Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region

Report of the Region 8 Old-Growth Team

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The Region 8 Old-Growth Team

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INTRODUCTION

The U.S. Department of Agriculture, Forest Service, Southern Region, recognizes old-growth forests as a valuable natural resource worthy of protection, restoration, and management. Old-growth forests provide a variety of values, such as biological diversity, wildlife habitat, recreation, esthetics, soil productivity, water quality, aquatic habitat, cultural values, and high-value timber products. Old-growth communities are rare or largely absent in the southeastern forests of the United States. Existing old-growth communities may represent around 0.5 percent (approximately 676,000 acres) of the total forest acreage (approximately 108,400,000 acres) in the Southeast (Davis 1996). For these reasons the national forests are making efforts to address the restoration of this missing portion of the southern forest ecosystems. The future decisions made regarding old growth on national forests during forest plan revisions will be based on sound ecological principles and on consideration of the many social values throughout the region. These guidelines do not render any programmatic or site-specific decisions related to old-growth forests, but rather aim to build a framework to be used by the southern national forests in making decisions about the protection, restoration, and management of old-growth forest communities.

Background

The current Federal laws and regulations associated with the management of national forests do not specifically mandate old-growth management. These various laws do, however, provide direction to the Forest Service in such areas as the management of multiple natural resources and values, the protection and recovery of federally listed threatened and endangered species and their habitats, providing habitats to sustain viable populations of vertebrate species, and maintaining and enhancing the diversity of plant and animal communities that would be expected in a natural forest. These considerations have been at the heart of old-growth planning in the Pacific Northwest (Hardt and Newman 1995).

In 1989, the Forest Service chief Dale Robertson at that time, issued a national position statement on old-growth forests (USDA FS 1989). He provided a generic definition stating, “Old-growth forests are ecosystems distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulation of large wood material, number of canopy layers, species composition, and ecosystem function.

The age at which old growth develops and the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site conditions, and disturbance regime. Old growth in fire-dependent forest types may not differ from younger forests in the number of canopy layers or

accumulation of down woody material. However, old growth is typically distinguished from younger growth by several of the following attributes:

1. Large trees for the species and site.
2. Wide variation in tree sizes and spacing.
3. Accumulations of large-sized dead standing and fallen trees that are high relative to earlier stages.
4. Decadence in the form of broken or deformed tops or boles and root decay.
5. Multiple canopy layers.
6. Canopy gaps and understory patchiness."

In response to this position statement, efforts began in 1990 among the National Forest System in Regions 8 and 9; the Forest Service research arm (Southern Research Station, North Central Experiment Station, and Northeastern Experiment Station); and The Nature Conservancy to develop old-growth definitions by forest community type (USDA FS 1992). The definitions developed for each forest community type included a description, a listing of representative old-growth stands, the geographic distribution, and old-growth attributes as described in the national position statement. These scientific definitions are currently in various stages of development.

In the absence of the definitions, the Southern Region has relied on age criteria, site productivity, and administrative land classifications to initially identify possible old-growth forests (USDA FS 1993a). Current land management decisions regarding old growth have been implemented on the Ouachita National Forest (USDA FS 1994b), the Nantahala-Pisgah National Forests (USDA FS 1994c), and the George Washington National Forest (USDA FS 1993b).

In December, 1995, the regional forester chartered the Region 8 Old-Growth Team "to finalize the old growth effort and make the [draft] definitions operational and useful." This report is the culmination of the team's effort over the past year and a half.

Team Goals and Objectives

The management of old-growth forests in the Southeast is a challenging issue. Today, old-growth forests are limited in area and distribution on the southern landscape due to past natural events and human disturbances. For this reason, strategies addressing old-growth forest communities will primarily address the restoration of existing second-growth forests to develop old-growth attributes over time. Also of importance are identifying existing old-growth forest communities and developing directions for these representative sites.

Due to the finite number of representative old-growth sites, the available scientific information is somewhat limited for defining old-growth conditions and attributes. Martin (1992) in discussing the difficulty of defining "old growth" stated: "Old growth should reflect the evolutionary history of a forest, but it is

difficult for us to understand it. The long-term history of a forest is like a motion picture representing thousands and millions of years. Unfortunately, we will only see one or two frames in our lifetime. From these frames we are supposed to interpret the past, predict the future, and manage accordingly." Adding to the difficulty of defining "old growth" in the South is the wide range of ecological conditions and diversity of forest communities. But regardless of this difficulty and the inherent information gaps when dealing with this natural resource issue, there is an immediate need to provide regional old-growth guidance (Hardt and Newman 1995). The following are the Region 8 Old-Growth Team's goals and objectives.

Team Goals

The goals of the Region 8 Old-Growth Team as stated in the charter are to:

1. Review the definitions (drafted from the research) and other related information to develop guidance for useful operational applications across the Region

2. Develop consistency in this information for use in forest and project-level planning

3. Include internal as well as external reviews as part of this process

4. Coordinate this effort with other agencies and regions as appropriate.

Team Objectives

The objectives of the Southern Region's old-growth strategy are to:

1. Finalize operational definitions for 16 old-growth communities that are found on southern national forests utilizing scientific descriptions being developed by researchers and augmenting these descriptions with additional current information

2. Provide guidelines to inventory all possible old-growth communities during forest land management planning using consistent criteria

3. Provide considerations for determining minimum amounts and spatial distribution of old-growth communities at the subregional, forest, and local levels

4. Develop procedures and rules for identifying existing and future old growth during the implementation of the forest plan through field inventories, which will be based on the operational definitions and

5. Provide regional standards for maintaining data about old-growth forests.

Team Process

After first considering a total of 24 old-growth forest community types, the team determined that 19 had the potential to occur on national forests in the Southern United States. The team then decided that the sand pine forests and woodlands (type 34), cedar woodlands (type 37), and bay forests (type 41) would be addressed better in the context of rare natural communities than as old-growth community types. Furthermore, none of the tropical old-growth (primary) forest community types in the Caribbean National Forest are included in these guidelines. The recent revision of the Caribbean National Forest land management plan addressed these tropical primary forests. These decisions resulted in a total of 16 old-growth forest community types with the potential of occurring on national forests in the Southern United States.

Researchers have been working on the scientific definitions for these 16 old-growth forest community types following the national protocol as provided by Chief Robertson (USDA FS 1989). Because the old-growth definitions are in various stages of completion the team requested that each of the principal scientists working on the definitions provide summaries of their work for developing operational definitions.

All of the researchers provided this information, including narrative descriptions of the old-growth forest community types, a discussion of the geographic distribution, a listing of representative stands for each type, and the measurements of various attributes as described in the national generic definition (USDA FS 1989). Originally, the team intended for the information provided by the researchers to serve both as summaries of the scientific definitions and as operational definitions. However, after reviewing the scientific information received from Forest Service personnel, researchers, and outside interests, the operational definitions and the summaries of the scientific definitions were treated separately.

The purpose of operational definitions is to provide a simplified set of criteria for making decisions in the field regarding a forest stand's status as old growth. The summaries of the scientific definitions serve as descriptions of the old-growth forest community types and help to formulate forest plans regarding the desired future conditions of old-growth stands, management prescriptions, and monitoring to determine if the desired conditions are met.

With the operational definitions and the summaries of scientific definitions completed, the team developed guidance for addressing old growth in forest and project-level planning and monitoring.

INCORPORATING OLD GROWTH INTO FOREST PLAN REVISIONS

Overview

National forests will have the opportunity to develop management strategies for old-growth forest communities when forest plans are revised. The successful restoration of old-growth stands will require broad-scale information and coordination among national forest managers whose forests share similar ecological and social settings. Old-growth management will be accomplished in the context of ecosystem management principles that include both biological and social considerations. Due to the current scarcity of old-growth communities, most of the efforts on southern national forests will involve identifying areas for old-growth restoration. The guidance, which will be implemented through the individual forest plans, include:

- developing a preliminary inventory of old-growth communities
- evaluating the old-growth values and developing issues
- developing land allocation strategies during alternative development
- providing management direction for old-growth allocations and individual stands of old-growth forest communities.

Terminology

Various terms are used to describe old growth such as: primary forest; virgin forest; potential old growth; designated old growth; type A, B, or C old growth; ancient forest; or old forest. To minimize confusion, these guidelines use three terms to be used by national forests when describing old growth:

Existing Old Growth. Forest stands or patches that meet the age, disturbance, basal area, and tree size criteria described in the operational definitions for the 16 forest community types. A stand or patch must meet all four criteria in order to be classified as existing old growth.

Future Old Growth. Forest stands or patches allocated to old growth through land management decisions, but which do not meet one or more of the old-growth criteria in the operational definitions.

Possible Old Growth. Forest stands identified during the preliminary inventory of old growth because they meet one or more of the preliminary inventory criteria. The areas of possible old growth will be used to help identify areas to consider for old-growth allocation during forest plan alternative development and to establish priorities for areas of old-growth field inventories during project-level planning. The identification of a

stand as possible old growth infers no land management decision regarding the stand's status as existing or future old growth.

Preliminary Inventory of Possible Old-Growth Forests

In preparing to revise forest plans and prior to alternative development, a preliminary inventory of possible old growth will be conducted on the national forests to analyze the distribution and representation of possible old-growth communities. This process will need to be coordinated among national forests sharing common ecological boundaries, the public, and other State and Federal agencies.

The preliminary inventory will not, in itself, identify areas of old-growth for protection, restoration, or management. However, it does provide information for alternative development and for making planning decisions. Some national forests have already conducted this inventory using previous criteria (USDA FS 1994a). For the Southern Appalachians Assessment (SAA), an "initial old-growth inventory" was used. This SAA inventory will be updated as part of the forest plan revisions. The following criteria for the preliminary inventory replace all previous criteria and should be followed by national forests in the revising or amending their forest plans. The national forests within the SAA will notify the public when the shift from the SAA initial inventory to the preliminary inventory based on these regional guidelines is made.

This preliminary inventory will be developed based on information the national forests currently have available from internal as well as external sources. The preliminary inventory process and screening criteria include:

1. Refine the relationship between the Continuous Inventory of Stand Condition (CISC) forest types and the 16 old-growth forest community types as shown in this report.

2. Include stands identified by national forests as old growth through past inventories or land management decisions.

3. Include all areas allocated to old-growth management through past land management decisions.

4. Identify additional areas (not already identified in number 2 or 3 above)
   as possible old growth. Criteria for identifying these additional areas of possible old growth are needed because current forest cover information for national forests is incomplete regarding old-growth conditions. Since a final inventory of those forests containing old-growth characteristics will not be available for many years, an inventory of additional areas of possible old growth will be required as part of the current forest-planning process using the following criteria:

- Query CISC, based on the relationship between the old-growth forest community types and CISC forest type codes, to supply a list of stands/areas with ages equal to or greater than the minimum ages shown in table 1 for each old-growth forest community type. This list will include stands currently classified as suitable and unsuitable for timber production.

- Include all lands, whether CISC data about them exist or not, that are congressionally or administratively precluded from timber production such as wildernesses, wild and scenic rivers, and research natural areas.

- Due to the limitations associated with CISC stand ages, supplement the CISC query with information from additional areas that may also contain old-growth forest communities. Utilize people who know of possible areas that might be included such as:

  - Forested and relatively undisturbed riparian areas of stand size

  - Late successional forest areas, in which relatively little human disturbance has occurred over the past five decades

  - Late successional areas which are inaccessible from roads;

  - Stands of low site productivity that have had little or no human disturbance (productivity class 7; i.e., less than 20 ft^3/acre/year growth capability) and

  - Consult other inventories concerning possible old growth on national forest lands as appropriate (including information from other agencies and the public).

5. Display the preliminary inventory information in both spatial and tabular format for all stands identified in the inventory by individual national forest and by ecological section. Make the inventory available for public review prior to the development of alternatives in the forest plan. Display the information from criteria 2, 3, and 4 according to:

-total acres of possible old growth stratified by old-growth forest community types, including uninventoried acres not assigned to a community type. The CISC stand description data may or may not exist for unsuitable forest land. Where possible,

Table 1. - *The minimum stand age by old-growth forest community type for use during the preliminary inventory of possible old growth on southern national forests.*

Old-Growth Community Type	Minimum Stand Age
	Years
Northern hardwood forest	100
Conifer-northern hardwood forest	140
Mixed mesophytic and western mesophytic forests	140*
Coastal plain upland mesic hardwood forest	120*
Hardwood wetland forest	120*
River floodplain hardwood forest	100
Cypress-tupelo swamp forest	Pondcypress - 120 Baldcypress - 200
Dry-mesic oak forest	130*
Dry and xeric oak forest, woodland, and savanna	Widespread subtype - 110* Southern subtype - 90*
Xeric pine and pine-oak forest and woodland	Shortleaf - 100* Other pine and mixed - 100
Dry and dry-mesic oak-pine forest	120*
Upland longleaf and south Florida slash pine forest, woodland, and savanna	Longleaf - 110 Slash - 80
Seasonally wet oak-hardwood woodland	100*
Eastern riverfront forest	100*
Southern wet pine forest, woodland, and savanna	Longleaf - 110 Slash - 80 Pond - 80
Montane and allied spruce and spruce-fir forest	120*

*Based on half life (typical mortality) of dominant tree species (Loehle 1988).

augment this information gap with available satellite imagery or aerial photography to come up with estimates of acres of each old-growth forest community type for these areas

-acres of possible old growth stratified by the selection criteria (i.e.,
wildernesses, research natural areas, minimum ages, past allocations)

-acres of possible old-growth forest community types stratified according to lands suitable and unsuitable for timber production (as identified in the existing forest plan).

A purpose for the preliminary inventory is to ensure that management options related to possible old growth on national forests are identified, so the areas can be fully considered during forest plan revisions. Once these possible old-growth areas are identified in the preliminary inventory and until the revised forest plan is approved, the environmental analysis for project-level activities proposed within these areas will consider the effects the proposed action has on the area's old-growth forest characteristics (USDA FS 1994a).

First, it should be determined if the stand meets the criteria for existing old growth based on the operational definitions (table 2) through field inventory. If the stand is existing old growth, then the effects of a proposed project on the stand's old-growth characteristics will be fully disclosed and considered through the National Environmental Protection Act (NEPA) process. The district should consult with the forest-planning team regarding draft forest plan options under consideration for the old-growth forest community type in question, as well as for the entire project area.

Second, if the stand in question is determined not to be existing old growth, a project-level analysis should consider if the area is being included as part of an old-growth allocation in the revised forest plan alternatives. The analysis should consider the effects of the proposed actions to the old-growth allocation area. If the area does not meet the old-growth operational definition and is not being considered as part of an old-growth allocation area, then there is no old-growth issue related to the area.

Determining Forest-wide Old-Growth Issues

Public Scoping

The protection, restoration, and management of old-growth forests through an ecological approach is an important issue to many public interests and is a major concern to national forest managers. National forests should actively

seek public input and participation while addressing this issue. During this involvement, national forest managers should begin to understand the public's perception of old-growth forests and their values. Other Federal agencies, State agencies, non-governmental organizations, and academia must be included when developing issues and strategies for old-growth forests. After the public scoping process and following the issuance of the notice of intent (NOI) to revise forest plans, the national forests will clarify and define the old-growth issues for each forest plan. The clarification should include land allocation concerns, biological values and requirements, and social values. Public involvement will be important in determining the areas to be allocated to old growth in the forest plan alternatives and in developing the desired future conditions and objectives.

Determining Biological and Social Values of Old-Growth Forests

An important step in addressing the old-growth issue is to determine the relationship of old-growth communities to biological resources, as well as recreational, scientific, and cultural values. Building these relationships will be important in determining areas to be allocated to old growth and in providing a credible analysis of effects to these various values for different alternatives. Old growth should be considered in the context of a wide array of possible vegetative/habitat conditions, resource objectives, scientific values, and social/cultural values.

Wildlife and Botanical Resources. -- Habitat relationships among special plant and animal species identified using the screening process (SAMAB 1996, USDA FS 1996) to meet forest-planning regulations (36 CFR 219.) should include old-growth habitats. These special species will include federally listed species, Forest Service sensitive species, game species, species with high-management and public interest, species with demanding habitat requirements, and species considered keystone species. The habitat relationships for these species should be determined for all forest cover types and successional classes, rare communities, and special habitat variables. Old-growth communities should be included in developing these habitat relationships. Based on the documented habitat relationships, the contribution of old growth to wildlife and botanical species' habitats can be assessed. This analysis should be quantified according to acres of suitable habitat for the appropriate group of species.

To date no species or species group has been identified as being obligate to old-growth forest communities. However, old-growth forest communities may serve as optimal habitat for some species associates (i.e., red-cockaded woodpecker and landbird late successional habitat associates). Much is still unknown about many species (especially non-vascular plants and invertebrates) associated with old growth. To account for these unknowns, the argument to provide representative old-growth forest communities goes back to Aldo Leopold's conservative approach of "keeping all of the pieces" (Leopold 1949). This "coarse filter" approach of providing a representation of the different old-

growth forest communities will help to address overall biological diversity goals and to provide a "biological safety net."

Recreational Values. -- The contributions of old growth to forest recreational use should be considered. These contributions include nature watching, hunting, camping, hiking, and photography. While these activities may not necessarily be dependent upon old-growth forest communities, the relationship of recreation activities to old-growth forest communities should be estimated.

Research and Scientific Values. -- Old-growth areas can provide opportunities to further understand the ecological processes associated with these communities and to further test the principles of forest dynamics and development. Martin (1992) stated that old-growth forests "are invaluable because they provide the controls against which to best test hypotheses about younger, successional forests and forests actively managed for specific products or purposes. These baseline sites can be systematically compared and contrasted with old growth of different forest types to promote a more integrated understanding of structure and function of all forests. . . . They can and should serve as monitoring sites to follow natural processes through periods of time that extend beyond funding cycles and the lifetimes of decision-makers, scientists, and resource managers."

The best data for investigating the changes that occur in a forest over time come from permanent plots that have been frequently measured. However, many forests are unstudied or have been examined only briefly, and such data are often not available. In the absence of long-term studies, dendrochronology can be useful in providing information on the history of old-growth forests. Tree growth rings provide a permanent record of the effects of climate on tree growth as well as a record of disturbances caused by fire, insects, or pollution. Tree rings are available whether or not the forest has been studied in the past (Stahle and others 1988).

Educational Values. -- Old-growth areas provide opportunities for outdoor classrooms to teach old-growth processes and to furnish examples of natural history.

Cultural and Spiritual Values. -- The values associated with people's cultural and spiritual attitudes toward old-growth forests are complex and difficult to describe. Many times these attitudes do not easily conform to scientific definitions of old growth, but people can obtain religious experiences or rejuvenation that come with solitude in nature. Some cultures may have traditional ties to old-growth areas (Standing Women and Comer 1996). These complex values should be considered when defining old-growth issues.

Due to the longevity and low disturbance of some old-growth areas, they may have historical values or archeological sites related to past historical events.

Existence Values. -- Many people may value southern old-growth forest communities, but never visit them. These existence values related to people "just knowing" that old-growth forests exist should be included in any consideration of old-growth values.

Potential High-Value Timber Products. -- The management of forests to achieve old growth has the potential to produce high-value sawtimber products. The forest plans will need to determine which of these areas will be part of the "suitable" timber base (with planned scheduled harvests) and which areas will be part of the "unsuited" timber base.

Realistically, many areas allocated to old-growth management will probably be classified as unsuitable for timber production. While these areas may contain valuable wood products, the products would most likely not be available for regulated harvesting. In addition, depending on the decisions made when revising upcoming forest plans, the potential exists for old-growth allocations to reduce the acreage of national forest lands suitable for timber production.

Values Associated with Other Land Uses.-- The relationship of old growth to other land uses associated with economic and utilitarian values should also be considered. These relationships could be either positive or negative. Examples include current or planned needs for utility rights-of-way, mining, roads, recreational development, and recreational uses (i.e., off-road vehicles and hunting).

Developing Directions for Old Growth in Forest Plans

National forest managers will consider a range of possible areas to be allocated to old growth through the forest plan alternatives and the NEPA process. The amount of land allocated will be based upon the issues developed during public scoping, the goals and objectives within each alternative, and ecological capabilities of the planning area. The ecological classification system (ECS) will be used to provide information to help in the allocation of old growth by community types and to incorporate old growth into the overall management of the forest. Since very little old growth currently exists, managers will emphasize areas for developing or restoring old growth. This planning guidance includes developing a network of old-growth areas of varying sizes to provide for the distribution, linkages, and representation of all old-growth forest community types on national forest lands. The level of representation of the individual old-growth forest community types will depend on the range of resource and social issues at both the subregional and national forest levels. This process will require considerable coordination among national forests and will be open to the public.

Forest plans will provide directions for old growth through forest-wide and management area goals and objectives, management area allocations, and management standards and guidelines. These plans will require close

coordination between national forests in close proximity to each other (e.g., national forests in the southern Appalachians). These plans will include goals and objectives needed to address the issues and demands for old growth and to identify the forests' contribution to regional old-growth conservation. In addition, managers will identify the methods by which these goals, objectives, standards and guidelines relating to old growth will be monitored. The monitoring program will address the ways that new information and research will be incorporated.

National Forest Goals and Objectives

The desired future condition (DFC) of the national forest and management areas will include descriptions of old-growth forest management, when appropriate. The DFC description, objectives, and standards will be quantified in terms of measurable parameters (i.e., acres or proportion of an area). Maps will be included showing areas allocated to old-growth management. The old-growth forest community types targeted in an area will be also be identified. The forest plans will use the summaries of the scientific definitions of old-growth forest community types contained within this guidance to help formulate the DFC statements related to old-growth areas.

When the DFC, goals, and objectives of the forest plan for an old-growth area is compatible with timber production, this area will be classified as suitable. When these goals and objectives are not compatible with timber production, the lands will be classified as unsuitable.

Old-Growth Management Strategy

National forests managers will develop a network of old-growth areas of various sizes and will develop management prescriptions for these areas.

Developing a Network of Old-Growth Areas. -- A centerpiece of the regional guidance for conserving old-growth communities is a network of old-growth areas. Many of the concepts regarding this network of old-growth areas come from landscape ecology theories (Harris 1984, Hunter 1990, Vankat and others 1991). These theories relate to the effective patch size, the distribution of patches across the landscape, the relationship of the patches to the adjacent forest matrix, and the relationship or connectivity of the patches. These guidelines attempt to incorporate these theories by providing a network of old-growth areas of different sizes, which in the future will provide the ecological integrity of old-growth communities, the representatives of the 16 identified old-growth forest community types, and an adequate distribution of these community types. While there is a need for a consistent regional approach, individual national forests also need flexibility to address old-growth allocation based on local conditions and public issues. For instance, guidelines that work for national forests in the mountains may not work for national forests on the Coastal Plain. For this reason, this guidance is broadly written and distinguishes between areas within the region.

Old-Growth Patches of Different Sizes. National forest lands in the Southeastern United States will contain a mix of large-, medium-, and small-sized old-growth areas. The national forests in the Ozark/Ouachita Highlands and the SAA area will contain a mix of all three sizes. National forests within these subregions are in close proximity to each other, with fairly consolidated land ownership.

National forests in the Coastal Plains, Northern and Southern Cumberland Plateau, Southern Appalachian Piedmont, and Mississippi Alluvial Valley will, at a minimum, provide management direction for establishing a network of medium- and small-sized old-growth restoration areas during forest plan revisions. The national forests within these ecological units typically are distant from each other and contain broken ownership patterns. While the identification of large-sized patches is warranted for these areas, in reality the land ownership patterns and natural resource management considerations may make the identification of large-sized old-growth areas impractical. However, nothing in the guidance precludes national forests in these subregions from including large old-growth patches within their network.

Large-sized Areas. The large-sized areas are designed to ensure the integrity of ecological functions and the distribution of old-growth conditions at the subregional scale. A first step for national forests within the Ozark/Ouachita Highlands and the SAA area is to identify large old-growth areas when developing alternatives for forest plans. Planning for these large areas should be accomplished at the ecological section level and across forest administrative boundaries.

Determining the biological needs and minimum areas necessary to maintain the integrity of ecological functions requires consensus building. For example, the Nantahala-Pisgah National Forests identified large-sized old-growth patches as areas greater than 2,500 acres (USDA FS 1994c). The Nantahala-Pisgah National Forests used this size criteria primarily to address public issues pertaining to area size requirements and interior breeding habitats for some landbird species. The Ouachita National Forest identified areas for shortleaf old-growth restoration which ranged in size from 600 to 6,000 acres (USDA FS 1994b).

National forests sharing ecologically similar areas should use a consistent minimum patch size during forest planning when describing large-sized patches. The Nantahala-Pisgah National Forests documented the rationale for their minimum size criteria in a recent amendment to their forest plan (USDA FS 1994c), and the public comments related to the regional old-growth guidance supported their decisions related to size criteria for large patches. To facilitate regional consistency and in the absence of other

criteria indicating a different minimum, old-growth areas larger than 2,500 acres should be considered as large-sized patches. This minimum size criteria does not represent any specific biological requirements of species or groups of species associated with a specific forested habitat.

Medium-sized Areas. Next, the national forests in Ozark/Ouachita Highlands and the SAA area should identify medium-sized areas to fill in gaps in old-growth forest community type representation or to improve the spatial distribution between the large-sized areas.

A first step for national forests in the Coastal Plains, the Northern and Southern Cumberland Plateau, the Southern Appalachian Piedmont, and the Mississippi Alluvial Valley is to identify medium-sized old-growth areas during forest planning alternative development. For these national forests, the medium-sized areas should be designed to ensure the integrity of ecological functions, provide for the distribution of old-growth conditions at the forest level, and a representation of old-growth forest community types. An option for these forests is to use state-level information to put forest planning for old growth into the context of the larger landscape.

In the absence of other criteria, old-growth areas between 100 and 2,499 acres should be considered as medium-sized patches.

Small-sized Areas. The forest plans will provide for small-sized old-growth areas through the management prescription(s) for a particular management area and will be implemented through project-level decisions. The management prescriptions will define the procedures for determining the number and priority of the small-sized areas. The emphasis will be to identify stands which:

- meet the operational definitions (table 2) for existing old growth. The forest plan will then provide direction regarding the management of small-sized, existing old-growth stands when found.

- the forest plan has identified as a priority for future old growth, because they are an underrepresented old-growth forest community type and/or normally occur in small, isolated patches (e.g., montane spruce-fir forests and cypress-tupelo forests).

In the absence of other criteria, it is recommended that old-growth areas between 1 and 99 acres should be considered as small-sized patches.

Representation of Old-Growth Forest Community Types. Sixteen old-growth forest community types have the potential of occurring on southern national forest lands. National forests, in establishing a network of old-growth areas, will need to consider a representation of all potential old-growth forest community types. The level of representation of each community type will be based on the issues raised in the forest plans, as well as on the ecological capabilities of a particular national forest.

Distribution of Old-Growth Patches. The network of old-growth areas will be designed to provide a distribution of old-growth conditions representing various ecological sections for all national forests in the Southeast. The allocation of different size patches of old growth can be used to fill voids in their present distribution. The density of the old-growth areas (i.e., the number of areas per ecological section) will depend on the level of old-growth acreage needed to address the significant issues of each forest planning alternative. For example, an alternative with 15 percent of an ecological section allocated to old growth may have a higher density of old-growth areas than an alternative with 5 percent of an ecological section allocated to old growth.

Linkage of Old-Growth Patches. In most cases on national forests, the basic assumption is that management will lead to a forest matrix which includes a full array of forest conditions, but which is dominated primarily by mid- and late-successional forests (SAMAB 1996). Harris (1984) states: "a patch of old growth that is surrounded by mature timber is less distinct than a patch surrounded by regeneration areas." For this reason, when old-growth areas are included within this type of forest matrix, there will not be a need to physically interconnect old-growth areas by the use of old-growth corridors. The forest conditions normally found on southern national forests should provide the necessary linkages for old-growth areas. As an additional safeguard, the guidance provides for identifying small-sized areas to improve the distribution of a particular forest community type and to provide a "stepping stone" effect between large-sized and medium-sized patches.

Old-Growth Allocations and Management Prescriptions. -- Based on the issues developed during public scoping and the preliminary inventory of possible old growth, national forests should develop alternatives containing different amounts of old-growth allocations. The old-growth areas will consist of a network of patches of varying sizes. The percentage of the total forest acres within an ecological section or an individual forest allocated to old growth will vary by alternative, based on the biological and social issues involved.

The purpose of the following guidance is to better clarify the relationships among the preliminary inventory, public comments regarding old growth, old-growth allocations, the probable range of management prescriptions for these allocations, and the relationship of the old-growth allocations to lands suitable or unsuitable for timber production. The national forests in the SAA area and the Ozark/Ouachita Highlands will be discussed separately from national forests in other areas of the Southeast.

The SAA area and the Ozark/Ouachita Highlands. National forests in these areas should, at a minimum, allocate a network of large- and medium-sized old-growth areas during forest plan revisions. In addition, the forest plans should provide directions regarding existing and future old growth which occurs in small patches. The Nantahala-Pisgah National Forests (USDA FS 1994c) and the Ouachita National Forest (USDA FS 1994b) Forest Plans provide excellent working examples of this process (see appendix A).

Public involvement may generate a range of options from "use only lands currently excluded from timber production to meet old-growth objectives" to "allocate additional lands for old-growth management to protect all existing old growth and for the purpose of managing the majority of national forest lands for future old growth."

Development of Allocations. To consider the range of alternatives for addressing public comments, national forest managers should consider the following screening process:

Screen for large-sized patches. Based on the preliminary inventory, national forests should first include all congressionally and administratively designated lands not available for timber production (e.g., wildernesses, wild and scenic rivers, research natural areas) and lands currently classified as unsuitable for timber production within an ecological section. To complete these large-sized areas, some additional stands classified as suitable for timber production may need to be included. When including these additional stands, consider the oldest available stands and the old-growth forest community types that may be underrepresented. National forest managers should determine which old-growth forest community types are represented within these large-sized areas (if data are available) and which ones are not. The amount, the number, and distribution of the large-sized old-growth areas should then be determined.

Next, national forests should identify additional large-sized old-growth areas which include primarily lands classified as suitable for timber, in order to address other

public comments. The preliminary inventory should help to identify these areas. To complete these large-sized areas, some additional stands classified as unsuitable for timber production may need to be included. The emphasis of this step is to increase the proportion of national forests within an ecological section allocated to old growth, as well as the distribution of large-sized areas.

Screen for medium- and small-sized patches. After determining the locations of the large-sized old-growth areas, determine if some old-growth forest community types are not represented or if additional areas should be identified because the distance between the large-sized areas are too great. The representatives and amount of old-growth forest community types included in the large-sized areas should be analyzed.

If needed, medium-sized areas should be identified primarily from lands unsuitable for timber production, for the purpose of including old-growth community types which are absent or underrepresented in the large-sized areas. In addition, the identification of medium-sized areas can be used to improve the distribution of old-growth areas, when there is a great distance between the large-sized areas.

Next, if needed to address other public comments, national forests should identify additional medium-sized areas primarily from lands suitable for timber production.

Specific management direction will be provided to address the management of small-sized patches of old growth at the project-level, as discussed on page 26.

Management Prescriptions. The management prescriptions will specify the type of strategies for the areas allocated to old growth. Guidelines 1 through 3 should be used when determining the level of activities or intervention and the suitability for timber production for large-, medium-, and small-sized patches of old growth. Additionally, guidelines 4 and 5 should be used for only large-sized and medium-sized patches.

1. No management activities or intervention allowed for the entire area. The area would be classified as unsuitable for timber production.

2. Management activities for restoration, protection, or maintenance of old-growth conditions are prescribed.

The area would be classified as unsuitable for timber production.

3. A mix of no management and intensive restoration activities are prescribed, due to the mixture of old-growth forest community types within an area. The area would be classified as unsuitable for timber production.

4. The identification of small, core, old-growth areas, surrounded by extended forest rotations (even-aged or two-aged management), designed to sustain a flow of replacement old-growth stands over time. A certain proportion of the area would meet the old-growth operational definitions at any given time. The core old-growth area would be classified as unsuitable for timber production, and the portion under long forest rotations would be classified as suitable for timber production.

5. Small, core, old-growth areas, surrounded by uneven-aged forest management, would be designed to sustain a flow of old-growth conditions across most of the area over time. Much of the area would meet the old-growth operational definitions at any given time. The core old-growth area would be classified as unsuitable for timber production, and the portion under uneven-aged management would be classified as suitable for timber production.

National Forests in the Coastal Plains, Northern and Southern Cumberland Plateau, Southern Appalachian Piedmont, and Mississippi Alluvial Valley. National forests in these areas should, at a minimum, allocate medium-sized old-growth areas during forest plan revisions. In addition, the forest plans should provide directions regarding existing and future old growth which occurs in small patches to address remaining gaps in old-growth forest community representation, distribution of old-growth areas, or linkages between these areas.

Development of Allocations. The guidance for identifying areas of old-growth and for addressing issues raised by the public are similar to the guidance provided for the SAA and Ozark/Ouachita Highlands. The difference is that medium-sized areas will be the beginning point for national forests in the Coastal Plains, the Northern and Southern Cumberland Plateau, the Southern Appalachian Piedmont, and the Mississippi Alluvial Valley.

Management Prescriptions. See guidelines 1 through 5 for medium-sized patches and guidelines 1 through 3 for small-sized patches, listed previously for the SAA area and the Ozark/Ouchita Highlands.

Effects Analysis

In describing the effects of the different forest plan alternatives, the following items should be addressed: (1) identify how old growth relates to other resources, and to social and economic issues; (2) for each alternative, identify those areas that, because of land allocations and prescriptions, will move toward an old-growth condition in the future (include such areas as Wildernesses, research natural areas, and special areas); and (3) disclose the effects on the old-growth component and the old-growth restoration areas of each alternative. These effects should be quantified using acres as the unit of measurement.

Forest Plan Monitoring

A long-term, old-growth monitoring program should include the monitoring of management activities associated with old growth to determine if directions in the forest plan are being implemented as stated.

In addition, field inventories will be conducted over time for old-growth areas, to track the effectiveness of the forest plan in moving these areas toward the old-growth DFC. These inventories determine if the stand contained existing old growth and would follow the protocol as discussed under the field inventory section.

Additional validation monitoring should include verifying the old-growth scientific definitions and management assumptions regarding the 16 old-growth forest community types. Additional data collection on structural and compositional attributes of existing old-growth stands would be required (see appendix B).

The implementation of this monitoring program will be challenging considering national forest budgets and workloads. Determining the status of existing old growth will take many years. National forests are encouraged to develop partnerships with researchers, other agencies, and public interests to implement the monitoring programs.

IMPLEMENTING DIRECTIONS IN FOREST PLANS

These project-level guidelines and operational definitions focus on identifying existing old growth in field inventories for project-level decision-making and monitoring. In addition, guidance is provided for tiering to the forest plan to identify small-sized old-growth areas.

Field Inventory of Old-Growth Forests

The guidance for field inventory to identify existing old-growth conditions is provided in this section. The team originally considered utilizing eight structural and demographic attributes for use in defining old growth during field inventory. However, this number of attributes caused concerns about consistent field applications, increased inventory work load, and the collection of unnecessary data for making decisions on existing old growth. Due to this, the team determined a simpler set of criteria would be used to make decisions regarding old growth in the field.

Operational Old-Growth Definitions

The information from the summaries of the scientific descriptions of the 16 old-growth communities were used to develop these operational definitions. The operational definitions are designed for field applications in determining the old-growth status of forest stands.. The determination of a stand's status as existing old growth will be based on age, past disturbance, basal area, and tree size. Table 2 provides the attributes for determining the old-growth status of forest stands on southern national forests. If during field inventory, a stand meets all four criteria, it will be considered existing old growth.

Project-Level Old-Growth Field Inventory

The field inventory for old growth will mostly follow the protocol used during Forest Service Silvicultural Examinations (USDA FS 2409.26d). The exception is that the age of the stands should be determined based on the oldest age class as opposed to the "representative stand age." The information collected or verified by Forest Service natural resource professionals will be used to make project-level decisions concerning old growth, to implement the forest plan, and to monitor and report forest-wide old growth.

Table 2. ***The operational definitions* to determine old-growth forest community types during the field inventory and monitoring on southern national forests.***

Old-growth forest community type	Minimum age of the oldest existing age class	Minimum basal area	D.b.h. of largest trees
	Years	Ft^2/acre	Inches
Northern hardwood forest	100	40	≥ 14
Conifer-northern hardwood forest	140	40	≥ 20
Mixed mesophytic and western mesophytic forest	140**	40	≥ 30
Coastal plain upland mesic hardwood forest	120**	40	≥ 24
Hardwood wetland forest	120**	40	≥ 20
River floodplain hardwood forest	100	40	≥ 16
Cypress-tupelo swamp forest	Pondcypress -120 Baldcypress - 200	40	≥ 8 ≥ 30
Dry-mesic oak forest	130**	40	≥ 20
Dry and xeric oak forest, woodland, and savanna	"Widespread" Subtype - 110** "Southern" Subtype - 90**	10 10	≥ 16 ≥ 8
Xeric pine and pine-oak forest and woodland	Shortleaf - 100** Pine & mixed - 100	30 20	≥ 20 ≥ 10
Dry and dry-mesic oak-pine forest	120**	40	≥ 19
Upland longleaf and south Florida slash pine forest, woodland, and savanna	Longleaf - 110	10	≥ 16
Seasonally wet oak-hardwood woodland	100**	40	≥ 20
Eastern riverfront forest	100**	40	≥ 25
Southern wet pine forest, woodland, and savanna	Longleaf - 110 Slash - 80 Pond Pine - 80	10 10 10	≥ 20 ≥ 21 ≥ 9
Montane and allied spruce and spruce-fir forest	120**	40	≥ 20

*The disturbance criteria is discussed in the narrative section.

**Based on half life (typical mortality) of dominant tree species (Loehle 1988)

Minimum Age of the Oldest Age Class. --Table 2 provides the minimum age for the oldest age class for each old-growth forest community type. In most cases, the scientific definitions do not contain information regarding the number of trees per acre in this age class. Some estimates were provided for the following forest community types: mixed mesophytic and western mesophytic forest (type 5); xeric pine and pine-oak forest and woodland (type 24); dry and dry-mesic oak-pine forest (type 25); eastern riverfront forest (type 28); and southern wet pine forest, woodland, and savanna (type 29). Based on that information and as a conservative rule of thumb, the age criteria (table 2) is applicable when at least 8 to 10 trees per acre for pine forest community types (possibly fewer trees per acre for savanna conditions) or when at least 30 trees per acre for some deciduous community types are present. There is a need for flexibility in applying this guidance during the field inventory, because these estimates are not absolutes. This criterion would be applicable to both even- and uneven-aged stands.

Disturbance Criteria. -- To many people interested in old-growth issues, past human disturbance is important in determining an area's status as existing old growth. However, the acceptable level of past human disturbance can prove difficult to quantify. For this reason, a "coarse, non-quantified, and common sense" approach will be used when considering past human disturbance. For a stand to be considered as existing old growth, no obvious evidence of past human disturbance which conflicts with the old-growth characteristics of the area should be present. Recent vegetative management activities which maintain characteristics consistent with old growth probably would not disqualify an area as existing old growth. Examples of these activities may include commercial thinnings, mid-story treatments, prescribed fire, or interpretive trails.

Minimum Basal Area. -- The minimum basal area for each old-growth forest community type in table 2 is a conservative estimate to ensure that stands are not excluded due to the variety of ecological conditions which exist in the Southeast. This minimum is provided as a measurement of stand density and reflects the variability among old-growth forest community types ranging from forests to savannas. Tree sizes for inclusion in the estimate of stand basal area will follow the Forest Service silvicultural stand examination protocols for pine and hardwood species.

Diameter at Breast Height (d.b.h.) of the Largest Trees. -- The presence of large trees is a key old-growth attribute. Again, the scientific definitions do not contain information regarding the number of trees per acre in the size categories shown in table 2. Some estimates for numbers of large trees per acre were provided for the following forest community types: mixed mesophytic and western mesophytic forest (type 5); xeric pine and pine-oak forest and woodland (type 24); dry and dry-mesic oak-pine forest (type 25); eastern riverfront forest (type 28); and southern wet pine forest, woodland, and savanna (type 29). Based on that information and as a conservative rule of thumb, the criteria for the d.b.h.'s of the largest trees are applicable when at least 6 to 10 trees per acre for

all old-growth forest community types (possibly fewer trees per acre for savanna conditions) are present. There is a need for flexibility in applying this guidance during the field inventory because there are situations in which the number of large trees per acre could be fewer.

Field Inventory Monitoring

Field inventories should be part of the long-term monitoring program to determine if forests in the old-growth allocations are moving toward the DFC. Because only small annual monetary commitments to this monitoring program are likely due to lack of funding, the use of challenge-cost share agreements should be considered. In addition, the information obtained during normal compartment prescription process should be included in the monitoring program.

Considerations for Old-Growth Forests During Project-Level Planning

During project-level planning, a first step is to review any stands identified in the preliminary inventory as possible old growth. These stands should be visited in the field in order to determine their status as existing old growth. As previously stated, a stand must meet all four criteria in the operational definitions (table 2) to be existing old growth. A second step is to determine the old-growth status of other stands in the project area. For those stands which meet the operational definitions for old growth, the directions in the forest plan will provide management options. For those stands that do not meet the operational definitions for old growth and if they are not a part of any old-growth allocation or management direction identified in the forest plan, then there is no old-growth issue associated with the project.

Project-level planning will be tiered to the forest plan direction for old growth when developing the project's purpose and needs, and proposed actions. When addressing areas allocated to old growth in the forest plan, the district managers should examine the current conditions and compare them to the DFC for the area in question. Based on this examination and public issues raised during public scoping, the district can implement natural resource management activities not restricted by the forest plan.

When addressing areas with old-growth direction, but containing no forest plan land allocations, the district will have the added responsibility of designating small-sized old-growth areas. The forest plan should provide directions regarding the portion of an area to be allocated to old growth, the distribution of these patches, and the old-growth forest community types involved. The district should use the information from the preliminary inventory and the field examination to help in designating these areas to old growth. The forest plan directions for the area, the current conditions, and public issues will determine the appropriate management activities.

When developing overall management strategies for an area, care should be taken not to isolate the medium- and small-sized old-growth patches from the mid- and late- successional forests. The districts should follow the forest plan directions for small, isolated, old-growth stands, identified as existing old growth during the field inventory, but which are located in areas not having old-growth objectives.

Monitoring Old-Growth Forests

National forest managers will gather information, utilizing data collected during field examinations within old-growth allocation areas and through compartment prescriptions, to track the development of old growth for the long-term (effectiveness monitoring). Inventory protocols are the same as those described for project-level planning. Managers should ensure that the management prescriptions are being implemented properly. In addition, priorities should be established for appropriate research to validate assumptions regarding the old-growth scientific definitions and associated silvicultural treatments. This more detailed validation monitoring will collect information on numerous old-growth variables to validate the scientific definitions and provide new information for modifying the definitions over time (see appendix B).

Information Management

The information for old-growth forests will be maintained in the National Forest Continuous Inventory of Stand Conditions (CISC) and related geographic information system (GIS) forest cover layers.

Old-Growth Land Classes

Stands allocated to old-growth management will be assigned the appropriate land class code based on the management prescriptions in the forest plan. The land class code may refer to the area allocated as old growth or be associated with another resource description (e.g.,. red-cockaded woodpecker [RCW] cluster or RCW foraging stand). The relationship between management prescriptions and timber suitability are discussed in the forest planning section of this guidance.

Old-growth areas identified as suitable for timber production and which do not have a compatible old-growth special land class or a suitable land class description (e.g., RCW foraging) will be assigned the following land class code:

- 699 - Old-Growth Area (even- or uneven-aged)

Old-growth areas identified as suitable for timber production and which already have a compatible old-growth standard or special land class description,

will most likely maintain their current land class codes (e.g., RCW active cluster). Where possible, the stand will be coded with a 9 in the third digit for these land classes to denote old growth. If it is determined that old-growth management is the priority for a stand, then a special old-growth land class code (discussed in the previous paragraph) can be assigned.

Old-growth areas identified as unsuitable for timber production and which do not have a current reserved, deferred, lack of technology, not appropriate for timber production, or unproductive land class descriptions, will be assigned the following land class code:

- 819 - Old-Growth Area

Old-growth areas identified as unsuitable for timber production and which already have a current reserved, deferred, lack of technology, not appropriate for timber production, or unproductive land class description will most likely maintain their current land class codes (e.g., wilderness). Where possible, the stand/area will be coded with a 9 in the third digit of these land classes to denote old growth. If it is determined that old-growth management is the priority for a stand, then the old-growth land class code (discussed in previous paragraph) can be assigned.

Old-Growth Status and Forest Community Type

In addition, two local use columns in the CISC database will be used to specifically track information regarding old-growth stands. One column will be used to identify whether a stand is existing or future old growth as follows:

- Existing Old Growth - 01
- Future Old Growth - 02

Stands identified during the preliminary inventory as possible old growth should be made available to the districts to assist in making project-level decisions. If a forest chooses, these stands can be coded 03 in the same local use old-growth status column.

Stands coded as old growth will have an old-growth forest community type code in the other local use column as follows:

- Northern hardwood forest 01
- Conifer-northern hardwood forest 02
- Mixed mesophytic and western mesophytic forest 05
- Coastal plain upland mesic hardwood forest 06
- Hardwood wetland forest 10
- River floodplain hardwood forest 13
- Cypress-tupelo swamp forest 14
- Dry-mesic oak forest 21

THE OLD-GROWTH FOREST COMMUNITY TYPES OF THE SOUTHERN REGION

Overview

Sixteen old-growth forest community types occur on national forest lands in the Southeast based on information provided by research scientists developing definitions of the old-growth forest communities. The summary of scientific definitions provided in the following guidance are designed to help national forest managers describe the desired future condition (DFC) of old growth in forest plans. This information was also used to formulate the operational definitions previously described.

Each scientific summary contains a community description, a disturbance regime, and representative old-growth areas. As part of the definitions, tables are provided showing the relationship the old-growth forest community types have to current vegetation classifications, their relationship to ecological units and national forests, and various old-growth attributes.

Northern Hardwood Forest Old-Growth Forest Community Type 1

Community Description

Northern hardwood forests occur exclusively in the northern tier of States in the East, except for a southern extension along the Appalachian Mountains (table 3). In the middle and southern Appalachians, this forest type is restricted to higher elevations that possess cool, mesic conditions. These conditions are most prevalent on northern- and eastern-facing slopes where direct radiation and evapotranspiration rates are reduced. These forests are poorly developed in certain parts of the Northern Ridge and Valley section, where elevation is relatively low (Tyrrell and others, in preparation).

Table 3. *The potential distribution of the northern hardwood old-growth forest community type.*

Ecological Province	Ecological Section	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington - Jefferson
	Blue Ridge Mountains	Nantahala - Pisgah Chattahoochee (Brasstown and Tallulah RD*only) Sumter (Andrew Pickens RD*) Cherokee George Washington - Jefferson (Pedlar, Glenwood RD*, Mount Rogers NRA**)

*RD = Ranger district
**NRA = National recreation area

Sugar maple (Acer saccharum), American beech (Fagus grandifolia), and yellow birch (Betula alleghaniensis) are the dominant northern hardwood species (table 4.). Other deciduous associates include American basswood (Tilia americana), white ash (Fraxinus americana), red maple (A. rubrum), black cherry (Prunus serotina), northern red oak (Quercus rubra), and yellow poplar (Liriodendron tulipifera). Evergreen associates include eastern hemlock (Tsuga canadensis), eastern white pine (Pinus strobus), and red spruce (Picea rubens). The combined overstory coverage of these evergreen species is less than 25 percent in this old-growth forest community type (Nowacki 1993; Tyrrell and others, in preparation).

This old-growth forest community type can be distinguished from mixed mesophytic forests (old-growth forest community type 5) in that (1) northern hardwoods occur only at high elevations, (2) northern hardwoods have a lower level of tree species richness and diversity, and (3) the presence of northern plant species, such as yellow birch and red spruce (Nowacki 1993; Tyrrell and others, in preparation). Table 5 contains old-growth attributes for the northern hardwood forest community type.

Disturbance

Fires occur infrequently and are usually limited to small surface burns due to the moist conditions associated with this type. Ice and wind storms occur periodically and vary in intensity, ranging from complete destruction of a forest to removal of less than 10 percent of the canopy. Species composition is usually not significantly altered by these events.

Table 4. *The relationship of the northern hardwood old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC* cover type	81	Sugar maple - beech - yellow birch
Society of American Foresters forest type codes	25	Sugar maple-beech-yellow birch
	27	Sugar maple
	28	Black cherry-maple
	60	Beech-sugar maple
The Nature Conservancy International Classification of Ecological Communities **	I.B.2.N.b.010	Yellow birch
	I.B.2.N.b.020	Yellow birch-American beech-yellow buckeye-(sugar maple)
	I.B.2.N.b.040	American beech montane
	I.B.2.N.b.080	Red oak montane

*CISC = Continuous inventory of stand conditions
**Ecological communities = Forest alliances

Representative Northern Hardwood Old-Growth Stands

Black Mountain Research Natural Area, Yancey County, North Carolina
Cherry Cove, near the Blue Ridge Parkway, North Carolina
Walker Cove Research Natural Area, near Asheville, North Carolina
Wayah Bald Area, Nantahala National Forest, North Carolina

Table 5. *Attributes of the northern hardwood old-growth forest community type (Tyrrell and others, in preparation).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Mean age of large trees	Sugar maple - 113 -136 yrs Beech - 104 - 173 yrs Unspecified - 59 - 238 yrs	Maine Critical Areas Program 1983
2. D.b.h. of largest trees	Sugar maple - 14 - 38 inches Beech - 6 - 28 inches Yellow birch - 13 - 37 inches	
3. Stand density	D.b.h. $\geq$4 - 153 - 235*	Carbonneau 1986, Leak 1973
	$\geq$20 - 19 - 25*	Leak 1973, Tubbs 1977
	$\geq$28 - 2 - 10*	Leak 1973, Milfred 1967
4. Stand basal area	D.b.h. $\geq$4 - 112 - 217**	Bourdo 1956, Carbonneau 1986, Pregitzer and Barnes 1984
	$\geq$20 - 43**	Bourdo 1956
	$\geq$28 - 8 **	Bourdo 1956
5. Number of standing snags per acre	13 - 350	Carbonneau 1986, Leopold and others 1988, Lutz 1930
6. Volume of downed logs per acre	3,244 - 6,874 ft^3	Carbonneau 1986
7. Number of canopy layers	1 to 3	Carbonneau 1986, Leopold et al. 1988, Lutz 1930,
8. Percentage of the canopy in gaps	3.2 to 25	Maine Critical Areas Program, 1983

*Trees per acre

**Ft^2 per acre

Conifer-Northern Hardwood Forest
Old-Growth Forest Community Type 2

Community Description

The distribution of conifer-northern hardwood forests is similar to that of northern hardwood forests (old-growth forest community type 1). Conifer-northern hardwood forests are found in the northern tier of States from Minnesota to Maine southward along the Appalachian Mountains to north Georgia (table 6).

Table 6. *The potential distribution of the conifer-northern hardwood old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington - Jefferson
	Blue Ridge Mountains	Nantahala - Pisgah Chattahoochee Sumter (Andrew Pickens RD*) Cherokee George Washington - Jefferson (Pedlar, Glenwood RD*, Mount Rogers NRA**)
Eastern Broadleaf Forest	Northern Cumberland Plateau	Daniel Boone

*RD = Ranger district
**NRA = National recreation area

In the southern Appalachians, this forest type occurs on cooler sites found primarily on north- and east-facing slopes. At least 25 percent of the overstory canopy contains either coniferous or deciduous trees (table 7). Three subtypes are recognized within this broad community type. Table 8 contains old-growth attributes for the conifer-northern hardwood forest community type.

Hemlock-Northern Hardwood Forest (Subtype 2a). - - Eastern hemlock (Tsuga canadensis) is considered a wet-mesic species, developing best on cool, moderately wet to somewhat poorly drained sites. Main associates are yellow birch (Betula alleghaniensis), sugar maple (Acer saccharum), American beech (Fagus grandifolia), red maple (A. rubrum), and eastern white pine (Pinus strobus). Soil surfaces consist mostly of needles and twigs. Hemlocks greatly limit the amount of light reaching the forest floor, which in turn results in sparse

understory vegetation. The exception is in canopy gaps, where abundant understory vegetation exists.

Table 7. *The relationship of the conifer-northern hardwood old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC* cover type	3	Eastern white pine
	4	Eastern white pine-hemlock
	5	Eastern hemlock
	8	Hemlock-hardwoods
	17	Red spruce-northern hardwoods
Society of American Foresters forest type code	20	White pine-northern red oak-red maple
	21	Eastern white pine (in part)
	22	White pine-hemlock
	23	Eastern hemlock
	24	Hemlock-yellow birch
	30	Red spruce-yellow birch
	31	Red spruce-sugar maple-beech
	32	Paper birch-red spruce-balsam fir (in part)
The Nature Conservancy International Classification of Ecological Communities*	I.B.8.N.b.140	Eastern white pine
	I.B.8.N.b.150	Eastern white pine-hemlock
	I.C.2.N.a.260	Eastern hemlock-tuliptree upland
	I.C.3.N.a.045	Red spruce-yellow birch
	I.A.2.N.c.070	Eastern hemlock upland

*CISC = Continuous inventory of stand conditions
**Ecological communities = Forest alliance

White Pine-Northern Hardwood Forest (Subtype 2b). -- The distribution of this type is closely related to historical fire patterns, largely occupying the drier end of the conifer-northern hardwood complex. Common associates include red maple and northern red oak (Quercus rubra) on dry sites and sugar maple, beech, white ash (Fraxinus americana), and hemlock on moist sites.

Red Spruce-Northern Hardwood Forest (Subtype 2c). -- This subgroup is found on cool microsites and occurs only in the Northern Ridge and Valley Section and Southern Blue Ridge Section. It is found at progressively higher elevations when moving south occurring only on mountaintops in the southern Appalachians. Common species associates include yellow birch, sugar maple, beech, and red maple.

Disturbance

For hemlock-northern hardwood forest (subgroup 2a), windthrow is particularly common on many sites due to high water tables, which limit the downward expansion of roots. This type of disturbance allows for frequent gap-phase regeneration. Pit-and-mound microtopography is characteristic of subtype 2. Currently, the hemlock woolly adelgid, an exotic insect, is causing widespread mortality among eastern hemlocks and will affect efforts to maintain or restore this old-growth forest community subtype. Fire has historically had little impact to this subtype. In contrast, fire plays a central role in maintaining eastern white pine in subtype 2b. Insect outbreaks, wind and ice storms, and fire are common disturbances in red spruce-northern hardwood forests (subgroup 2c).

Representative Conifer-Northern Hardwood Old-Growth Stands

Lilly Cornett Woods, Letcher County, Kentucky
Flagpole Knob, George Washington National Forest, Virginia
Hunting Creek, Bedford County, Virginia
The Skidmore Special Mgt. Area, George Washington National Forest, Virginia
Bottom Creek Gorge, Virginia
Roaring Branch, north of Big Stone Gap, Virginia

Table 8. *Attributes of the conifer-northern hardwood old-growth forest community type (Tyrrell and others, in preparation).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Mean age of large trees	Eastern hemlock - 147 to 264 yrs. White pine - 153 to 272 yrs. Red spruce - 97 to 129 yrs. Sugar maple - 114 yrs	N/A
2. DBH of largest trees	Eastern hemlock - 15 to 51 inches White pine - 28 to 50 inches Red spruce - 6 to 28 inches Sugar maple - 38 inches	N/A
3. Stand density	D.b.h. $\geq$ 4 - 91 to 475* $\geq$ 20 - 3 to 33* $\geq$ 28 - 0 to 10*	N/A
4. Stand basal area	D.b.h. $\geq$ 4 - 107 - 279** $\geq$ 20 - 7 - 107** $\geq$ 28 - 0 - 59**	N/A
5. Number of standing snags per acre	6 to 73	N/A
6. Volume of downed logs per acre	157 to 5,374 ft^3	N/A
7. Number of canopy layers	N/A	N/A
8. Percentage of the canopy in gaps	2 to 17	N/A

*Trees per acre

**Ft^2 per acre

Mixed Mesophytic and Western Mesophytic Forest Old-Growth Forest Community Type 5

Community Description

Western mesophytic forests are found in provinces in western portions of the Southeast and the mixed mesophytic forests can be found primarily in the southern Appalachians (table 9). Western mesophytic forests occur on a wide range of topographic positions, including drier sites than mixed mesophytic forests, which occur on lower north- and east-facing slopes and mesic coves up to an elevation of about 5,000 feet. In less mountainous terrain, they may cover the entire landscape where conditions are suitable.

Western mesophytic forests are typically dominated by oaks, but also include many of the species of the mixed mesophytic forests, which are among the most biologically diverse ecosystems of the United States. Species dominance patterns vary with geographic location and site condition, such as topographic features, moisture, and fertility.

Of 25 to 30 characteristic species the following are the most common: sugar maple (Acer saccharum), beech (Fagus grandifolia), hemlock (Tsuga canadensis), silverbell (Halesia carolina), yellow poplar (Liriodendron tulipfera), red maple (A. rubrum), white oak (Quercus alba), northern red oak (Q. rubra), yellow birch (Betula alleghaniensis), yellow buckeye (Aesculus flava), and basswood (Tilia americana) (table 10). Yellow buckeye and basswood are indicator species for the mixed mesophytic forests, but yellow buckeye is absent from western mesophytic forests. The age structure of the old growth is broadly uneven aged or all aged. Irregular distributions are common and reflect severe natural disturbances or irregularities in seed production (Greenberg and others, in preparation). Table 11 contains old-growth attributes for the mixed mesophytic and western mesophytic forest types.

Table 9. *The potential distribution of the mixed mesophytic and western mesophytic old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington - Jefferson
	Blue Ridge Mountains	Nantahala - Pisgah Chattahoochee Sumter (Andrew Pickens RD*) Cherokee George Washington - Jefferson (Pedlar, Glenwood RD*, Mount Rogers NRA**)
Southeastern Mixed Forest	Southern Ridge and Valley Section	Talladega (Talladega Division) Chattahoochee (Armuchee RD*)
	Southern Cumberland Plateau	Bankhead
	Southern Appalachian Piedmont	Sumter
Ouachita Mixed Forest	Ouachita Mountains	Ouachita
Lower Mississippi Riverine Forest	Mississippi Alluvial Basin	St. Francis
Eastern Broadleaf Forest	Ozark Highlands	Ozark NF
	Northern Cumberland Plateau	Daniel Boone

*RD = Ranger district

**NRA = National recreation area

Table 10. *The relationship of the mixed mesophytic and western mesophytic old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC* cover type	41	Cove hardwoods-white pine-hemlock
	50	Yellow poplar
	56	Yellow poplar-white oak-northern red oak
	81	Sugar maple-beech-yellow birch (in part)
Society of American Foresters forest type code	25	Sugar maple-beech-yellow birch (in part)
	27	Sugar maple
	52	White oak-black oak-northern red oak
	57	Yellow poplar-eastern hemlock
	59	Yellow poplar-white oak-red oak
The Nature Conservancy International Classification of Ecological Communities**	I.B.2.N.a.235	Tuliptree-Appalachian basswood-yellow buckeye-sugar maple
	I.B.2.N.b.140	American beech lowland
	I.B.2.N.b.150	American beech-sugar maple-(tuliptree)
	I.B.2.N.a.070	Sugar maple-red oak-bitternut hickory
	I.B.2.N.a.235	Tuliptree-American basswood-yellow buckeye-sugar maple
	I.C.3.N.a.260	Eastern hemlock-tuliptree upland

*CISC=Continuous inventory of stand conditions
**Ecological communities=Forest alliance

Disturbance

The creation of relatively small canopy gaps from the death of a group of trees is the driving "background" disturbance and accounts for a relatively constant turnover of trees and species in old-growth mixed mesophytic forests.

Estimates of canopy turnover rates vary from less than 0.4 to 1.0 percent annually. Less frequent, large-scale disturbances such as severe windstorms, ice storms, floods, landslides, fire, damage by native or non-native insects, or fungal infections may also create openings. The shade tolerance of different species (as well as the initial composition of species and their regeneration strategies) influence tree regeneration in relation to the size and age of the gap.

Table 11. *Attributes of the mixed mesophytic and western mesophytic old-growth forest community type (Greenberg and others, in preparation).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Maximum age of large trees	Yellow poplar - 226 yrs. Basswood - 198 yrs. Sugar maple - 372 yrs. Yellow buckeye - 431 yrs. Beech - 412 yrs. Eastern hemlock - 607 yrs.	Runkle 1982 Runkle 1982 Tubbs 1977 Runkle 1982 Morey 1936 Morey 1936
2. Maximum d.b.h. of largest trees	Yellow poplar - 65 inches Basswood - 77 inches Sugar maple - 46 inches Yellow buckeye - 41 inches Beech - 43 inches Eastern hemlock - 45 inches	McLeod, unpublished
3. Stand density	D.b.h. $\geq$ 4 - 68 to 184*	Bryant 1987, Muller 1982, Palmer 1987, McLeod, unpublished
4. Stand basal area	D.b.h. $\geq$ 4 - 113 to 296**	Bryant 1987, Muller 1982; Palmer 1987, McLeod, unpublished
5. Number of standing snags per acre	4 to 28	Muller 1982, McComb and Muller 1983, McLeod unpublished
6. Volume of downed logs per acre	944 to 5,862 ft^3	Muller and Liu 1991 McLeod, unpublished
7. Number of 4 inch size classes (trees $\geq$ 4" d.b.h.)	10 to 19	McLeod, unpublished
8. Percentage of the canopy in gaps	3 to 24	Runkle 1982

*Trees per acre

**Ft^2 per acre

Coastal Plain Upland Mesic Hardwood Forest
Old-Growth Forest Community Type 6

Community Description

These mixed evergreen-deciduous forests occur on the Coastal Plain at latitudes where evergreen species are not killed by cold winter temperatures. This old-growth forest community type most often occurs along mid-to-lower slopes on well drained, but moist, fine-textured soils protected from frequent fires (table 12).

These forests are multilayered, containing species of overstory trees that reach 60 to 110 feet in height and understory species that usually are less than 50 feet in height. Major overstory hardwood species commonly include American beech, (Fagus grandifolia), southern magnolia (Magnolia grandiflora), sweet gum (Liquidambar stryaciflua), several oak species (Quercus michauxii, Q. nigra, Q. alba, Q. shumardii), hickories (Carya glabra, C. cordiformis), and tulip poplar (Liriodendron tulipifera). In these forests, pines (particularly Pinus glabra and P. taeda) also may be among the most abundant overstory species. Composition shifts towards more evergreen species along the southern edge of the Coastal Plain. In Florida and Louisiana, these forests may be primarily live oaks (Q. virginiana) and palms (Sabal palmetto and S. minor) (table 13). Table 14 contains old-growth attributes for the Coastal Plain upland hardwood forest community type.

Dominant understory species commonly include hophornbeam (Ostrya virginiana), blue beech (Carpinus caroliniana), American holly (Ilex opaca), yaupon (I. vomitoria), flowering dogwood (Cornus florida), sourwood (Oxydendron arboreum), red maple (Acer rubrum), and horse sugar (Symplocos tincture). Many rarer species also are likely to be present in the understory, resulting in 40 or more woody species in these forests. Lianas are commonly present, such as grapes (Vitus rotundifolia), poison ivy (Rhus toxicodendron), Virginia creeper (Parthenocissus guinquefolia), and cross vine (Bignonia capreolata). Few herbaceous species occur beneath the multilayered canopy (Batista and Platte, in preparation).

Disturbance

Disturbances in this forest community type are characterized by frequent, small-scale gaps of one to a few overstory trees and periodic (every few decades) larger scale disturbances in the form of hurricanes. Even moderate intensity hurricanes may cause major damage of more than 25 percent of the overstory; mortality of these overstory trees may be as much as 10 percent several years after the hurricane. The proportion of shade-tolerant species, such as American beech and southern magnolia, relative to the proportion of light-demanding species, such as oaks, hickories, and pines, appears to reflect the frequency of large-scale disturbances such as hurricanes. Commonly, gaps are captured by understory species, and so large portions of the canopy (as much as 60 percent

immediately after hurricanes and as much as 30 percent after several decades) contain no overstory trees. A large amount of coarse woody debris may be present after hurricanes, but this decays rapidly and does not last much beyond 10 years. Reductions in the frequency at which fires burn down slopes, especially under drought conditions, have resulted in the spread of mesic hardwood forests up slopes into longleaf pine stands. The role of fire in Coastal Plain upland mesic hardwood forests is unknown (Batista and Platte, in preparation).

Representative Coastal Plain Upland Mesic Hardwood Old-Growth Stands

Woodyard Hammock, Tall Timbers Research Station, Leon Co., Florida
Titi Hammock, Thomas Co., Georgia
San Felasco Hammock, Alachua Co., Florida
Highlands Hammock, Highlands Co., Florida
Raglan Hills, Forrest Co., Mississippi
Weir Woods, Hardin Co, Texas
Zemurray Forest, Tangipahoa Parish, Louisiana
Tunica Hills, West Feliciana Parish, Louisiana

Table 12. *The potential distribution of the Coastal Plain upland mesic hardwood old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Outer Coastal Plain Mixed Forest	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Desoto Bienville Homochitto
	Atlantic Coastal Flatwoods	Osceola
	Florida Coastal Lowlands, Western Gulf Section	Apalachicola (in part)
	Coastal Plains and Flatwoods, Western Gulf Section	Kisatchie (all except Caney RD*) Davy Crockett Angelina Sabine (in part)
Southeastern Mixed Forest	Coastal Plain, Middle Section	Holly Springs Tombigbee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD* only) Sam Houston Sabine (in part) Ouachita (Tiak RD* only)

*RD=Ranger district

Table 13. *The relationship of the Coastal Plain upland mesic hardwood old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover type	13	Loblolly-pine hardwoods
	53	White oak-red oak-hickory
	69	Beech-magnolia
	77	Oak hammock
Society of American Foresters		
forest type code	82	Loblolly pine-hardwood
	89	Live oak (in part; mesic salt domes)
The Nature Conservancy		
International Classification of		
Ecological Communities**	I.C.3.N.a.170	Loblolly pine-(sweetgum, tuliptree) upland
	I.C.2.N.a.010	American beech-southern magnolia
	I.C.2.N.a.040	Live oak-sugarberry
	I.B.2.N.a.160	American beech-white oak
	I.B.2.N.a.250	White oak
	I.A.4.N.a.030	Live oak

*CISC=Continuous inventory of stand conditions

**Ecological communities=Forest alliance

Table 14. *Attributes of the Coastal Plain upland mesic hardwood old-growth forest community type (Batista and Platt, in preparation).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Median age of large trees (from one site)	Southern magnolia - 214 yrs. American beech - 210 yrs. Sweetgum - 210 yrs. White oak - 170 yrs. Loblolly pine - 94 yrs.	Platt and Hermann 1986, Hirsh 1981, Platt and Schwartz 1990
2. Maximum d.b.h. of the largest trees	Southern magnolia - 28 - 50 inches American beech - 30 - 39 inches Sweetgum - 23 - 34 inches White oak - 19 - 32 inches Loblolly pine - 18 - 31 inches	Glitzenstein and others 1986; Harcombe and Marks 1978; Hirsh 1981; Platt 1985; Platt and Hermann 1986; Platt and Schwartz 1990; Quigley 1994; White 1987
3. Stand density	D.b.h. $\geq$ 4 inches - 139 - 186* $\geq$ 20 inches - 16 - 28*	Glitzenstein and others 1986; Harcombe and Marks 1978; Hirsh 1981; Platt 1985; Platt and Hermann 1986; Platt and Schwartz 1990; Quigley 1994; White 1987
4. Stand basal area	D.b.h. $\geq$ 4 inches - 118 - 165** $\geq$ 20 inches - 52 - 105**	Glitzenstein and others 1986; Harcombe and Marks 1978; Hirsh 1981; Platt 1985; Platt and Hermann 1986; Platt and Schwartz 1990; Quigley 1994; White 1987
5. Median number of standing snags per acre	4	Hirsh 1981; Platt and Hermann 1986; Platt and Schwartz 1990
6. Median volume of downed logs per acre	1,022 ft^3	Hirsh 1981; Platt and Hermann 1986; Platt and Schwartz 1990
7. Number of 4 inch size classes (trees $\geq$ 4" size class)	8-11	Glitzenstein and others 1986; Harcombe and Marks 1978; Hirsh 1981; Platt 1985; Platt and Hermann 1986; Platt and Schwartz 1990; Quigley 1994; White 1987

*Trees per acre

**Ft^2 per acre

Hardwood Wetland Forest
Old-Growth Forest Community Type 10

Community Description

Hardwood wetland forests occur mainly in nonriverine, topographically defined basins on uplands, small drainage's, and along the margins of Coastal Plain ponds and bays (Tyrrell and others, in preparation). High water tables are usually present, and most sites are moist to wet throughout most of the year (table 15).

Species include red maple (Acer rubrum), black ash (Fraxinus nigra), green ash (F. pennsylvanica), elms (Ulmus spp.), sweetgum (Liquidambar styraciflua), and black tupelo (Nyssa sylvatica). Other associates may include silver maple (A. saccharinum), swamp white oak (Quercus bicolor), bur oak (Q. macrocarpa), sycamore (Platanus occidentalis), and eastern cottonwood (Populus deltoides) (table 16). Highbush blueberry (Vaccinium corymbosum), black chokeberry (Aronia meloncarpa), and holly (Ilex spp.) are common shrubs (Tyrrell and others, in preparation). Table 17 contains old-growth attributes for the hardwood wetland old-growth forest community type.

Hardwood wetland forests are different from seasonally wet oak-hardwood woodlands (type 27) due to a lack of seasonal dryness, fewer oaks, and little to no disturbance from fire (Nowacki 1993).

Disturbance

Because high water tables restrict rooting and limit tree anchorage, trees may be prone to windthrow in some parts of these forests. This type of disturbance causes a prevalence of tip-up mounds, downed trees, and canopy gaps. Tree mortality is also caused by fluctuating water levels or flooding due to beaver activity (Nowacki 1993).

Representative Hardwood Wetland Forest Old-Growth Stands

Orange Black Gum Swamp, Franklin Co., Massachusetts
Brandon Swamp, Rutland Co., Vermont
Cornwall Swamp, Addison Co., Vermont

Table 15. *The potential distribution of the hardwood wetland old-growth forest community type.*

Ecological Province	Ecological Section	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington-Jefferson
Southeastern Mixed Forest	Southern Appalachian Piedmont	Uwharrie Sumter Oconee
Outer Coastal Plain Mixed Forest	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Ocala Desoto Bienville Homochitto
	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Coastal Plains and Flatwoods Lower Section	Kisachie (All exept Caney RD*) Davy Crockett Angelina Sabine (in part)
Eastern Broadleaf Forest	Northern Cumberland Plateau	Daniel Boone

*RD = Ranger district

Table 16. *The relationship of the hardwood wetland old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC* cover type	68	Sweet bay-swamp tupelo-red maple
	71	Black ash-American elm-red maple
Society of American Foresters forest type code	39	Black ash-American elm-red maple
	65	Pin oak-sweetgum (in part)
	104	Sweet bay-swamp tupelo-redbay
	108	Red maple
The Nature Conservancy International Classification of Ecological Communities**	I.B.2.N.d.200	Bur oak-swamp white oak-pignut hickory temporarily flooded
	I.B.2.N.e.020	Red maple-green ash seasonally flooded
	I.B.2.N.g.015	Red maple-blackgum saturated
	I.B.2.N.d.130	Blackgum temporarily flooded
	I.B.2.N.g.020	Swamp blackgum-Carolina red maple saturated

*CISC=Continuous inventory of stand conditions

**Ecological community = Forest alliance

Table 17. *Attributes of the hardwood wetland old-growth forest community type. (Tyrrell and others, in preparation).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Maximum age of large trees (From one site)	Black gum - 400 yrs.	Vogelmann 1976
2. Maximum d.b.h. of the largest trees	Black gum - 23 inches Oak spp. - 39 inches	Boerner and Cho 1987; Vogelmann 1976
3. Stand density	All trees - 21 to 324*	Boerner & Kooser 1991; Lindsey et al. 1961
4. Stand basal area	All trees - 28 to 160**	Boerner & Kooser 1991; Lindsey and others 1961
5. Number of standing snags per acre	N/A	
6. Volume of downed logs per acre	N/A	
7. Number of 4 inch size classes (trees $\geq$ 4" size class)	N/A	

*Trees per acre

**Ft^2 per acre

N/A= Not available

River Floodplain Hardwood Forest
Old-Growth Forest Community Type 13

Community Description

River floodplain hardwood forests range from the Piedmont and the mountains, and into the Coastal Plain in the Southeast United States (table 18). These sites are some of the most productive in the South due to the deposit of sediments from periodic flooding. These river bottom (first bottom) soils are well-drained loam's and silt loam's. Tree species include red maple (Acer rubrum), river birch (Betula nigra), water hickory (Carya aquatica), water oak (Quercus nigra), green ash (Fraxinus pennsylvanica), sweetgum (Liquidambar styraciflua), sycamore (Platanus occidentalis), willow oak (Q. phellos), laurel oak (Q. laurifolia), overcup oak (Q. lyrata), and elms (Ulmus spp.) (table 19). Tree species on the adjacent higher elevation second bottoms where flooding is less frequent, include cherrybark oak (Q. falcata), swamp chestnut oak (Q. michauxii), hickories (Carya spp.), American beech (Fagus grandifolia), and tulip poplar (Liriodendron tulipifera) (Shear and others, in preparation). Table 20 contains old-growth attributes for the river floodplain hardwood forest community type.

Disturbance

The primary disturbances are flooding and natural tree mortality resulting in small gaps in the forest canopy. Infrequent fires could also play a role in this forest type during dry years. Because annual flooding cycles have been altered and fires have been suppressed, American beech and red maple may become more prominent in this community type (Shear and others, in preparation).

Meandering channels often isolate, then destroy significant areas of river floodplain hardwood forests along major rivers. Furthermore, tornado frequently occur in areas where this forest community predominates.

Representative River Floodplain Hardwood Forest Old-Growth Stands

Boiling Springs Natural Area, Sumter National Forest, South Carolina
Green Ash Research Natural Area, Delta National Forest, Mississippi
Red Gum Research Natural Area, Delta National Forest, Mississippi
Overcup Oak Research Natural Area, Delta National Forest, Mississippi
Mormon Branch Botanical Area, Coal National Forest, Florida
Congaree Swamp National Monument, Richland Co., South Carolina
Savannah River Site, near New Ellenton, South Carolina
Moro Creek Bottoms Preserve, south-central Arkansas

(Nowacki 1993; Shear and others, in preparation)

Table 18. *The potential distribution of the river floodplain hardwood old-growth-forest community type.*

Ecological Province	Ecological Section	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington - Jefferson
Southeastern Mixed Forest	Southern Appalachian Piedmont	Uwharrie Sumter Oconee
Outer Coastal Plain Mixed Forest	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Ocala Desoto Bienville Homochitto
Southeastern Mixed Forest	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee Holly Springs Tombigbee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD* only) Sam Houston Sabine (in part) Ouachita (Tiak RD* only)
Lower Mississippi Riverine Forest	Mississippi Alluvial Basin	Delta St. Francis
Ouachita Mixed Forest	Ouachita Mountain	Ouachita
Eastern Broadleaf Forest	Ozark Highlands	Ozark
	Northern Cumberland Plateau	Daniel Boone

*RD=Ranger district

Table 19. *The relationship of the river floodplain hardwood old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover type	46	Bottomland hardwood- yellow pine
	71	Black ash-American elm-red maple
	58	Sweetgum-yellow poplar
	61	Swamp chestnut oak-cherrybark oak
	62	Sweetgum-nuttall oak-willow oak
	63	Sugarberry-American elm-green ash
	64	Laurel oak-willow oak
	65	Overcup oak-water hickory
	68	Sweet bay-swamp tupelo-red maple
	69	Beech-magnolia
	72	River birch-sycamore
	75	Sycamore-pecan-American elm
Society of American Foresters		
forest type code	65	Pin oak-sweetgum (in part)
	82	Loblolly pine-hardwood
	87	Sweetgum-yellow poplar
	88	Willow oak-water oak-laurel oak
	91	Swamp chestnut oak-cherrybark oak
	92	Sweetgum-willow oak
	93	Sugarberry-American elm-green ash
	94	Sycamore-sweetgum-American elm
	96	Overcup oak-water hickory
	108	Red maple (in part)

*CISC=Continuous inventory of stand conditions

Table 19 (continued). *The relationship of the river floodplain hardwood old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
The Nature Conservancy International Classification of Ecological Communities**	I.B.2.N.e.100	Overcup oak-(water hickory) seasonally flooded
	I.B.2.N.d.190	Laurel oak temporarily flooded
	I.B.2.N.e.020	Red maple-green ash seasonally flooded
	I.B.2.N.d.050	River birch-sycamore seasonally flooded
	I.B.2.N.d.250	(Willow oak, water oak, diamond leaf oak) temporarily flooded
	I.B.2.N.d.215	Water oak-cherrybark oak temporarily flooded
	I.B.2.N.d.110	Green ash-American elm-(northern hackberry, sugarberry) temporarily flooded

**Ecological communities=Forest alliance

Table 20. *Attributes of the river floodplain hardwood old-growth forest community type (Shear and others, in preparation).*

Old-Growth Attribute	Old-Growth Parameters	Data Sources
1. Age of oldest trees	$\geq$ 100 yrs.	Shear and others, in preparation
2. D.b.h. of the largest trees	$\geq$ 16 inches	Shear and others, in preparation
3. Stand density	$\leq$ 162*	Shear and others, in preparation
4. Stand basal area	N/A	
5. Number of standing snags per acre	N/A	
6. Volume of downed logs per acre	N/A	
7. Number of 4 inch size classes (trees $\geq$ 4" size class	N/A	

*Trees per acre
N/A = Not available

Cypress-Tupelo Swamp Forest
Old-Growth Forest Community Type 14

Community Description

Cypress-tupelo forests occur mainly on the Coastal Plain from southern Delaware through south Florida to southeastern Texas and extend northward along the Mississippi River and its major tributaries to southern Illinois (table 21). Most of the cypress occurs within 100 feet of sea level. This forest community type is found almost exclusively in depressions that are prone to frequent flooding, such as swamps, deep sloughs, alluvial flats of major river floodplains, tidal estuaries, margins of coastal marshes, and isolated depressions of the Coastal Plain (Devall, in preparation).

Principal tree species include baldcypress (Taxodium distichum), pondcypress (T. ascendens), water tupelo (Nyssa. aquatica), and swamp tupelo (N.sylvatica var. biflora). These species occur either singly or in mixtures (table 22). Baldcypress grows larger and more rapidly than pondcypress and is usually associated with flowing water. Pondcypress ordinarily dominates shallow ponds, edges of strands, and other locations where water collects and stands for part of the year. Though these tree species are not considered shade tolerant, this forest community type as a whole is considered stable (climax) on most sites because prolonged periods of deep flooding curtail invasion by more shade-tolerant species. However, where sediment accumulates and/or the frequency of flooding diminishes, this forest type may be replaced by others (e.g., river floodplain hardwood forests) (Devall, in preparation). Table 23 contains attributes for the cypress-tupelo swamp old-growth forest community type.

Disturbance

Historically, low-intensity, small-scale disturbances were probably common in these forests, although their nearness to the coast ensured occasional large-scale disturbances, such as hurricanes. Due to hydric conditions, fire is unusual in these forests except during periods of drought. The principal tree species typically have long life spans; baldcypress, for instance, can live 1,600 years or longer.

Representative Cypress-Tupelo Swamp Forest Old-Growth Stands

Pondcypress Swamps, Apalachicola National Forest, Florida
Gum Swamp Research Natural Area, Osceola National Forest, Florida
Big Cypress, Bienville Parish, Louisiana
Congaree Swamp National Monument, Richland Co., South Carolina

Table 21. *The potential distribution of the cypress-tupelo swamp old-growth forest community type.*

Ecological Province	Ecological Section	National Forest
Outer Coastal Plain Mixed Forest	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Florida Coastal Lowlands, Western Gulf Section	Apalachicola (in part)
	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Ocala Desoto Bienville Homochitto
	Coastal Plains and Flatwoods, Western Gulf Section	Kisatchie (all except Caney RD*) Davy Crockett Angelina Sabine (in part)
Southeastern Mixed Forest	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee Holly Springs Tombigbee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD* only) Sam Houston Sabine (in part) Ouachita (Tiak RD* only)
Lower Mississippi Riverine Forest	Mississippi Alluvial Basin	Delta St. Francis

*RD=Ranger district

Table 22. The relationship of the cypress-tupelo swamp old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.

Classification	Code	Forest Type
National Forest CISC*		
cover type	23	Pondcypress
	24	Baldcypress
	67	Baldcypress-water tupelo
	68	Sweet bay-swamp tupelo-red maple
Society of American Foresters		
forest type code	100	Pondcypress
	101	Baldcypress
	102	Baldcypress-tupelo
	103	Water tupelo-swamp tupelo
The Nature Conservancy		
International Classification of		
Ecological Communities**	I.B.2.N.d.290	Pondcypress-sycamore temporarily flooded
	I.B.2.N.e.180	Pondcypress seasonally flooded
	I.B.2.N.e.190	Baldcypress-swamp tupelo seasonally flooded
	I.B.2.N.f.030	Water tupelo-(baldcypress) semipermanently flooded
	I.B.2.N..f.060	Baldcypress semipermanently flooded
	I.B.2.N.h.010	Swamp blackgum-(baldcypress) tidal
	I.B.2.N.g.050	Baldcypress-swamp blackgum

*CISC=Continuous inventory of stand conditions

**Ecological communities=Forest alliance

Table 23. *Attributes of the cypress-tupelo swamp old-growth forest community type (Devall, in preparation).*

Old-Growth Attribute	**Old-Growth Parameter**	**Data Sources**
1. Age of oldest tree	Baldcypress - 200 to 1200 yrs.	Ewel & Odom 1984; Hall and Penfound 1943; Lynch and others. 1991; Porcher 1981.
	Pondcypress - 120 to 900 yrs.	Schlesinger 1978
2. D.b.h. of largest trees	Baldcypress - 30 to 144 inches	Gresham 1995a; Gresham 1995b; Harlow and Ellwood 1969; Lindsey and others 1961; Lynch and others 1991
	Pondcypress - 8 to 27.5 inches (above swell)	Schlesinger 1978
3. Stand density	Baldcypress D.b.h. $\geq$ 1 inch - 36 to 52*	Hall and Penfound 1939a; Hall and Penfound 1939b
	Pondcypress D.b.h. $\geq$ 1 inch - 1447 to 7702*	Schlesinger 1978
4. Stand basal area	Baldcypress D.b.h. $\geq$ 1 inches - 203**	Hall and Penfound 1939a
	Pondcypress D.b.h. $\geq$ 1 inches - 202 to 443**	Schlesinger 1978
5. Number of standing snags per acre	3 to several	Martin and Smith 1991
6. Volume of downed logs per acre	3 to several	Martin and Smith 1991
7. Number of canopy layers	1	Hall and Penfound 1939a; Hall and Penfound 1943; Schlesinger 1978

*Trees per acre

**Ft^2 per acre

Dry-Mesic Oak Forest
Old-Growth Forest Community Type 21

Community Description

Dry-mesic oak forests occur throughout the South in all ecological provinces (table 24), most commonly in the mountains. They are usually found on dry, upland sites on southern and western aspects and ridgetops (Nowacki 1993).

The species composition of this forest type varies greatly due to its wide distribution. The major species include chestnut oak (Quercus montana), northern red oak (Q. rubra), black oak (Q. velutina), white oak (Q. alba), and scarlet oak (Q. coccinea). Additional associates include southern red oak (Q. falcata), post oak (Q. stellata), blackjack oak (Q. marilandica), pignut hickory (Carya glabra), mockernut hickory (C. tomentosa), and red maple (Acer rubrum) (table 25). Coniferous species such as shortleaf pine (Pinus echinata), eastern white pine (P. strobus), and table mountain pine (P. pungens) may occur as a mixture, with an overstory coverage of less than 25 percent. American chestnut (Castanea dentata) was a major species in this old-growth forest community type up until the 1930's (Nowacki 1993). Table 26 contains attributes for the dry-mesic oak old-growth forest community type.

The scarlet oak and chestnut oak stands (national forest [CISC] forest types 52, 59, and 60) associated with dry-xeric conditions are included in old-growth forest community type (22) to better separate old-growth forest community types 21 and 22.

Disturbance

The frequency of fire is important in the disturbance regime for this community type. The dry sites on which this community type occurs are conducive to recurring, low-intensity surface fires thought to have been quite common prior to European settlement. These fires helped maintain the oak component by eliminating fire-sensitive competitors and stimulating oak regeneration (Nowacki 1993). Furthermore, blowdowns of single or multiple trees result in gap phase regeneration, and infrequent tornadoes can destroy an entire stand. Other important disturbances for this community type include oak decline, infestations by gypsy moths, and ice storm damage.

Representative Dry-Mesic Oak Forest Old-Growth Stands

Joyce Kilmer Memorial Forest, Graham Co., North Carolina
Crabtree Creek, George Washington National Forest, Virginia
Dolly Anne Special Management Area, George Washington National Forest, Virginia
Little Walker Mountain, Jefferson National Forest, Virginia

The Skidmore Special Management Area, George Washington National Forest, Virginia
Linville Gorge, Pisgah National Forest, North Carolina
Mackey Mountain, Pisgah National Forest, North Carolina
Duncan Cove, Pisgah National Forest, North Carolina
Roaring Branch Research Natural Area, Ouachita National Forest, Arkansas

Table 24. *The potential distribution of the dry-mesic oak old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington - Jefferson
	Blue Ridge Mountains	Nantahala - Pisgah Chattahoochee Sumter (Andrew Pickens RD*) Cherokee George Washington-Jefferson (Pedlar, Glenwood RD*, Mount Rogers NRA**)
Southeastern Mixed Forest	Southern Ridge and Valley Section	Talladega (Talladega Division) Chattahoochee (Armuchee RD*)
	Southern Appalachian Piedmont	Uhwarrie Sumter Oconee
	Southern Cumberland Plateau	Bankhead
	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee Holly Springs Tombigbee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD* only) Sabine (in part) Sam Houston Ouachita (Tiak RD* only)

*RD=Ranger district
**NRA=National recreation area

Table 24 (continued). *The potential distribution of the dry-mesic oak old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Outer Coastal Plain Mixed Forest	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Florida Coastal Lowlands, Western Gulf Section	Apalachicola (in part)
	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Ocala Desoto Bienville Homochitto
	Coastal Plains and Flatwoods, Western Gulf Section	Kisatchie (all except Caney RD*) Davy Crockett Angelina Sabine (in part)
Lower Mississippi Riverine Forest	Mississippi Alluvial Plain	St. Francis
Ouachita Mixed Forest	Ouachita Mountain	Ouachita
Eastern Broadleaf Forest	Ozark Highlands	Ozark
	Northern Cumberland Plateau	Daniel Boone

*RD=Ranger district

Table 25. *The relationship of the dry-mesic oak old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover type	51	Post oak - black oak
	52	Chestnut oak (in part)
	53	White oak-red oak-hickory
	54	White oak
	55	Northern red oak
	59	Scarlet oak (in part)
	60	Chestnut oak-scarlet oak (in part)
Society of American Foresters		
forest type code	44	Chestnut oak
	52	White oak-black oak-Northern red oak
	53	White oak
	55	Northern red oak
	110	Black oak
The Nature Conservancy International Classification of Ecological Communities**	I.B.2.N.a.250	White oak
	I.B.2.N.a.260	White oak-(scarlet oak, red oak, black oak)
	I.B.2.N.a.270	White oak-red oak
	I.B.2.N.a.340	Rock chestnut oak-(white oak, southern red oak, red oak, black oak)
	I.B.2.N.a.360	Rock chestnut oak-red oak
	I.B.2.N.a.390	Black oak-white oak

*CISC=Continuous inventory of stand conditions

**Ecological community = Forest alliance

Table 26. *Attributes of the dry-mesic oak old-growth forest community type (Graney, in preparation).*

Old-Growth Attribute	Old-Growth Parameters	Data Sources
1. Age of large trees	Southern Appalachians White oak - 245 - 348 yrs.* Northern red oak - 240 - 270 yrs.* Black oak - 180 - 211 yrs.* Chestnut oak - 66 - 362 yrs.* Mockernut hickory - 335 yrs.* Pignut hickory - 327 yrs.*	Blozan 1994; Carlson 1995; White and Lloyd, in preparation
	Piedmont White oak/red oak/ black oak - 200 - 324 yrs.	Frei and Fairbrothers 1963; Monk 1961
	Interior Highlands White oak - 87-320 yrs. Northern red oak - 65-120 yrs. Post oak - 140-300 yrs. Chinkapin oak - 139-204 yrs. Shortleaf pine - 106-300 yrs.	Stahle and others 1985; Wuenscher 1967
2. D.b.h. of large trees	Southern Appalachians White oak - 14-27 inches Northern red oak - 22-26 inches Black oak - 18-26 inches Chestnut oak - 14-22 inches Mockernut and Pignut hickory - 14-26 inches	Blozan 1994; Carlson 1995; Delapp and Wentworth 1977
	Piedmont White oak - 20-40 inches Black oak - 20-40 inches Northern red oak and scarlet oak - 20-30 inches Red hickory - 15-25 inches	Monk 1961
	Interior Highlands White oak - 12-40 inches Northern red oak - 11-24 inches Post oak - 14-21 inches Chinkapin oak - 9-27 inches Shortleaf pine - 12-21 inches	Fountain and Sweeny 1985; Stahle and others, 1985; Wuenscher 1967
	Interior Low Plateau White oak - 20-32 inches Black oak - 20-32 inches Northern red oak - 15-20 inches Hickory spp. - 10-15 inches	Potzger and Friesner 1934

*Range includes ages reported as maximum ages

Table 26 (continued). *Attributes of the dry-mesic oak old-growth forest community type (Graney, in preparation)*

Old-Growth Attribute	Old-Growth Parameters	Data Sources
3. Stand density	Southern Appalachians	
	D.b.h. ≥ 4 inches 251-401**	Delapp and Wentworth 1977
	Piedmont	
	D.b.h. ≥ 1 inch 319-931**	Oosting 1942; Sulser 1971
	Interior Highlands	
	D.b.h. ≥ 4 inches 121-618**	Dale and Watts 1980
	Interior Low Plateau	
	D.b.h. ≥ 4 inches 153-174** (means)	Fralish and other, 1991; Potzger and Friesner 1934
4. Stand basal area	Southern Appalachians	
	D.b.h. ≥ 4 inches 73-115***	Delapp and Wentworth 1977
	Piedmont	
	D.b.h. ≥ 4 inches 87-191***	Oosting 1942; Sulser 1971
	Interior Highlands	
	D.b.h. ≥ 4 inches 53-139***	Dale and Watts 1980
	Interior Low Plateau	
	D.b.h. ≥ 4 inches 91-144*** (means)	Fralish and others, 1991; Potzger & Friesner 1934
5. Number of standing snags per acre	Southern Appalachians	McComb and Muller 1983;
	D.b.h. ≥ 4 inches 26-36 (means)	Rosenburg and others 1988
	Piedmont	
	D.b.h. ≥ 6 inches 6 (mean)	Reiners and Reiners 1965
	Interior Highlands	
	D.b.h. ≥ 4 inches 0-53	N/A
6. Volume of downed logs per acre	Southern Appalachians	Muller and Liu 1991
	D.b.h. ≥ 8 inches 403-1438 ft^3	
	Piedmont	
	D.b.h. ≥ 4 inches 9.7 tons (mean)	Lang and Forman 1978
	Interior Highlands	
	D.b.h. ≥ 4 inches 60-1831 ft^3	N/A
7. Percent canopy in gaps	1 to 13	Monk 1957; Monk 1961; Sulser 1971

**Trees per acre

***Ft^2 per acre

N/A = Not available

Dry and Xeric Oak Forest, Woodland, and Savanna Old-Growth Forest Community Type 22

Community Description

Dry and xeric oak forests, woodlands, and savannas are found throughout the southeast in all ecological provinces. They usually occur on very dry and infertile uplands (table 27). They also occur on steep, south-facing slopes or rock outcrops. Soils are usually coarse textured, and dry soil conditions may prevail most of the year (Tyrrell and others, in preparation).

Two recognized subtypes occur in the South: the "widespread" subtype and the southern subtype. The southern subtype is associated primarily with longleaf (Pinus palustrus) or slash pine (P. elliottii) communities in the Coastal Plain and oak barrens located in the western portion of region. The southern subtype community is made up of small-statured trees that include turkey oak (Quercus laevis), bluejack oak (Q. incana), sand post oak (Q. margaretta), Mohr's oak (Q. mohriana), and sand live oak (Q. geminata). Larger trees such as live oak (Q. virginiana) may also be present (table 28). Table 29 contains attributes for the dry and xeric oak forest, woodland, and savanna old-growth forest community type.

The "wide spread" subtype includes black oak (Quercus veltina), post oak (Q. stellata), blackjack oak (Q. marilandica), chestnut oak (Q. montana), scarlet oak (Q. coccinea), and white oak (Q. alba) as the major species (Nowacki 1993).

Disturbance

Periodic surface fires are important for maintaining the open condition of this old-growth forest community type. Fires are thought to have burned frequently enough to restrict tree density and promote the growth of shade intolerant grasses, forbs, and shrubs (Nowacki 1993).

Representative Dry and Xeric Oak Forest, Woodland, and Savanna Old-Growth Stands

Linville Gorge, Pisgah National Forest, North Carolina
Post Oak Stand, Long Cane Ranger District, South Carolina

Table 27. *The potential distribution of the dry and xeric oak forest, woodland, and savanna old-growth forest community type.*

Ecological Province	Ecological Section	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington - Jefferson
	Blue Ridge Mountains	Nantahala - Pisgah Chattahoochee Sumter (Andrew Pickens RD*) Cherokee George Washington-Jefferson (Pedlar, Glenwood RD*, Mount Rogers NRA**)
Southeastern Mixed Forest	Southern Ridge and Valley Section	Talladega (Talladega Division) Chattahoochee (Armuchee RD*)
	Southern Appalachian Piedmont	Uhwarrie Sumter Oconee
	Southern Cumberland Plateau	Bankhead
	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee Holly Springs Tombigbee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD* only) Sam Houston Sabine (in part) Ouachita (Tiak RD* only)

*RD=Ranger district
**NRA=National recreation area

Table 27. (continued). *The potential distribution of the dry and xeric oak forest, woodland, and savanna old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Outer Coastal Plain Mixed Forest	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Florida Coastal Lowlands, Western Gulf Section	Apalachicola (in part)
	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Ocala Desoto Bienville Homochitto
	Coastal Plains and Flatwoods, Western Gulf	Kisatchie (all except Caney RD *) Davy Crockett Angelina Sabine (in part)
Ouachita Mixed Forest	Ouachita Mountain	Ouachita
Lower Mississippi Riverine Forest	Mississippi Alluvial Basin	St. Francis
Eastern Broadleaf Forest	Ozark Highlands	Ozark
	Northern Cumberland Plateau	Daniel Boone

*RD=Ranger district

Table 28. *The relationship of the dry and xeric oak old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover type	52	Chestnut oak
	57	Scrub oak
	59	Scarlet oak
	60	Chestnut oak-scarlet oak
Society of American Foresters		
forest type code	40	Post oak-blackjack oak
	43	Bear oak (in part)
	44	Chestnut oak
	72	Southern scrub oak
	89	Live oak
	110	Black oak
The Nature Conservancy		
International Classification of		
Ecological Communities**	I.B.2.N.a.350	Rock chestnut oak - (scarlet oak-black oak) forest
	I.B.2.N.a.380	Post oak-blackjack oak forest
	II.B.2.N.a.050	Live oak-bluejack oak woodland
	II.B.2.N.a.060	Arkansas oak woodland
	II.B.2.N.a.080	Bluejack oak-Arkansas oak woodland
	II.B.2.N.a.100	Turkey oak woodland
	II.B.2.N.a.130	Rock chestnut oak-bluejack oak woodland
	II.B.2.N.a.140	Rock chestnut oak-blackjack oak woodland
	II.B.2.N.a.160	Post oak-blackjack oak woodland
	II.C.2.N.a.040	Live oak woodland
	II.C.2.N.a.050	Live oak-bluejack oak woodland
	II.A.2.N.a.060	Live oak-post oak woodland

*CISC=Continuous inventory of stand conditions

**Ecological communities = Forest and woodland alliance

Table 29. *Attributes of the dry and xeric oak forest, woodland, and savanna old-growth forest community type (Tyrrell and others, in preparation).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Mean age of large trees	Oak sp. - 65 to 150 inches	N/A
2. D.b.h. of largest trees	Bur oak - 36 to 74 inches	Gleason 1913
	Black oak - 16 to 40 inches	N/A
	White oak - 36 to 61 inches	N/A
	Chestnut oak - 26 inches	Lindsey and others, 1961
3. Stand density	D.b.h. $\geq$ 4 inches 11 to 179*	McCarthy and others, 1987
4. Stand basal area	D.b.h. $\geq$ 4 inches 40 to 95**	McCarthy and others, 1987
5. Number of standing snags per acre	10	Johnson and Schnell 1985
6. Volume of downed logs per acre	N/A	
7. Number of canopy layers	N/A	
8. Percentage of the canopy in gaps	N/A	

*Trees per acre

**Ft^2 per acre

N/A = Not available

Xeric Pine and Pine-Oak Forest and Woodland Old-Growth Forest Community Type 24

Community Description

Xeric pine and pine-oak forests and woodlands are found throughout most of the eastern United States, from southern Missouri and northeast Texas east to the Atlantic coastline from southern Maine to South Carolina (table 30). Because this old-growth forest community type covers a broad geographic range, there are distinctive differences between the communities separated by the Mississippi River. All principal species discussed below are found in the communities east of the river However, shortleaf pine (Pinus echinata) is the only pine species which occurs west of the river and chestnut oak is confined to the region east of the river. Xeric pine and pine-oak forests and woodlands typically occur on ridgetops and south-facing upper slopes in the mountains or on excessively-drained, sandy uplands in gentler terrain, such as in the Piedmont (Murphy and Nowacki, in preparation).

This old-growth forest community type normally exists on strong acidic soils with extreme moisture and nutrient deficiencies. Xeric site conditions may exist due to: (1) low precipitation, (2) limited moisture absorption/retention because of exposed bedrock, steep slopes, coarse-textured soils, rocky soils, or shallow soils, and/or (3) elevated evapotranspiration rates on southern-facing slopes. Principal overstory species of this community type include pitch pine (P. rigida), Virginia pine (P. virginiana), shortleaf pine, eastern white pine (P. strobus), table mountain pine (P. pungens), and chestnut oak (Quercus prinus) (table 31). Associated species include scarlet oak (Q. coccinea), black oak (Q. velutina), blackjack oak (Q. marilandica), post oak (Q. stellata), northern red oak (Q. rubra), southern red oak (Q. falcata), white oak (Q. alba), and pignut hickory (Carya glabra) (Murphy and Nowacki, in preparation). Table 32 contains attributes for the xeric pine and pine-oak forest community type.

Disturbance

Due to the prevailing xeric conditions and chemical content (volatile resins and pitch) of most plant species occurring in this community type, these forests and woodlands have historically experienced frequent fires. Most fires were probably low intensity, surface burns since they occurred frequently and did not allow significant amounts of fuel to build up, although occasional fires occurred in some areas that destroyed an entire stand. On sites where moisture and nutrients are not as limiting, periodic fires are required to maintain a dominance of yellow pines, because pine seedlings rarely become established in oak litter. Over many decades, increases in the amount of dead biomass can predispose these forests and woodlands to catastrophic fires, especially in older stands that have experienced mortality caused by southern pine beetles. In the absence of fire, successional changes on xeric sites are normally quite restricted.

On other sites, succession in the absence of fire leads to a dominance by oaks and/or white pine along with other shade tolerant and fire intolerant species (Murphy and Nowacki, in preparation).

Ice or glaze storms along with strong winds often cause extensive uprooting or blowdown of trees in these stands. These disturbances typically form large light gaps, and the downed biomass increases fuel loads which may lead to high-intensity fires.

Representative Xeric Pine and Pine-Oak Forest and Woodland Old-Growth Stands

Lake Winona Research Natural Area, Ouachita National Forest, Arkansas
Roaring Branch Research Natural Area, Polk Co., Arkansas
Marshall Forest Preserve, near Rome, Georgia
Linville Gorge, Pisgah National Forest, North Carolina
Torreya State Park, Liberty Co., Florida

Table 30. *The potential distribution of the xeric pine and pine-oak forest and woodland old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington - Jefferson
	Blue Ridge Mountains	Nantahala - Pisgah Chattahoochee Sumter (Andrew Pickens RD*) Cherokee George Washington - Jefferson (Pedlar, Glenwood RD*, Mount Rogers NRA**)
Southeastern Mixed Forest	Southern Ridge and Valley	Talladega (Talladega Division) Chattahoochee NF (Armuchee RD*)
	Southern Appalachian Piedmont	Uhwarrie Sumter Oconee
	Southern Cumberland Plateau	Bankhead
	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee Holly Springs Tombigbee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD* only) Sabine (in part) Sam Houston Ouachita (Tiak RD* only)
Outer Coastal Plain Mixed Forest	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Florida Coastal Lowlands, Western Gulf Section	Apalachicola (in part)
	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part)

*RD=Ranger district

**NRA=National recreation area

Table 30 (continued). *The potential distribution of the xeric pine and pine-oak forest and woodland old-growth forest community type.*

Ecological Provinces	**Ecological Sections**	**National Forest**
Ouachita Mixed Forest	Ouachita Mountain	Ouachita
Eastern Broadleaf Forest	Ozark Highlands	Ozark
	Northern Cumberland Plateau	Daniel Boone

Table 31. *The relationship of the xeric pine and pine-oak forest and woodland old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover types	32	Shortleaf pine
	33	Virginia pine
	38	Pitch pine
	39	Table mountain pine
	12	Shortleaf pine-oak
	15	Pitch pine-oak
	16	Virginia pine-oak
	20	Table mountain pine-hardwoods
Society of American Foresters		
forest type codes	43	Bear oak
	45	Pitch pine
	51	White pine-chestnut oak
	75	Shortleaf pine
	76	Shortleaf pine-oak
	78	Virginia pine-oak
	79	Virginia pine
The Nature Conservancy		
International Classification of		
Ecological Communities**	I.A.8.N.b.030	Shortleaf pine forest
	I.A.8.N.b.140	Eastern white pine forest
	I.A.8.N.b.190	Virginia pine forest
	I.A.8.N.b.070	Shortleaf pine-post oak-blackjack oak forest
	I.A.8.N.b.145	(Pitch pine, table mountain pine)-(rock chestnut oak, scarlet oak) forest
	I.A.8.N.b.220	Virginia pine-(white oak, post oak, southern red oak, black oak) forest
	I.A.8.N.b.230	Virginia pine-(scarlet oak, rock chestnut oak) forest
	I.C.3.N.a.060	Shortleaf pine-(scarlet oak, southern red oak, rock chestnut oak) forest
	I.C.3.N.a.160	Eastern white pine-(scarlet oak, rock chestnut oak) forest

*CISC=Continuous inventory of stand conditions

**Ecological community = Forest alliance

Table 32. *Attributes of the xeric pine and pine oak forest and woodland old-growth forest community type (Murphy and Nowacki, in preparation).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Mean age of large trees	Shortleaf pine 200 yrs. Pitch pine 150 yrs. Tablemountain pine 200 yrs. Virginia pine 140 yrs.	Hepting 1971
2. D.b.h. of largest trees	Shortleaf pine 22 to 25 in. Pitch pine 12 to 15 in. Table mountain pine 10 to 15 in. Virginia pine 10 to 15 in.	Fountain and Sweeny 1985 Turner 1935
3. Stand density	<u>Interior Highlands</u> Shortleaf pine D.b.h. $\geq$ 4 in. 234 to 434* Hardwoods D.b.h. $\geq$ 4 in. 86 to 167* <u>Southern Appalachians</u> Table mountain pine D.b.h. $\geq$ 4 in. 45*	Dale and Watts 1980; Fountain and Sweeny 1985; Johnson 1986 Zobel 1969
4. Stand basal area	<u>Interior Highlands</u> Shortleaf pine D.b.h. $\geq$ 4 in. 37 to 77** Hardwoods D.b.h. $\geq$ 4 in. 18 to 22** <u>Southern Appalachians</u> Table mountain pine D.b.h. $\geq$ 4 in. 24**	Dale and Watts 1980; Fountain and Sweeny 1985; Johnson 1986 Zobel (1969)
5. Standing snags per acre	D.b.h. $\geq$ 3 in. 3.5 - 13.1 tons (range of means)	Johnson and Schnell 1985
6. Volume of downed logs per acre	0.1-4.2 tons (range of means)	Johnson and Schnell 1985
7. Number of 4" size classes	Shortleaf pine - 6 Hardwood - 4	Fountain and Sweeny 1985
8. Percentage of the canopy in gaps	N/A	

*Trees per acre

**Ft^2 per acre

Dry and Dry-Mesic Oak-Pine Forest
Old-Growth Forest Community Type 25

Community Description

Dry and dry-mesic oak-pine forests constitute a large part of the eastern deciduous forest, extending from southern Missouri and east Texas in the west to the Atlantic coast from New Jersey to north Florida (table 33). Most of these forests occur on coarse-textured soils on ridges and south-facing slopes in the mountains and droughty uplands in the Piedmont and Coastal Plain (White and Lloyd, in preparation). The oak-pine old-growth forest community type consists of least 20 percent of the basal area in pine and at least 20 percent in oak.

The dry and dry-mesic oak-pine (type 25) and dry-mesic oak (type 21) old-growth forest community types may develop on the same type of sites depending on type and intensity of disturbances. Across eastern old-growth sites, shortleaf pine (Pinus echinata) and white oak (Quercus alba) are the most common canopy species, whereas pitch pine (P. rigida), scarlet oak (Q. coccinea) and chestnut oak (Q. prinus) are more common in mountainous areas. Other common canopy species include Virginia pine (P. virginiana), table mountain pine (P. pungens), post oak (Q. stellata), blackjack oak (Q. marilandica) on dry sites and loblolly pine (P. taeda), southern red oak (Q. falcata), black oak (Q. velutina), mockernut hickory (Carya tomentosa), pignut hickory (C. glabra), and red maple (Acer rubrum) on dry-mesic sites (table 34). Ericaceous species, such as blueberry (Vaccinium spp.), huckleberry (Gaylusaccia spp.), and mountain laurel (Kalmia latifolia), typically dominate the shrub layer, while dogwood (Cornus florida), sourwood (Oxydendrum arboreum), sassafras (Sassafras albidum), and blackgum (Nyssa sylvatica) are common in the midstory. Common understory and vine species include sedges (Carex spp.), panicum grasses (Panicum spp.), broom sedge (Andropogon spp.) and other grasses, pipsessewa (Chimaphila maculata), begger's ticks (Desmodium spp.), bracken fern (Pteridium spp.), greenbriar (Smilax spp.)., Virginia creeper (Parthenocissus quinquefolia), and grapes (Vitis spp.). Currently a lower frequency of fires is resulting in species composition changes. Table 35 contains attributes for the dry and dry-mesic oak-pine old-growth forest community type.

Disturbance

The dry and dry-mesic oak-pine old-growth forest community type is transitory on a given site. Historically, fire, aboriginal activities, windfall, natural mortality, and other disturbances maintained this forest community type. Disturbances vary across its range, with lightning fires prevalent in the Coastal Plain and Ozark Mountains, hurricanes in the Coastal Plain, and tornadoes in the Ouachita and Ozark Mountains. Fire is less frequent in the Appalachian Piedmont and Mountains. The frequency of natural fires is estimated at between 5 and 32 years throughout the Southeast (White and Lloyd, in preparation).

Beyond a certain gap size (0.1 acre in the Piedmont), fire (or other forest floor disturbance) is the limiting factor for maintaining this old-growth forest community type.

Representative Dry and Dry-Mesic Oak-Pine Forest Old-Growth Stands

John de la Howe Tract, near McCormick, South Carolina
Duke Forest, North Carolina
Roaring Branch Research Natural Area, Arkansas
Lake Winona Research Natural Area, Ouachita National Forest, Arkansas
Bob's Creek Shortleaf Stand, Kisatchie National Forest, Louisiana
Old Shortleaf Slope Stand, Kisatchie National Forest, Louisiana

Table 33. *The potential distribution of the dry and dry-mesic oak-pine old-growth forest community type.*

Ecological Province	Ecological Section	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington - Jefferson
	Blue Ridge Mountains	Nantahala - Pisgah Chattahoochee Sumter (Andrew Pickens RD*) Cherokee George Washington-Jefferson (Pedlar, Glenwood RD*, Mount Rogers NRA**)
Southeastern Mixed Forest	Southern Ridge and Valley	Talladega (Talladega Division) Chattahoochee (Armuchee RD*)
	Southern Appalachian Piedmont	Uhwarrie Sumter Oconee
	Southern Cumberland Plateau	Bankhead
	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee Holly Springs Tombigbee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD*) Sam Houston Sabine (in part) Ouachita (Tiak RD* only)

*RD = Ranger district
**NRA = National recreation area

Table 33 (continued). *The potential distribution of the dry and dry-mesic oak-pine old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Outer Coastal Plain Mixed Forest	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Florida Coastal Lowlands, Western Gulf Section	Apalachicola (in part)
	Coastal Plains and Flatwoods Lower Section	Conecuh Apalachicola(in part) Ocala Desoto Bienville Homochitto
	Coastal Plains and Flatwoods Western Gulf	Kisatchie (all except Caney RD*) Davy Crockett Angelina Sabine (in part)
Lower Mississippi Riverine Forest	Mississippi Alluvial Basin	St. Francis
Ouachita Mixed Forest	Ouachita Mountain	Ouachita
Eastern Broadleaf Forest	Ozark Highlands	Ozark
	Northern Cumberland Plateau	Daniel Boone

*RD=Ranger district

Table 34. *The relationship of the dry and dry-mesic oak-pine old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover type	31	Loblolly pine
	32	Shortleaf pine (in part)
	33	Virginia pine (in part)
	10	White pine-upland hardwood
	12	Shortleaf pine-oak
	13	Loblolly pine-oak
	16	Virginia pine-hardwood
	44	Southern red oak-yellow pine
	45	Chestnut oak-scarlet oak-yellow pine
	47	White oak-black oak-yellow pine
	48	Northern red oak-hickory-yellow pine
Society of American Foresters		
forest type code	51	White pine-chestnut oak
	75	Shortleaf pine
	76	Shortleaf pine-oak
	78	Virginia pine-oak
	79	Virginia pine
	80	Loblolly pine-shortleaf pine
	81	Loblolly pine
	82	Loblolly pine-hardwood

*CISC=continuous inventory of stand conditions

Table 34 (continued). *The relationship of the dry and dry-mesic oak-pine old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
The Nature Conservancy International Classification of Ecological Communities**	I.C.3.N.a.050	Shortleaf pine-(white oak, southern red oak, post oak, black oak)
	I.C.3.N.a.060	Shortleaf pine-(scarlet oak, southern red oak, rock chestnut oak)
	I.C.3.N.a.070	Shortleaf pine-post oak-blackjack oak
	I.C.3.N.a.090	(Shortleaf pine, loblolly pine, Virginia pine) - (white oak, red oak) - tuliptree
	I.C.3.N.a.100	(Shortleaf pine, loblolly pine, Virginia pine) - (bluejack oak, sand post oak, laurel oak)
	I.C.3.N.a.110	(Shortleaf pine, Virginia pine) - tuliptree
	I.C.3.N.a.140	Longleaf pine-shortleaf pine-(loblolly pine) - (post oak, southern red oak)
	I.C.3.N.a.150	White pine - (white oak, red oak, black oak)
	I.C.3.N.a.230	Virginia pine - (scarlet oak, rock chestnut oak)
	I.C.3.N.a.220	Virginia pine - (white oak, post oak, southern red oak, black oak)
	I.C.3.N.a.190	Loblolly pine - (blackjack oak, southern red oak, post oak)
	I.C.3.N.a.160	Eastern white pine - (scarlet oak, rock chestnut oak)
	I.C.3.N.a.180	Loblolly pine - (white oak, southern red oak, post oak)

**Ecological community = Forest alliance

Table 35. *Attributes of the dry and dry-mesic oak-pine old-growth forest community type (White and Lloyd, in preparation).*

Old-Growth Attribute	Old-Growth Parameters	Data Sources
1. Age of large trees	Southern Appalachians	
	White oak 347 yrs.*	Blozan 1994; White and Lloyd, in preparation
	Black oak 180 yrs.*	
	Chestnut oak 66-347 yrs.*	
	Pignut hickory 327 yrs.*	
	Scarlet oak 72-165 yrs.*	
	Pitch pine 148 yrs.*	
	Piedmont	
	White oak 82-207 yrs.	White and Lloyd, in preparation
	Shortleaf pine 89-205 yrs.	
	Loblolly pine 79-189 yrs.	
	Hickory sp. 142-207 yrs.	
	Post oak 101-216 yrs.	
	Southern red oak 64-190 yrs.	
	Yellow poplar 94-194 yrs.	
	Interior Highlands	
	Shortleaf pine 108-314 yrs.	Stahle and others 1985
2. D.b.h. of large trees	Piedmont	
	White oak 12-33 inches	White and Lloyd, in preparation
	Post oak 8-19 inches	
	Shortleaf pine 11-32 inches	
	Loblolly pine 12-39 inches	
	Hickory sp. 10-23 inches	
	Interior Highlands	
	Shortleaf pine 14-26 inches	Stahle (1985)
3. Stand density	Southern Appalachians	
	D.b.h. $\geq$ 3 inches 312-328**	Delapp and Wentworth 1977;
	Piedmont	
	D.b.h. $\geq$ 4 inches 130-183**	White and Lloyd, unpublished data
	Interior Highlands	
	D.b.h. $\geq$ 4 inches 223-225**	Fountain and Sweeny 1985
	Gulf Coastal Plain	
	D.b.h. $\geq$ 5 inches 61-107**	Martin and Smith 1991

*Range includes ages reported as maximum ages

**Trees per acre

Table 35 (continued). *Attributes of the dry and dry-mesic oak-pine old-growth forest community type (White and Lloyd, in preparation)*

Old-Growth Attribute	Old-Growth Parameters	Data Sources
4. Stand basal area	Southern Appalachians D.b.h. ≥ 3 inches 90 to 110***	Delapp and Wentworth 1977
	Piedmont D.b.h. ≥ 4 inches 64 to 150***	White and Lloyd, in preparation
	Interior Highlands D.b.h. ≥ 4 inches 80 to 81***	Fountain and Sweeny 1985
	Gulf Coastal Plain D.b.h. ≥ 5 inches 59 to 128***	Martin and Smith 1991
5. Number of standing snags per acre****	D.b.h. ≥ 4 inches 15 to 69 ≥ 20 inches 2 to 16	White & Lloyd (In Draft)
6. Volume of downed** logs per acre	747 to 2,528 ft^3 per acre	White & Lloyd (In Draft)
7. Number of canopy layers	2-3 (mean gap size - 0.002 to 0.5 ac.)	White & Lloyd (In Draft)
8. Percent canopy in gaps****	24 to 80 (37 mean)	White & Lloyd (In Draft)

***Ft^2 per acre

****The range of values given for these variables represent data collected from low to high mortality areas within a single stand which underwent significant insect-related pine mortality

Upland Longleaf and South Florida Slash Pine Forest, Woodland, and Savanna Old-Growth Forest Community Type 26

Community Description

The upland longleaf pine forest, woodland, and savanna community type can be found from Virginia south through central Florida and west to east Texas, with extensions into the Appalachian Piedmont and Mountains of north Alabama and northwest Georgia (table 36). On the Coastal plains, this forest community is typically found on sandhills, although in central and south Florida, it occurs on slight rises in flatwoods. In the mountains, it is usually restricted to sites that are apt to burn, specifically ridge tops and middle and upper slopes with south and southwest exposures (Nowacki 1993).

In this old-growth forest community type the dominant canopy tree is longleaf pine (Pinus palustris), providing relatively dense to patchy and very open canopies. These old-growth communities have frequent transitions in ages, tree sizes, and tree density. Sometimes associated with this forest community type are clusters of deciduous scrub oaks, evergreen scrub oaks, and mesic hardwoods (table 37). The groundcover consists of hundreds of species of herbs and low shrubs sometimes dominated by wiregrass (Aristida stricta and A. beyrichiana) in the eastern portion of its range and by bluestem grasses (Schizachyrium tenerum and S. scoparium) in the western portion (Landers and Boyer, in preparation). Table 38 contains the attributes for the upland longleaf and south Florida slash pine old-growth forest community type.

The slash pine forest community forms large savannas in south Florida where it is considered an ecological equivalent of longleaf pine. This old-growth community has frequent transitions in ages, tree sizes, and tree density. Sometimes associated with this communities are clusters of deciduous scrub oaks, evergreen scrub oaks, and mesic hardwoods. In south Florida, the groundcover consists of hundreds of species of herbs and shrubs dominated by wiregrass. Slash pine communities outside south Florida typically contain large portions of evergreen shrubs such as Serenoa repens or Ilex glabra (Landers and Boyer, in preparation). No National Forest System land is within the range of south Florida slash pine.

Disturbance

Fires during the growing season are the major disturbances in the upland longleaf and south Florida slash pine old-growth communities. In most instances, the frequency of fires associated with maintaining longleaf pine is estimated to be every 2 to 4 years. In the Coastal Plain sandhills and transition areas, the frequency is estimated to be 3 to 10 years. In addition to normal fire regimes, other disturbances include lightening, wind events (e.g., tornadoes, tropical

storms, and microbursts), and periodic droughts that result in conditions conducive to intense fires (Landers and Boyer, in preparation).

Representative Upland Longleaf and South Florida Slash Pine Forest, Woodland, and Savanna Old-Growth Stands

Boykins Springs Management Area, Angelina National Forest, Texas
Wade Tract Preserve, Thomas Co., Georgia
Moody Tract, Appling Co., Georgia
Big Woods, Greenwood Plantation, Thomas Co., Georgia
Big Cypress National Preserve, Collier Co., Florida
Patterson Natural Area, Eglin Air Force Base, Florida
Boyd Tract, Weymouth Woods Sandhills Nature Preserve, Moore Co., North Carolina
Havis Park, Flamaton Natural Area, Escambia Co., Alabama
Lostman's Pines, Everglades National Park, Florida

Table 36. *The potential distribution of the upland longleaf and south Florida slash pine forest, woodland, and savanna old-growth forest community type.*

Ecological Provinces	Ecological Sections	National Forest
Southeastern Mixed Forest	Southern Ridge and Valley	Talladega (Talladega Division)
	Southern Appalachian Piedmont	Uhwarrie Sumter
	Southern Cumberland Plateau	Bankhead
	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD*) Sam Houston Sabine (in part) Ouachita (Tiak RD*)
Outer Coastal Plain Mixed Forest	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Florida Coastal Lowlands, Western Gulf Section	Apalachicola (in part)
	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Ocala Desoto Bienville Homochitto
	Coastal Plains and Flatwoods, Western Gulf	Kisatchie (all except Caney RD*) Davy Crockett Angelina Sabine (in part)

*RD=Ranger district

Table 37. *The relationship of the upland longleaf and south Florida slash pine forest, woodland, and savanna old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC* cover type	21	Longleaf pine
Society of American Foresters forest type code	70	Longleaf pine
	71	Longleaf pine-scrub oak
	83	Longleaf pine-slash pine
The Nature Conservancy International Classification of Ecological Communities**	I.A.8.N.b.070	Longleaf pine-slash pine temporate forest
	I.A.4.N.a.130	Longleaf pine-oak species woodland
	I.A.4.N.a.120	Longleaf pine woodland
	I.A.4.N.f.060	Longleaf pine-pond pine-saturated woodland
	I.A.4.N.f.050	Longleaf pine-slash pine saturated woodland
	I.A.4.N.f.040	Longleaf pine saturated woodland

*CISC=Continuous inventory of stand conditions
**Ecological community = Forest and woodland alliance

Table 38. *Attributes of the upland longleaf and south Florida slash pine forest, woodland, and savanna old-growth forest community type (Landers and Boyer, in preparation).*

Old-Growth Attribute	Old-Growth Parameters	Data Sources
1. Minimum age	112 years	Schopmeyer (1974)
2. D.b.h. of oldest trees at minimum age	7 to 24 inches	Chapman 1909; Schwarz 1907
3. Stand density	D.b.h. $\geq$ 2 inches 52 to 167*	Schwarz 1907;
	$\geq$ 1 inch 70*	Platt and others, 1988;
	$\geq$ 1 inch 0.2-3.9**	Bartrum 1765-66
4. Stand basal area	N/A	
5. Number of standing snags per acre	0 to 12	Schwarz 1907
6. Volume of downed logs	N/A	
7. Percent canopy in gaps	N/A	

*Trees per acre
**Savanna condition
N/A = Not available

Seasonally Wet Oak-Hardwood Woodland
Old-Growth Forest Community Type 27

Community Description

Seasonally wet oak-hardwood woodlands are commonly known as oak glades or flatwoods and with relatively open understories. They occur from the Midwest to eastern Oklahoma and Texas and east to Virginia (table 39). This old-growth forest community type is most completely developed within the Ohio, Arkansas, and southern Mississippi River Valleys and occurs principally within river bottomlands and isolated depressions that are seasonally flooded for short periods (Kennedy and Nowacki, in preparation).

The principal species are pin oak (Quercus palustris), willow oak (Q. phellos), white oak (Q. alba), water oak (Q. nigra), laurel oak (Q. laurifolia), and nuttall oak (Q. nuttallii). Common associates include overcup oak (Q. lyrata), red maple (Acer rubra), sweetgum (Liquidambar styraciflua), water hickory (Carya aquatica), and waterlocust (Gleditsia aquatica) (Kennedy and Nowacki, in preparation). Table 40 contains the relationships between the seasonally wet oak-hardwood woodland old-growth community type and other forest classification systems, and table 41 contains its old-growth attributes.

Disturbance

Prior to European settlement, low-intensity fires may have occurred when dry surface conditions developed during the summer. Although such burns would probably have been confined to the litter layer, they would have helped to maintain open conditions in these woodlands. Current fire regimes have caused most of these communities to shift from woodlands to forests. Canopy tree deaths and gap phase regeneration are common in these old-growth stands resulting in a multiple-aged stand (Kennedy and Nowacki, in preparation).

Representative Seasonally Wet Oak-Hardwood Woodland Old-Growth Stands

Delta Experimental Forest, Washington County, Mississippi
Delta National Forest, Sharkey Co., Mississippi

Table 39. *The potential distribution of the seasonally wet oak hardwood woodland old-growth forest community type.*

Ecological Province	Ecological Section	National Forest
Outer Coastal Plain Mixed Forest	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Ocala Desoto Bienville Homochitto
Southeastern Mixed Forest	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee Holly Springs Tombigbee
	Southern Cumberland Plateau	Bankhead
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD*) Sam Houston Sabine (in part) Ouachita (Tiak RD*)
Ouachita Mixed Forest	Ouachita Mountain	Ouachita
Eastern Broadleaf Forest	Ozark Highlands	Ozark
	Northern Cumberland Plateau	Daniel Boone
Lower Mississippi Riverine Forest	Mississippi Alluvial Basin	Delta St. Francis

*RD=Ranger district

Table 40. *The relationship of the seasonally wet oak hardwood woodland old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover type	54	White oak (in part)
	62	Sweetgum-nuttall oak-willow
	64	Laurel oak-willow oak
Society of American Foresters		
forest type code	53	White oak (in part)
	65	Pin oak-sweetgum
	68	Willow oak-water oak-laurel oak
The Nature Conservancy		
International Classification of		
Ecological Communities	N/A	N/A

*CISC=Continuous inventory of stand conditions
N/A = Not available

Table 41. *Attributes of the seasonally wet oak-hardwood woodland old-growth forest community type (Kennedy and Nowacki, in preparation).*

Old-Growth Attribute	Old-Growth Parameters	Data Sources
1. Age of large trees	80 to 150 yrs.	Frye 1980; Meadows 1992; Putman and Bull 1932
2. D.b.h. of largest tree	45 inches	Frye 1980; Meadows 1992
3. Stand density	D.b.h. $\geq$ 4 inches - 40 - 215*	Frye 1980; Meadows 1992; Putman and Bull
4. Stand basal area	D.b.h. $\geq$ 4 inches -44 - 214**	Frye 1980; Meadows 1992; Putman and Bull 1932
5. Number of standing snags per acre	D.b.h. $\geq$ 4 inches - 0 - 75	Frye 1980; Meadows 1992
6. Volume of downed logs	N/A	
7. Number of 4" dbh classes	9	Frye 1980

*Trees per acre
**Ft^2 per acre
N/A = Not available

Eastern Riverfront Forest
Old-Growth Forest Community Type 28

Community Description

Eastern riverfront forests occur over a large portion of the Eastern United States, from the forest-prairie margin eastward to the Atlantic coastline. These communities have the potential to occur on all national forests in the South. As the name implies, this forest community type is predominant on sites immediately adjacent to major rivers and streams (i.e., river banks and first bottoms, natural levees, sandbars, and islands).

The principal species in the eastern riverfront forest community type include river birch (Betula nigra), sycamore (Platanus occidentalis), silver maple (Acer saccharinum), American elm (Ulmus americana), eastern cottonwood (Populus deltoides), swamp cottonwood (P. heterophylla), sweetgum (Liquidambar styraciflua), black willow (Salix nigra), and live oak (Quercus virginiana) (table 42). Common associates are red maple (A. rubra), boxelder (A. negundo), hackberry (Celtis occidentalis), slippery elm (U. rubra), pin oak (Q. palustris), swamp white oak (Q. bicolor), green ash (Fraxinus pennsylvanica), sugarberry (C. laevigata), water oak (Q. nigra), and pecan (Carya illinoensis) (Meadows and Nowacki 1996). Table 43 contains old-growth attributes for the eastern riverfront forest community type.

Disturbance

This forest community type is restricted to riparian zones where intense flooding, such as ice and water scouring, routinely occur. These floods expose mineral soils, reduce competing undergrowth, and increase surface light levels. The locations of these forests will shift as the river courses change. In the absence of floods, these forests are susceptible to encroachment by shade tolerant species (Meadows and Nowacki 1996).

Representative Eastern Riverfront Forest Old-Growth Stands

Green Ash Natural Area, Delta National Forest, Mississippi
River Birch Bottom, Kisatchie National Forest, Louisiana

Table 42. *The relationship of the eastern riverfront old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover type	72	River birch-sycamore
	73	Cottonwood
	74	Willow
	75	Sycamore-pecan-American elm
	76	Silver maple-American elm
	82	Black walnut
Society of American Foresters		
forest type code	61	River birch-sycamore
	62	Silver maple-American elm
	63	Cottonwood
	89	Live oak
	94	Sycamore-sweetgum-American elm
	95	Black willow
The Nature Conservancy		
International Classification of		
Ecological Communities**	I.B.2.N.d.280	Black willow temporarily flooded
	I.B.2.N.d.070	Pecan-(sugarberry) temporarily flooded
	I.B.2.N.d.160	Cottonwood temporarily flooded
	I.B.2.N.d.030	Silver maple temporarily flooded
	I.B.2.N.d.270	Carolina willow temporarily flooded
	I.B.2.N.d.050	River birch-(sycamore) temporarily flooded
	I.B.2.N.d.140	Sycamore-(green ash, sugarberry, silver maple) temporarily flooded
	I.B.2.N.d.210	(Swamp chestnut oak, cherrybark oak, shumard oak) - sweetgum temporarily flooded
	I.B.2.N.d.100	American beech temporarily flooded

*CISC=Continuous inventory of stand conditions

**Ecological community = Forest alliance

Table 43. *Attributes of the eastern riverfront old-growth forest community type (Meadows and Nowacki 1996.*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Age of large trees	All species - 58 to 120 yrs.	Hardin and others 1989; Lamb 1915; Martin and Smith 1991; Putman and Bull 1932; Williamson 1913
2. DBH of largest tree	All species - 25 to 72 inches	Lamb 1915; Martin and Smith 1991; Putman and Bull 1932; Williamson 1913
3. Stand density	D.b.h. $\geq$ 4 inches - 32 to 179*	Martin and Smith 1991; Williamson 1913
4. Stand basal area	D.b.h.$\geq$4 inches - 160 to 220**	Robertson and others 1978; Wiseman 1982
5. Number of standing snags per acre	Several	Martin and Smith 1991
6. Volume of downed logs	High	Martin and Smith 1991
7. Number of canopy layers	$\geq$ 3	Martin and Smith 1991; Putman and Bull 1932; Wiseman 1982
8. Number of 4" dbh classes	6 to 10	Martin and Smith 1991; Winters and others 1938; Wiseman 1982

*Trees per acre

**Ft^2 per acre

Southern Wet Pine Forest, Woodland, and Savanna Old-Growth Forest Community Type 29

Community Description

Southern wet pine forests, woodlands, and savannas are part of the pine flatwoods forests of the Atlantic and Gulf Coastal Plain (table 44). Representative sites include boggy non-riverine flatlands, coastal flatlands, swamps, and lowlands adjacent to ponds, streams, and other wet areas.

Species composition differs widely among stands and is largely dependent on degree of flooding. On mineral soils where flooding is limited, longleaf pine (Pinus palustris) and/or slash pine (P. caribea) is predominant (table 45). Fire usually restricts hardwood species. Longleaf and slash pine are replaced by pond pine (Pinus serotina) on organic soils subject to prolonged flooding. Associates of the pond pine community are swamp tupelo (Nyssa sylvatica), water oak (Quercus nigra), baldcypress (Taxodium distichum), pondcypress (T. ascendens), sweetbay (Magnolia virginiana) and red bay (Persea borbonia) (Harms 1996, Nowacki 1993). Table 46 contains old-growth attributes for the southern wetland pine forest, woodland, and savanna forest community type.

Disturbance

This old-growth forest community type is fire dependent and in the absence of fire, pines are eventually replaced by hardwoods (Harms 1996).

Representative Southern Wet Pine Forest, Woodland, and Savanna Old-Growth Stands

Beehead Ranch Pine Flatwoods, Tosohatchee State Preserve, Florida
Big Cypress National Preserve, Collier Co., Florida
Slash Pine Tract, Bradwell Bay Wilderness, Apalachicola National Forest, Florida

Table 44. *The potential distribution of the southern wet pine forests, woodland, and savannas old-growth forest community type.*

Ecological Province	Ecological Section	National Forest
Outer Coastal Plain Mixed Forest	Atlantic Coastal Flatwoods	Francis Marion Croatan Osceola
	Florida Coastal Lowlands, Western Gulf Section	Apalachicola(in part)
	Coastal Plains and Flatwoods, Lower Section	Conecuh Apalachicola (in part) Ocala Desoto Bienville Homochitto
	Coastal Plains and Flatwoods, Western Gulf	Kisatchie (all except Caney RD*) Davy Crockett Angelina Sabine (in part)
Southeastern Mixed Forest	Coastal Plain, Middle Section	Talladega (Oakmulgee Division) Tuskegee
	Middle Coastal Plain, Western Section	Kisatchie (Caney RD*) Sabine (in part) Sam Houston Ouachita (Tiak RD*)

*RD=Ranger district

Table 45. *The relationship of the southern wet pine forest, woodland, and savanna old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC* cover type	21	Longleaf pine
	22	Slash pine
	14	Slash pine-hardwood
	36	Pond pine
	18	Pond pine-hardwood
Society of American Foresters forest type code	70	Longleaf pine
	83	Longleaf pine-slash pine
	84	Slash pine
	85	Slash pine-hardwood
	98	Pond pine
The Nature Conservancy International Classification of Ecological Communities**	I.A.8.N.g.070	Longleaf pine saturated forest
	I.A.8.N.g.060	Slash pine-pond pine saturated forest
	I.A.8.N.g.085	Pond pine saturated forest
	I.A.8.N.g.040	Slash pine saturated forest
	I.C.3.N.c.012	Slash pine-sweet bay-pondcypress-swamp blackgum saturated forest
	II.A.3.N.f.010	Slash pine saturated woodland
	II.A.3.N.f.040	Longleaf pine saturated woodland

*CISC=Continuous inventory of stand conditions

**Ecological community = Forest and woodland alliance

Table 46. *Attributes of the southern wet pine forest, woodland, and savanna old-growth forest community type (Harms 1996).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Minimum age	Longleaf pine - 150 - 200 yrs	Chapman 1909; Wahlenberg 1946;
	Slash pine - 80 - 100 yrs	Hebb and Clewell 1976;
	Pond pine - 60 - 100 yrs	Schumacher and Coile 1960
2. Average stand d.b.h.	Longleaf pine - 20 inches	Chapman 1909; Wahlenberg 1946;
	Slash pine - 21 inches	Hebb and Clewell 1976;
	Pond pine - 9 inches	Schumacher and Coile 1960
3. Minimum stand density	Longleaf pine - 61*	Chapman (1909), Wahlenberg (1946)
	Slash pine - 61*	Hebb & Clewell (1976)
	Pond pine - 81*	Schumacher and Coile (1960)
4. Stand basal area	N/A	
5. Number of standing snags per acre	N/A	
6. Volume of downed logs	N/A	
7. Stand structure	Forest - hardwood understory present Woodland - shrub understory dominant Savanna - grass-herb understory dominant	

*Trees per acre
N/A = Not available

Montane and Allied Spruce and Spruce-Fir Forest Old-Growth Forest Community Type 31

Community Description

Montane and allied spruce and spruce-fir forests typically occur at middle-to-high elevations in the Appalachians from Maine to North Carolina (table 47). This old-growth forest community type occurs on the highest mountains of the southern Appalachians, where it caps many of the highest peaks. Site conditions are usually severe, including short frost-free seasons and shallow, poorly developed soils that erode easily on steep slopes. The montane and allied spruce and spruce-fir forest community type typically occurs in fog-shrouded locations where moisture is obtained through direct cloud contact (Tyrrell and others, in preparation).

Table 47. *The potential distribution of the montane and allied spruce and spruce-fir old-growth forest community type.*

Ecological Province	Ecological Section	National Forest
Central Appalachian Broadleaf-Coniferous Forest Meadow	Northern Ridge and Valley	George Washington-Jefferson
	Blue Ridge Mountains	Nantahala-Pisgah Cherokee George Washington-Jefferson (Mount Rogers NRA*)

*NRA = National recreation area

Red spruce (Picea rubens), yellow birch (Betula alleghaniensis), mountain ash (Sorbus americana), and mountain maple (Acer spicatum) are commonly found in this forest community (table 48). Other typical tree species are Fraser fir (Abies fraseri) and pin cherry (Prunus pensylvanica). Hobble bush (Viburnum alnifolium) and bearberry (Vaccinium erythrucarpum) are common understory plants (Tyrrell and others, in preparation). Table 49 contains old-growth attributes for the montane and allied spruce and spruce-fir forest community type.

Table 48. *The relationship of the montane and allied spruce and spruce-fir old-growth forest community type to the forest classification systems of the National Forest System and the Society of American Foresters, and the International Classification of Ecological Communities of The Nature Conservancy.*

Classification	Code	Forest Type
National Forest CISC*		
cover type	6	Fraser fir
	7	Red spruce-Fraser fir
Society of American Foresters		
forest type code	32	Red spruce
	34	Red spruce-Fraser fir
The Nature Conservancy		
International Classification of		
Ecological Communities**	I.A.8.N.c.010	Fraser fir-(red spruce)
	I.A.8.N.c.030	Red spruce
	I.C.3.N.a.045	Red spruce-yellow birch

*CISC = Continuous inventory of stand conditions
**Ecological communities = Forest alliance

Disturbance

Disturbances are usually intense and affect large areas of this forest community type. Because of exposure and limited rooting depth, these forests are susceptible to large-scale blowdowns during storms. Tree mortality may occur in waves across the landscape.

Insect outbreaks, including the balsam woolly adelgid, can cause widespread devastation.

Tree mortality due to windthrow or insect attack can predispose these areas to fire during droughts (Tyrrell and others, in preparation).

Concerns about spruce decline have been raised due to pollution such as acid deposition. While this decline has been documented for this community type in the northeast portion of its range, the detection of decline is problematic due to disturbances from insects (SAMAB 1996).

Representative Montane and Allied Spruce and Spruce-Fir Forest Old-Growth Stands

Black Mountain Research Natural Area, Yancey Co., North Carolina
Mount Pisgah, near Blue Ridge Parkway, North Carolina
Northwest side of Roan High Bluff, Tennessee

Table 49. *Attributes of the montane and allied spruce and spruce-fir old-growth forest community type (Tyrrell and others, in preparation).*

Old-Growth Attribute	**Old-Growth Parameters**	**Data Sources**
1. Average age of large trees	Red spruce - 81-390 yrs Balsam fir - 40-130 yrs Yellow birch - 140-225 yrs	N/A
2. DBH of largest trees	Red spruce - 13-36 inches Balsam fir - 8-24 inches Fraser fir - 9-24 inches Yellow birch - 18-48 inches	N/A
3. Stand density	D.b.h. $\geq$ 4 inches - 30-529*	N/A
4. Stand basal area	D.b.h. $\geq$ 4 inches - 99-276**	N/A
5. Number of standing snags per acre	D.b.h. $\geq$ 2 inches - 133-445 D.b.h. $\geq$ 8 inches- 14-67	N/A
6. Volume of downed logs	9,875 to 13,591 ft^3 per acre	N/A
7. Number of canopy layers	1 to 3	N/A
8. Number of 4" dbh classes	4 to 22	N/A

*Trees per acre

**Ft^2 per acre

N/A = Not available

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GLOSSARY

Basal area (BA) - the area, in square feet, of the cross section of a single tree, or all of the trees in a stand, measured at 4.5 feet above ground, usually expressed as square feet per acre.

Biodiversity - the variety of life in an area, including the variety of genes, species, plant and animal communities, and ecosystems, as well as the interactions of these elements.

Diameter of breast height (d.b.h.) - the standard method for measuring tree diameter at 4 1/2 feet from the ground.

Continuous inventory of stand conditions (CISC) - the USDA Forest Service, Southern Region's forest stand database containing descriptive and prescriptive data about mapped stands of forest land.

Ecological classification system (ECS) - a hierarchical system used in classifying ecological types and ecological units for making comparisons. The system is ecologically based and integrates existing data about site conditions, such as climate, topography, geology, soil, hydrology, and vegetation. It includes four planning and analysis scales of ecological units (from largest to smallest): ecoregion, subregion, landscape, and land unit. These ecological units are then subdivided as follows: ecoregion - domain, division, and province; subregion - section and subsection; landscape - landtype association; and land unit - landtype, landtype phase, and site**.**

Ecological section - an area with a similar geomorphic process, geologic origin, drainage network, topography, and regional climate. Such areas are often inferred by relating geologic maps to potential natural vegetation. Boundaries of ecological sections approximate those of geomorphic provinces, as recognized by geologists.

Even-aged - a stand of trees which originated at a single point in time, so that the individual trees are approximately the same age or a regeneration system designed to produce such a stand.

Existing old growth - individual stands on a national forest currently recognized as meeting the parameters of the old-growth operational definitions (table 2).

Forests - an area of trees with overlapping crowns (generally forming a 60 to 100 percent cover).

Future old growth - areas on national forests that have been allocated to old-growth restoration through land management decisions.

Habitat - the physical and biological environment for a plant or animal in which all the essentials for its development, existence, and reproduction are present.

Habitat linkage - vegetation or other conditions, that permit a species to move between habitat areas without encountering barriers.

Late seral (successional) stage - the stage of forest development during which the age of trees is usually greater than 80 years depending on the composition of tree species. Small gaps become more common as some trees die allowing full sunlight to reach the mid- and understories. This stage contains the largest trees within a forest and provides the highest capability for large snags, large live cavities, and den tree production. The presence of large, downed, woody material is highest during this period. Old-growth forests occur during the later periods of the seral stage.

Mesic - pertaining to or adapted to an area that has a balanced supply of water; neither wet nor dry.

Mid seral (successional) stage - the stage of forest development during which distinct overstory, midstory, and understory canopies are present. The age of trees range from about 20 years to about 90 years depending on the composition of tree species. The trees are usually greater than 10 inches in d.b.h. This stage provides capability for hard mast production, large standing snags, and live cavities. During this period, tree species reach economic maturity.

Montane - relating to the zone of relatively moist, cool, upland slopes characterized by the presence of large evergreen trees as a dominant life form.

Natural plant community - an association of plant species which are endemic to an area and whose characteristics have not been adversely affected by human disturbance.

Obligate species - a plant or animal species which occurs naturally only in a specific type of habitat.

Old-growth forests - an ecosystem distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics including tree size, accumulation of large dead woody material, number of canopy layers, species composition, and ecosystem function. Old growth is not necessarily virgin or primeval. It can develop over time following human disturbances, just as it does following natural disturbances. Old growth encompasses both older forests dominated by early seral species and forests in later successional stages dominated by shade tolerant species.

Possible old growth - areas with the highest probability of being existing or future old growth based on the preliminary inventory criteria.

Rare community - an association of plant and animal species which occurs only on a very small portion of the overall ecosystem.

Savannas - an open area with trees covering less than 25 percent and with herbaceous species dominating.

Seral stage - a developmental, transitory stage in the ecological succession of a biotic community.

Terrestrial - of, or pertaining to, land as distinct from water.

Uneven-aged - a stand of trees in which the individual trees originated over a long period of time and, thus, differ widely in age; a regeneration system designed to produce such as stand.

Virgin forests - an eastern forest characterized as being unaltered by European settlers; a forest in its original state.

Woodlands - an open stand of trees with crowns not usually touching (generally forming a 25 to 60 percent cover).

Xeric - characterized by a lack of moisture.

EXAMPLES OF FOREST PLAN DECISIONS RELATED TO OLD GROWTH APPENDIX A

Three national forests have specifically addressed old-growth issues through forest plan revisions or amendments.

George Washington National Forest - The forest plan provides an interim policy, until the regional policy is developed. These interim directions address old-growth management through a series of forest-wide standards and guidelines. The plan states:

- no silvicultural practices will be scheduled in stands identified as "present old growth" in the "preliminary inventory" and located on lands classified as unsuitable for timber management in any of the old-growth forest community type.

- no regeneration harvest practices will be scheduled in stands identified as "present old growth" in the "preliminary inventory" and located on lands classified as suitable for timber production in 9 of the 10 old-growth forest community types that occur on the forest.

- prior to scheduling any silvicultural practices in stands identified as "present old growth" in the "preliminary inventory" and located on lands classified as suitable for timber production in old-growth forest community type 21, the area will be inventoried according to the interim forest definition.

Ouachita National Forest - Approximately 40 percent of the 1.6 million acres is classified as unsuitable for timber production, including wilderness areas, scenic areas, riparian areas along streams, rocky ridgetops, and almost all lands where hardwoods are dominant. These areas, predominantly mature or approaching maturity, include upland and mixed oak-pine forest community types. Under the current plan directions, and without substantial disturbances, these areas will develop old-growth conditions. The pine-grass types maintained by fire is an ecological gap in community type representation.

A management area was created to restore fire-dependent, old-growth communities, and developed management area prescriptions for the restoration of old-growth pine-grass communities that would be allocated to continuous areas between around 600 to 6,000 acres in size. The acres within this management prescription could be either suitable (replacement stands) or unsuitable (core areas) for timber production based upon a specified set of conditions. The replacement stands are managed on a 160-year rotation.

Nantahala-Pisgah National Forests - The desired future condition (DFC) for old growth was defined as a network of small-, medium-, and large-sized old-growth areas that are representative of sites, elevation gradients, and landscapes and that are well dispersed and interconnected by forested lands. These areas should meet the following criteria: (1) high-quality old-growth characteristics; (2) unique species diversity; (3) community, soil type, aspect, elevation, ecological land unit, etc.; and (4) other specific resource concerns and management objectives.

The Nantahala-Pisgah National Forests used the following approach to develop a network of old-growth areas:

- Designated a series of large-sized areas (2,500+ contiguous acres), which will serve as reservoirs of biological diversity. The intent is to restore functional old-growth ecosystems at the subregional, forest, and landscape scales.

- Designate a series of medium-sized areas resulting in a series of old-growth areas that are each around 100 to 2,500 acres in size. They are located in each watershed or ecological subregion, or in whatever identifier unit is used for the scale of analysis. These medium-sized areas will serve as reservoirs of biological diversity. The intent is to restore functioning old-growth ecosystems at the landscape and Forest scales.

- Designated a series of small-sized areas resulting in a series of old-growth areas that are each around 50 to 100 acres in size. They are located in each compartment, or in whatever identifier unit is used for this scale of analysis. These small-sized areas will serve to increase biological diversity and to provide structural components of old growth at the stand and landscape levels.

AN EXAMPLE FIELD INVENTORY FORM FOR USE IN OLD-GROWTH VALIDATION MONITORING
APPENDIX B