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An Old-Growth Definition for Wet Pine Forests, Woodlands, and Savannas

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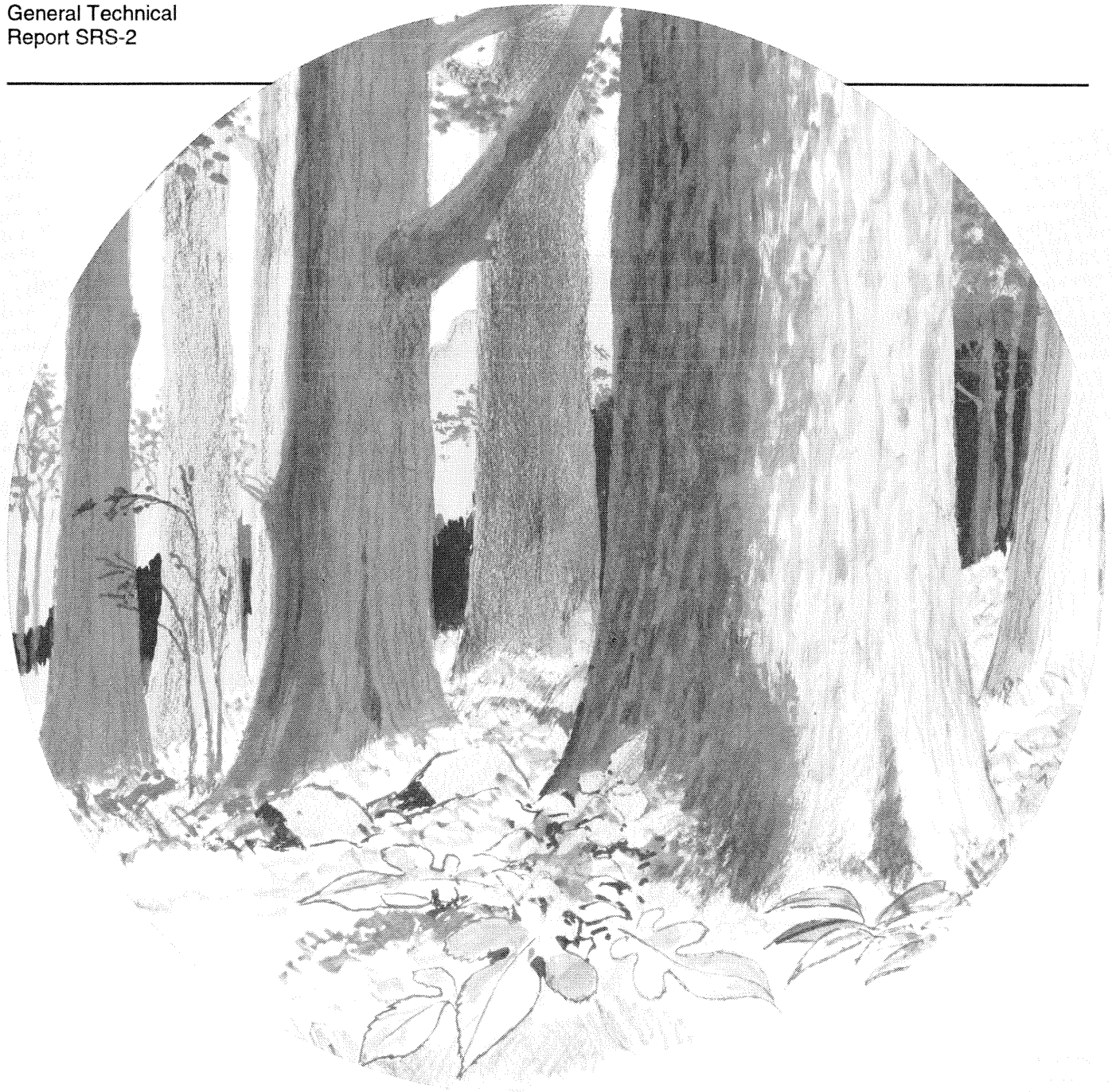

A Section of the Old-Growth Definition Series

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Preface

Old growth is widely acknowledged today as an essential part of managed forests, particularly on public lands. However, this concept is relatively new, evolving since the 1970's when a grassroots movement in the Pacific Northwest began in earnest to define old growth. In response to changes in public attitude, the U.S. Department of Agriculture, Forest Service began reevaluating its policy regarding old-growth forests in the 1980's. Indeed, the ecological significance of old growth and its contribution to biodiversity were apparent. It was also evident that definitions were needed to adequately assess and manage the old-growth resource. However, definitions of old growth varied widely among scientists. To address this discrepancy and other old-growth issues, the National Old-Growth Task Group was formed in 1988. At the recommendation of this committee, old growth was officially recognized as a distinct resource by the Forest Service, greatly enhancing its status in forest management planning. The committee devised "The Generic Definition and Description of Old-Growth Forests" to serve as a basis for further work and to ensure uniformity between Forest Service Stations and Regions. Emphasis was placed on the quantification of old-growth attributes.

At the urging of the Chief of the Forest Service, all Forest Service Stations and Regions began developing old-growth definitions for specific forest types. Because the Southern and Eastern Regions share many forest communities (together they encompass the entire Eastern United States), their efforts were combined, and a cooperative agreement was established with The Nature Conservancy for technical support. The resulting project represents the first large-scale effort to define old growth for all forests in the Eastern United States. This project helped bring the old-growth issue to public attention in the East.

Definitions will first be developed for broad forest types and based mainly on published information and so must be viewed accordingly. Refinements will be made by the Forest Service as new information becomes available. This document represents 1 of 35 forest types for which old-growth definitions will be drafted.

In preparing individual old-growth definitions, authors followed National Old-Growth Task Group guidelines, which differ from the standard General Technical Report format in two ways—the abstract (missing in this report) and the literature citations (listed in Southern Journal of Applied Forestry style). Allowing for these deviations will ensure consistency across organizational and geographic boundaries.

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Introduction

Wet pine forests, woodlands, and savannas of the Southeastern United States are subtypes within the pine flatwoods forest region of the Atlantic and Gulf Coastal Plains. This review briefly describes the edaphic and vegetation characteristics of the dominant plant communities in this type group and provides a working definition that may be used to identify and evaluate stands for inclusion in an old-growth management program. The old-growth definitions offered below are based on available published information on the type group; no field investigations were made.

The distinction among the vegetation structure of forests, woodlands, and savannas is determined by the relative density of the dominant stand and the composition of the shrub and herb layers. Forests have closed stands of trees with touching crowns, well-developed understories of trees and shrubs (if not frequently burned), and little if any grass or herb ground cover. Woodlands have fewer trees per unit area than forests, crowns of the dominant stand do not generally touch, and the understory is dominated by woody shrubs, giving the woodland a two-layered structure. Savannas tend to have widely scattered trees and a predominantly grass-herb understory of high-species diversity (Christensen 1988, Harcombe et al. 1993, Peet and Allard 1993).

Forest Type Group Narrative

Wet pine forests, woodlands, and savannas (type no. 27) are classed as palustrine forests with frequent, low-intensity, widespread fires. They are found in the coastal plain physiographic province from Delaware south to Florida and west to eastern Texas, primarily in the flatwoods of the outer marine terraces. Representative sites include boggy nonriverine flatlands, poorly drained seasonally wet coastal flatlands, and lowlands adjacent to ponds, streams, and other wet areas. Soils range widely in texture from clay to sand.

Moisture conditions are influenced by impermeable soil layers that restrict the downward movement of water. Poor drainage limits aeration of the soils on many sites and peat mats commonly develop over mineral surfaces. Acidic conditions prevail on most sites.

Three principal tree species are characteristic of the wet pine type group: longleaf pine (*Pinus palustris* Mill.), slash pine (*P. elliottii* Engelm), and pond pine (*P. serotina* Michx.). They define specific subtypes and occur either in pure stands or in mixtures, depending on geographical location, soil and hydrological conditions, and fire regime. For ease of reference, the subtypes are named according to the forest cover type classification system published by the Society of American Foresters (SAF) (Eyre 1980). The types are wet-site variants of longleaf pine (SAF 70), longleaf pine-slash pine (SAF 83), slash pine (SAF 84), and pond pine (SAF 98).

Species composition differs widely among subtypes and is shaped by fire frequency and intensity, soil characteristics, season and duration of flooding or soil waterlogging, and latitude. The subtypes are segregated on the landscape primarily on the basis of the soil moisture-hydroperiod gradient. On mineral soils where flooding is limited, longleaf pine is the predominate overstory tree. The stands tend to be pure with few if any trees in the midstory. Fires on longleaf sites occur at 2- to 5-year intervals. On wetter sites where fire is less frequent, both longleaf and slash pine dominate the overstory. On sites with growing-season hydroperiods, slash pine dominates. Fire usually restricts hardwood associates, such as sweetgum (*Liquidambar styraciflua* L.), red maple (*Acer rubrum* L.), blackgum (*Nyssa sylvatica* Marsh.), and cabbage palmetto [Sabal palmetto (Walt.) Lood. ex J.A. & J.H. Shult], to understory positions on sites where they occur. On organic soils subject to prolonged flooding, longleaf and slash pine are replaced by pond pine communities. Associates of pond pine include swamp tupelo [*N. sylvatica* var. *biflora* (Walt.) Sarg.], water oak (*Quercus nigra* L.), baldcypress [*Taxodium distichum* (L.) Rich.], pondcypress (*T. ascendens* Brongn.), sweetbay (*Magnolia virginiana* L.), live oak (*Q. virginiana* Mill.),

loblolly-bay [*Gordonia lasianthus* (L.) Ellis], and redbay [*Persea borbonia* (L.) Spreng.].

Fire

All the communities in this type group are fire dominated and depend on fire for their continued existence (Christensen 1981). Although the frequency and intensity of fire vary among the different subtypes, it is a natural phenomenon in each one. Without continued disturbance from fire, it is likely that these vegetation types would dominate a particular site for a single generation, then gradually lose control to invading species and eventually disappear from the community (Wade 1983). The pre-settlement natural fire regimes for these ecosystems are not known, but studies of species life histories and patterns of fuel accumulation indicate that light-to-moderate intensity surface fires occurred every 2 to 8 years in the grass- and herb-dominated savannas (Wahlenberg 1946, Christensen 1981). In the wetter, shrub-dominated slash pine and pond pine woodlands, fire frequency was probably 10 to 30 years, less than in the savannas, because of the more moist conditions. Frequency in these types depends on occurrence of drought conditions sufficient to increase the flammability of the understory to where it will burn readily. Such fires are intense and usually burn all the aboveground vegetation, especially in pond pine woodlands (Christensen 1981, 1993). Fire is necessary for the establishment and maintenance of these ecosystems. In the longleaf types, grasses, such as wiregrass, are essential fuel components to ensure that fire will occur frequently (Noss 1989). The range of ecological processes and conditions that recurring fire initiates, terminates, and continues cannot be duplicated by any other disturbance (Volga 1979).

Forest Subtype Narratives

Longleaf Pine Type

Range—The natural range of longleaf pine covers most of the coastal plain from southeastern Virginia south to central Florida and west to Texas. It also occurs in areas of the piedmont and interior uplands of Georgia and Alabama (Wahlenberg 1946). Wet longleaf pine sites occur primarily in the flatwoods section of the Atlantic and east Gulf Coastal Plains and on seepage areas in the fall line section from central North Carolina south to Alabama (Peet and Allard 1993). In the west Gulf region, wet pine lands occur on poorly drained interstream areas of the outer coastal plain terraces in southwest Louisiana and southeast Texas (Harcombe et al. 1993).

Sites—Wet pine sites are seasonally wet, often saturated during the winter and droughty during the growing season. Most soils are sandy with low organic matter content and include predominantly Aquods (Spodosols) and Aquults (Ultisols). They are characterized by high and fluctuating water tables, often with a fine textured spodic (organic) or argillic (clay) horizon that restricts drainage (Boyer 1990).

Vegetation—High stand densities are not typical of longleaf pine in the natural state (Landers et al. 1990); virgin stands are described as mosaics of widely scattered trees intermingled with patches of seedlings, saplings, and pole-sized trees, and an understory of grasses and herbs (Schwartz 1907, Wahlenberg 1946). Longleaf pine communities, therefore, are typically woodlands or savannas. Longleaf is pure or is the dominant species on poorly to moderately drained soils. On wetter soils from southern South Carolina south and west along the Gulf, slash pine is a common associate or may dominate. In Florida and southeast Georgia, slash pine and/or pond pine replace longleaf pine on wet sites. Pond pine assumes dominance in Virginia and the Carolinas on the wettest sites and on organic soils.

In woodland stands, the understory is absent or may contain invading hardwoods such as blackgum, sweetgum, and water oak. A low shrub layer of varying density is usually present. Common species include gallberry [*Ilex glabra* (L.) Gray], redbay, sweetbay, and swamp cyrilla (*Cyrilla racemiflora* L.). On better drained sites, saw-palmetto [*Serenoa repens* (Bartr.) Small] may dominate the shrub layer. The herb layer is dominated by wiregrass (*Aristida stricta* L.). On wet savannas, the dominant pines occur in stands of widely scattered trees. Understory trees and shrubs are generally absent. Scattered gallberry, blueberry (*Vaccinium* spp.), waxmyrtle (*Myrica cerifera* L.), or other shrubs may be present. The herb layer is generally dense and is very diverse, with grasses, sedges, composites, orchids, and lilies particularly prominent. In the eastern part of its range and south to central Alabama and northwest Florida, wiregrass is the dominant species. In the western part of the range, bluestem (*Andropogon* L. spp.) and panic (*Panicum* spp.) grasses are dominant (Boyer 1980, Frost et al. 1986, Harcombe et al. 1993, Peet and Allard 1993).

Community dynamics—Longleaf pine is the longest lived species of this type group; Platt et al. (1988) reported trees older than 400 years. The longleaf pine types are fire maintained successional stages in the natural ecological progression to the southern mixed hardwood climax forest

(Quarterman and Keever 1962). The existence of pure pine stands in the virgin forest is attributed to frequent, naturally occurring, low-to-moderate intensity surface fires. Such fires create a favorable environment for seedling establishment and growth by keeping competing shrubs and herbs and invading hardwoods in check and controlling the brown-spot needle blight [*Scirrhia acicola* (Dern.) Siggers], which is a major cause of poor seedling growth and mortality (Boyer 1990). Frequent fire is essential for maintaining species diversity and community structure in the longleaf pine types (Landers et al. 1995). Without frequent fire, the fire-sensitive shrub and hardwood components already present in the stand, plus invaders from seed sources outside the stand, increase and eventually suppress the pines and dominate the site (Wahlenberg 1946, Quarterman and Keever 1962).

Slash Pine Type

Range—Slash pine has the most restricted natural range of the major southern pines. It is native only on a narrow strip of flatwoods along the southeast coastal plain from southern South Carolina into central Florida and westward along the Gulf Coastal Plain to eastern Louisiana. Its range has been extended by planting west through central Louisiana into eastern Texas, north in Alabama, Mississippi, and southern Arkansas, and in parts of North and South Carolina (Hodges 1980, Lohrey and Kossuth 1990).

Sites—Slash pine occupies wetter sites than longleaf. The original distribution of the species within its natural range was largely determined by its susceptibility to fire injury during its seedling stage, and its tolerance of wet soil conditions (Lohrey and Kossuth 1990, Stout and Marion 1993). It grows in irregular stands often mixed with longleaf or loblolly pine (*P. taeda* L.), pondcypress, swamp tupelo, and other wetland species. Historically, it was not noted for forming large forests, and extensive natural stands occurred only in central Florida (Mohr 1897, Schultz 1983). The sites where slash pine grows naturally include wet savannas and pitcher plant flats, poorly drained flatwoods, stream edges and pond margins, and seasonally flooded areas such as bays, ponds, and swamps where fires are rare (Mohr 1897, Hodges 1980, Schultz 1983). The soils range from Ochraquults and Albaquults (Ultisols) to Humaquents (Entisols), depending on the surface texture, color, and depth to a clay layer. They vary from loamy sands to sandy loams in surface texture. Because they are wet, they often accumulate organic matter (Pritchett and Comerford 1983).

Vegetation—The community has an open-to-closed tree canopy comprised predominantly of slash pine. On wet sites, associated species may include swamp tupelo, sweetbay, pondcypress, loblolly-bay, live oak, pond pine, southern redcedar [*Juniperus silicicola* (Small) Bailey], cabbage palmetto, red maple, and, less commonly, sweetgum, water oak, and swamp laurel oak (*Q. laurifolia* Michx.). Seasonally flooded bays dominated by slash pine will have sweetbay or loblolly-bay and sometimes swampbay [*P. borbonia* var. *pubescens* (Pursh) Little], pondcypress, and swamp tupelo in the canopy. The understory will often include swamp cyrilla, and buckwheat-tree [*Cliftonia monophylla* (Lam.) Britton ex Sarg.]. The herb layer is absent except in bays where sphagnum species are present. On boggy flatwoods sites, slash pine is commonly mixed with longleaf pine and a shrub layer of waxmyrtle, gallberry, buckwheat-tree, dahoon (*I. cassine* L.), and yaupon (*I. vomitoria* Ait.) is usually present. Species of pitcher plants occur in the herb layer (Hodges 1980).

Community dynamics—Slash pine is a relatively short lived species; mature trees more than 100 to 150 years old have seldom been reported (Mohr 1897, Pomeroy and Cooper 1956). The slash pine type is fire maintained but, because seedlings are less tolerant of fire than longleaf pine, it is generally restricted to wetter, less frequently burned sites (Abrahamson and Hartnett 1990). It is a transition species lying on a soil moisture gradient between seasonally wet longleaf pine sites and seasonally flooded ponds and bay swamps. With the elimination of fire, succession of wet-site slash pine tends toward the bay community type (Monk 1968) or swamp hardwoods (Abrahamson and Hartnett 1990).

Longleaf Pine—Slash Pine Type

Range—The geographic range of this cover type is determined by the natural range of slash pine. It extends in the coastal plain flatwoods from southern South Carolina to southeast Louisiana.

Sites—Fire history and moisture regime of the site are responsible for the occurrence of this type. It occurs on flatwoods and savanna sites where longleaf pine is adjacent to or in the vicinity of a slash pine seed source. In the prolonged absence of fire, slash pine will seed into neighboring longleaf stands to become established in the understory and, over time, grow into the overstory. Because slash pine seedlings are susceptible to fire damage, the site must be fire-free for 5 to 10 years to allow seedlings to reach fire-resistant size of approximately 9.8 feet (3 meters) tall (Grelen 1980).

Vegetation—Slash and longleaf pines occur in the overstory in varying proportions. The most common shrub associates are gallberry and saw-palmetto. On wet sites, sweetbay, blackgum, buckwheat-tree, titi, greenbriers

(*Smilax* spp.), fetter-bush [*Lyonia lucida* (Lam.) K. Koch], sweet pepperbush (*Clethra alnifolia* L.), St. Andrew's Cross (*Ascyrum hypericoides* L.), and blueberries are common. Wiregrass is a major component of the herbaceous layer if fire is frequent enough to control the abundance of the shrub layer (Grelen 1980).

Community dynamics—With or without fire, this community is temporary. Fire destroys young slash pine; but where exclusion of fire allows slash pine to become established with longleaf pine, hardwoods and shrubs will invade and dominate the understory and eventually the overstory, eliminating subsequent regeneration of both pines (Grelen 1980). With frequent fire, the type will revert to longleaf pine.

Pond Pine Type

Range—Pond pine occurs in the coastal plain from southern New Jersey south to central Florida and west into southeastern Alabama (Bramlett 1990).

Sites—Pond pine occupies the wettest sites within this type group. It is found in swamps, pond borders, and pocosins, characterized by undrained peat soils and wet, sandy flats. It grows most extensively in the broad, poorly drained interstream areas of peaty soils in the lower coastal plain of North Carolina. Farther south, it is found on the wet pine flatwoods and savannas of the lower coastal marine terraces and in bays and ponds throughout the coastal plain. The species can make excellent growth on better drained mineral soils, but the faster earlier growth of slash and loblolly pine usually restricts it to a subordinate position on such sites (Johnson 1980, Bramlett 1990). The soils range from Ochraquults and Albaquults (Ultisols) to Humaquents (Entisols), depending on the surface texture, color, and depth to a clay layer. Organic soils include oligotrophic (nutrient-poor, rain-fed) mineral soils with shallow organic surface layers, represented by Haplaquods (Ultisols), and shallow-to-deep Humaquepts and Medisaprists (Histosols) (Schafale and Weakley 1990).

Vegetation—The dominant tree canopy of pond pine stands is open woodland to nearly closed forests. Associates include sweetbay, swampbay, red maple, loblolly pine, and Atlantic white-cedar [*Chamaecyparis thyoides* (L.) B.S P.] The shrub layer includes swamp cyrilla, fetter-bush, maleberry [*L. ligustrina* (L.) DC], gallberry, blue huckleberry [*Gaylussacia frondosa* (L.) T.&G.], saw-palmetto, sweet pepperbush, laurel-leaved greenbrier (*S. laurifolia* L.), and swampbay. Switch-cane (*Arundinaria* spp.) is often present and may dominate in Atlantic Coastal Plain sites. Saw-palmetto is the dominant shrub in Georgia and Florida. There is generally no herb layer (Edmisten 1965, Schafale and Weakley 1990).

Community dynamics—Pond pine communities are wet and nutrient-poor and are susceptible to fires during droughts that allow the organic soils to dry. The large amount of fuels produced by the understory make fires extremely intense. Pond pine has serotinous cones that require hot fires to release seed and produces epicormic sprouts when injured. Regeneration of new stands is therefore tied directly to fire (Woodwell 1958). All the dominant species sprout readily and the shrub layer regrows to its former height in just a few years. Stands persist indefinitely in the absence of fire but are readily regenerated after burning by sprouting, as well as from seeds (Schafale and Weakley 1990).

Old-Growth Definitions

Elimination of fire regimes of natural and Indian origin, indiscriminate logging, and conversion of forests to farms produced sweeping changes in the vegetation landscape that was present in the Southeast at the time of European settlement. As a result, few stands representative of the virgin or old-growth conditions of wet pine forests still exist. New old-growth forests will have to develop from existing stands with the help of an active management program and a set of old-growth definitions to guide it. Published data from examples of virgin or old-growth forests of this type group from which old-growth definitions can be constructed are limited. There are, however, descriptions of upland longleaf stands (Chapman 1907, Schwatrz 1907, Wahlenberg 1946, Platt et al. 1988) and a slash pine stand (Hebb and Clewell 1976) that provide limited guidance. No descriptions of old-growth pond pine have been found.

Provisional Definitions

These definitions are provisional in that they are based on limited information. They should be modified as new information from research and field study becomes available. There are five basic stand-selection criteria for the wet pine forests, woodlands, and savannas: (1) The environment must have seasonally wet soils. (2) It must include the fire regime appropriate to one of the subtypes described. (3) There must be a stand of trees of the required species composition and minimum age. The minimum age of most stands in all subtypes in this group will be 80 to 100 years, assuming that most of the oldest stands date from the late 1800's to the early 1900's, when the last of the old-

growth southern pines were harvested (table 1). (4) There should be no evidence of recent soil disturbance or tree harvest. (5) Stand structures must be appropriate for forest, woodland, or savanna. Given these criteria, other characteristics and attributes of old-growth forests, such as snags, large and small woody debris in various stages of decay, herbaceous and woody undergrowth typical of the type, and regeneration of the dominant canopy species must be either present or the conditions necessary for their development evident.

Stand attributes used to identify old-growth wet pine forests are presented in table 1. Standards are defined for each of the forest subtypes except for longleaf pine-slash pine. Standards for this type are assumed to be the same as for the individual longleaf and slash pine types. Decadence in old, dominant trees, such as dead, broken, or deformed tops, and stem or root rot, also indicates old growth and should be evaluated. The minimum area for a stand to be considered viable for old growth is not defined. Acceptable size must be determined in the context of the landscape in which the stand occurs; some factors that should be considered when determining stand size include extent of edge effects from neighboring stands and ecosystems, and vulnerability to catastrophe.

Table 1—Provisional standards for old-growth wet pine forests, woodlands, and savannas in the southeastern coastal plain[a]

Species	Standard attributes[b]		
	Minimum no. trees/ha	Average stand d.b.h.	Minimum age
		cm	*yr*
Live canopy trees (forest structure):			
Longleaf pine	150	50	150 - 200
Slash pine	150	53	80 - 100
Pond pine	200	23	60 - 100
Stand structure[c]:			
Forest	Hardwood understory present		
Woodland	Shrub understory dominant		
Savanna	Grass-herb understory dominant		

[a] Forest = most crowns touching or nearly touching; woodland = trees widely scattered, shrub layer prominent; savanna = few scattered trees, herb layer prominent.

[b] Standards are for forest conditions and are extracted from various sources: longleaf pine (Chapman 1907, Wahlenberg 1946); slash pine (Hebb and Clewell 1976); pond pine—extrapolated from natural stand yield tables of Schumacher and Coile (1960) for age 80 and site index 70. Standard attributes for canopy trees in woodlands and savannas are not known—they can be set using the forest standards as a base.

[c] Stand structure will depend on the existing fire regime. Frequent fires favor a grass-herb understory, while less frequent fires favor a hardwood understory.

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The ecological, site, and vegetation characteristics of pine wetland forests of the flatwoods region of the Southeastern United States are described. Provisional working definitions of old-growth characteristics are provided for longleaf pine, slash pine, and pond pine forests. These definitions can be used to identify and evaluate stands for retention in old-growth management programs.

Keywords: Forested wetlands, longleaf pine, old growth, old-growth management, pine flatwoods, pond pine, slash pine.

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