



### **Chapter 3: The East Texas Pineywoods**

The climate, culture, and vegetation of the East Texas Pineywoods share many features with neighboring southeastern states. East Texas receives higher annual rainfall (40-56 inches) than any other part of Texas. Landscapes of East Texas, as in much of the southeast, are a mosaic of regenerating forest, timber plantations, and small farms. Soils range from well-drained sands to loams and permeable or impermeable clays; the varying availability of moisture strongly influences the occurrence of vegetation types (Warner 1942, Frost 1949).

The colloquial name “Pineywoods” refers specifically to that part of eastern Texas where loblolly pine, shortleaf pine, or longleaf pine naturally occur (slash pine and hybrid species are also widely planted). Pine-hardwood forests are the dominant vegetation type throughout this region, though the structure and composition of most stands have been influenced by logging activities. Pines may have been naturally more abundant than hardwoods on upland sites, with the

opposite usually true on slopes and floodplains. Pines are completely absent only in frequently inundated floodplains and in certain unusual local habitats (e.g. prairie openings). Longleaf pine, which is naturally restricted to the southern half of the Pineywoods, grew in extensive pure stands prior to Anglo-American settlement. Then as now, loblolly and shortleaf pines occurred in mixed stands with many hardwood species, including oaks, sweetgum, elms, and hickories.

Floodplains of East Texas support forests of large hardwoods and scattered loblolly pine, with dominant species varying with elevation and average duration of inundation, or hydroperiod (USFWS 1985). Frequently inundated areas support species tolerant of inundation, such as baldcypress, tupelo, and planer-tree. Saturated soils around seeps and springs support unique taxa adapted to acidic, nutrient-poor conditions (Correll and Johnston 1970).

Variation in vegetation from east to west within the pine belt is gradual, with relatively few differences between forests at the western edge of the Pineywoods and on the Louisiana border (Wilson and Hacker 1986). However, southeastern Texas, including the area colloquially termed the "Big Thicket," contains many species and several communities that are uncommon or absent elsewhere in Texas (McLeod 1971, Watson 1979, Ajilvsgi 1979).

## **Plant Communities of the East Texas Pineywoods**

### **1. Xeric sand woodlands and barrens.**

Synonyms: Arid Sandyland (Watson 1979); Sandhill Pine Forest (Marks and Harcombe 1981); Bluejack Oak-Pine Series (Diamond 1993); Longleaf Pine/Oak species Alliance, in part; (Shortleaf Pine, Loblolly Pine)-(Arkansas Oak, Bluejack Oak, Sand Post Oak) Alliance, in part (Weakley et al 2000).

Description: Despite the region's relatively high rainfall, xeric conditions occur locally in the East Texas Pineywoods where extremely well drained soils remove water rapidly. Deep sand ridges may support sparse, xerophytic woodlands of bluejack oak, post oak and stunted pines as well as barrens characterized by

lichens, Riddell's spikemoss, and unusual forb and graminoid species. Sand drifts occur very occasionally along major rivers in southeast Texas and may support xeric barren communities ("sandylands"). Characteristic herbaceous species include threadleaf hairsedge, curly threeawn, pinewoods dropseed, little bluestem, thin paspalum, lanceleaf gaillardia, and eastern prickly pear (Matos and Rudolph 1985, Bridges and Orzell 1989a, Orzell 1990, MacRoberts and MacRoberts 1996).

Status: Sand barren communities are rare and local. Excellent examples are protected at two conservation areas, the Roy E. Larsen Sanctuary owned by the Nature Conservancy of Texas (TNC) and the Turkey Creek Unit of the Big Thicket National Preserve, totaling roughly 200 acres (Matos and Rudolph 1985, Marks and Harcombe 1981).

Suggested Priority for Further Protection of Community: High

## **2. Longleaf pine open forests.**

Synonyms: Upland Pine Forest (Marks and Harcombe 1981); Longleaf Pine-Sandjack Oak (McMahan et al. 1984); Longleaf Pine Uplands (Watson 1979); Longleaf Pine-Little Bluestem Series (Diamond 1993); Mesic Woodlands, Southern Dry Woodlands, Northern Dry Woodlands (Turner 1999); Longleaf Pine-(Slash Pine) Forest Alliance, Longleaf Pine-Oak species Woodland Alliance, Longleaf Pine Woodland Alliance (Weakley et al. 2000).

Description: Stands of longleaf pine formerly covered large areas across the southeastern United States, including southeast Texas (Gow 1904, Bray 1906). Though present on clay soils, longleaf pine was most dominant on sand ridges. Many stands are believed to have been open and nearly monospecific in the canopy layer because of natural fires that discouraged growth of less fire-adaptive species (Chapman 1932, Christensen 1981). Remnants usually contain a sparse deciduous midstory of oaks, flowering dogwood, and farkleberry, with a highly developed and species-rich herbaceous layer consisting of little bluestem and other bluestems, pinewoods dropseed, threeawns, rosettegrasses,

beaksedges, bracken fern, composites, legumes, and many other forbs and grasses (Ajilvsgi 1979, Ward 1980, Marks and Harcombe 1981, Wilkinson 1982, Orzell 1990, Bridges and Orzell 1989b, USDA 1996, Turner 1999).

Status: Most virgin longleaf stands were logged by 1920 and most stands have been replaced by plantations of other pine species. Today, only small remnants of longleaf pine forest remain in Jasper, Newton, Angelina, and a few other counties in Texas. Overgrazing and other activities have disturbed the herbaceous layer at many sites, and many stands have become dominated by hardwoods in the absence of fire (USDA 1996, TPWD 1989a). The Upland Island Wilderness contains several thousand acres of managed longleaf pine in fair condition, with small tracts preserved at the Nature Conservancy's Little Rocky Preserve and Timberlakes tract and in the Big Thicket National Preserve. Less than 10,000 acres of this community is protected in Texas (Ward 1980; Matos and Rudolph 1985; Fritz 1986; LeGrande 1998; McWhorter, Wolfe pers. comm.). The unprotected "Longleaf Ridge" area in the Angelina National Forest near Upland Island Wilderness contains excellent remnants of longleaf pine forest, as well as herbaceous and forested seeps and sandstone barrens (Orzell 1990).

Suggested Priority for Further Protection of Community: Fairly High

### **3. Upland hardwood-pine forests.**

Synonyms: Upper Slope Pine Oak Forest (Marks and Harcombe 1981); Shortleaf Pine-Post Oak-Southern Red Oak (McMahan et al. 1984); Shortleaf Pine-Oak Series, Post Oak-Black Hickory Series (Diamond 1993); Shortleaf Pine-(White Oak, Southern Red Oak, Post Oak, Black Oak) Forest Alliance, Loblolly Pine-(Blackjack Oak, Southern Red Oak, Post Oak) Forest Alliance, Shortleaf Pine Forest Alliance (Weakley et al. 2000).

Description: Upland sandy loam sites in east Texas usually support mixed pine-hardwood forests except where stands have been replanted in commercial timber species. Stand structure may be greatly altered in logged areas, and the

abundance of pine in this community prior to Anglo-European settlement is uncertain. Common species include southern red oak, post oak, shortleaf pine, black hickory, white oak, blackjack oak, flowering dogwood, sweetgum, winged elm, sassafras, farkleberry, American beautyberry, long-leaf spikegrass, bracken fern, rosettegrasses, panicums, muscadine, greenbriars, Virginia-creeper and other vines, legumes, composites, and other forbs (Bray 1906, Sullivan and Nixon 1971, Langston 1974, Johnson 1984, TPWD 1989c, Wilkinson 1982). Loblolly pine may be present but is less abundant than on more mesic sites. Shumard oak may be dominant at the western margins, where upland forests may be increasingly dominated by hardwood species (Wilson 1990).

Status: These forests are the dominant vegetation type in northeast Texas and uplands throughout East Texas, but most examples have been altered in composition or structure by multiple timber harvests. Good examples of this community in parks and reserves are mostly small in areal extent, occurring in Atlanta, Daingerfield, and Tyler State Parks, Lennox Woods Preserve, Pat Mayse WMA, Gus Engeling WMA, and Big Slough Wilderness Area. The total acreage in conservation areas is approximately 10,000 acres (Fritz 1986; Wilson and Hacker 1986; TPWD 1989c, 1990c, 1996; Singhurst et al. 2000).

Suggested Priority for Further Protection of Community: Fairly Low

#### **4. Pine-hardwood dry-mesic forests.**

Synonyms: Loblolly Pine-Hardwood (SAF# 82) (Eyre 1980); Mid Slope Oak Pine Forest (Marks and Harcombe 1981); Loblolly Pine-Sweetgum (McMahan et al. 1984); Loblolly Pine-Oak Series (Diamond 1993); Eastern Dry-Mesic Upland Forests, Western Dry-Mesic Upland Forests (Turner 1999); Loblolly Pine Forest Alliance, Loblolly Pine-Shortleaf Pine Forest Alliance, Loblolly Pine-(White Oak, Southern Red Oak, Post Oak) Forest Alliance (Weakley et al. 2000).

Description: Most forests in East Texas may be characterized as managed or regenerating stands of loblolly and shortleaf pine, with hardwood species usually codominant where not removed or discouraged by human management.

Species occurrence varies somewhat with soil texture and chemistry, but many overstory species are common throughout (Langston 1974). Sweetgum, southern red oak, post oak, white oak, water oak, elms, hickories, and sugarberry are often important in the canopy, with the midstory and understory including flowering dogwood, red maple, southern wax-myrtle, hollies, blueberries, hawthorns, and American beautyberry. Poison-ivy, greenbriars, Virginia-creeper, grapes, rattan-vine, and Carolina-jessamine are common vines. Herbaceous species include long-leaf spikegrass, caric-sedges, beaked panicum, whip nutrush, and scattered forbs including tickclovers, violets, wild indigos, downy milkpea, broadleaf snoutbean, partridgeberry (on wetter sites), and other species (Warner 1942, Schuster 1962, Blair and Enghardt 1976, Fountain and Risner 1988, Sanders 1994).

Status: Sites with semi-natural structure and composition are increasingly uncommon as millions of acres have been planted in monoculture stands of pines for commercial harvesting. All conservation areas in East Texas contain examples of pine-hardwood forest (totaling some 35,000 acres), but most sites have been significantly altered by logging and grazing. A few somewhat mature examples occur in the five national forest wilderness areas and a few state parks (Ward 1980, TPWD 1996, Singhurst pers. comm.). Over time, other protected stands will hopefully regain natural diversity and structure.

Suggested Priority for Further Protection of Community: Low

##### **5. Sandstone barrens.**

Synonyms: Little Bluestem-Nuttall's Rayless Goldenrod Series (Diamond 1993); Nuttall Rayless-goldenrod Herbaceous Alliance (Weakley et al. 2000).

Description: Rock outcrops occur rarely and locally in east Texas. Catahoula sandstone outcrops at a few points in Angelina and adjacent counties, creating small areas of shallow, regularly saturated but frequently xeric soils supporting only sparse growth of woody species. Most examples occur within a matrix of dry, upland oak woodland or pine savanna and are characterized by an

herbaceous layer of Nuttall's rayless-goldenrod, little bluestem, Kearney threeawn, Silveanus dropseed, blackseed needlegrass, Riddell's spikemoss, lichens, and a number of unusual and disjunct forbs, including white marshallia, narrowleaf rushfoil, and common least-daisy (Marietta and Nixon 1984, Orzell 1990, MacRoberts and MacRoberts 1992, USDA 1996, Weakley et al. 2000).

Status: The only protected site comprises less than one acre at the Nature Conservancy's Little Rocky Preserve (Wolfe pers. comm.). The best-known examples of these communities are unprotected sites owned by the U.S. Forest Service in the Angelina National Forest (Orzell 1990).

Suggested Priority for Further Protection of Community: High

#### **6. Glauconitic shale (Weches Formation) glades.**

Synonym: Widow's-cross Saturated Herbaceous Alliance (Weakley et al. 2000).

Description: Glauconitic shales of the Weches Formation are exposed at a few sites in San Augustine and adjacent counties, creating a natural glade community on shallow, seasonally saturated but often very dry soils. Common species include rock moss, *Nostoc commune* (a cyanobacterium), Ozark savory, poverty dropseed, oneseed croton, caric-sedges, and exotic grasses and clovers as well as white bladderpod and Texas leavenworthia, two endemic species from genera associated with chalk glades in the southeastern United States. Woody species, where present, are suggestive of central Texas limestone and chalk sites (e.g. roughleaf dogwood, redbud, eastern redcedar) (Reese 1981).

Status: There are no examples of this community within protected areas. All known examples are privately owned; most have been extensively grazed, and some sites lost due to cultivation or quarrying (Nixon and George 1990).

Suggested Priority for Further Protection of Community: High

#### **7. Herbaceous acid seeps (East Texas Pineywoods).**

Synonyms: Sphagnum-Beakrush Series, in part (Diamond 1993); Wet Herbaceous Seeps (Turner 1999); Feather-bristle Beaksedge-Pitcherplant

species-(Southern Wiregrass, Toothache Grass) Saturated Herbaceous Alliance (Weakley et al 2000).

Description: Seepage areas or "acid bogs" occur in East Texas usually where a permeable sand surface layer meets impermeable clay or sandstone. The resulting saturated areas are often strongly acidic and nutrient-poor. These communities support a species-rich herbaceous layer containing beaksedges, yellow-eyed grasses, yellow pitcher-plant, sundews, pipeworts, bluestems, panicums, rosettegrasses, nutrushes, flatsedges, caric-sedges, gayfeathers, orchids, cinnamon ferns, sphagnum, and club mosses. Most examples occur in upland pine forests from Smith County south to Tyler and Newton counties. Burning these communities is recommended by many land managers to counter encroachment by shrub species such as wax-myrtles, redbay, and hollies. Adjacent, lower-lying areas protected from natural fires may contain forested seeps (Nixon and Ward 1986, Bridges and Orzell 1989b, Orzell 1990, MacRoberts and MacRoberts 1991, USDA 1996).

Status: Most sites are less than 50 acres in size, isolated, and threatened by logging and site preparation activities, alteration of hydrology, and fire suppression (USDA 1996). Some examples in protective management are reportedly overgrown, including seeps in Upland Island Wilderness (Orzell 1990, MacRoberts and MacRoberts pers. comm.). The Gus Engeling WMA contains excellent bog habitat. Excellent examples near Boykin Springs in the Angelina National Forest (the "Longleaf Ridge" area) are unprotected (Orzell 1990).

Suggested Priority for Further Protection of Community: High

### **8. Pine wetland savannas.**

Synonyms: Pine Savanna Wetlands (Watson 1979); Wetland Pine Savanna (Marks and Harcombe 1981); Longleaf Pine-Beakrush Series (Diamond 1993); Longleaf Pine-(Slash Pine, Pond Pine) Saturated Woodland Alliance (Weakley et al 2000).

Description: Southeast Texas (Tyler, Jasper, Hardin and Newton counties) contains local areas of poorly drained upland flats with a fluctuating water table that support open, fire-influenced pine stands with a diverse herbaceous layer. Though usually larger in area, these "pine savannas" are floristically similar to acid seeps and may be very species-rich (Frost et al. 1986). Vegetation of remaining examples consists of scattered longleaf pine with dropseeds, rosettegrasses, switchgrass, beaksedges, umbrella-sedges, sundews, yellow stargrass, yellow-eyed grasses, pipeworts, orchids, and switchgrass (Correll and Johnston 1970, Bridges and Orzell 1989b, Ajilvsgi 1979, Streng and Harcombe 1982, Harcombe et al. 1993). Prescribed burning to discourage woody species (e.g. titi, wax-myrtle, hollies) is regarded as necessary to optimize species diversity (Frost et. al. 1986).

Status: This community has almost vanished due to the effects of logging, fire exclusion, and grazing. Examples of this community remain only on the Montgomery Formation; they are small and vulnerable to regression in the absence of active management (Bridges and Orzell 1989b). Protected examples totaling about 2,000 acres occur in the Lance Rosier and Hickory Creek Savanna units of the Big Thicket National Preserve (National Park Service 1997a).

Suggested Priority for Further Protection of Community: High

### **9. Forested acid seeps and wet creeksides.**

Synonyms: Sweetbay Magnolia Series (Diamond 1993); Wet Forested Seeps (Turner 1999); Sweetbay-Swamp Blackgum-(Diamondleaf Oak) Saturated Forest Alliance, in part (Weakley et al. 2000).

Description: Forested seepage areas may occur downslope from herbaceous-dominated acid seeps and along creek drainages in southeast Texas. Sites are usually saturated, nutrient-poor, and strongly acidic and contain unusual and rare plants. This community was probably subject to less frequent natural fires than herbaceous seeps. Characteristic woody species include sweetbay, blackgum, titi, red maple, red bay, hollies, sweetgum, evergreen bayberry, Elliott's

blueberry, azaleas, poison sumac, and other shrubs; pines and southern magnolia may be present. Ferns, sedges, sphagnum, and club mosses are often important (Warner 1942, Correll and Johnston 1970, Nixon and Ward 1988, Orzell 1990, Brooks et al. 1993). North and west of the range of sweetbay (e.g. Henderson, Leon, and Robertson counties), forested seeps may be dominated by possumhaw viburnum, smooth alder, Elliott's blueberry, and southern wax-myrtle (Nesom et al. 1997).

Status: These communities are usually limited in area. Small sites are protected in the Big Creek Scenic Area, Upland Island Wilderness Area, and Little Rocky TNC Preserve. Probably less than 300 acres are protected statewide (Ward 1980, Telfair 1988, Orzell 1990, Wolfe pers. comm.).

Suggested Priority for Further Protection of Community: Fairly High

#### **10a. Mesic slope forests.**

Synonyms: Mesic Forests, in part (USDA 1996); Western Mesic Lower Slope Forests, Western Mesic Upland Forests (Turner 1999); Loblolly Pine-(White Oak, Southern Red Oak, Post Oak) Forest Alliance, in part (Weakley et al. 2000).

Description: Sand slopes and gullies in eastern Texas are typically mesic and support forests that are slightly different in composition from adjacent uplands or bottomlands downslope. The most abundant trees are usually hardwoods, especially white oak, southern red oak, Shumard oak, hickories, maples, white ash, and hophornbeam, with some loblolly pine. A diverse herbaceous flora may be present, including some vernal forbs more common in the southeastern United States (Sullivan and Nixon 1971, Wilkinson 1982, Nixon et al. 1987, USDA 1996, Singhurst et al. 2000). This vegetation type often occurs in narrow zones between upland and bottomland forests. Mesic slopes and streamside forests on slightly calcareous soils may support codominant species that are otherwise more abundant west of the Pineywoods, such as cedar elm, sugarberry, green ash, roughleaf dogwood, and deciduous holly (Turner 1999). Ravines or gullies may contain small springs supporting cinnamon ferns,

mosses, viburnums, and azaleas but lacking most species characteristic of acid seeps.

Status: Small sites containing examples of this widespread vegetation type occur at several protected areas, including Atlanta, Caddo Lake, Davis Hill, and Lake Bob Sandlin State Parks, Gus Engeling WMA, and Big Slough Wilderness Area, but the total protected acreage of this type in Texas may be no more than 1,000 acres (Fritz 1986, TPWD 1990c, Singhurst pers. comm.).

Suggested Priority for Further Protection of Community: Medium

**10b. American beech mesic slope forests.**

Synonyms: American Beech-White Oak Series (Diamond 1993); Eastern Mesic Lower Slope Forests (Turner 1999); American Beech-White Oak Forest Alliance (Weakley et al. 2000).

Description: Sandy, calcareous slopes, ravines, and creeksides from Sabine County south and west to Jasper, Newton, and Tyler counties may be dominated by American beech with white oak, maples, and other hardwoods (Orzell 1990). Several southeastern forbs reach the western extent of their ranges in this type.

Status: These forests are limited in extent in Texas due to moisture and soil chemistry. Examples are found in the Indian Mounds and Turkey Hill Wilderness Areas and Upper Colorow Creek and Beech Ravines USFS scenic areas, totalling perhaps 5,000 acres (Fritz 1986, Orzell 1990, LeGrande 1998).

Suggested Priority for Further Protection of Community: Fairly High

**11. Herbaceous depressional wetlands (East Texas Pineywoods).**

Synonyms: Flatwoods Ponds (Watson 1979); Longleaf Threeawn-(White Bluestem, Chalky Bluestem)-Beaksedge species Seasonally Flooded Herbaceous Alliance (Weakley et al. 2000).

Description: Blown-out depressions occur occasionally in sand deposits over hard clays in uplands or on stream terraces in southeastern Texas. These depressions or "flatwoods ponds" hold water of fluctuating depths for parts of the year and may support vegetation that is very diverse in structure and

composition. Relatively shallow examples (maximum water depths of 3-4 feet) may be dominated by graminoids and forbs. These "sedge ponds" or "grass lakes" may contain longleaf threeawn, bluestems, beaksedges, switchgrass, sphagnum, spadeleaf, maidencane, pipeworts, yellow-eyed grasses, St. John's-worts, hedge-hyssops, Carolina water-hyssop, and may be edged by common persimmon, mayhaw, blackgum, swamp gum, buttonbush, and southern wax-myrtle. Deeper ponds also contain bladderworts and other aquatic plants. Infrequently inundated flatwoods ponds may enter later successional stages (perhaps in the absence of fire), becoming mayhaw thickets, oak-dominated forest, or baygalls (Ward 1980, Bridges and Orzell 1989a, Bridges and Orzell 1989b, Orzell 1990, Weakley et al. 2000, Jackson pers. comm.).

Status: These communities are uncommon and are usually only a few acres in size. Many flatwoods ponds have been drained; however, there are examples in the Big Thicket National Preserve, Roy E. Larsen Sanctuary, Upland Island Wilderness, the Houston Audubon Society's Damuth Preserve, and other protected areas in southeast Texas (Watson 1980, Ward 1980, Stewart 1998).

Suggested Priority for Further Protection of Community: Fairly High

### **12. Forested depressional wetlands (baygalls).**

Synonyms: Acidbog-Baygall Association, in part (Watson 1979); Bay-Gallberry Holly Bogs (Ajilvsgi 1979); Sweetbay-Swamp Tupelo (SAF #104) (Eyre 1980); Wetland Baygall Shrub Thicket (Marks and Harcombe 1981); Swamp Blackgum Seasonally Flooded Woodland Alliance, Sweetbay-Swamp Blackgum-(Diamondleaf Oak) Saturated Forest Alliance, Titi-Big Gallberry-(Black Titi) Saturated Shrubland Alliance (Weakley et al. 2000).

Description: Strongly acidic, nutrient-poor, often seasonally flooded swamps or "baygalls" occur in depressions in pine flatwoods or along stream floodplains of the lower Neches and lower Sabine basins (the "Big Thicket"). These communities are densely forested with vegetation somewhat similar to forested acid seeps (Harcombe et al. 1993). Swamp gum and laurel oak are often

dominant in the canopy; other species may include red maple, sweetbay, gallberry holly, Carolina ash, titi, mayhaw, baldcypress, Virginia sweet-spire, southern wax-myrtle, greenbriars, sedges, cinnamon ferns, sphagnum, and some unusual forbs. Flooded areas may contain Carolina water-hyssop, water-lilies, and other aquatic plants (Watson 1980, Ajilvsgi 1979, Marks and Harcombe 1981, Matos and Rudolph 1985, Bridges and Orzell 1989b).

Status: These unusual communities are essentially limited to the margins of floodplains in Jasper, Hardin, Newton, and Tyler counties. Excellent examples are protected in the Roy E. Larsen Sanctuary and the Big Thicket National Preserve (especially the Jack Gore Baygall and Turkey Creek units), totalling about 2,000 acres (Matos and Rudolph 1985, National Park Service 1997a).

Suggested Priority for Further Protection of Community: Fairly High

### **13. Magnolia-beech mesic forests.**

Synonyms: Beech-Southern Magnolia (SAF #90) (Eyre 1980); Lower Slope Hardwood Pine Forest, in part (Marks and Harcombe 1981); Beech-Magnolia-Loblolly Slopes (Watson 1979, Ajilvsgi 1979); American Beech-Southern Magnolia Series (Diamond 1993); American Beech-Sweetgum-Loblolly Pine-(Southern Magnolia) Temporarily Flooded Alliance (Weakley et al. 2000).

Description: Mesic slopes, small stream drainages, and low-lying intertributary flats in southeast Texas may support forests in which southern magnolia and American beech are codominant. Soils are moderately acidic sandy loams. These forests may contain species characteristic of baygalls or higher floodplain forests, including laurel oak, white oak, American holly, maples, and blueberries (McLeod 1975, Ajilvsgi 1979, Marks and Harcombe 1981, Schafale and Harcombe 1983, Orzell 1990). American beech becomes uncommon in the southern part of the East Texas Pineywoods, where flatwoods and lower slopes support oaks, loblolly pine, hornbeams, and scattered southern magnolia (Marks and Harcombe 1981, Moulton and Jacob 2000).

Status: This community is limited in distribution and most examples have been logged or cleared (USDA 1996). Marks and Harcombe (1981) classified more than 20,000 acres of the Big Thicket National Preserve as "Lower Slope Hardwood Pine Forest" dominated by southern magnolia and American beech, but most of that area is probably more appropriately defined as pine-oak forest with a minor component of southern magnolia, at least presently. Perhaps 10,000 acres of mature beech-magnolia forest are protected in the Big Thicket National Preserve, with small examples at Martin Dies Jr. State Park and TNC's Wier Woods Preserve. The Mill Creek Cove Research Natural Area is an old growth example of this vegetation type (Watson 1980, Nixon et al. 1980, Orzell 1990, TPWD 1996, McWhorter pers. comm.).

Suggested Priority for Further Protection of Community: Fairly High

#### **14. Swamp chestnut oak-oak floodplain forests.**

Synonyms: Swamp Chestnut Oak-Cherrybark Oak (SAF #91) (Eyre 1980); Flatland Hardwood Forest (Marks and Harcombe 1981); Swamp Chestnut Oak-Willow Oak Series (Diamond 1993); (Swamp Chestnut Oak, Cherrybark Oak, Shumard Oak)-Sweetgum Temporarily Flooded Forest Alliance, Loblolly Pine Temporarily Flooded Forest Alliance (Weakley et al. 2000).

Description: Rarely inundated sites in southeast Texas over a shallow water table, including creeksides, higher areas of floodplains, and interdistributary flats, support hardwood forests in which large oaks and other hardwoods and loblolly pine are codominant in the overstory. Loblolly pine may be dominant on disturbed levees and ridges. Swamp chestnut oak, cherrybark oak, sweetgum, blackgum, willow oak, southern red oak, green ash, laurel oak, red maple, American elm, deciduous holly, hornbeams (on well drained sites), Sebastian bush, partridgeberry, and many other species may be common (McLeod 1971, Marks and Harcombe 1981, Christensen 1988, Orzell 1990, Neal pers. comm.).

Status: Like other bottomland communities, most examples were logged in the early twentieth century, but partially logged stands may contain very large trees

(Fritz 1986, Marcus pers. comm.). A number of unprotected, relatively undisturbed sites exist (e.g. Orzell 1990). This community is the least extensively preserved type of bottomland forest in Texas, with roughly 16,000 acres protected in Big Slough and Upland Island Wilderness Areas, the Big Thicket National Preserve, Trinity River National Wildlife Refuge, Davis Hill State Park, and sites in the Sam Houston National Forest (Marks and Harcombe 1981; Fritz 1986; Orzell 1990; TPWD 1990c; TPWD 1996; Moulton and Jacob 2000; Marcus, Neal pers. comm.). Suggested Priority for Further Protection of Community: Medium

**15a. Floodplain hardwood forests.**

Synonyms: Sweetgum-Willow Oak (SAF #92) (Eyre 1980); Floodplain Hardwood Forest, in part (Marks and Harcombe 1981); Willow Oak-Water Oak-Blackgum Forest, in part (McMahan et al. 1984); Water Oak-Willow Oak Series (Diamond 1993); Loblolly Pine/Water Oak Ridges (Mundorff 1998); Wet Floodplain Forests, Wet Flatland Forests (Turner 1999); (Willow Oak, Water Oak, Diamondleaf Oak) Temporarily Flooded Forest Alliance (Weakley et al. 2000).

Description: Bottomland hardwood forests in the Pineywoods and eastern Post Oak Savannas grow on lower terraces of mature stream floodplains. Frequently dominant species include water oak, sweetgum, willow oak, American hornbeam, elms, hophornbeam, blackgum, southern red oak, loblolly pine, deciduous holly, poison-ivy, muscadine grape, rattan-vine, crossvine, greenbriars, violets, St. John's worts, Sebastian bush, giant cane, long-leaf spikegrass, ferns, mosses, and many others (Raines 1971, Sullivan and Nixon 1971, Nixon et al. 1973, Chambless and Nixon 1975, Marks and Harcombe 1981, USFWS 1985, Nixon et al. 1987, TPWD 1989c, Crowley 1993, Sanders 1994). Large stands of giant cane are occasional in openings on ridges, perhaps artifacts of burning by pre-Europeans (Platt and Brantley 1997). River birch is often abundant along streams and in swamps. Floodplain forests in the western Pineywoods and Post Oak Savanna differ in species composition, perhaps due to calcareous soils or decreased rainfall (TPWD 1990c, Turner 1999). These forests are highly productive wildlife habitats.

Status: Bottomlands have been less extensively logged than upland forests in East Texas. However, reservoirs have flooded more than 500,000 acres in East Texas since 1950, mostly bottomlands (McMahan and Frye 1987). Unpreserved bottomland forests of high quality remain along the Neches, Sabine, Cypress, Trinity, and Angelina rivers as well as smaller streams (Neal pers. comm.), but the majority of the best sites may be eliminated by construction of reservoirs proposed in new water plans (TPWD 1990; Buescher, Willis and Ratliff 2000; Schaumberg and Polk Inc. 2000). Examples of mature bottomland forest are protected in the Little Sandy, Caddo Lake, and Trinity River National Wildlife Refuges; the Angelina-Neches State Scientific Area; Big Slough, Turkey Hill and Upland Island Wilderness Areas; Big Thicket National Preserve; Caddo Lake WMA, Big Lake Bottom WMA, White Oak Creek WMA, Keechi Creek WMA, Lennox Woods Preserve, and other areas (Littlejohn 1979; Ward 1980; Espey Huston and Assoc. 1987; TPWD 1996; Daniel and Fleet 1999; Singhurst et al. 2000; Marcus, Neal pers. comm.).

Suggested Priority for Further Protection of Community: Fairly Low

**15b. Frequently inundated floodplain forests.**

Synonyms: Palmetto-hardwood Association (Watson 1979); Water Oak-Willow Oak Series, in part; Overcup Oak Series (Diamond 1993); Mixed Oak Flats (Mundorff 1998); Willow Oak Seasonally Flooded Forest Alliance; Overcup Oak-(Water Hickory) Seasonally Flooded Forest Alliance (Weakley et al. 2000).

Description: Willow oak, overcup oak, bottomland post oak, elms, green ash, sweetgum and other species may form fairly pure stands on frequently inundated flats within floodplains. Dwarf palmetto may be dominant in the understory (Nixon et al. 1973, Ward 1980, Dolezel 1986, Mundorff 1998).

Status: These communities occur as inclusions in bottomland forests at most of the sites listed above.

Suggested Priority for Further Protection of Community: Medium

### **16. Sloughs and seasonally flooded floodplain forests.**

Synonyms: Overcup Oak-Water Hickory (SAF #96) (Eyre 1980); Flatland Hardwood Forest, in part (Marks and Harcombe 1981); Water Elm-Swamp Privet Series (Diamond 1993); Overcup Oak Depressions, Water Elm Depressions (Mundorff 1998); Overcup Oak-(Water Hickory) Seasonally Flooded Forest Alliance, in part; Planertree Seasonally Flooded Forest Alliance; Water Ash Semipermanently Flooded Forest Alliance (Weakley et al. 2000).

Description: Floodplain sloughs, backswamps, and swamp margins that may be inundated for 20 percent or more of the year are dominated by plants such as water hickory, planer-tree, overcup oak, swamp privet, sweetgum, green ash, Carolina ash, red maple, mayhaw, buttonbush, lizard's tail, sedges, cutgrasses, water-willows, and smartweeds (Burandt et al. 1977, Christensen 1988, Orzell 1990, Mundorff 1998, Weakley et al. 2000). Similar communities occur in forested swamps of Brazoria and Fort Bend counties, with green ash, swamp privet, and water hickory (see Chapter 6) (Carr 1999a).

Status: As mentioned above, significant acreage of bottomland forest remains in East Texas, most of it owned by private landowners, timber companies, or hunting and fishing clubs. Protected examples of seasonally flooded forest include the Angelina Neches State Scientific Area, Big Slough Wilderness, Big Lake Bottom WMA, Alazan Bayou WMA, White Oak Creek WMA, Trinity River and Little Sandy National Wildlife Refuges and other sites, totaling roughly 5,000 acres (Littlejohn 1979; Ward 1980; Fritz 1986; TPWD 1996; Marcus, Neal, Singhurst pers. comm.).

Suggested Priority for Further Protection of Community: Fairly Low

### **17. Baldcypress-tupelo inundated forests.**

Synonyms: Cypress-Tupelo Sloughs and Swamps (Watson 1979); Baldcypress (SAF #101), Baldcypress-Water Tupelo (SAF #102) (Eyre 1980); Baldcypress-Tupelo Series (Diamond 1993); Swamp Cypress-Tupelo Forest (Marks and Harcombe 1981); Baldcypress Semipermanently Flooded Forest Alliance, Water

Tupelo-(Baldcypress) Semipermanently Flooded Forest Alliance, Baldcypress-(Water Tupelo, Swamp Blackgum, Ogeechee Tupelo) Semipermanently Flooded Forest Alliance; (Water Tupelo, Swamp Blackgum, Ogeechee Tupelo) Pond Seasonally Flooded Forest Alliance (Weakley et al. 2000).

Description: Stands of baldcypress and water tupelo grow in semipermanently inundated sloughs, open lakes, reservoirs, creek and river margins, and swamps in East Texas and along the upper Gulf coast. Commonly associated species in East Texas include red maple, Carolina ash, buttonbush, water hickory, planer-tree, sweetgum, swamp privet, and common persimmon; Spanish moss is common. Tree bases, logs, and waterlines support water-milfoil, water-pennyworts, water-willows, false-nettle, cypress swamp sedge, lizard's tail, water-primroses, and floating-leaved aquatic plants (Burandt et al. 1977, Van Kley and Hine 1998, Turner 1999, Weakley et al. 2000).

Status: This community is preserved in a number of parks and refuges, notably Caddo Lake State Park and WMA, the Angelina Neches State Scientific Area, Trinity River National Wildlife Refuge, the Big Thicket National Preserve, and along rivers in Village Creek State Park, the Roy E. Larsen Sanctuary, and Upland Island and Big Slough Wilderness Areas. More than 13,500 acres is protected (Ward 1980, Marks and Harcombe 1981, Littlejohn 1979, TPWD 1996, Marcus pers. comm.). The U. S. Army Corps of Engineers' Wallisville Reservoir tract includes more than 20,000 acres of high-quality cypress swamps and bottomlands, but future management of the area is undetermined (mcNamara pers. comm.). Other sites outside these protected areas are threatened by reservoir construction and, near the coast, saltwater intrusion.

Suggested Priority for Further Protection of Community: Medium

### **18. Freshwater shrub swamps.**

Synonyms: Buttonbush Series (Diamond 1993); Buttonbush Semipermanently Flooded Shrubland Alliance (Weakley et al. 2000).

Description: Buttonbush grows along shallow, fluctuating margins of swamps, ponds, streams, and artificial reservoirs almost statewide. In eastern Texas, other species of vegetated margins of water bodies often include green ash, smartweeds, water-willows, sedges, water-primroses, grasses, lizard's tail, black willow, and other emergent and aquatic species; smooth alder and river birch are common in East Texas forests (Penfound 1953).

Status: This vegetation type is not threatened at present (Diamond 1993). Natural and artificial examples are extensive (4,000 acres or more) and occur in many parks and wildlife areas such as the Angelina Neches State Scientific Area, Big Slough Wilderness, Texas State Railroad State Park, and White Oak Creek WMA (Fritz 1986, TPWD 1996).

Suggested Priority for Further Protection of Community: Low

### **19. River banks.**

Synonyms: River Birch-Sycamore (SAF #61), Cottonwood (SAF #63), Black Willow (SAF #95) (Eyre 1980); Black Willow Seasonally Flooded Forest Alliance, Black Willow Temporarily Flooded Forest Alliance, River Birch-(Sycamore) Temporarily Flooded Forest Alliance, Eastern Cottonwood Temporarily Flooded Forest Alliance (Weakley et al. 2000).

Description: Black willow, sycamore, eastern cottonwood, and green ash are common on subirrigated sandbars and streambanks along rivers throughout the eastern two-thirds of Texas. Though fast growing, this is not always a successional vegetation type, as old specimens can often be found.

Status: Riverine communities are widespread and resilient, but are also heavily utilized and often have been invaded by non-native species such as giant reed and planted grasses. Examples of this community occur at many protected sites.

Suggested Priority for Further Protection of Community: Low

## **20. Freshwater wetlands (upland Texas).**

Synonyms: American Lotus Permanently Flooded Temperate Herbaceous Alliance, White Waterlily- Yellow Pondlily species Permanently Flooded Temperate Herbaceous Alliance, Big Floatingheart Permanently Flooded Herbaceous Alliance, Watershield Permanently Flooded Herbaceous Alliance, Floating Water-primrose Semipermanently Flooded Herbaceous Alliance, Smartweed species Seasonally Flooded Herbaceous Alliance (Weakley et al. 2000).

Description: Permanently flooded lakes, reservoirs, swamps, slow-moving rivers, oxbows, and wetlands of depths up to 4-5 feet in depth in eastern Texas are typically colonized by aquatic plants, with common species including water-lilies, American lotus, duckweeds, spatterdock, watershield, common hornwort, Carolina fanwort, pondweeds, arrowheads, rushes, cattails, spikesedges, water-pennywort, smartweeds, the exotic alligator weed, water-primroses, buttonbush, mudplantains, bladderworts, water-milfoil, and algae (Penfound 1953, Correll and Johnston 1970, Nixon et al. 1977, Christensen 1988). Freshwater marshes occur only rarely in inland counties of East Texas, usually associated with large streams, and may support switchgrass, sugarcane plume grass, eastern gammagrass, southern wildrice or other graminoids (Singhurst et al. 2000). Further classification of freshwater aquatic communities is probably appropriate but has not been attempted in this thesis.

Status: Natural water bodies are rare in Texas except near the coast, with most examples occurring in large floodplains. Many parks throughout the state contain lakes and reservoirs colonized by aquatic plants, but species diversity in reservoirs is often lower than natural sites. Ditches and swales throughout the state contain small areas of aquatic vegetation and are often heavily utilized by wildlife. The Gus Engeling WMA contains a freshwater grass marsh (Singhurst et al. 2000).

Suggested Priority for Further Protection of Community: Medium

Table 3. Conservation areas in the East Texas Pineywoods, with types of vegetation occurring within each area.

Conservation Area and Manager	Vegetation Types Occurring in Area (fair condition or better)	Acreage of Area	Source of Information
Alazan Bayou State WMA (TPWD)	3 (2%),4 (2%),15b (51%),16 (6%),20 (4%)	1,973	TPWD 1996
Angelina-Neches State Scientific Area (COE/TPWD)	4 (6%),15a (34%),15b (5%),16,17 (33%),18 (4%)	11,000 (land)	TPWD 1996
Atlanta State Park (COE/TPWD)	3 (50%),10a (9%),15a (5%),21 (33%)	1,474	TPWD 1996, Singhurst pers. comm.
Beech Ravines Scenic Area (USFS)	4,10b	1,020	Orzell 1990
Big Creek Scenic Area (USFS)	4,9,13,15a	1,920	Orzell 1990
Big Slough USFS Wilderness Area (USFS)	3,4,10a,14,15a,15b,16,19,20	3,584	Fritz 1986
Big Thicket Bogs and Pinelands Preserve (TNC)	3,12	49	McWhorter pers. comm.
Big Thicket National Preserve (NPS)	1 (<1%),2 (1%),3 (9%),4 (6%),8 (3%),11,12 (2%),13 (33%),14 (14%),15a and 15b (20%),16,17 (2%)	86,038	Marks and Harcombe 1981, NPS 1997a
Caddo Lake National Wildlife Refuge (USFWS)	Not available (established October 2000)		
Caddo Lake State Park and WMA (TPWD)	3 and 4 (20%),15a (20%),15b and 17 (55%),17,20,21 (<1%)	7,412	Esey Huston & Assoc. 1987, TPWD 1996
Caddoan Mounds State Historical Park (TPWD)	3 (20%),15a (12%),18 (8%)	94	TPWD 1996
Cassells-Boykin State Park (USFS/TPWD)	4,10b	265	TPWD 1990b
Colorow Creek Scenic Area (USFS)	4,10b	230	Orzell 1990
Daingerfield State Park (TPWD)	3 (50%),10a (3%),21 (15%)	551	TPWD 1996, Singhurst pers. comm.
Damuth Preserve (Houston Audubon Society)	4,11 and 20 (20%),13,15a	617	Stewart 1998
Davis Hill State Park (TPWD)	4 (38%),15a (46%),15b,16 and 17(7%),19 (4%),21 (1%)	1,293	TPWD 1990c,1996

East Texas Ecological Education Center (TPWD)	4 (47%)	85	TPWD 1996
Edith L. Moore Nature Sanctuary (HAS)	15a	17	Burkett pers. comm.
Grass Lake/Naconiche Creek Preserve (NAPA)	4,10a,11,15a	81	Shelton pers. comm.
Gus A. Engeling State WMA (TPWD)	4 (1%),7 (7%),10a (<1%),15a (5%),15b (6%),16 (1%),20 and 29 (<1%),21 (56%)	11,034	Singhurst et. al. 2000
Houston Arboretum and Nature Center (City of Houston)	15a	155	
Huntsville State Park (TPWD)	4 (80%)	2,083	TPWD 1996
Indian Mounds Wilderness Area (USFS)	4,10b,15a	11,033	Fritz 1986
Ivy's Wildlife Refuge (NAPA)	4,15a	450	
Lake Bob Sandlin State Park (TPWD)	4 (30%),10a (6%),21 (10%)	380 (land)	TPWD 1996, Singhurst pers. comm.
Lake Houston State Park (TPWD)	4 (80%),14 (14%),17 (<1%),19 (2%)	4,912	TPWD 1996
Lake Livingston State Park (TPWD)	4,15a (6%)	626	TPWD 1996
Lennox Woods Preserve (TNC)	3,15a	366	Sanders 1994
Little Lake Creek USFS Wilderness Area (USFS)	3,4,15a	3,810	Fritz 1986
Little Rocky Preserve (TNC)	2 (60%),4 (20%),5 (<1%),7 (1%),9 (6%),13 (12%)	134	Wolfe pers. comm.
Little Sandy National Wildlife Refuge (USFWS conservation easement) and Old Sabine Bottom State WMA (TPWD)	4 (<5%),14,15a, 15b,16,26	3,802 (USFWS); 5,158 (TPWD)	TPWD 1996; Neal, Singhurst pers. comm.
Martin Creek Lake State Park (TPWD)	4 (80%),15a (8%)	286	TPWD 1996
Martin Dies, Jr. State Park (TPWD)	4 (37%),13 (28%), 15a (2%),17 (10%)	857	TPWD 1996
Mill Creek Cove Research Natural Area (USFS)	4 (50%), 13 (50%)	225	Orzell 1990
Mission Tejas State Historical Park (TPWD)	3,4,14,15a	366	TPWD 1996
Pat Mayse State WMA (COE/TPWD)	3 (10%),15a (9%),21 (40%),31 (20%)	7,928 (land)	TPWD 1996; Singhurst pers. comm.
Roy E. Larsen Sandyland Sanctuary (TNC, conservation easement)	1,2,11,12 ,15a (13%),17 (1%)	2,889 (TNC) 2,806 (easement)	Matos and Rudolph 1985; McWhorter pers. comm.
Sheff's Woods Preserve (TNC)	3,10a,15a	75	

Sheldon State WMA (TPWD)	17,20,39	1,025 (land)	TPWD 1996
Texas State Railroad State Historical Park (TPWD)	3 (22%),4,10a (3%),18 (14%)	500	TPWD 1986, Singhurst pers. comm.
Timberlakes tract (TNC)	2 (90%),11	240	McWhorter pers. comm.
Tony Houseman State Park and WMA (TPWD)	4 (9%),17 (80%),20 (9%)	3,286	TPWD 1996
Trinity River National Wildlife Refuge (USFWS)	4 (1%),13 (<1%),14 (10%),15a and 15b (50%),16 (15%),17 (12%),18 (<1%),20, 26 (1%)	10,000	Marcus pers. comm.
Turkey Hill USFS Wilderness Area (USFS)	2 (4%?),3 (26%),4 (10%?),10a and 10b (8%?)14,15a (50%)	5,286	Fritz 1986, LeGrande 1998
Tyler State Park (TPWD)	3 (36%),10a (5%),15a,21,26	983	TPWD 1996, Singhurst pers. comm.
Upland Island Wilderness Area (USFS) and Catahoula Preserve (NAPA)	2 (20%),3 and 4 (50%?),7 (<1%),9 (<1%),11 (<1%),14,15a,15b,16,17 (<1%)	12,634 (USFS); 90 (NAPA)	Ward 1980, LeGrande 1998
Village Creek State Park	1,3 and 4 (15%),15a (60%),16?,17 (11%),19	1,002	TPWD 1989a, TPWD 1996
Wier Woods Preserve (TNC and conservation easement)	13 (100%)	88	McWhorter pers. comm.
White Oak Creek State WMA (TPWD)	4 (12%),10a,15a (55%),15b (12%),16 and 18 (2%)	24,574	TPWD 1996, Singhurst pers. comm.
Winters Bayou Scenic Area (USFS) and Winters Bayou Preserve (NAPA)	4,9,11,13 and 14 (70%?)	1,587 (USFS) 80 (NAPA)	Jackson pers. comm.
Winters Bayou Preserve (HAS)	4,9,15a	131	Burkett pers. comm.
Total: 238,568 acres (1.37 percent of region)			
<p>Abbreviations of Managing Entities:</p> <p>TPWD=Texas Parks and Wildlife Dept.                      NPS=National Park Service</p> <p>COE=U. S. Army Corps of Engineers                      TNC=Nature Conservancy of Texas</p> <p>USFS=U.S Dept. of Agriculture Forest Service                      HAS=Houston Audubon Society</p> <p>USFWS=U. S. Fish and Wildlife Service                      NAPA=Natural Area Preservation Assoc.</p>			