other statewide initiatives regarding natural resource conservation and education. Specific strategic documents utilized during the creation of this plan include North Carolina's Forest Resources Assessment (2010), The North Carolina Wildlife Action Plan (2005), The Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (1999), The North Carolina Environmental Education Plan (2009), and The North Carolina Forestry Best Management Practices Manual Related to Water Quality (2006).

Plan Organization

Chapter 1 includes the mission statement for DuPont State Forest, lists the property-level management objectives, and broadly describes the management themes that guide the planning process.

Chapter 2 provides a description of the current condition of the ecological and social resources of DuPont State Forest as they relate to the management themes. Detailed descriptions of the natural community types represented on DuPont State Forest are also provided in this chapter. Specific goals and desired future conditions are included with the descriptions of each forest resource. The goals and desired conditions provided describe how the forest is expected to look and function in the future when management has been successfully implemented.

Chapter 3 outlines resource-specific objectives meant to accomplish the goals and achieve the desired future conditions provided in Chapter 2. The objectives are time-specific tasks scheduled over a 15 year planning horizon.

Chapter 4 establishes standards and guidelines to ensure that the resources of DuPont State Forest are protected while objectives are met in an efficient, scientifically-sound manner.

Chapter 5 identifies and describes areas requiring special management consideration on DuPont State Forest. Included in this chapter is information regarding the management of ecologically significant examples of natural communities, threatened and endangered species, and areas of high historical and cultural value. The special-use permitting process, the process for future land acquisition, and considerations for place-based economic development are also included in this chapter.

Chapter 6 describes the monitoring process that will be utilized to assess the efficacy of management in terms of resource protection and progress towards the desired conditions of the forest. A summary statement is also included in Chapter 6.

Appendix A: DuPont State Forest Land Management Plan Strategic Document Crosswalk

Appendix B: Historical Overview and Administrative Structure of DuPont State Forest

Appendix C: DuPont State Forest Maps

- C1: Map of Natural Communities
- C2: Map of the DuPont Dedicated Nature Preserve Areas
- C3: Map of Soil Types
- C4: Map of Water Resources and Topography
- C5: Map of Recreational Trails and Roads

Appendix D: Soil Types of DuPont State Forest

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Chapter 1: Introduction

Mission Statement

DuPont State Forest will provide an exemplary model of scientifically sound, ecologically-based natural resource management for the social and economic benefit of its diverse community of users.

Property Level Management Objectives

- Enhance and maintain the ecological value and natural resilience of the forest while deriving desired resources, including recreation opportunities, healthy wildlife populations, forest products, and ecosystem services.

- Evaluate the efficacy of management by how it contributes to landscape-scale biodiversity, wildlife habitat connectivity, and watershed health.

- Fulfill the terms of the grant agreement with the North Carolina Division of Forest Resources and the North Carolina Natural Heritage Program regarding the maintenance of the "DuPont Dedicated Nature Preserve".

- Demonstrate the use of a variety of management techniques for the purpose of public education.

- Provide hunting and fishing opportunities through the North Carolina Wildlife Resources Commission Game Land program.

- Support the portions of the local economy dependent on a stable forest products industry, as well as the multitude of enterprises dependent on providing local services to forest visitors.

- Maintain the forest infrastructure of roads and trails to allow access for management activities, recreation, fire control, emergency response, and handicap access.

- Make available research opportunities to the scientific and education communities.

- Accommodate training exercises for military personnel, state agencies, educational institutions, law enforcement groups, non-profits and other entities as feasible.

Management Themes

The North Carolina Division of Forest Resources (NCDFR) has developed four broad themes for the management plan of DuPont State Forest (DSF) meant to address both our mission and varied objectives.

1. Maintaining and supporting the development of natural communities

"A natural community is an interacting assemblage of organisms, their physical environment, and the natural process that affect them." (Thompson and Sorenson, 2000)

The management of DSF will be based on the concept of natural communities. The Classification of The Natural Communities of North Carolina Third Approximation (CNCNC) has delineated "communities whose characteristics and functioning are shaped by the processes of evolution and ecological interactions of long periods of time, without the overriding influence of modern human activities." (Schafale and Weakley, 1990) What makes the concept of natural communities so useful is that the individual communities, as described within the CNCNC, provide examples of how different assemblages of organisms will develop over time, across environmental gradients, in the absence of human intervention. With this understanding we may gain greater insight as to how our resource use and management affects ecological function and resiliency.

As natural resource managers we are not as concerned with making areas more "natural" as we are with endorsing the development of natural community components that are necessary to maintain long-term ecological integrity. Managing for ecological integrity assumes the "conservation of viable populations of native species, maintenance of natural disturbance regimes, reintroduction of native, extirpated species and the representation of ecosystems across natural ranges of variation." (Grumbine, 1994)

Management will be implemented with the understanding that the natural community attributes considered desirable in many cases will not be possible to establish over the course of one or even several rotations. The aim is to gradually establish these characteristics through long-term management and to conserve these characteristics where they are already present.

2. Conserving soil, water, and fisheries resources

Soil structure and productivity may be heavily influenced by forest management. All management activities will be designed to protect organic and mineral soil components, particularly the organic soil horizon, and allow for natural levels of nutrient cycling.

Water quality is generally high throughout the Little River and its tributaries on DSF and these watercourses support cold water fish communities in areas above Lake Julia, Lake Imaging, and Bridal Veil Falls. Non-point source pollution in the form of sedimentation is the primary threat to water quality on DSF. It is essential that accelerated erosion as a result of forest management activities and recreation use is prevented where possible and controlled where it occurs.

3. **Providing environmentally sound opportunities for recreation and scenic enjoyment**

DSF is a popular multi-use recreation destination with over 130,000 visitors annually. Resource degradation is likely to occur in the absence of strong policies regarding the management of recreation use. Opportunities for recreation that do not compromise the ecological integrity of DSF will be made available. Forest personnel will continuously evaluate the impact of recreation uses that are permissible under the current forest regulations, and reexamine those regulations if negative impacts become apparent from use.

4. **Offering environmental education and outreach programs, opportunities for natural resource and social research, and demonstrations of resource management implementation**

The accessibility of DSF for a variety a visitors makes the forest an excellent platform for the demonstration of different forest management and resource protection techniques. As management practices are implemented, field tours and workshops will be conducted for local landowners, natural resource professionals, students, and other interested forest visitors. Research projects designed to advance our understanding of the ecology of DSF and the social and economic importance of the forest to the local community will be developed over time with our cooperators and utilized to inform our management.

Chapter 2: Resource Conditions and Goals Related to Management Themes

Theme 1 - Maintaining and Supporting the Development of Natural Communities

This theme will address the management of vegetation for the development of specific natural community attributes and wildlife habitat components.

Vegetation - Historical and Potential Conditions

The primary challenge when developing and implementing forest management prescriptions for the purpose of ecosystem restoration is in being able to identify the historical condition of the various ecosystems across thousands of years of disturbance and change. In essence, being able to properly define what is being restored and why.

The North Carolina Geological Survey publication, "Timber Trees and Forests of North Carolina" (Pinchot and Ashe, 1897) provides a primary source regarding the condition of forestland across the state at the turn of the twentieth century. Throughout the mountain region of North Carolina, the authors indicated that the presence of vegetation was most broadly influenced by elevation. For this reason, the forestland within the western mountain region was first classified in their work as "forests of the lower mountains, forests of the higher mountains, and forests of the mountain summits." The majority of DuPont State forest, excluding Stone Mountain and the approaching slopes, would be placed in the lower mountain classification, defined as having an elevation of 1500 and 3000 feet.

The second level of classification, as defined by Pinchot and Ashe, involved the relative presence of the different conifer species, referred to as "resinous" species in the authors' description. Regarding the overall abundance of pine species at the time of the survey, the authors indicate that pines across the lower mountain region, including shortleaf pine, pitch pine, Table mountain pine, scrub (Virginia) pine, and white pine, occurred at varying densities across communities, and never constituted more than one half of the trees present. A distinction is made between established forestland and abandoned fields, the latter often containing a higher percentage of pine than what would be found in more developed forest systems.

The authors indicated that the lower mountain region could be further classified into three broad communities based the relative abundance of the different pine species. The three areas included those where Table mountain pine and pitch pine were the dominant resinous trees, those where shortleaf pine, pitch pine and Virginia pine were the dominant resinous trees, and those where white pine was the dominant resinous tree.

The forestland where Table mountain pine and pitch pine were the primary resinous species were generally confined to low-elevation mountain peaks along the eastern and southern slopes of the

Blue Ridge escarpment and in a similar position on the highest peaks of the foothills and western piedmont. Within these systems shortleaf pine became a forest component as elevation decreased and soil became deeper. Other associated species included scarlet oak, chestnut oak, American chestnut and locally, white pine. Frequent fire and widespread grazing was typical throughout this community. Though no Table mountain pine has been identified on DSF, pitch pine is a common component of our Pine-Oak/Heath natural community.

The forestland where shortleaf pine, pitch pine, and Virginia pine were the primary resinous species included the area of the French Broad River basin in Buncombe County and Madison County, the hills surrounding the Swannanoa River in Buncombe County, and those surrounding the French Broad River in Henderson County, and the lower-lying hills (those below 2800 ft.) in Haywood, Swain, Jackson, Macon, Cherokee, and Graham counties. These areas included white oak, black oak, scarlet oak, chestnut oak, American chestnut, and hickory. The pine species comprised from 10% to 30% of any given stand. The proportion of pine increased in the Asheville basin at lower elevations. The soils supporting these stands were generally loamy, and rarely sandy. This mixed hardwood/shortleaf pine condition was also prevalent throughout the western piedmont and eastern portion of the Blue Ridge escarpment. It was also common for shortleaf pine to form pure stands following agricultural abandonment in the western piedmont and portions of the foothills and escarpment. If shortleaf pine was ever a component of the DSF landscape it likely occurred in mixed composition stands with hardwood species, at elevations ranging from 2200 to 2800 ft., supported by relative deep, loamy soil, throughout the drier portions of the forest.

At the time of Pinchot and Ashe's work, the areas of the Blue Ridge where white pine was the dominant coniferous species were localized and far less extensive than areas where yellow pine species were more common. It is interesting to note that the area that would become DSF was included as an area where white pine was more prevalent than the yellow pine species. Pinchot and Ashe remark that the French Broad River Valley of Transylvania County, to which the watershed of DSF drains into, contained some of the most extensive forests in which white pine was an important component. This forest type was also common in the southern portions of Macon and Jackson counties at elevations between 2800 and 3800 feet.

This type of forestland still existed in Transylvania and Macon counties having not yet been harvested by the 1890's. White pine commonly comprised 10% to 30% of these uncut stands with white oak, black oak, chestnut oak, and American chestnut the most common associates. The bottomland where white pine was present had been largely cut. White pine did occupy abandoned farmland in some instances. Where regular burning occurred white pine was replaced by hardwoods capable of sprouting. White pine was common in browsed pastures as it was less palatable to livestock. Portions of this forest type had a dense understory of mountain laurel with relatively open canopies.

The presence of white pine throughout these counties was likely influenced by a combination of relatively high local precipitation, and the presence of sandy soil derived predominantly from granite. The historical description provided by Pinchot and Ashe aligns well with the work of Simon, et al. and their 2005 work "Ecological Zones in the Southern Appalachians: First Approximation," in which the authors identified ecological units in the Southern Appalachians

based on local geology, soil fertility, moisture regime, and other climatic and topographic variables. “White Pine-Oak Heath” is included as 1 of the 11 ecological zones modeled by the authors. The presence of low fertility soils derived from granitic parent material, in conjunction with high growing-season rainfall differentiates this type from modeled zones with a higher proportion of yellow pine species. These abiotic factors are characteristic of much of the DSF upland forests, as is the presence of plant species utilized as model predictors including white pine, scarlet oak, sourwood, chestnut oak, huckleberry, blueberry, mountain laurel, and blackgum.

It is interesting to compare the forest composition predicted by the ecological zone model with what we have delineated as our natural community types.

The Acidic Cove and Rich Cove areas delineated by the model line up well with what we have delineated as Acidic Cove communities with a strong white pine component, and the small areas of Rich Cove present.

What have been delineated as Acidic Cove communities with a strong yellow poplar component generally correspond to areas delineated as Mesic Oak-Hickory in the ecological model.

Our white pine plantations fall within the modeled boundaries, in order of occurrence, of the White Pine-Oak Heath, Acidic Cove, and Mesic Oak-Hickory zones.

What we have delineated as Montane Oak-Hickory lines up well with the Mesic Oak-Hickory zone in all areas of the forest, excluding the northwest portion. In the northwest portion of the forest, what we have delineated as Montane Oak-Hickory overlaps the White Pine-Oak Heath zone, as well as the Mesic Oak-Hickory zone.

Areas we have delineated as Chestnut Oak Forest generally fall within the boundaries of the Xeric Pine-Oak heath, Oak Heath, and White Pine-Oak Heath zones respectively.

The largest discrepancy between our natural community delineation and the predicted ecological zones, is the lack of predicted areas of Xeric Pine-Oak Heath. What we have classified as Pine-Oak/Heath in areas adjacent to Granitic Dome outcrops should fall within the Xeric Pine-Oak Heath ecological zone. This discrepancy can likely be attributed to the scale at which the ecological zones were predicted, which is too coarse to account for all local variation.

We can utilize ecological modeling in conjunction with historical accounts and current inventory information to establish broad landscape-scale priorities for DSF.

White pine was likely a historical component of the forest communities of DSF, more so than shortleaf pine or Virginia pine, though it is unlikely that this species represented over a third of the stocking in most settings. White pine likely grew in conjunction with hardwoods throughout the forest, and in some localized settings grew in conjunction with pitch pine. The presence of large blocks of forestland in which white pine is the sole canopy species, as is the case in portions of DSF currently, is undesirable for reasons of forest health and ecological resiliency. This situation may be improved upon utilizing a variety of management prescriptions.

Though mountain laurel was an understory component of the forest historically it likely was not present to the extent that it currently is on DSF. The presence of anthropogenic fire and the grazing of livestock precluded the development of dense understory vegetation in dry upland hardwood communities, and Pine-Oak/Heath communities. Where frequent, uncontrolled fire events throughout the forest may be deleterious, the judicious use of prescribed fire may allow us to increase understory species diversity, increase the opportunity to naturally regenerate desirable species, and increase the amount of browse for a variety of wildlife species.

Past land-use has resulted in the development of a homogenous age structure across DSF. This mid-successional condition results in little in-stand vertical structure and leaves the forest susceptible to widespread decline, particularly in areas with a high proportion of scarlet oak, upon maturity. A systematic effort to develop a more balanced mix of early, mid, and late successional forestland throughout DSF may alleviate these conditions.

Vegetation - Existing Conditions

DSF is comprised of several diverse species assemblages within the Blue Ridge Province of the Southern Appalachian mountain region. As a part of the Southern Appalachians, the vegetation of DSF has been influenced by a long history of ecological change as well as natural and human disturbance.

Several natural community types, as described by Schafale and Weakley are represented throughout DSF. The primary natural community type represented is Montane Oak-Hickory Forest. A portion of the Montane Oak-Hickory Forest on DSF is considered a rare dry variant by the North Carolina Natural Heritage Program.

The Acidic Cove Forest community is also common. Much of these cove areas have a high proportion of white pine in the overstory. White pine is common in portions of DSF as it was the primary species planted during the tenure of the DuPont Corporation on pasture land and clearcut areas. Several other less common upland and riparian communities are present throughout DSF including Chestnut Oak Forest, Low Elevation Granitic Dome, Pine-Oak/Heath, Rich Cove Forest, Swamp Forest Bog Complex, Southern Appalachian Bog, and Spray Cliff.

Former pasture areas planted by the DuPont Corporation with white pine following intensive site preparation currently exhibit little overstory species diversity and a uniform age structure. Other areas, particularly throughout the Montane Oak-Hickory Forest and Acidic Cove Forest communities, were heavily cut and regenerated with planted white pine following various levels of site preparation. The areas harvested and then planted are somewhat more diverse in species composition than the planted pasture land, but still maintain relatively uniform age structures and more closely resemble traditional white pine plantations rather than any particular natural community as defined by Schafale and Weakley.

Throughout many communities, particularly areas of Montane Oak-Hickory Forest, Acidic Cove Forest, and Pine-Oak Heath, mountain laurel is the most common understory component. This condition, which has resulted in the exclusion of many other midstory and understory species,

may be a result of fire exclusion since the early to mid 1900's, as well as the loss of American chestnut, which dominated many mid-elevation upland communities in the Southern Appalachians prior to the onset of the Chestnut Blight.

The historic return interval of fire throughout natural communities on DSF is difficult to pinpoint given the cumulative effects of how fire was utilized by pre-European inhabitants, European settlers, and the generations that followed. The presence of periodic fire, in conjunction with the loss of American chestnut, was likely an important reason for the development of oak and hickory species as dominant overstory components. Periodic fire has also played a role in the perpetuation of xeric pitch pine dominated communities, which are present on DSF (Wear and Greis, 2002)

The maintenance and restoration of fire adapted species and fire dependent ecosystems is included as a goal within North Carolina's Forest Resources Assessment (NCFRA), 2010 and is also addressed in the North Carolina Wildlife Action Plan (NCWAP), 2005. Of particular concern is the replacement of fire adapted species including pitch pine, shortleaf pine, and various oak species, with more mesophytic species with less wildlife habitat value including yellow poplar, and white pine. The mixed shortleaf pine-hardwood forest is identified as a declining forest type in need of re-establishment throughout its range. Pitch pine, and the Pine-Oak/Heath community with which it is commonly associated, is represented in areas throughout the forest, though shortleaf pine is not represented.

Natural Communities of DuPont State Forest

These natural communities are influenced and perpetuated by disturbance regimes that function at a variety of spatial and temporal scales. Humans have been an integral part of the disturbance regime of the Southern Appalachian forest for thousands of years. The individual communities and the natural disturbance regime associated with maintaining each community are described in this section. The communities are listed based on their relative abundance throughout DSF. The descriptions are based on three primary sources of information: The North Carolina Natural Heritage Program's Classification of the Natural Communities of North Carolina, Third Approximation, 1990, developed by Michael Schafale and Alan Weakley, inventory data for DSF compiled by Natural Heritage Program (NHP) botanist Michael Schafale from 1995-2001, and forest inventory data compiled by NCDFR staff from 1998 to 2010

Montane Oak-Hickory Forest: (Approx. 5715 ac.)

This is the most abundant natural community throughout DSF. Present along mesic and dry-mesic slopes and exposed ridgetops at moderate to relatively high elevations, the overstory of this community is dominated by scarlet oak and white oak. Chestnut oak, black oak, sourwood, and pignut hickory are also common associates. Red maple, yellow poplar, black locust and black gum are common in the overstory but are generally scattered and less abundant. Mountain laurel is a common understory component as are blueberry and huckleberry species. American chestnut sprouts are widespread indicating the presence of this species as an overstory component prior to the onset of the chestnut blight. Herbaceous species common to dry, acidic sites, including bracken fern and galax are present throughout the understory.

Natural disturbance throughout the community commonly results in the creation of canopy gaps of varying sizes and an un-even age forest structure. Local wind events and ice storms are the most common forms of natural disturbance.

On DSF these areas generally occur in even-age units. The origin of most stands can be traced back to clearcut harvest areas that were allowed to regenerate without planting from the 1930's to the 1970's. The majority of these stands are 50 to 70 years old. Large canopy gaps of sizes sufficient to initiate the establishment of new tree cohorts are not widely present as a result of this age structure. Incidents of Oak Decline, though not severe, are visible throughout these areas. Given the age structure, species composition, and general vigor of the dominant trees throughout this community, the number of trees affected by Oak Decline will likely increase over this management period and into the future. Fire has been excluded throughout the development of these stands resulting in heavy shrub layers and a reduced level of competitive oak and hickory regeneration.

Acidic Cove Forest: (Approx. 3056 ac.)

The Acidic Cove Forest natural community is scattered throughout DSF and is present along mesic slopes, cove areas, and throughout both broad and narrow drainages. The overstory of this community is dominated by white pine and yellow poplar with red maple, white oak, scarlet oak, black oak, sourwood and pignut hickory present as common associates. Eastern hemlock and Carolina hemlock are common adjacent to riparian areas. Northern red oak, black locust, black gum, and Fraser magnolia are present in the overstory but are generally scattered and less abundant. Rhododendron is a common understory component as are mountain laurel, doghobble, witch hazel, greenbrier, and eastern hemlock. Carolina hemlock and American beech are also present in the understory to a limited extent. Several fern species are present in the understory including New York fern and lady fern. Other herbaceous species present include pink lady-slipper and galax.

Natural disturbance throughout the community commonly results in the creation of canopy gaps of varying sizes and an un-even age forest structure. Given that these communities occur in sheltered, low slope positions, disturbances are typically limited to small group windthrow events. Though ice damage may occur, these events are not as common compared to the more exposed communities.

The majority of these areas contain dominant trees in the 40 to 60 year old age class as a result of past harvesting. Some scattered individuals left during previous harvesting activities, mostly relatively poorly-formed hardwoods of low vigor and hemlock, are in excess of 100 years old. Large canopy gaps of sizes sufficient to initiate the establishment of new tree cohorts are not widely present as a result of this age structure.

White Pine Plantation: (Approx. 797 ac.)

White pine plantations were established throughout areas of pasture during the tenure of the DuPont Corporation. Areas that were clearcut and planted with white pine during the DuPont ownership are also included under this description. Understory vegetation is variable, and tends to be sparse in stands that were never thinned. Scarlet oak, white oak, black oak, and white pine regeneration is common in those stands that were thinned.

The uniform species composition of these stands causes an increased risk of damage occurring as a result of insect and disease outbreaks. Annosum root disease, which has been identified in some pine stands on DSF, is more common throughout plantations with closely spaced trees. The risk of infection is exacerbated by repetitive thinnings because the fungus occupies freshly cut stumps. Physical damage to residual trees incurred during harvesting may also result in infection. Infections may eventually cause tree mortality independent of any other factors, but the risk of mortality due to windthrow is increased as root systems are weakened. Pure pine stands are also at a greater risk to incur extensive damage during southern pine beetle outbreaks, particularly if trees are less vigorous due to the impact of other disturbance agents.

The majority of these stands were established 30 to 50 years ago and they occur in even-age units. Some small canopy gaps have developed in the more mature stands due to windthrow and lightning strikes. Extensive ice damage is also prevalent in portions of these stands. The canopies of younger, unthinned stands tend to be very dense.

Chestnut Oak Forest: (Approx. 166 ac.)

The Chestnut Oak Forest natural community is not abundant throughout DSF and is relegated to dry-mesic positions along and adjacent to ridgetops. Examples are present on Stone Mountain and Long Rock. The overstory of this community is dominated by chestnut oak and scarlet oak. White oak, pignut hickory and red maple are also common associates. Pitch pine, blackgum, and sourwood are present to a limited extent in the overstory. Sassafras, eastern hemlock, and Carolina hemlock are present throughout the midstory. Mountain laurel occurring in dense patches is a common understory component as are huckleberry species. American chestnut sprouts are widespread indicating the presence of this species as an overstory component prior to the onset of the chestnut blight in this community. Herbaceous species common to dry, acidic sites, including bracken fern and galax, are present throughout the understory.

The natural disturbance regime throughout this community is similar to that of the Montane Oak-Hickory community. The exposed positions of these communities leave them highly susceptible to ice storm and wind damage. Natural disturbances such as these have the potential to cause extensive damage. Past disturbance, including the chestnut blight, has left portions of these communities with open canopies and very dense understories of ericaceous species, particularly mountain laurel.

The age distribution of dominant trees in these areas tends to be similar to that of the Montane Oak-Hickory community with most trees ranging in age from 40 to 60 years old. Some scattered residual trees, particularly pitch pines that were either not removed during previous harvesting, or not eliminated by natural disturbance are also present. These individuals occasionally exceed 90 years old in age. Portions of this community on DSF were heavily impacted by ice-storms occurring in 2009-2010 which resulted in extensive crown damage, and an increase in open canopy conditions.

Low Elevation Granitic Dome and Pine-Oak/Heath: (Approx. 101 ac.)

Characterized by smooth expanses of exposed granite, the distribution of vegetation in the Low Elevation Granitic Dome community is controlled by the amount of available soil and organic

matter. In the limited areas where soil is present, it is typically very shallow due to a lack of crevices in the exposed rock. These low elevation domes are primarily xeric due to rapid drainage and lack of soil. Small depressions in the rock retain moisture for a limited amount of time. Vegetation consists of moss species, grasses, and sedges throughout the exposed rock areas. Along the periphery of the rock, vegetation resembles that which is characteristic of adjacent Pine-Oak/Heath, and Montane Oak-Hickory forest communities. Tree species include pitch pine, scarlet oak, and chestnut oak. The understory is typically occupied by huckleberry and mountain laurel. Grass and sedge species are more prevalent throughout the exposed rock areas.

Windthrow is the most common disturbance throughout the community as a result of the shallow soil and exposed topographic position. As trees age and become larger the threat of windthrow increases.

The age structure of dominant overstory vegetation, where it exists in this community, is similar to adjacent areas. These trees, including pitch pine and associated hardwood trees, generally fall within the 40 to 60 year old age class. Older trees are uncommon as there is little soil to support their development, though individuals in excess of 100 years old have been identified.

Examples of the Pine Oak-Heath community occur adjacent to some Low Elevation Granitic Dome areas. These areas are distinguished from the Montane Oak-Hickory Forest community and the Chestnut Oak Forest community by the overstory dominance of pitch pine in conjunction with dense understories of mountain laurel and huckleberry species. These areas are typically xeric due to shallow soil, rapid drainage, and predominantly south aspects.

Periodic fire is believed to be the primary disturbance required to perpetuate this community. The slope position, dryness, and vegetative characteristics of these areas result in higher intensity midstory burns that perpetuate pine in the overstory. It is also likely that American chestnut was a previous overstory component. The removal of that species may have contributed to open canopy areas with heavier shrub layers.

The age distribution of dominant trees in these areas tends to be similar to that of the Montane Oak-Hickory community with most trees ranging in age from 40 to 60 years old. Some scattered residual trees, particularly pitch pines that were either not removed during previous harvesting, or not eliminated by natural disturbance are also present.

Rich Cove Forest: (Approx. 28 ac.)

The Rich Cove Forest natural community type is rare throughout DSF as a result of the sandy and acidic soil present. Like the Acidic Cove Forest community, Rich Cove Forest areas are present along mesic slopes, in cove areas, as well as throughout both broad and narrow drainage areas. Species present throughout the overstory and midstory of this community include yellow poplar, sweet birch, red maple, American beech, Fraser magnolia, basswood, and bitternut hickory. Rich Cove communities are characterized by a diverse mix of herbaceous species. Understory plants present in these areas, as identified in the botanical surveys referenced previously, include black cohosh, southern lady fern, baneberry, wood nettle, and bloodroot.

The natural disturbance regime, and age-class distribution of these areas is similar to that which is described previously for the Acidic Cove Forest Areas.

Swamp Forest-Bog Complex and Southern Appalachian Bog [+]

These two natural communities often occur in conjunction with each other and generally share vegetative characteristics. Small boggy openings are present throughout Swamp Forest-Bog Complex communities. To be considered a Southern Appalachian Bog, the bog area typically encompasses 1 acre or more. One significant Appalachian Bog was discovered by North Carolina Natural Heritage Program botanists along Dry Branch. The area is characterized by an open canopy of yellow poplar and red maple, over a dense bed of sphagnum moss, and various sedges. Hazel alder is the primary shrub present.

The bog is surrounded by a Swamp Forest-Bog Complex community that consists of denser vegetation with some smaller bog openings. Other examples of this community occur along the Little River. The overstory of these areas is dominated by yellow poplar, red maple, and white pine. The shrub layer is dense and consists of rhododendron, doghobble and hazel alder. The understory includes clubmoss, and New York fern. In the small boggy openings that are present, vegetation is similar to that found in the Southern Appalachian Bog community.

The natural disturbance regimes of these areas, as well as the cause for their origination are not well understood. Soil deposition and hydrological changes may have occurred as a result of past agriculture, grazing, or logging practices. Hydrologic change may also be attributed to beaver activity or tree windthrow. In the absence of the historical disturbances that may have contributed to bog development (i.e. beaver activity, fire, grazing by large mammals) bog areas have a tendency to develop the characteristics of surrounding communities with an increase in canopy cover and denser shrub vegetation. This successional trend away from open herbaceous conditions to forest may be accelerated by other human and natural disturbance.

Spray Cliff [+]

The most notable spray cliff communities as documented by NHP inventories occur in the areas of Triple Falls and High Falls along the Little River. These areas consist of bare rock with small pockets of organic matter and mineral soil. Spray cliff communities are constantly saturated with water from adjacent waterfalls resulting in high humidity and high moisture availability. Vegetation consists of mosses, liverworts, other herbaceous species, and some shrubs. Yellowroot, rock fir-clubmoss, and rhododendron have all been identified in the DSF Spray Cliff community areas.

The location of these communities provides protection against extreme temperature fluctuations, but severe drought or freezing conditions can result in the loss of sensitive species. Flooding and rock slides may also result in the injury of vegetation, though these areas are generally sheltered from major disturbances.

[+] ***Collectively riparian and wetland communities occupy approx. 327 ac.***

Vegetation- Goals and Desired Conditions

VEG-1: The forest will be maintained in a healthy condition against widespread insect and disease occurrence.

VEG-2: Forest-wide structural diversity will be enhanced through the establishment of canopy gaps and the perpetuation of a variety of successional stages.

VEG-3: The spread and establishment of non-native invasive plant species will be controlled through systematic inventory, treatment, and monitoring processes.

VEG-4: White pine plantations will be managed for the purposes of increasing species and structural diversity so that they may more closely resemble the natural community type appropriate for the site.

VEG-5: Prescribed fire will be utilized to manage fire dependent vegetation including pitch pine and shortleaf pine and the natural community types in which they are found or introduced.

VEG-6: Oak and hickory regeneration will be gradually established in the understory of target communities to ensure the long-term retention of these species.

VEG-7: Where appropriate, shortleaf pine will be re-introduced as a forest component. This species holds significant ecological importance to the region and has been reduced in abundance due to past land-use. All other threatened plant species as identified will be protected.

Wildlife - Existing Conditions

Overall, management of DSF will focus on the perpetuation of healthy natural communities including a natural distribution of fauna, while avoiding the manipulation of vegetation for the sole benefit of a single species. The suitability of an area for a given species of wildlife is a function of the presence of essential resources. These resources include food, water, cover, and space. Forestland is inherently dynamic and disturbances over time cause changes in vegetation composition, structure, and distribution. This process of change, referred to as succession, is what provides a variety of habitat components varying in spatial arrangement, size and development stage. The presence and distribution of habitat components can be positively influenced by forest management activities.

Enhancing and increasing fish and wildlife habitat on North Carolina's forests is included as a goal in the NCFRA. Several recommendations provided in the assessment are applicable to DSF, including the replication of natural disturbance during harvesting operations, and the lengthening of harvest rotations for the development of late successional attributes.

The North Carolina Wildlife Action Plan (NCWAP) includes several forest types that are represented on DSF as conservation priorities that may be enhanced or protected through

management activities. Conservation priorities include early successional habitat, mountain bogs and wetlands, riparian zones, and fire adapted ecosystems.

The Partners in Flight (PIF) Bird Conservation Plan for The Southern Blue Ridge region identifies several habitat types that are represented on DSF as important for the conservation of priority songbird species. The PIF plan outlines not only important vegetative characteristics but also describes the age structures most desirable to achieve conservation goals. Specific region-wide recommendations made within the PIF plan that the management of DSF can contribute to include protecting and restoring Table Mountain pine/pitch pine forests, increasing the amount of late successional hemlock-white pine forest, cove hardwood forest, and southern yellow pine forest, improving the structural complexity of presently closed canopy, mid-successional stands in all forest types, protecting and restoring mountain wetlands and bald communities, increasing the amount of early successional habitat in Appalachian oak, and southern yellow pine forests, and improving the condition and increasing the amount of lowland riparian buffers.

Excluding the most inaccessible portions of forestland on DSF, much of the property across all natural communities could be classified as mid-successional with very little in-stand structure. With the exception of Low Elevation Granitic Domes and forest wetland communities little early successional habitat is naturally perpetuated. The PIF plan makes specific mention of Table Mountain pine/pitch pine associations as restoration and conservation priorities. The Pine-Oak/Heath natural community present on DSF encompasses this association though no Table Mountain pine has been identified through inventory.

The management of wildlife throughout DSF occurs through a partnership between NCDFR and The North Carolina Wildlife Resources Commission (NCWRC). DSF is enrolled in the NCWRC Game Land Program, and a fisheries management plan was prepared for DSF by the NCWRC in 2003. The inclusion of DSF in the NCWRC's Game Land Program ensures that there will always be stakeholder interest in the perpetuation of quality habitat for charismatic game species including white-tailed deer, turkey, grouse, and although there is currently no hunting season for it, black bear. Currently the NCWRC in cooperation with DSF staff maintain 15 wildlife food plots of varying size and composition across the property. Hunting by permit is allowed though trapping is not under the current regulations.

Wildlife - Goals and Desired Conditions

WLD-1: A variety of successional stages across all natural communities will exist throughout DSF, the extent and proximity of which will adequately support a diverse assemblage of vertebrates, non-vertebrates, game and non-game species appropriate for the southern Blue Ridge province.

WLD-2: Habitat for all federally listed threatened or endangered species, as well as federally listed species of concern that have been indentified on DSF will be protected and perpetuated throughout the natural communities in which they are currently present.

WLD-3: An abundance of hard and soft mast will be available, and those species that produce mast will be perpetuated across DSF.

WLD-4: The amount of in-stand vertical structure will be increased to provide higher quality habitat as outlined in the PIF conservation plan and the NCWAP.

WLD-5: Habitat components that are currently lacking throughout DSF, including those associated with both early and late successional forestland will be present and supported through management.

WLD-6: Open areas and designated wildlife food plots will be managed against the presence of invasive species, and be maintained with a mix of non-invasive annual plants, forage species and native perennial grass, shrub, and tree species.

Theme 2 - Conserving Soil, Water, and Fisheries Resources

This theme describes the current conditions of soil and aquatic resources throughout DSF, and outlines desired future conditions related to soil conservation, water quality and fisheries.

Soil, Water, and Fisheries - Existing Conditions

Soil

The local geology and terrain characteristics of DSF make it a unique portion of the southern Blue Ridge province. Igneous bedrock, predominantly granite and gneiss, is the primary parent material throughout the forest, and the weathering of that parent material has resulted in upland soil that is generally sandy loam in composition and acidic. Granite rock outcrops are present throughout the most exposed portions of the property, particularly in the vicinities of Big Rock, Cedar Rock, Long Rock, and Stone Mountain. Stony loam soils are common in the steeper portions of upland areas of the forest. Fine sandy loam, silt loam, and loam soils are present throughout areas adjacent to streams and in floodplains.

The major soil types present on DSF and their associated characteristics can be viewed in Appendix D. A map of all soil types is included in Appendix C. Ashe-Edneyville complex soil and Ashe stony sandy loam soil are the primary upland soils throughout the majority of the property. A significant portion of land south of Lake Julia contains Evard soil and Evard-Coweee complex soil. Rosman fine sandy loam is an abundant floodplain soil throughout the Little River corridor. Site index information is provided for each soil type in Appendix D utilizing white pine, white oak, and yellow poplar as index species. In the instances where site index information was not available for a given species an x is used. Site index information is provided solely for the purposes of comparing the relative productivity of soil across the landscape.

Topography and Climate

The topography through DSF is highly variable as is to be expected for an extensive property in the Southern Appalachians. The majority of the forest occurs on broad rolling land, although some narrow ridges, exposed mountain peaks, steep slopes and gorges, bottomlands, and wetlands are also present. Expanses of exposed granite are present throughout the higher elevations of the forest. These granitic domes are ecologically unique and contain very distinctive species assemblages. DSF ranges in elevation from 2240 feet at Cascade Lake to 3620 at the peak of Stone Mountain.

The local wind profile and topography of the area including and directly surrounding DSF results in a greater amount of annual precipitation than in other areas of the Southern Appalachians. National Weather service data for the 30-year period of 1961 to 1990 indicates that the DSF area on average receives 60-70 inches of precipitation a year. Areas directly southwest of DSF in portions of Transylvania, Jackson, and Macon counties receive an average of 70-80 inches of precipitation a year. This is in contrast to the Asheville basin which receives an average of 40 inches of precipitation a year, with the majority of the surrounding area receiving 50 inches a year. Freezing rain events and ice storms are more common in winter than heavy snow events.

Though rare, hurricane events have occurred with significant impact on vegetation. Frontal passages in the winter and spring, and summertime thunderstorms are also common disturbances.

Water and Fisheries

DSF is located in the French Broad River Basin and contains approximately 38 miles of streams including the Little River. The North Carolina Division of Water Quality (NCDWQ) includes the area of DSF in the French Broad River Subbasin 04-03-01, which includes the headwaters of the French Broad River and the Little River.

The Little River is classified as a major tributary to the middle main-stem of the French Broad River within the NCWAP and is a priority watershed for freshwater conservation within the French Broad River Basin.

Habitat degradation from non-point source pollution including sedimentation and nutrient enrichment due to urbanization, development, road construction, and agriculture is considered the most widespread problem throughout the basin. A short portion of the Little River between Cascade Lake and Crab Creek is considered high quality habitat for priority mussel species as identified in the NCWAP. Though this portion of the river is outside the forest boundary, activities throughout DSF will have an impact on the quality of water in the area.

Studies conducted by NCDWQ indicate that the underlying geology of the DSF area results in a sandy stream substrate more typical of a Coastal Plain watercourse, but that the amount of sand and silt present in the Little River exceeds even what would be expected for a stream with a similar natural substrate. The presence of excess sediment in streams above Cascade Lake is a result of land-use prior to the ownership tenure of NCDFR, as well as a result of residential development and the presence of gravel roads within the watershed. Downstream, below Cascade Lake, the Little River is impacted more heavily by agricultural practices. In 2007, a restoration project was completed by NCDFR along the Little River above and below Hooker Falls to re-establish and stabilize a severely eroded section of riverbank and to improve public access.

There are twelve named streams that are present in DSF that are tributaries of the Little River. These watercourses are listed in Table 1 with their use classification, basin index number, and approximate length. In addition to those listed, short segments of Cannon Creek, Cox Branch and Dismal Creek are present on the forest. As described in the NCWRC fisheries management plan for DSF, lengthwise just over 10 percent of streams on DSF contain warmwater fish communities, approximately 40 percent contain no fish species, and the remaining streams contain coldwater communities characterized by brook trout, brown trout, and rainbow trout. Brook and rainbow trout are the most prevalent cold water fish. The Little River from the Dense Lake outflow to Hooker Falls is stocked with trout in the months of October, November, March, April and May as a component of the NCWRC delayed harvest program. Fishing is permitted in forest lakes and streams for licensed individuals.

Table 1: Streams of DuPont State Forest

Stream	Current Classification[1]	Basin Index Number	Approx. Length (ft.)
Briery Fork Creek	WS-V; Tr	6-38-14-5	6,240
Buckhorn Creek	C; Tr	6-38-9	4,640
Dry Branch	C; Tr	6-38-15-5	4,780
Grassy Creek	C; Tr	6-38-15-(2)	16,120
Hooker Creek	C; Tr	6-38-16	7,390
Jim Branch	C; Tr	6-38-16-1	2,820
Jim Creek	C; Tr	6-38-15-3	11,110
Little Briery Creek	WS-V; Tr	6-38-14-5-1	6,270
Little River	C; Tr	6-38-(1)	37,210
Reasonover Creek (above Lake Julia	WS-V; Tr	6-38-14-(4)	1,490
Reasonover Creek (below Lake Julia)	C; Tr	6-38-14-(5)	4,710
Shoal Creek	C	6-38-23-4	5,060
Tarkiln Branch	C; Tr	6-38-15-4	6,820
Tom Creek	C; Tr	6-38-13	4,080

[1] Waters suitable for aquatic life propagation, fishing, and secondary recreation (C); Waters having conditions to allow for trout propagation and stocked trout survival on a year-round basis (Tr); Waters previously used as a drinking water source (WS V)

In total DSF contains five lakes. In addition to those five present entirely in DSF, the south end of Cascade Lake extends across the forest boundary below Hooker Falls. Most lakes were stocked with trout when the DuPont Company owned the property. The stocked trout have been depleted over the years. Lake Imaging is the only impoundment that continues to be stocked for special fishing events.

Lake Julia, the largest lake in DSF at approximately 99 acres in size, contains largemouth bass, bluegill, redbreast sunfish and bullhead catfish. The sport fish population in the lake is low. As recommended in the fisheries management plan, discarded Christmas trees have been placed in the lake in an effort to enhance fish habitat and NCWRC personnel has worked with DSF staff to cut some shoreline trees into the lake to create additional cover for fish.

Fawn Lake, located in the southern portion of DSF, is approximately 6 acres in size and is a popular swimming location for forest visitors. Largemouth bass is the primary fish species in Fawn Lake. Bluegill fingerlings were stocked in Fawn Lake in 2006 as recommended by NCWRC. The lake has a low nutrient level because it is located near the top of the watershed and the amount of fish habitat is low.

Lake Dense, approximately 5 acres in size, contains both largemouth bass and bluegill, and it is likely the most productive impoundment on DSF. The lake also contains snapping turtles. A trail around the north side of the lake was recently improved and both of the piers have been reconstructed for fishing access.

Lake Imaging is the most accessible lake in the forest and is only 1/4 mile walk from the parking lot. Due to its small size of approximately 1 acre, stocking for special fishing events does not

require a large number of fish. The water temperature remains low enough for trout except during summer drought events.

Lake Alford, less than 1/2 an acre in size, is located at the end of Lake Dense Trail. No fisheries management action has been recommended by NCWRC for this impoundment.

Soil, Water, and Fisheries - Goals and Desired Conditions

SWF-1: The Little River and its tributaries will continue to function properly providing high quality aquatic habitat for both game and non-game organisms.

SWF-2: Riparian areas will contain a natural assemblage of vegetation and coarse woody debris, sufficient to maintain stream hydrologic function and aquatic habitat. Riparian areas will effectively filter sediment from roads and trails and provide important wildlife corridors.

SWF-3: Waterfalls will remain available for public visitation, but public access will not be granted to an extent that adversely affects soil or water quality.

SWF-4: All forest roads and trails will remain stable with adequate water control structures in place to prevent accelerated erosion and stream sedimentation.

SWF-5: Road and trail crossings will be designed and implemented in a manner that prevents sedimentation, and does not alter the hydrologic function of the watercourse. Crossings will permit the passage of fish and other aquatic organisms.

SWF-6: The recommendations outlined in the NCWRC DuPont State Forest Fisheries Management Plan will be implemented as specified.

SWF-7: Restoration of degraded water quality or hydrologic conditions will occur in a manner that limits disturbance to the surrounding vegetative community.

SWF-8: Lake dam structures will remain safe for impounding water at a level sufficient to meet recreational and fisheries management goals.

Theme 3 - Providing Environmentally Sound Opportunities for Recreation and Scenic Enjoyment

This theme will address the current conditions of recreation resources throughout DSF and how ecological integrity will be maintained as opportunities for recreation and scenic enjoyment continue to be provided for a variety of forest users.

Recreation Resources - Existing Conditions

DSF is a popular destination for individuals with a variety of recreation interests, with an estimated annual visitor load in excess of 130,000 people. There are approximately 80 miles of mixed-use roads and trails throughout the forest. Of the 80 miles of road and trail, nearly 35 miles are passable by four-wheel drive vehicle. The remaining 45 miles of trail are 5 feet wide or narrower.

Primary user-groups include hikers, sightseers, mountain bicyclists, equestrians, hunters, and fishermen. A map illustrating all forest roads and trails is included in appendix C5 of this plan. Roads and trails are numbered and assigned a difficultly descriptor (easy, moderate, difficult) based on trail location, conditions, and relative ease of travel.

An environmental assessment (EA) concerning recreation at DSF was developed by Dr. Gary Blank and several graduate students at North Carolina State University in 2006. This document offered several planning alternatives for DSF in recognition of the current ecological, social, and economic impacts of forest visitation, as well as the expected impact due to increased visitation over time. "Alternative 1" as proposed in the EA has generally been the operational procedure for DSF as described below. This procedure has been the most effective way to accommodate forest visitors while not permitting use to the point of resource degradation.

Currently DSF offers access to the forest for limited day-use through six parking areas located along state roads throughout the property. There are also limited parking areas at several forest perimeter trail heads. No motorized vehicles are permitted in the forest interior with the exception of NCDFR personnel, those in possession of a handicapped or special-use permit, forest workers, and volunteers. Occasionally volunteer groups and other special-use permit holders are granted permission to camp overnight. With the exception of these organized groups, neither backcountry, nor roadside camping is permitted. Hunting by permit is permissible and regulated by the NCWRC. Fishing is also permissible with a valid license.

The sustainability of this multiple-use system will rely on the ability of forest managers to conserve ecological and social resources and minimize conflict. Forest visitors are made aware of trail closures and changes through kiosk signage at parking areas where those areas are accessed. Wood barricades with appropriate signage are placed at trail entrances and junctions when closures occur. The DSF link from the NCDFR website (www.dfr.state.nc.us/Contacts/dsf.htm) is updated as needed to apprise visitors of trail

information. This website also includes contact information for DSF personnel, a listing of forest rules, weather information, hunting dates, and a message from the forest supervisor. An independent website maintained by the Friends of DuPont State Forest (FODF) (www.dupontforest.com/fodf.asp) also contains information regarding forest activities. Forest managers are informed of the public's perception of trail conditions through direct interaction with forest visitors, as well as through phone calls and emails from concerned or interested parties.

Recreation Resources - Goals and Desired Conditions

REC-1: A variety of trails will be accessible to forest users. Those trails will be designed and maintained to prevent adverse ecological impacts including accelerated soil erosion, stream sedimentation, destruction of vegetation, and loss of wildlife habitat components.

REC-2: Visitation levels will be managed to ensure the sustainability of ecological, social, and historical resources.

REC-3: User-group conflict will be rare, and potential for conflict will be minimized. Forest use of one interest group will not consistently preclude the use of another.

REC-4: The quality of the user experience will not be reduced by overall visitation levels.

Facility Resources - Existing Conditions

The ownership history of DSF has resulted in the establishment of several different types of facilities and infrastructure improvements. Most facilities are available for public use, and some improvements have been made to forest infrastructure specifically to enhance the visitor experience. Tables 2 and 3 provide an overview of existing structures and selected improvements throughout DSF. An important facility addition is the visitor center that is currently being constructed at the High Falls access area. The center will serve as the primary on-site source of information for forest visitors. A facilities master plan outlining infrastructure conditions and needs, as well as future work and maintenance schedules will be developed at a later date.

Table 2: Recreation Facilities of DuPont State Forest

Type	Primary Use	Recent Improvements	Improvement Needs
Barn	Day-use by visitors and volunteers	None	TBD based on Master Facilities Plan
Guion farm classroom	Meetings and training	Exterior and interior renovation 2000	Needs vinyl siding and double-pane windows
Picnic shelter (Guion farm)	Picnics and gatherings	Constructed 2001	TBD based on Master Facilities Plan
Picnic shelter (High Falls)	Picnics and gatherings	Renovated 2005	TBD based on Master Facilities Plan
Picnic shelter (High Falls)(2)	Picnics and gatherings	None	TBD based on Master Facilities Plan
Picnic shelter (Lake Dense)	Picnics and gatherings	Renovated 2003	TBD based on Master Facilities Plan
Picnic shelter (Lake Imaging)	Picnics and gatherings	Renovated 2008	TBD based on Master Facilities Plan
Picnic shelter (Triple Falls)	Picnics and gatherings	Renovated 2006	TBD based on Master Facilities Plan
Pier (Fawn Lake)	Fishing, swimming	Renovated 2007	TBD based on Master Facilities Plan
Pier (Lake Alford)	Fishing	None	TBD based on Master Facilities Plan
Pier (Lake Dense)	Fishing, swimming	Renovated 2008	TBD based on Master Facilities Plan
Pier (Lake Dense)(2)	Fishing	Renovated 2009	TBD based on Master Facilities Plan
Pier (Lake Imaging)	Fishing	Constructed 2004	TBD based on Master Facilities Plan
Canoe Pier (Lake Julia)	Fishing, swimming, canoeing	Renovated 2007	TBD based on Master Facilities Plan
Pier (Lake Julia)	Fishing, swimming, canoeing	None	TBD based on Master Facilities Plan
Restrooms at High Falls Access	Public use	Constructed 2008	TBD based on Master Facilities Plan
Visitor center	Future site of education and interpretation	Renovations ongoing 2005-present	Completion awaiting capital improvement funding
Viewing platform (Bridal Veil Falls)	Waterfall viewing	Constructed in 2007	TBD based on Master Facilities Plan
Viewing platform (Hooker Falls)	Waterfall viewing	Constructed 2001	TBD based on Master Facilities Plan

Table 3: Non-Recreation Facilities of DuPont State Forest

Type	Use	Recent Improvements	Improvement Needs
Airstrip hanger	Material/tool storage	None	In need of roof repair
Airstrip house	Ranger residence	Renovated back deck 2006; Basement ceiling installed 2009	Needs double-pane windows
Boathouse	DSF Boat storage	None	Needs siding repairs
Camp Summit Cart house	Not useable	None	To be demolished
Cottage house	Ranger residence	Gutters installed 2006	TBD based on Master Facilities Plan
DSF office	Staff office	Gutters installed 2006	TBD based on Master Facilities Plan
Equipment shed (large)	Equipment storage	Renovations ongoing 2004-present	Needs radiant heaters installed
Equipment shed (small)	Equipment storage	Grading for improved access completed 2006	In need of roof repair
Former Camp Summit dining halls (2)	Not useable	None	To be demolished
Guion farm house	Ranger residence	Painted 2009; Insulation installed 2010	TBD based on Master Facilities Plan
Log building	Not in use	Roof completed 2005	TBD based on Master Facilities Plan
Sky Valley house	Ranger residence	Interior renovations completed 2008	TBD based on Master Facilities Plan
Training center	Meetings and training	None	Needs water and septic system installed

Facility Resources - Goals and Desired Conditions

FAC-1: All facilities and associated infrastructure needed to carry out the mission of DuPont State Forest will be maintained and remain functional. All unnecessary facilities will be eliminated.

Scenic Resources - Existing Conditions

Visually DSF appears as an extensive area of unbroken forest with inclusions of exposed rock outcrops, waterfalls, streams, wildlife food plots, and small open fields. Experiencing a feeling of remoteness or wildness may be a reason for exploring DSF for some visitors. There are several unique scenic features located throughout DSF that are attractions.

According to informal access area surveys conducted by DSF staff, over 28,000 visitors per year come specifically to view the waterfalls along the Little River. Beginning with the furthest upstream these waterfalls include Bridal Veil Falls, High Falls, Triple Falls, and Hooker Falls. Three smaller waterfalls are located on Grassy Creek, including Grassy Creek Falls, Wintergreen Falls and Upper Grassy Falls. Viewing platforms are available at Hooker Falls and Bridal Veil Falls. Both provide excellent views and are handicap accessible by permit. Corn Mill Shoals, a section of the Little River with extensive boulders and gravel bars is present upstream of Bridal Veil Falls.

Large granite outcrops associated with the Low Elevation Granitic Dome natural community in the southern and eastern portions of the forest offer expansive views of the DSF property as well as views of the surrounding landscape. Stone Mountain, with an elevation of 3,620 ft., is the highest point in the forest and is therefore of special interest to many visitors.

The connection achieved by visitors with their surrounding environment will be a consideration during the planning of all management activities. Regardless of whether a forest visitor is hiking, biking, or riding a horse, the scenic quality of the property has a direct impact on that visitor's experience.

Scenic Resources - Goals and Desired Conditions

SNC-1: The scenic integrity of DSF will be considered in all management decisions.

SNC-2: The visual impact of management activities on areas within the view-shed of significant points of interest (i.e. waterfalls, heavily used trails) will be considered prior to initiating the treatment.

SNC-3: Access points to areas of special scenic interest will be provided and maintained in a way that minimizes the site impact of frequent visitation.

Theme 4 - Offering environmental education and outreach programs, opportunities for natural resource and social research, and demonstrations of resource management implementation

This theme will address the need for educational outreach as management and research is implemented, and the benefits such programs may afford the local community.

Educational Programs - Existing Conditions

The North Carolina Environmental Education Plan, Third Edition (NCEEP), focuses on several objectives to move towards the broader goal of increasing environmental literacy among the citizens of North Carolina. Educational programming at DSF can contribute directly to advancing the objectives of increasing public participation in environmental awareness and education opportunities, and strengthening North Carolina's ability to provide sustainable and comprehensive environmental education programs.

By coupling ecologically-based management with effective educational outreach, DSF staff has the potential to exhibit the fact that resource use and resource protection are not mutually exclusive goals. A survey developed in 2008 by the interagency planning team for DSF highlighted the existence of several gaps in natural resource education in the region. The survey pointed out the need for educational programs that specifically target landowners unfamiliar with the concept of managing forestland for multiple benefits, and those unfamiliar with the importance of "working lands" to the local economy. Another gap identified by the survey was a lack of educational programs for older students, specifically middle school, high school, and college students.

Currently educational programs are delivered by DSF rangers and foresters through both formal presentations and informal discussions with forest visitors. Some educational programs are conducted in cooperation with educational rangers from the adjacent Holmes Educational State Forest. DSF staff have led or been involved in a variety of educational programs including presentations regarding plants and wildflowers native to DSF, trail construction demonstrations, and the North Carolina Woodlands Stewards series. Future educational outreach efforts will focus specifically on the gaps identified by the interagency survey.

Listed in Table 4 are others providers of environmental education in close proximity to DSF. This table was modified from one provided in the Draft State Environmental Assessment Concerning Recreation Plans for DuPont State Forest, 2006, as developed by Dr. Gary Blank of North Carolina State University

Table 4: Locations of Environmental Education Providers in Close Proximity to DuPont State Forest

Name	Location	Target Audience	Operating Schedule
Bullington Environmental Center	Hendersonville, NC	youth, adults, students	open all year
Holmes Educational State Forest	Hendersonville, NC	youth, adults, students	open Mar-Nov
Mountain Trail Outdoor School	Hendersonville, NC	youth, adults, 3rd grade and older students	open Sep-May
Green River Preserve	Brevard, NC	youth, 4th to 8th grade students	open all year
Eagle's Nest Camp / Outdoor Academy of the Southern Appalachains	Pisgah Forest, NC	youth, 1st to 11th grade students	open Jun-Aug
Earthshine Mountain Lodge	Lake Toxaway, NC	youth, adults, 3rd grade and older students	open all year
Forest Discovery Center, Cradle of Forestry	Pisgah Forest, NC	youth, adults, K and older students, teachers	open all year
Gorges State park	Sapphire, NC	youth, adults, students	open all year
Pisgah Center for Wildlife Education	Pisgah Forest, NC	youth, adults, students	open all year
YMCA Camp Greenville	Cedar Mountain, NC	youth, 3rd to 8th grade students	open all year

Educational Programs - Goals and Desired Conditions

EDP-1: Educational offerings at DSF will be designed and scheduled to compliment those currently offered by Holmes Educational State Forest and other natural resource education providers that focus primarily on elementary school-aged children. Programs which target a broad demographic including middle school, high school, and college students, as well as retirees and other forest users will be developed.

EDP-2: Programs will be specifically developed for new forestland owners and community members who are unfamiliar with the principles of, and need for, forest management in western North Carolina. Offerings will be widely promoted through a variety of media.

Visitor Information - Existing Conditions

Currently forest visitors are made aware of forest activities and trail conditions through a combination of sources. On-site notification of forest rules and regulations, current trail information, and current forest events are provided at kiosks located in the parking areas. The NCDFR website, as well as the independent FODF website, both described in the "Recreation Resources" section of this plan provide similar information, as well as maps, photos, and links to other local resources. Occasionally DSF staff will provide local news media with press release information regarding topics of special importance.

Volunteer Involvement

DSF has benefited greatly from the service of hundreds of volunteers, assisting with a wide variety of projects since the state forest was first established in 1997. From 2003 through 2009 volunteers donated 36,340 hours of service. Trail maintenance projects accounted for nearly 40 percent of volunteer work hours. Volunteers also assist with office tasks, facility construction, maintenance projects, forest tours, and provide other visitor services.

Major contributors of volunteer work include The Friends of DuPont Forest (FODF), a non-profit organization dedicated to the protection and promotion of DSF , The Pisgah Trailblazers an equestrian user-group, as well as several biking associations including the Southern Off-Road Bicycling Association (SORBA), the International Mountain Biking Association (IMBA), and the Blue Ridge Bike Club.

Several groups from Brevard College, as well as some area high schools, conduct service projects periodically. Recently the forest has benefited from a working relationship with the Building Construction Technology department at Western Piedmont Community College. This group has been involved in rebuilding picnic shelters, piers, steps, and other construction projects. Trout Unlimited members assist the NCWRC in stocking trout in the Little River several times each year. Several other civic clubs, non-profit organizations, summer camps and businesses have donated time for work projects, and numerous individuals donate time directly to the forest without being directly associated with a group or club.

Every effort will be made to continue and perhaps expand the volunteer program. Transylvania and Henderson Counties are highly rated as locations to retire and there are lots of very talented senior citizens looking for meaningful volunteer work experiences. There are also several user groups that realize the benefits to maintaining forest trails and facilities for their own enjoyment. This has been demonstrated by the willingness of hiking, biking and equestrian groups to hold work days to repair trails. DSF will continue to provide opportunities for many clubs and groups to conduct natural resource based service projects.

Volunteer projects are matched to the capabilities of individuals and groups depending on their job skills, age and group size. An effort is made to assign work projects that are meaningful, rewarding and have a sense of completion at the end of the project. FODF has a host program to provide information during high visitation periods. Volunteers are positioned at the Hooker Falls and High Falls access areas on weekends during the summer and fall leaf season. Volunteers provide trail maps, give directions, and answer questions related to the forest.

Hours worked are reported to the volunteer coordinator for inclusion in the DSF volunteer time database. It is important to track the time so it can be used as in-kind service for grant projects, and so volunteers and groups can be given recognition for their service.

When the visitor center at the High Falls access area is completed the host program will be expanded. Volunteers will be asked to staff the center seven days a week during the busy season, and on weekends during the winter and early spring. An annual training program will be

conducted for active and prospective volunteers. A seasoned volunteer will provide on the job training for new recruits.

Visitor Information - Goals and Desired Conditions

VIS-1: The official NCDFR DSF website will act as the primary online source of forest information, and will provide a central location for visitors to provide feedback and comments to DSF managers.

VIS-2: Through newsletters and other media DSF staff will inform the general public of educational opportunities, management projects, and other forest events.

VIS-3: Visitors will be made aware of current trail closures, re-routes, and permanent changes to trail and access points through website resources and onsite kiosk postings.

VIS-4: Accurate maps and brochures indicating the location of forest roads, trails, and specific points of interest will be made available to forest visitors to endorse a safe and positive experience.

Research and Demonstration - Existing Conditions

As a biologically diverse portion of forestland frequented by a population of visitors with diverse expectations and use-values DSF has vast potential as a platform for formal research, both ecological and social. Several academic institutions offering natural resource or environmental science programs of study are in close proximity to DSF including Brevard College, Western Carolina University, Warren Wilson College, Haywood Community College, The University of North Carolina at Asheville and Clemson University. Other potential academic partners include North Carolina State University, Duke University, The University of Tennessee and the University of Georgia. In addition, the US Forest Service Southern Research Station, a major source of forest management research, and the American Chestnut Foundation have headquarters in Asheville. Research initiated by NCDFR staff and our cooperating agencies will be supported as well.

The NCFRA highlights the need to maintain and build forestry research capacity throughout North Carolina. DSF can serve as stable land-base on which long-term studies may be conducted. Proactive steps will be taken throughout the course of this planning period to further develop relationships with our research partners.

The size of DSF will allow for the demonstration of management practices at a scale meaningful to private woodland owners. By demonstrating these commercial-scale activities, landowners will be provided with a greater understanding of what techniques may be appropriate for their property in the context of their own goals, objectives, ecological setting, and economic constraints.

Currently the primary demonstration at DSF is a series of signs highlighting road and trail construction techniques designed to protect water quality during use. Signs are present along

portions of Buck Forest Road, Tarkiln Branch Road, Holly Road, and Thomas Cemetery Road describing the use and purpose of broad based dips, turnouts, riparian buffers, daylighting measures, culvert stream crossings, rock fords, and surface materials. In 2007 a state and federal grant funded stream restoration project was completed on the Little River at Hooker Falls. Information regarding that project is presented on a sign at the restoration location. Other management techniques including the use of prescribed fire and crop-tree release to enhance wildlife habitat are also currently highlighted on DSF.

Research and Demonstration - Goals and Desired Conditions

RSD-1: DSF will be utilized by schools, colleges, and natural resource management organizations for use as an outdoor classroom and laboratory.

RSD-2: The results of ecological and social research conducted on DSF will be utilized to inform forest management decisions.

RSD-3: As management practices are implemented throughout the forest, the practices will be accompanied by signs describing the specific objective, and environmental benefit of the given treatment.

RSD-4: Workshops will be conducted for resource professionals, forest landowners, and other visitors to highlight implemented techniques and the ecological rationale for their use.

Chapter 3: Resource Management Objectives

The management objectives listed below are accomplishment targets DSF staff will work towards in conjunction with our cooperators. These objectives are time specific tasks designed to accomplish our stated goals, and to gradually move towards the desired future conditions for each specific resource. Time schedules and management approaches may be adjusted based on funding limitations, availability of personnel, and other unforeseen factors. The objectives will be accomplished utilizing the standards and guidelines outlined in Chapter 4. Though it is intended that this planning document be dynamic and adaptable over time, the planning period to address the following objectives is limited to 15 years (2011-2025).

General Resource Management Approaches

Our management approach will focus on the maintenance and endorsement of resilient natural communities, while working to develop the wildlife habitat components considered essential within the North Carolina Wildlife Action Plan (WAP) to keep common critters common and to promote rare and threatened wildlife species. Important habitat goals include the perpetuation of hard mast producing vegetation, particularly oak and hickory species, the maintenance and development of fire adapted communities through the utilization of prescribed fire, and the creation of a greater variety of successional stages within stands through vegetation management. We will work cooperatively with the NCWRC to develop baseline information regarding important wildlife species, and to monitor the success of our treatments.

The quality of soil and water resources will be maintained and enhanced through proper planning prior to the implementation of management. We will be proactive in monitoring these resources through cooperation with the NCDWQ, the NCWRC and the NCDFR Non Point Source Pollution branch. Restoration projects will be initiated where past land-use has resulted in the degradation of these resources.

Given the importance of DSF as a recreation destination for many local residents and tourists, it is essential that we continue to provide opportunities for low-impact, ecologically friendly activities. Trails will be designed and maintained to protect the natural resources of DSF, and to minimize conflict among different user-groups. The cooperation of volunteer groups during trail work days and related projects has been, and will continue to be, very important to accomplish the routine tasks necessary to maintaining a high-quality network of trials. We will strive to develop efficient ways for the public to comment on the condition of recreation resources throughout the forest and provide feedback regarding any necessary improvements.

It is important that research opportunities are made available to interested parties as a means of advancing our knowledge regarding ecological function, as well as our knowledge of how to best manage resources in light of the objectives and values of our visitors and local community. Occasionally research will coincide with planned management. Special protections may need to be provided in order to maintain the long-term integrity of research study sites. Such protective measures will be evaluated on an individual project basis.

The management of DSF will continuously be informed by the most current scientific research available regarding natural resource management. Of particular importance is the research that can occur on the forest through collaboration with our interagency, academic, and forest industry partners. Demonstration events and educational programs will highlight how we are applying science to reach our management goals and emphasize how particular management techniques may be applicable to other forest landowners.

Vegetation and Wildlife Objectives

Vegetation and wildlife objectives are combined since wildlife habitat depends largely on the structure and composition of the vegetation within each natural community.

1. Within five years (2011-2015) collect stand-level data for The DuPont Dedicated Nature Preserve beginning with the "primary" area and the "primary restoration" area. As data is collected, establish management protocols and initiate treatments to fulfill the agreement between NCDFR and the NC Natural Heritage Trust Fund.

2. Complete the first round of continuous forest inventory plots and develop the protocol for re-measuring within the first year (2011).

3. Delineate stand specific age-classes throughout all natural communities within the first year (2011) utilizing previous NCDFR inventory information and any additional inventory necessary to achieve that end.

4. Identify white pine plantation stands that are overstocked and are at an elevated risk for southern pine beetle infestation within the first year (2011).

5. Over the entire planning period (2011-2025) initiate the regeneration of declining, unhealthy, or degraded white pine plantation stands, Montane Oak-Hickory stands, and Acidic Cove stands utilizing the techniques outlined in the Standards and Guidelines portion of this plan. Regeneration harvests will focus on increasing species and structural diversity and restoring desirable natural community attributes to areas impacted by past management. The amount of area targeted for regeneration within each natural community throughout the first five planning years (2011-2014) is addressed in the Standards and Guidelines Portion of this plan.

6. Over the entire planning period (2011-2025) conduct thinnings of overstocked white pine stands at high risk for southern pine beetle infestation. The amount of area targeted for this activity is addressed in the Standards and Guidelines Portion of this plan.

7. Conduct oak shelterwood treatments on 10 acres annually during the planning period (2011-2025) as a means of establishing competitive oak and hickory regeneration in areas of Montane Oak-Hickory Forest and Acidic Cove Forest where it is lacking but desired. The shelterwood procedure for this objective is outlined in the Standards and Guidelines portion of this plan.

8. Identify a total of 300 acres of Montane Oak-Hickory Forest, Chestnut Oak Forest, or Pine-Oak/Heath annually throughout the planning period (2011-2025) that would benefit from the reintroduction of fire, and conduct prescribed burns throughout those areas.

9. Treat 10 acres for control of non-native and invasive plant species annually throughout the planning period (2011-2025). Area inspections and invasive species treatments will coincide with the implementation of other management procedures, as well as with the monitoring of areas following active management.

10. Continue to treat designated eastern hemlock and Carolina hemlock trees to control the effects Hemlock Wooly Adelgid, and monitor the efficacy of those treatments throughout the course of this management period (2011-2025). Treat a minimum of 100 individual trees annually.

11. Within the first planning year (2011) in cooperation with NCWRC establish a list of important wildlife indicator species, including federally listed threatened and endangered species with the potential to inhabit DSF, and develop the procedure to establish baseline abundance numbers.

12. Within the first planning year (2011) identify and delineate potential areas for the establishment of shortleaf pine.

Soil, Water, and Fishery Objectives

1. Contact the NCDWQ within the first planning year (2011) to assess the need and feasibility of establishing additional stream monitoring stations in the Little River and its tributaries. If established, these stations will be used to monitor water quality throughout the entire planning period (2011-2025).

2. Contact the North Carolina Division of Land Resources (NCDLR) within the first planning year (2011) to review the current and potential maintenance needs of all lake dam structures on DSF.

3. Contact the NCDWQ within the first planning year (2011) to determine the extent of native freshwater mussel populations and potential habitat on DSF. In cooperation with NCDWQ develop an action plan that describes the steps needed to sustain, protect, or improve mussel populations throughout this planning period (2011-2025).

4. Within the first two planning years (2011-2012) conduct a comprehensive baseline assessment of the Little River and its tributaries regarding stream bank degradation.

5. Monitor the Little River and its tributaries for possible stream bank degradation and restore or stabilize affected areas to improve water quality and enhance aquatic habitat for the duration of this planning period (2011-2025). This could include the restoration of wetlands, bogs, or riparian floodplain forests.

6. Annually assess the forest road network regarding the need for grading, resurfacing, drainage improvement, or stabilization work for the duration of this planning period (2011-2025). Road improvement projects will be prioritized based on the severity of damage, and the potential for water quality degradation. Road improvement and maintenance will be viewed as a continuous process with constant monitoring by all DSF personnel during normal work duties. The annual assessment is to ensure that even those segments of road that are not commonly used are systematically inspected. Roads posing an imminent threat to water quality will be the highest priorities for improvement.

7. Annually inspect all road and trail stream crossings regarding the stability of those crossings, and the potential for water quality degradation as a result of their condition for the duration of this planning period (2011-2025). Poorly functioning crossings should be stabilized or replaced with a more appropriate structure (i.e. replacing culverts with bridges). Stream crossings posing an imminent threat to water quality will be the highest priorities for improvement.

8. Annually inspect all forest trails to assess the need for stabilization work, rerouting, or closure as a means of minimizing accelerated erosion throughout the network, and eliminating potential sources of sedimentation for the duration of this planning period (2011-2025). Trails posing an imminent threat to water quality will be the highest priorities for improvement.

Recreation and Scenic Resource Objectives

1. Within the first two years of this planning period (2011-2012), generate an updated trails map for mass distribution including all trail changes, trail re-routes, permanent trail closures, and other infrastructure changes that have occurred through DSF since the last map printing in 2008.

2. Construct trail re-routes on Grassy Creek, Stone Mt., and Rocky Ridge trail within five years (2011-2015) to reduce erosion potential.

3. Replace the closed Galax trail with a trail connecting Sheep Mountain trail to Triple Falls trail within the first planning year (2011) to mitigate erosion and over-use.

4. Construct a trail connection between Turkey Knob road and Briery Fork trail within three years (2011-2013).

5. Conduct a road to trail conversion on the 750 ft. Shortcut trail to maintain the characteristics of a recreational trail rather than those of a road within three years (2011-2013) to reduce environmental impact and enhance the recreational experience of the trail.

6. Control vegetation to maintain important view-sheds at the High Falls shelter, Triple Falls shelter, and Bridal Veil Falls platform bi-annually for the duration of this planning period (2011-2025).

7. Annually assess the forest road and trail network regarding the need to trim and control vegetation for the duration of this planning period (2011-2025). Overgrown trails will be

maintained through a combination of mechanical and manual methods to ensure they are passable as designed. Priority will be given to roads most utilized for emergency response. Road and trail clearing will be viewed as a continuous process, with the objective of having all roads and trails examined annually and treated as necessary. The clearing of vegetation will be designed to last up to 5 years

8. Organize a minimum of 25 trail work days with volunteer groups annually for the duration of this planning period (2011-2025), consisting of erosion control work, trail clearing, litter removal, and other related tasks.

9. Within the first two planning years (2011-2012) develop and administer a systematic DSF user-group survey to ascertain the current level of visitor satisfaction and to uncover any potential sources of user-group conflict.

Facility Resources Objectives

1. A facilities master plan will be developed within the first five years of this planning period (2011-2015) taking into account the current condition of the existing infrastructure and the anticipated need for facilities based on user-group feedback.

2. A visitor center will be completed within the first five years of this planning period (2011-2015) at the High Falls access area to provide information regarding the history of DSF, resource management techniques, educational offerings, and recreation opportunities.

Educational Program Objectives

1. Develop curriculums and field tours within three years (2011-2013) for interested community members to examine the purpose and techniques of resource management on DSF. The programs will provide a rationale for resource management and highlight implemented treatments designed to achieve a variety of natural resource goals.

2. Continue annual participation in the USFS Woodland Stewards Series workshops at Holmes Educational State Forest for the duration of this planning period (2011-2025).

3. Actively promote all educational offerings at DSF for the duration of this planning period (2011-2025) within school systems, in central locations within the local and surrounding communities, and through multiple forms of media.

Visitor Information Objectives

1. Within the first planning year (2011) work with the NCDFR Information and Education branch, as well as the NCDFR Webmaster to further the development of a comprehensive NCDFR DSF website.

Research and Demonstration Objectives

1. Within the first planning year (2011) contact organizations and individuals that may potentially be interested in utilizing DSF as a platform for research applicable to our mission.

2. Throughout the duration of the planning period (2011-2025) highlight implemented treatments as demonstration areas during educational programs.

Chapter 4: Management Standards and Guidelines

The standards and guidelines described below are the operational mechanisms DSF managers will utilize to accomplish property level and natural community level management objectives. The complexity of managing a natural system dictates that these standards and guidelines may require adjustment over time.

Operational Standards

1. Stand-level unit narratives will be developed prior to the initiation of any treatment. The unit narrative will first outline the baseline condition of the area as determined during an initial inventory. This information will be utilized to specify silvicultural objectives and desired future conditions. The unit narrative will include known management history, operational concerns and limitations, and management guidelines. Once management has been implemented, the site will be revisited and monitored. Findings of the post-treatment visit will be included within the unit narrative. All subsequent entries to the unit should be documented in a similar fashion, providing for cohesive adaptive management over time.

2. Stand-level data will be compiled and organized within a Geographic Information System (GIS). This will allow for the consideration of several ecological and operational components during harvest planning. The GIS database will be continuously updated as management is implemented to provide a mechanism for monitoring overtime.

3. The southern variant of the Forest Vegetation Simulator (FVS) and the NED Ecosystem Management Decision Support program, both developed by the U.S. Forest Service (USFS), will be the primary programs used for inventory data compilation and analysis. SILVAH, an inventory program designed specifically for use in mixed-oak ecosystems in the mid-Atlantic region may also be utilized.

4. FVS will serve as the primary growth and yield modeling program utilized for project analysis. Growth and yield programs designed for uniform species compositions, such as the North Carolina State University Managed Pine Plantation Model, may also be utilized.

5. All harvesting operations will utilize a written contract and utilize standard operating procedures established by the State of North Carolina regarding the sale of state property. Contracts will specify terms, payment schedules, silvicultural objectives, water quality considerations, logging expectations, and other pertinent information. In some instances DSF may contract harvesting services and market the harvested material independently

An important component of harvest planning is to find operators with the equipment most appropriate to achieve the desired management goals. Harvesting systems where only the merchantable bole of the tree is removed from the woods, in contrast to whole tree harvesting systems, will be the preferred methods of tree removal. Retaining coarse woody debris and fine vegetative material on the forest floor will aid in nutrient retention and the maintenance of soil

productivity over time. These systems should also help limit residual stand damage and reduce the impact of landing areas. Whole-tree systems may be employed in instances where there is no other feasible alternative and where the above ecological considerations can be made.

Vegetation and Wildlife Standards

Regeneration of Vegetation

1. Regeneration harvesting levels have been established utilizing principles of area-regulation based on the expected longevity and vigor of the primary species within each community. Harvests will be arranged across communities to endorse the presence of a desirable mix of age classes within each community. Decisions regarding how regeneration harvests are arranged will be made during stand-level planning.

Table 5 contains a list of the most common overstory species on DSF, a range of commercial rotation ages for each species, and an estimate of expected longevity. The variation in commercial rotation lengths displayed can be attributed to the potential variations in overall site quality and differences in management strategy. Rotation ages are not the only considerations during management planning, but they will be used to prioritize management while working towards the development of desirable age structures throughout each natural community.

Table 5: Rotation Lengths for Selected Tree Species of DuPont State Forest

Tree Species	Commercial Rotation Ages	Expected Longevity
Scarlet oak [2]	70 – 80 yrs.	100 yrs.
White oak [1,2]	80 – 120 yrs.	300+ yrs.
Black oak [1,2]	80 – 100 yrs.	150 yrs.
Chestnut oak [1,2]	90 – 100 yrs.	250+ yrs.
Northern red oak [1,2]	65 – 100 yrs.	200+ yrs.
Hickory (sp.) [2]	90 – 100 yrs.	250+ yrs.
Yellow poplar [1,2]	50 – 100 yrs.	200+ yrs.
Eastern white pine [2,3,4]	60 – 120 yrs.	300+ yrs.
Pitch pine [2]	80 – 100 yrs.	200 yrs.
Shortleaf pine [2]	70 – 90 yrs.	150+ yrs

[1] (Smith, 1994); [2] (Parker and Merritt, 1994); [3](Johnson, 1994); [4] (Burns and Honkala, 1990)

2. During the first five planning years (2011-2014), the forest-wide allowable regeneration harvest will be 340 ac., or just under 70 ac. annually. Areas to be regenerated will include portions of white pine plantation, Montane Oak-Hickory Forest, and Acidic Cove Forest. These regeneration rates will result in a total annual disturbance of approximately 0.7% across the property as a whole, and 0.9% throughout the area not dedicated as primary reserve by the Natural Heritage Program. This regeneration limit has been set to remain within a natural range of variability regarding expected natural disturbance on the landscape, with the understanding that natural disturbance will occur independently from harvesting. For our planning purposes the expected range of natural disturbance is 0.5% to 2.0%, with an average annual disturbance of 1.0% (Runkle, 1982).

3. Regeneration harvests will typically utilize patch or group removals and variations of shelterwood systems. When harvesting occurs in patches or groups, patch size will vary with natural community type, the type of regeneration desired, and to achieve the target age-class distribution of a stand. The amount of overstory retained during shelterwood harvesting will vary based on similar considerations. In some instances portions of the current overstory may be excluded from harvesting and retained to promote late successional stand characteristics.

4. Patch cut treatments and group selection designed to establish a mix of shade intolerant species (yellow poplar) and species of intermediate shade tolerance (white oak, scarlet oak, northern red oak, black oak, hickory sp., white pine), will utilize areas ranging in size from 1/3 ac. to 2 ac.

5. Expanding gap harvests, designed to utilize the partial shade of uncut areas for the establishment of species intermediate in shade tolerance will be initiated in stands as a means of endorsing oak and hickory establishment.

6. Patch clearcut harvests over 2 ac. in size may be utilized:

- to initiate the establishment of a greater percentage of shade intolerant species, or to rehabilitate areas that are significantly degraded from past land-use (i.e. repeated high-grading). Such rehabilitation harvests will typically include the retention of a sparse overstory of desirable species as future seed sources.

- to establish functional blocks of early successional habitat.

- to control insect or disease outbreaks, or to salvage large-scale weather-related damage.

- in areas targeted for conversion to mixed shortleaf pine and hardwood stands. Where shortleaf pine is planted, it will be planted at a spacing wide enough to not hinder the establishment and growth of other associated species, particularly hardwoods, through root sprouting or seed. Particular spacing requirements will be assessed on a stand-level basis.

7. Clearcut harvests will not exceed 25 ac. in a given portion of any stand, except for the control of insect infestations or disease outbreaks.

8. Traditional shelterwood treatments in white pine stands designed to promote the establishment of mixed hardwood regeneration in conjunction with the expected white pine regeneration will generally be initiated by a canopy reduction of 60 percent by removing trees primarily from below. This canopy reduction may be accomplished through multiple partial cuttings to encourage the development of the more shade tolerant hardwood species. The overstory will be removed once regeneration is deemed competitive, likely 5 to 10 years following establishment.

9. Oak shelterwood treatments, a non-commercial action designed to recruit oak and hickory into competitive midstory positions where they are typically outcompeted by less desirable species on highly productive sites, will be initiated by a canopy reduction of 25-35

percent by removing trees from below. Overstory removals will occur when regeneration is deemed competitive, likely 10 to 15 years following establishment.

10. Overstory removal harvests may be conducted in instances when advance regeneration is deemed desirable and competitive. This technique is distinguished from a clearcut by the fact that regeneration is already established prior to the harvest.

Tending of Vegetation

1. Intermediate tending operations in developing stands will focus on thinning from below and crown thinning to increase the abundance and vigor of desirable mast producing species. Thinning will also be a priority in stands dominated by white pine with basal areas over 150 sq. ft. per acre where there is a high risk of southern pine beetle infestation (SPB). As pine stands at risk for SPB are differentiated during stand level planning they will be the highest priority for intermediate treatment.

2. Pre-commercial thinning treatments and early crop tree release thinnings may be utilized in young stands to influence future species composition. These treatments will be important to release desirable hardwood stems in newly regenerated white pine stands where the goal is to increase species diversity, and in areas where shortleaf pine has been planted and requires release from competition. Crop tree release in areas dominated by hardwood regeneration should generally occur between 10 and 15 years after establishment to allow dominants to become apparent. Precommercial treatment of pine regeneration should generally occur between 2 and 5 years following establishment.

3. Prescribed fire will be utilized to reduce the amount of understory mountain laurel, rhododendron, and white pine in natural communities where it is desirable to increase grass and forb abundance, and provide conditions favorable to perpetuate fire dependent and other desirable species, including oak and hickory. Prescribed fire may be utilized as a tool to aid in the establishment of desirable oak and hickory regeneration prior to regeneration harvests.

4. All prescribed burns will be conducted utilizing a prescribed burn plan indicating appropriate weather parameters and other operational considerations. The smoke management guidelines developed by NCDFR will be adhered to.

5. All targeted non-native or invasive species will be treated utilizing principles of Integrated Pest Management (IPM). Mechanical and manual techniques will be initiated to compliment the use of herbicides where effective. An NCDFR Herbicide Action Plan (HAP) will be completed for any herbicide application. All state and federal laws will be followed regarding the handling, storage, use, and disposal of herbicides. All required personal protective equipment (PPE) as specified by the herbicide label will be utilized by applicators. Applicators will comply with the license requirements of the North Carolina Department of Agriculture Pesticide Section.

6. At least 2 cavity trees per acre and den trees in excess of 30 inches in diameter where they are present will be left during harvest operations.

Soil, Water, and Fisheries Standards

Regulatory and Administrative Reference

1. During forest management all applicable state and federal laws will be followed. In particular: N.C. Administrative Code 15A NCAC 01 .0100-.0209, *Forest Practices Related to Water Quality (FPGs)*, and N.C. General Statutes on stream, ditch, and waterway obstructions, *GS 77-13 and GS 77-14.*

2. The *North Carolina Forestry Best Management Practices Manual to Protect Water Quality (BMP manual)* will serve as the reference for generally accepted practices and guidelines during forest management.

Protection of Riparian Areas

1. The ecological function of riparian areas, including protection against adverse stream temperature fluctuations and sedimentation will not be compromised by the excessive removal of vegetation. This will involve the establishment of no-cut, or partial-cut areas within 50 feet of intermittent and perennial streams during any harvesting operation. Buffer areas may extend beyond 50 ft. in consideration of local topography, slope, and soil conditions. Riparian areas with management restrictions will be referred to generally as streamside management zones (SMZs).

2. The retention of coarse woody debris within SMZs will be encouraged during tree removal activities, so long as the woody debris is not in violation of state regulations and laws regarding stream obstructions.

3. Ground disturbing equipment will not be operated within 50 feet of any intermittent or perennial stream unless its use is necessary for a planned stream/wetland rehabilitation project, or for the construction and maintenance of a stream crossing.

Stream Crossings

1. Stream crossings will be avoided when possible, and made at right angles if feasible when necessary.

2. The installation, maintenance, stabilization, removal, and rehabilitation of stream crossings will be conducted in a manner that meet or exceed the recommendations provided by the BMP manual for those procedures.

3. When a new, temporary stream crossing is required to accomplish a management activity, metal or wood bridges will be used when possible.

4. Culverts are acceptable for use as permanent crossings. Bottomless arch culverts are the most preferred as they leave available natural stream substrate for aquatic habitat. If culverts are utilized for stream crossings they should be properly sized based on the watershed above the crossing, and installed as specified in the BMP manual.

Roads and Trails

1. Construction and maintenance of forest roads and trails will be conducted in a manner that meets or exceeds the recommendations provided by the BMP manual for those procedures. With the exception of stream crossings, construction of new roads will not occur within 75 feet of any stream classified as trout water (Tr. classification), or within 50 feet of any other perennial or intermittent stream.

2. Management work will be accomplished utilizing the existing road network to the greatest extent possible avoiding the construction of new roads.

3. Where graded skid trails are necessary, they will be designed to follow the contour of the land and will avoid long stretches of unbroken grade where possible.

4. Where any ground disturbing activity that may result in stream sedimentation is initiated, appropriate erosion control measures will be implemented. Specific examples of erosion control methods to be utilized during common forestry practices may be found in the BMP manual

Stream and Wetland Restoration

1. Stream and wetland restoration projects will adhere to natural stream design engineering principles, mimicking the geomorphology, aquatic habitat, hydrologic regime, and vegetative composition of an appropriate reference water-body.

2. Stream restoration will be conducted in a manner that will create or enhance aquatic habitat conditions, including opportunities for recreational fishing.

3. Stream and wetland restoration should allow for the creation or retention of ephemeral pools within the riparian zone.

Recreation and Scenic Resource Standards

1. The USFS Trail Construction and Maintenance Notebook, 2007 will serve as the primary reference concerning recreational trail improvements on DSF.

2. During trail design several factors will be considered to ensure the protection of the forest resource and the long-term stability of the trail. Factors to be considered include topography, slope, soil type and depth, the presence of sensitive vegetation and wildlife habitat components, the presence of important historical artifacts, and the dominant user-groups of the trail.

3. Trails will be re-located if they have an adverse impact on ecological, cultural, or historical resources. Potential impacts include, but are not limited to, accelerated erosion, soil compaction, damage to vegetation, and destruction of important historical artifacts.

4. Newly constructed or re-routed trails will lead to points of interest, create a loop, or connect to another trail. The construction of "dead end" trails will be avoided.

5. User-created trails (social trails) will not be allowed without prior approval of the Forest Supervisor.

6. All trails constructed by volunteer groups or individuals must meet established DSF trail standards. Standards are specified on all DSF trail contracts.

7. Current scenic vistas will be maintained as will the trails to access those vistas.

Educational Program Standards

1. Educational programs will be designed to engage the full-spectrum of forest users and community members.

2. The scheduling of programming will be adaptable depending on the needs of the desired audience (i.e. weekend workshops for participants who work full-time during the week)

3. The expertise of personnel from all cooperating organizations engaged in the management of DSF, including NCDFR, NCWRC, and NCNHP, may be requested to instruct or present depending on the nature of each educational program.

4. All educational programs will include an opportunity for participant feedback in the form of a survey or instructor evaluation to ensure programs are productive, engaging and effective.

Research and Demonstration Standards

1. Research will be conducted using generally accepted scientific methods, and where feasible, methodology and results will be peer-reviewed.

2. Data collected on DSF by external organizations will be made available to NCDFR and DSF staff.

3. Demonstration areas will be established to highlight the many facets of the management of DSF, including but not limited to, wildlife habitat creation, harvesting techniques, water quality protection and soil conservation measures during forest management, and recreational trail improvements.

4. Recreation surveys will be designed and administered to sample the full range of DSF user-groups throughout the year to solicit responses during busy and slower seasons.

Chapter 5: Special Management Considerations

Significant Natural Communities as Designated by the NC Natural Heritage Program

The DuPont Dedicated Nature Preserve

Over 8,000 acres of DSF was acquired through the use of the North Carolina Natural Heritage Trust Fund (NHTF). The NHTF was established in 1987 as source of supplemental funding for selected state agencies to purchase ecologically significant natural areas. As a condition of the grant agreement between the NHTF and NCDFR, 6,970 acres of DSF was dedicated as a North Carolina Nature Preserve in 2002.

A "primary area" of 2,584 acres was delineated based on the presence of rare and unique natural community types, and high quality examples of more common natural community types. A "buffer area" of 4,386 acres was delineated adjacent to the primary area to provide for further protection and connectivity of natural communities and wildlife habitat.

Primary Area Key Language:
"The cutting or removal of trees, dead or alive, or the disturbance of other natural resources is prohibited <u>except</u> as necessary for removal of hazards to visitors, control of disease that would damage or reduce the significance of the preserve, restoration after severe storm damage, trail clearance and maintenance, or for the purposes of maintenance or restoration of natural communities or rare species populations as stipulated in the preserve management plan…"

Buffer Area Key Language:
"Forest management activities will be conducted using Best Management Practices…The buffer area will be managed as a sustainable forest using stewardship philosophy and objectives…the following buffer functions will be addressed in the management plan: 1) retention of naturally occurring plant and animal assemblages, to the extent that they are known; 2) maintenance of habitat connectivity and continuity; 3) management needs of rare species populations occurring within the buffer area; 4) protection of soil and hydrologic resources."

As the primary custodian of the preserve NCDFR is obligated to develop a planning document to be approved by the NCNHP for the purposes of managing the preserve area. That level of planning is beyond the scope of this document and will be added as an addendum at a later date. The preserve management addendum will organize activities based on key language present in the letter of allocation for the "DuPont Dedicated Nature Preserve" regarding the intended purpose of both the primary area and the buffer area.

By definition the primary reserve area includes the best examples of well-functioning natural community types represented on DSF. Therefore, all management activities on DSF will utilize these areas as models for what is ecologically appropriate at a variety of spatial and temporal

scales. Table 6 provides a list of specific areas included in the dedication and the natural communities represented.

Table 6: Primary Areas of the DuPont Dedicated Nature Preserve

Location of Primary Area	Natural Communities Represented[1]
Area West of Buckhorn Creek	ACF
Wilkie Trail Bog	SAB
Area West of Sheep Mountain	ACF, MOH
Cedar Rock / Little River Area	LEGD, ACF, SAB, SC, SFBC
Cox Branch Area	RCF, MOH
The Nooks / Little River	SFBC, ACF
Bridal Veil Falls	SC, LEGD, ACF, MOH
Little River Floodplain	SFBC, SC, ACF
Reasonover Creek Cove	RCF, ACF, MOH
Table Rock Trail Area, Southeast of Joanna Mt.	MOH
Dry Branch Bog	SAB, SFBC, LEGD
Ridge/ Knob Northeast of Joanna Mt.	LEGD, MOH
Ridge Between Grassy Mt. and Joanna Mt.	MOH, CHF, POH
Tarkiln Mt. / Grassy Creek Gorge Area	LEGD, MOH, SC
Grassy Mt.	LEGD, CHF, MOH, ACF
Long Rock	CHF, LEGD
Stone Mt.	CHF, LEGD, MOH, ACF

[1] Acidic Cove Forest (ACF); Chestnut Oak Forest (CHF); Low Elevation Granitic Dome (LEGD); Montane Oak Hickory Forest (MOH); Pine-Oak/Heath (POH); Rich Cove Forest (RCF); Southern Appalachian Bog (SAB); Spray Cliff (SC); Swamp-Forest Bog Complex (SFBC)

Threatened and Endangered Species

The maintenance of ecological integrity across natural communities is a theme present throughout this management plan. A major objective associated with the maintenance of ecological integrity is the recognition and protection of threatened and endangered species.

The United States Fish and Wildlife Service (FWS) is the lead agency for the protection of federally recognized threatened and endangered species, including plant and animal species. Table 7 provides a list of species known to occur in the counties of Transylvania and Henderson that are federally classified as endangered (E) or threatened (T). Table 8 displays federally classified species of concern in those counties.

The North Carolina Department of Agriculture and Consumer Services (NCDA & CS) Plant Conservation Board develops and enforces the Plant Protection and Conservation Act regulations for North Carolina. The powers and duties of the board include the development and maintenance of a list of protected plant species in North Carolina, the authority to regulate the disturbance, harvest, sale, exchange, and transport of protected plant material, and the ability to enter into cooperating agreements with other federal, state, and private organizations for the purpose of plant conservation. Table 9 provides a list of state protected plant species that are known to occur, or likely to occur within Transylvania and Henderson counties. All species marked with an asterisk have been positively identified on DSF during NCNHP, NCWRC and NCDFR inventory surveys.

An important focus of management throughout DSF is to recognize the components that comprise the natural communities present on the forest as classified by NCNHP, and design treatments to maintain and support those components over time. This involves a systematic procedure for protecting threatened and endangered species to ensure compliance with the Endangered Species Act, and compliance with state regulations regarding protected plant species. The procedure for protecting these species is as follows:

- During management planning in areas suspected of supporting threatened or endangered species, the agency with particular knowledge of the given species (NCMHP, NCWRC, NCDA &CS) will be consulted to ensure its protection.

- If a threatened or endangered species is encountered during the initiation of management, the project will be stopped and the appropriate agency will be consulted regarding how to proceed.

- All forest management contracts will include provisions to stop work in the event of an encounter with a threatened or endangered species. The contract will outline how arrangements will be made to satisfy all parties in the instance that such a work stoppage occurs.

In cooperation with NCNHP, NCDA & CS, and NCWRC, NCDFR will facilitate inter-agency training opportunities for the purposes of identifying and delineating rare natural communities and species. This sharing of information will allow cooperating agencies to base management decisions on the same baseline ecological conditions. Furthermore, NCDFR will explore the development of a memorandum of understanding with NCDA & CS to provide for the management and protection of state and federally listed plant species found on DSF.

Table 7: Federally Listed Threatened and Endangered Species of Henderson and Transylvania Counties

Common Name	Scientific Name	Status
Vertabrates		
Carolina northern flying squirrel	*Glacomys sabrinus coloratus*	E
Bog turtle	*Clemmys muhlenbergii*	T
Invertabrates		
Appalachian elktoe	*Alasmodonta raveneliana*	E
Oyster mussel	*Epioblasma capsaeformis*	E
Vascular Plants		
Spreading avens	*Geum radiatum*	E
Bunched arrowhead	*Sagittaria fasciculata*	E
Small whorled pogonia	*Isotria meledeoloides*	T
Swamp pink*	*Helonius bullata*	T
Sweet Mountain pitcher plant	*Sarracenia jonesii*	E
Virginia spirea	*Spirea virginia*	T
White irisette	*Sisyrinchium dichotomum*	E
Lichens		
Rock gnome lichen	*Gymnoderma lineare*	E

Table 8: Federally Listed Species of Concern in Henderson and Transylvania Counties

Common Name	Scientific Name
Vertabrates	
Appalachian cottontail	*Sylvilagus obscurus*
Cerulean warbler	*Dendroica cerulea*
Green salamander*	*Aneides aeneus*
Hellbender	*Cryptobranchus alleganiensis*
Pygmy salamander	*Desmognathus wright*
Rafinesque's big-eared bat*	*Corynorhinus rafinesquii*
Southern Appalachian Bewick's wren	*Thryomanes bewickii altus*
Southern Appalachian black capped chickadee	*Poecila atricapellus practicus*
Southern Appalachian red crossbill	*Loxia curvirostra*
Southern Appalachian saw-whet owl	*Aegolius acadicus*
Southern Appalachian woodrat*	*Noetoma floridana haematoreia*
Southern Appalachian yellow-bellied sapsucker	*Sphyrapicus varius appalaciensis*
Invertabrates	
Diana fritillary butterfly*	*Speyeria diana*
French Broad crayfish	*Cambarus reburrus*
Grizzled skipper	*Pyrgus wyandot*
Margarita River skimmer	*Macromia margarita*
Oconee crayfish ostracod	*Epioblasma capsaeformis*
Tennessee clubshell	*Pleurobema oviforme*
Tennessee heelsplitter	*Lasmigona holstonia*
Transylvania crayfish ostracod	*Waltoncythere acuta*

Table 8 (cont.): Federally Listed Species of Concern in Henderson and Transylvania Counties

Vascular Plants	
Alexander's rock aster	*Aster avitus*
Blue Ridge ragwort	*Packera millefolium*
Bog asphodel	*Narthecium americanum*
Butternut	*Juglans cinerea*
Cuthbert's turtlehead	*Chelone cuthbertii*
Fort mountain sedge	*Carex communis var. amplisquama*
Fraser fir	*Abies fraseri*
Fraser's loosestrife	*Lysimachia fraseri*
French Broad heartleaf*	*Hexastylis rhombiformis*
Gray's lily	*Lilium grayi*
Large flowered Barbara's buttons	*Marshallia grandiflora*
Large-Leaved Grass of Parnassus	*Parnassia grandifolia*
Lobed barren-strawberry	*Waldsteinia lobata*
Mountain bitter cress	*Cardamine clematitis*
Mountain catchfly	*Silene ovata*
Mountain heartleaf	*Hexastylis contracta*
New Jersey Rush	*Juncus caesariensis*
Small-leaved meadow rue	*Thalictrum macrostylum*
Smoky Mountain mannagrass	*Glyceria nubigena*
Southern oconee bells	*Shortia galacifolia* var. *galacifolia*
Sweet pinesap	*Monotropsis odorata*
White fringeless orchid	*Platanthera integrilabia*
Non-vascular Plants	
Gorge moss	*Bryocrmia vivicolor*
Hornwort	*Aspiromitus appalachianus*
Liverwort	*Plagiochila sharpii*
Liverwort	*Plagiochila sullivantii* var. *sullivantii*
Liverwort	*Plagiochila virginica* var. *caroliniana*
Liverwort	*Porella wataugensis*

Table 9: State Listed Threatened and Endangered Plant Species of Henderson and Transylvania Counties

Common Name	Scientific Name	Status
Vascular Plants		
American bittersweet	*Celastrus scandens*	E
Bog rose	*Arethusa bulbosa*	E
Bunched arrowhead	*Sagittaria fasciulata*	E
Cranberry	*Vaccinium macrocarpon*	T
Creeping sunrose	*Crocanthemum propinquum*	T
Divided-leaf ragwort	*Packera millefolium*	T
Fraser's loosestrife	*Lysimachia fraseri*	E
Gray's lily	*Lilium grayi*	T
Large-leaved grass-of-parnassus	*Parnassia grandifolia*	T
Littleleaf sneezeweed	*Helenium brevifolium*	E
Lobed barren-strawberry	*Geum lobatum*	E
Mottled trillium	*Trillium discolor*	T
Mountain heartleaf	*Hexastylis contracta*	E
Mountain sweet pitcher plant	*Sarracenia jonesii*	E
New Jersey rush	*Juncus caesariensis*	E
Northern beech fern	*Phegopteris connectilis*	E
Red Canada lily	*Lilium canadense ssp. editorum*	E
Robin runaway	*Rubus dalibarda*	E
Rough blazing star	*Liatris aspera*	T
Single-sorus spleenwort	*Asplenium monanthes*	E
Small whorled pogonia	*Isotria medeoloides*	T
Spreading avens	*Geum radiatum*	E
Swamp pink*	*Helonias bullata*	T
Sweet gale	*Myrica gale*	E
Sweet white trillium	*Trillium simile*	T
Virginia spiraea	*Spriraea virginiana*	T
White irisette	*Sisyrinchium dichotomum*	E
Wiry panic grass	*Panicum flexile*	T
Lichens		
Rock gnome lichen	*Gymnoderma lineare*	E

Table 10: State Listed Plant Species of Concern in Henderson and Transylvania counties

Common Name	Scientific Name
Vascular Plants	
Alabama grape-fern	Sceptridium jenmanii
American barberry	Berberis canadensis
Appalachian yellow asphodel	Narthecium montanum
Appalachian golden-banner	Thermopsis mollis
Ash-leaved golden-banner	Thermopsis fraxinifolia
Barratt's sedge	Carex barrattii
Bent white trillium	Trillium flexipes
Brown bog sedge	Carex buxbaumii
Climbing fumitory	Adlumia fungosa
Cuthbert's turtlehead	Chelone cuthbertii
Freshwater cordgrass	Spartina pectinata
Large-flowered Barbara's buttons	Marshallia grandiflora
Longstalk sedge	Carex pedunculata
Mountain catchfly	Silene ovata
Perennial sundrops	Oenothera perennis
Piedmont horsebalm	Collinsonia tuberosa
Plains sunrose	Crocanthemum bicknellii
Rock muhly	Muhlenbergia sobolifera
Southern Oconee bells	Shortia galacifolia var. galacifolia
Sticky bog asphodel	Triantha glutinosa
Sweet pinesap	Monotropsis odorata
Non-vascular Plants	
Liverwort	Acrobolbus ciliatus
Liverwort	Chiloscyphus muricatus
Liverwort	Drepanolejeunea appalachiana
Liverwort	Lejeunea blomquistii
Lichens	
Worthy shield lichen	Canoparmelia amabilis

Invasive Species, Insects, Disease, and Potential Plant Pests

This management plan outlines the procedure for monitoring and controlling the spread of invasive plants. Multiflora rose (*Rosa multiflora*), Japanese stiltgrass (*Microstegium vimineum*), Chinese silvergrass (*Miscanthus sinensis*), and Japanese honeysuckle (*Lonicera japonica*) have all been identified on the forest. The control of invasive species is essential to maintain the health, habitat value, and productivity of DSF. Procedures are also described to combat the Hemlock Wooly Adelgid insect pest, and to mange stands towards healthy conditions to avoid widespread damage resulting from Southern Pine Beetle infestations, Oak Decline events, and Annosum root disease

The status of plant pests not currently present on DSF but with the potential of spreading to the area over time will also be monitored. Of particular concern are plant pests whose spread has been rapid and destructive enough to warrant federal or state quarantine measures. The NCDFR pest control branch and the NCDA &CS plant protection section will be notified if any of the pest species included below are identified on DSF to ensure that proper control measures are initiated. The information regarding these pests has been compiled from fact sheets made

available by the USDA Animal and Plant Health Inspection Service (APHIS), and the NCDA & CS Plant Protection section.

Plant Pests:

Cogongrass (*Imperata cylindrical*)
Cogongrass, an aggressive colony-forming perennial grass, is a federally listed noxious weed. The grass was introduced from Southeast Asia to Florida, southern Louisiana, southern Alabama, and southern Georgia for the purposes of soil stabilization in the early 1900's and grows well in full sunlight and partial shade. Cogongrass can invade a range of sites including old fields, pastures, open forestland, newly established forest plantations, and utility right-of-ways. Seeds are light in weight and easily dispersed by wind. Spread commonly occurs in a circular pattern through rhizome establishment. Though Cogongrass has not been identified in North Carolina, infestations have been identified in Pickens, Greenville, and Anderson counties in South Carolina. These counties are directly adjacent to Transylvania and Henderson counties.

Musk Thistle (*Carduus nutans*)
Musk thistle, a biennial plant, introduced from Western Europe in the early 1900s, competes well throughout disturbed and open areas including pastures, right-of-ways, grassy balds, meadows, and areas of frequent flooding. The competitiveness of the plant is highly dependent on light and water availability. Musk thistle is a Class B noxious weed in North Carolina, indicating it is present in 20 or fewer counties and poses a threat to the state. Buncombe and Polk counties, both adjacent to Henderson County, are included in the list of quarantine counties where musk thistle has been identified.

Oriental Bittersweet (*Celastrus orbiculatus*)
Oriental bittersweet, a deciduous woody vine, was introduced from Asia in 1736. It is a shade tolerant plant that germinates well under forest canopies. Seeding is prolific and the vine readily roots at nodes. Oriental bittersweet is common in forest openings, along forest margins, roadsides, right-of-ways, and in meadows. Infestations are often extensive. Oriental bittersweet is a Class C noxious weed in North Carolina indicating full statewide eradication is not possible. A state quarantine has been established throughout most of western North Carolina including Henderson and Transylvania counties.

Insect Pests:

Emerald Ash Borer (*Agrilus planipennis*)
The Emerald Ash Borer (EAB) is a beetle native to eastern Asia that was first identified in southeastern Michigan in 2002. Based on the level of destruction it is believed that the beetle was actually introduced up to twelve years earlier and was likely introduced through wood packing materials. EAB attacks only true ash trees including green, white, black, and blue ash, destroying the water and nutrient conducting tissue of those host species. The beetle can be transported from infested areas on ash nursery stock, firewood, and logs. EAB has not been identified in North Carolina, though it has been found in eastern Tennessee. A federal quarantine has been established for Michigan, Illinois, Indiana, Ohio, West Virginia, Pennsylvania, and

portions of Minnesota, Iowa, Wisconsin, Missouri, Kentucky, Tennessee, New York, and Virginia prohibiting the movement of potentially infested ash materials.

European Gypsy Moth (*Lymantria dispar*)
The European Gypsy Moth (EGM) arrived in Massachusetts in 1869. During the caterpillar life stage EGM has the potential to cause the extensive defoliation of over 300 different tree and shrub species. Hosts include oak, poplar, aspen, and birch. Such extensive defoliation leaves the host species more susceptible to other pests, diseases, and environmental stress, eventually resulting in mortality. Newly hatched EGM caterpillars may spread by wind from tree to tree. The egg masses of EGM, which tolerate extreme fluctuations in temperature and moisture, may be spread by humans through the transport and movement of wood products, nursery stock, wood pallets, shipping containers, equipment, and other household items. Control and eradication efforts including trapping and detection are coordinated by federal and state plant protection personnel. A federal quarantine exists for New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Washington DC, and Michigan. Portions of Maine, Wisconsin, Ohio, West Virginia, Virginia, and North Carolina have partial quarantines involving multiple counties, or portions of counties. In North Carolina, Currituck County and portions of Dare County are currently managed with federal and state quarantines.

Imported Fire Ant (*Solenopsis invicta*)
Imported fire ants were introduced into Mobile, Alabama from South America in 1918 and during the 1930s. These ants pose a hazard to people, small animals, and agricultural crops due to their venomous bites, feeding behavior, and large nests. Fire ants may spread during the mating process, through floods, and by hitchhiking on vehicles, plants with roots and soil attached, nursery stock, sand, gravel, grass, sod, hay, wood, and equipment. The federal quarantine area regulating the movement of restricted articles includes Florida, Louisiana, Mississippi, Alabama, Georgia, South Carolina, and portions of California, New Mexico, Texas, Oklahoma, Arkansas, Tennessee, Virginia, and North Carolina. In North Carolina, full county quarantines are in place for much of the Coastal Plain, and Sandhills area. In the western portion of the state full county quarantines are in place for Cleveland County, Gaston County, and Polk County which is adjacent to Henderson County. Partial county quarantines have been established in Rutherford County, Cherokee County, and Clay County.

Diseases:

Thousand Cankers Disease
(Geosmithia morbida) fungus in association with* the *(Pityophthorus juglandis) Walnut Twig Beetle
Thousand Cankers Disease (TCD) is a disease complex believed to be native to the United States first identified in Colorado in 2008 after examination of walnut mortality during the previous five years. The disease results from the combined action of the fungus and beetle identified above. The Walnut Twig Beetle has expanded its range over the past two decades. Walnut mortality attributed to this complex has been identified in California, Oregon, Washington, Idaho, Utah, Arizona, New Mexico, and Colorado. Walnut dieback as a result of the disease was reported in Knoxville, Tennessee in July 2010. There are no current federal regulations in place

to control the spread of TCD. Several states, including Indiana, Kansas, Michigan, Missouri, Nebraska, Oklahoma, Wisconsin, and North Carolina, have established exterior quarantines prohibiting the import of suspect material.

Areas of High Historical and Cultural Value

The protection of areas of high historical and cultural value begins with the identification of significant sites and the development of proactive management strategies. Technical assistance from other state agencies, particularly the North Carolina State Office of Archeology, will be sought as potentially unique sites are encountered. Any required protective measures that need to be taken will be documented and conveyed to forest personnel and user groups. Detailed assessments, recognition, and enforcement will play key roles in the protection of these heritage resources.

Three cemeteries of known cultural importance are present on DSF. Thomas Cemetery and Moore/Hooker Cemetery are currently maintained by DSF staff and signs are present indicating their location. These burial grounds date back to the 1800's and early 1900's, and are occupied by members of the Thomas, Moore, and Hooker families. These families lived in the Little River and Cedar Mountain Communities when the area consisted largely of small farms. The third cemetery, accessible from Rock Quarry Road, is not delineated by a sign and its origin is unknown.

Further archeological research is needed to assess the importance of other features of possible historic and cultural importance. Pre-historic petroglyphs have been potentially identified at Long Rock, Big Rock, and Bridal Veil Falls. These sites are currently being studied, and will be monitored and protected as necessary. DSF staff will enlist the expertise of our cooperating organizations to better understand these resources and develop protection mechanisms where required.

Special-Use Permitted Groups

The special-use permit system is designed to accommodate forest visitors whose desire to utilize the resources of DSF go beyond general recreation as permitted by DSF regulations. Special-use requests are evaluated based on the impact such use would have on the natural resources of DSF, the impact use would have on other visitors, and how the activity compliments the goals and objectives of DSF management. The most common permitted uses include:

- Training exercises for emergency response, search and rescue, law enforcement, and military organizations.

- Recreation activities and service projects involving organized youth groups (i.e. summer camps, Boy Scout groups, school groups).

- Service projects involving volunteer organizations.

- Harvesting of non-timber forest products by approved individuals

- Removal of dead and down trees for firewood by local community members

Place-Based Economic Development

The economic importance of DSF is suggested throughout this entire management plan. Work opportunities for loggers and other forest workers is a prime example of the economic benefit DSF may provide as a working forest. The economic benefits do not end with one logging company directly involved in a contracted project, but extends to the sawmill, manufacturing facility, and retailer of harvested products. Similarly, while outdoor recreation outfitters may benefit directly from DSF by utilizing the area to lead and facilitate outings, local lodging facilities and other service providers may benefit indirectly from the business provided by the individuals taking part in those outings.

The interagency planning report for DSF made explicit mention of the potential for DSF to provide even further economic benefit by proactively engaging members of the private business community. By supporting local business endeavors there is great potential to keep much of the value-added associated with forest products in the local and regional community. This support could involve an effort as direct as reaching out to specialty wood users and manufacturers as a local source of raw material, to something as indirect as helping to increase the marketing strength of local forest product manufacturers and craftspeople by allowing them to provide customers with a locally-sourced product that was harvested in an ecologically-friendly way. The "green certification" of DSF management through a third party auditing body like the Forest Stewardship Council, or the Sustainable Forestry Initiative may further that marketing effort and allow businesses manufacturing products from DSF-produced raw materials to differentiate themselves in the marketplace.

By increasing the connectivity of conserved land and green-space throughout the region there is potential to also increase the economic impact of outdoor recreationalists across population centers within that network of open, public land. Aside from the economic impact of increasing the availability of outdoor recreation opportunities throughout local communities, such an effort may also result in an increase in the quality of life of community members by allowing broader access to those opportunities. The management of DSF can contribute to this effort by participating in greenway initiatives such as the partnership between Land of Sky Regional Council and the North Carolina Department of State Parks, which highlights the connection of DSF, Brevard, Hendersonville, and Pisgah National Forest as a high priority.

Land Acquisition

Currently NCDFR is actively pursuing the acquisition of a tract adjacent to DSF on Stone Mt. in the northeastern corner of the property through a NC Natural Heritage Trust Fund grant, in addition to the remaining DuPont Corporation property in the central portion of the forest. It is expected that the remaining DuPont Corporation property will be donated to the state within the next ten years following additional environmental clean-up and monitoring. DSF does not have a budget allotment to purchase land. Any future acquisition will likely have to result from a

donation, or be purchased with grant funding. Lands considered for acquisition generally meet one of the below requirements:

- The acquisition provides for greater wildlife habitat connectivity, or connects with another conserved property.

- The acquisition of the property will protect water quality or a unique and important natural community type.

- The acquisition will create a buffer from intense development.

- The acquisition will establish a connecting boundary with Holmes Educational State Forest.

- The acquisition establishes a more regular boundary that would in turn be more identifiable, or connect to a major road.

- The acquisition includes an in-holding property.

Property that becomes available for acquisition will be inspected on the ground before being considered for addition to the forest. All land acquisition will be coordinated through the State Property Office using the established NCDFR land acquisition procedure.

Chapter 6: Monitoring and Summary

Monitoring Procedures

All management activities including tree harvesting, road and trail construction, invasive species control, prescribed burning, or any other special project will be closely monitored during implementation to ensure the protection of all forest resources addressed in this plan. What follows below are monitoring considerations following project completion.

The stand-level unit narrative described in the operational standards portion of this plan will provide the primary mechanism for evaluating and documenting the efficacy of a given treatment. In addition to providing a description of the baseline condition of an area prior to treatment, the narrative will also serve to document the findings of post-treatment inspections.

Following the implementation of any regeneration treatment the area will be re-inspected no later than the following growing season to evaluate the development of new regeneration, and the response of advance regeneration to release treatments. The results of the treatment, whether intended or not, will be documented and added to the unit narrative to provide for adaptive management over time. Periodic monitoring should continue, and findings documented, until a satisfactory condition has been met.

The development of invasive species and undesirable regeneration as a result of treatment are of particular concern following management implementation. Systematic monitoring will ensure those unwanted situations are identified and mitigated where possible.

The annual road and trail inspections outlined in the objectives section will serve as the monitoring process for the road and trail network. The standard DSF trail report form will continue to be used. The report is completed by the individual conducting the assessment and it documents trail condition and any work needed.

DSF managers will work with NCWRC to develop a list of wildlife species whose presence may act as indictors of forest health and habitat quality. Following the establishment of baseline abundance numbers, periodic species counts will allow managers to evaluate how well forest treatments are achieving the specified goals for wildlife.

GIS will be used to analyze the spatial proximity of treated areas to evaluate the contribution of management to landscape-scale goals of habitat connectivity and biodiversity. This platform will also be utilized to examine age-class distributions of forest stands, and associated natural communities over time.

Summary Statement

The physical landscape of DuPont State Forest has been influenced and shaped by thousands of years of ecological and cultural change. The primary focus of this management plan is the

development of a systematic procedure to maintain and enhance the ecological, cultural, and economic value of the property. The plan has been developed with recognition of the ecological importance of DSF to the larger landscape of the Southern Appalachians, and the social and economic importance of DSF to the local community. As natural resource professionals we will approach the management of DSF with humility in recognition of these attributes and remain adaptive over time in order to protect these resources in perpetuity.

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