



Chapter 6: The Gulf Coastal Prairies and Marshes

The Gulf Coastal Prairies and Marshes are approximately nine million acres of flat coastal plains, 20 to 80 miles in width, adjacent to the Gulf of Mexico. Soils are primarily clays and clay loams with some acidic sands and sandy loams; wetlands are common in poorly drained clay soils or in sand over impermeable subsoils (Carter 1931). Prairie and marsh grasses dominated most of the region prior to Anglo-European settlement and cultivation. However, as annual rainfall diminishes on the lower coast (from 40 inches at Victoria to 25 inches at Brownsville), marshes become less extensive and on the lower coast upland areas may be dominated by brush species (Tharp 1939).

Like most former grasslands on clay soils, the Gulf Coastal Prairies are well-suited to agriculture (except for a few areas of drift sand) and farming, cattle ranching, and urban and industrial development have transformed the region. Of the estimated one million acres of coastal marsh existing in 1950, at least 35

percent has been displaced by development (Gould 1975, USFWS 1991); prairies have been even more extensively replaced. Large areas are now dominated by exotic pasture grasses, weeds, and invasive species, particularly the Chinese tallow-tree, which grows in dense monocultures covering tens of thousands of acres along the upper coast. However, many remnants of most vegetation types survive, and more land has been set aside for wildlife conservation than in any other part of Texas except for the Trans-Pecos.

Vegetation types range from upland prairies to saturated or saline grasslands, vegetated dunes, and fresh, brackish and salt marshes near the coast. The region ranks high in floral diversity due to its broad east-west extent, the variety of soils, and adaptation to high levels of moisture and salinity. Salinity and hydroperiod (duration of seasonal inundation) are important influences on species occurrence. Each of the large coastal bay systems supports sizeable areas of emergent marsh dominated by cordgrasses and other halophytic grasses, shrubs, and forbs. Tidally inundated stands of smooth cordgrass provide vital nursery habitat for estuarine and marine fauna. Live oak woodlands occur on uplands in sand areas; river floodplains contain bottomland forests. Beaches and dunes run the length of the coast on the mainland and on barrier islands. The Laguna Madre on the lower coast is one of the few large hypersaline bays in the world and contains extensive seagrass beds and wind-tidal flats (Brown et al. 1980).

Plant Communities of the Gulf Coastal Prairies and Marshes

33. Upland tall grasslands (Coastal Prairies).

Synonyms: Bluestem Grassland (McMahan et al. 1984); Little bluestem-trichloris grassland, in part (McLendon 1991); Little Bluestem-Brownseed Paspalum Series (Diamond 1993); Little Bluestem-Brownseed Paspalum Herbaceous (Weakley et al. 2000).

Description: Grasslands on upland Alfisols and Vertisols of the Coastal Prairies are similar to the inland Blackland and Fayette Prairies, but some subdominant

species have relatively greater importance. Brownseed paspalum shares dominance bluestems, Indiangrass, and switchgrass; "increasers" (i.e. species increasing in abundance with prolonged grazing by livestock) include Texas wintergrass and silver bluestem. Other abundant species include littletooth sedge, Florida paspalum, tall dropseed, knotroot bristlegrass, hairyawn muhly, longtom, Scribner panicum, gayfeathers, yellow-puff, asters, spurges, and a variety of other forbs and grasses. Eastern gammagrass and switchgrass may dominate mesic areas (Durham 1975, Box and White 1969, Butler 1979, Brown 1981, Diamond and Smeins 1984, Pilko and Assoc. 1999, Weakley et al. 2000). Prior to cultivation and overgrazing, grasslands on the central Gulf coast (e.g. Kleberg and Nueces counties) included bluestems, Indiangrass, bristlegrasses, windmillgrasses, and buffalograss (McLendon 1991, Box and White 1969, Patterson pers. comm.).

Status: Perhaps 99 percent of coastal prairies in Texas have been converted to agricultural lands (McFarlane 1995). Many existing rangelands have been overtaken by invasive species --- including mesquite, huisache, eastern baccharis, smutgrass, yankeeweed and other weedy forbs, and the exotic Chinese tallow-tree and Macartney rose --- or replaced by non-native pasture grasses. Roughly 25,000 acres is protected in parks or refuges; some of that acreage is restored habitat and many sites lack the full range of original species. Areas of unplowed grassland are protected within the Attwater's Prairie Chicken and Brazoria National Wildlife Refuges (Johnston 1963; McLendon 1991; Box and White 1969; Lange, McAlister, Rossignol pers. comm.). A small remnant of prairie owned by Harris County for flood control protects several endangered plant species, but most of the site has been converted into an artificial wetland (Brown pers. comm.).

Suggested Priority for Further Protection of Community: Medium

34. Upland live oak woodlands (upper Gulf Coast).

Synonyms: Coastal Live Oak-Sugarberry Series (Diamond 1993); Live Oak-Sugarberry Woodland Alliance (Weakley et al. 2000).

Description: Upland mottes or woodlands of coastal live oak occur on ridges and salt domes (e.g. High Island) along the upper coast and are superficially similar to oak woodlands on coastal ridges (cheniers) in Louisiana (cf. Penfound and Hathaway 1938). However, most extant live oak groves between Galveston Bay and Sabine Lake apparently do not predate Anglo-European settlement (Burkett pers. comm.). Sugarberry, pasture haw, water oak, and yaupon form natural woodlands or mottes within grasslands in this range (Harcombe and Neaville 1977), but the original abundance of coastal live oak is uncertain.

Status: These communities have been cleared for pasture and development and supplanted by invasive species. They are important resting areas for migrating songbirds. Examples are protected at the Candy Abshier WMA and Houston Audubon Society's High Island preserves (TPWD 1996, Burkett pers. comm.).

Suggested Priority for Further Protection of Community: Fairly High

35. Upland live oak savannas (Ingleside Barrier).

Synonyms: Coastal Live Oak-Red Bay Series (Diamond 1993); Plateau Oak Forest Alliance, in part (Weakley et al. 2000).

Description: Former beach ridges on the Ingleside, Live Oak, and Blackjack peninsulas in Aransas, San Patricio, and adjacent counties support mottes, woodlands, and thickets of live oak, with openings dominated by little bluestem and other grasses. The species of live oak (or plateau live oak) is uncertain (Simpson 1988). Other abundant species include laurel oak (species also uncertain), redbay, southern wax-myrtle, yaupon, bluestems, paspalums, switchgrass, sedges, legumes, nutrush, Turk's cap, silver croton, beach ground-cherry, and other forbs. Live oak mottes (possibly a different species or cross) also grow on the eastern part of the South Texas Sand Sheet in Kenedy County (see Chapter 7) in a matrix of grasslands dominated by seacoast bluestem, brownseed paspalum, lovegrasses, and other species (Collins 1987).

Status: Large areas of live oak savanna have become dense, brushy thickets, including much of the acreage (more than 20,000 acres) of this community

protected at Aransas National Wildlife Refuge and Goose Island State Park (Springer et al. 1987, McAlister and McAlister 1987, TPWD 1996).

Suggested Priority for Further Protection of Community: Fairly Low

36. Coastal xeric brush.

Synonyms: Colima Shrubland Alliance (Weakley et al. 2000).

Description: A few clay or shell ridges (and spoil banks) near coastal bays support xerophytic brush species abundant on the South Texas Plains, including colima, Texas persimmon, granjeno, hackberries, Berlandier wolfberry, coma or gum bumelia, brasil, mesquite, Texas prickly pear, and Trecul yucca. While a number of brush species (e.g. huisache, mesquite, prickly pear) have invaded pastures throughout the Coastal Prairies, these mature brush communities apparently do not result from human disturbance (McAlister and McAlister 1987, Weakley et al. 2000).

Status: Protected examples occur at the Houston Audubon Society's North Deer Island, the Nature Conservancy's Mad Island Preserve, and the Aransas National Wildlife Refuge (McAlister and McAlister 1987; Dumesnil, Burkett pers. comm.).

Suggested Priority for Further Protection of Community: Fairly High

37. Live oak-water oak floodplain forests.

Synonyms: Coastal Live Oak-Pecan Series, Water Oak-Coastal Live Oak Series (Diamond 1993), Live Oak-Pecan Woodland Alliance, Live Oak-Water Oak Saturated Forest Alliance, Live Oak Temporarily Flooded Forest (Weakley et al. 2000).

Description: Live oak is a dominant canopy species in forested bottomlands, floodplain terraces, and interfluvial flats of the lower Brazos, Colorado, and adjacent river basins, with groves or mottes of live oak occurring in adjacent uplands. Pecan and water oak may be codominant; subdominant species may include sugarberry, elms, dwarf palmetto, gum bumelia, bois d'arc, hollies, vines (grapes, rattan-vine, Virginia-creeper, poison-ivy) and a sparse ground layer

including basketgrass, long-leaf spikegrass, Cherokee sedge, and a number of forbs. Baldcypress occurs on banks of larger streams. Swamps within these bottomlands are dominated by green ash, black willow, swamp privet, sedges, and smartweeds (TPWD 1978, Carr 1999b, Weakley et al. 2000, Lange pers. comm.). These bottomland forests are perhaps the westernmost vegetation type dominated by southeastern plant species.

Status: These coastal floodplain forests have been targeted for protection by conservationists in recent decades. Preserved acreage now exceeds 7,500 acres, including the Brazos Bend State Park, Nannie M. Stringfellow WMA, Peach Point WMA, and the Big Pond, Dance Bayou, and other tracts of the San Bernard National Wildlife Refuge. Several of these areas include mature examples of this forest type, and the Dance Bayou tract is apparently old growth (TPWD 1978; Lange, Ortego pers. comm.).

Suggested Priority for Further Protection of Community: Medium

38. Ephemeral freshwater wetlands.

Synonyms: Rush-Sedge Series, in part (Diamond 1993); Southern Umbrella-sedge-Beaksedge species Seasonally Flooded Herbaceous Alliance, Saltmeadow Cordgrass Seasonally Flooded Herbaceous Alliance, in part (Weakley et al. 2000).

Description: Shallow ephemeral or seasonally flooded areas occur throughout the Coastal Prairies and include interdunal swales on sand sheets (e.g. the Ingleside Barrier) and barrier islands as well as ditches and depressional potholes in clay soils. These wetlands are characterized by high water tables that maintain hydric conditions, though the surface may be dry for long intervals. Graminoids are dominant, including flatsedges, rushes, beaksedges, umbrella-sedges, white-topped sedge, fimbries, and bushy bluestem, with water-hyssops, American bulrush, water-pennywort, arrowheads, cattails, and bladderworts in more permanent swales (Carr 1997, Weakley et al. 2000).

Status: Many swales and potholes have been drained, a major contribution to wetland loss (Moulton and Jacob 1999). These herbaceous freshwater wetlands have been little studied and only small areas, totaling 5,000 acres or less, are protected at Aransas and Matagorda Island National Wildlife Refuges, Brazos Bend State Park, and other refuges (TPWD 1978, USFWS et al. 1990).

Suggested Priority for Further Protection of Community: Fairly High

39. Semipermanent freshwater wetlands (Coastal Prairies).

Synonyms: *Typha-Scirpus* consociates and *Mariscus* consociates (Penfound and Hathaway 1938); Maidencane-Alligator Weed Marsh (McMahan et al. 1984); Giant Bulrush Semipermanently Flooded Herbaceous Alliance; Maidencane Seasonally Flooded Temperate Herbaceous Alliance; Lanceleaf Arrowhead Semipermanently Flooded Herbaceous Alliance; (Narrowleaf Cattail, Common Cattail)-(Bulrush species) Semipermanently Flooded Herbaceous Alliance; Soft Rush Seasonally Flooded Herbaceous Alliance; Southern Wild Rice Seasonally Flooded Temperate Herbaceous Alliance, in part (Weakley et al. 2000).

Description: Freshwater marsh and aquatic plant communities occur in upland depressions and around streams and bodies of fresh water in every part of Texas, but the most species-rich examples occur near estuaries on the upper Gulf coast. Species of freshwater marshes and ponds in coastal Texas include giant bulrush, softstem bulrush, southern wildrice, maidencane (along the upper Gulf coast only), spikesedges, rushes, cutgrasses, arrowheads, flatsedges, cattails, smartweeds, alligator weed (an exotic), water-pennywort, paspalums, panicums, sprangletops, powdery thalia, marsh fleabane, burheads, water-primroses, lake acanthus, and many other forbs and grasses. Submergent and floating-leaved aquatic species in open water include duckweeds, pondweeds, water-lilies, watershield, southern naiad, American lotus, common hornwort, water-lettuce, water-ferns and the exotic common water-hyacinth (Penfound and Hathaway 1938, Fleetwood 1973, Harcombe and Neaville 1977, TPWD 1978, Scifres et al. 1980, Collins 1987, White and Paine 1992, Pilko and Assoc. 1999,

Weakley et al. 2000, Moulton and Jacob 2000). Slightly brackish to fresh marshes and swamps influenced by seasonal or storm tide intrusion produce some of the most diverse coastal habitats; these intermediate communities are limited in extent in Texas and are found primarily on the upper Gulf coast (Ortego pers. comm.).

Status: Many parks and refuges contain freshwater sloughs and other habitats, but much of the protected acreage consists of interdunal depressions on barrier islands such as Padre Island National Seashore (Laine and Ramsey 1988). True freshwater marshes and water bodies are protected at Brazos Bend State Park, McFaddin National Wildlife Refuge, and a few other sites, totaling about 10,000 acres (TPWD 1978, 1996; Ortego, Walther pers. comm.). Many impoundments in conservation areas (e.g. Peach Point WMA, Anahuac National Wildlife Refuge) have been colonized by freshwater hydrophytes and may be considered "natural" communities (Pilko and Assoc. 1999). Some of the largest extant freshwater marsh areas in Texas (e.g. Willow Slough in Jefferson County and the Trinity River delta in Chambers County) are not fully protected. Freshwater wetlands are important resources and may support a high diversity of animals and plants. Suggested Priority for Further Protection of Community: Medium

40. Coastal dune grasslands.

Synonyms: Seacoast Bluestem-Gulfdune Paspalum Series, in part (Diamond 1993); Gulfdune Paspalum-Bitter Panicgrass-(Seaside Little Bluestem) Herbaceous Alliance (Weakley et al. 2000).

Description: Secondary dunes on barrier islands or near bays are often dominated by seacoast bluestem and other grasses, such as gulfdune paspalum, seashore paspalum, brownseed paspalum, bitter panicum, and red lovegrass. Common forbs include seaside goldenrod, seaside heliotrope, woolly stemodia, and others. Cordgrasses or sedges may be dominant in low swales (Judd et al. 1977, Drawe et al. 1981, USFWS et al. 1990, Weakley et al. 2000). As with

other coastal grasslands, disturbance may favor an increase in woody species. Similar grasslands occur on the South Texas Sand Sheet (see Chapter 7).

Status: Roughly 25,000 acres of coastal grasslands in good condition are protected in Matagorda Island National Wildlife Refuge and State Park, Mustang Island State Park, and Padre Island National Seashore (TPWD 1996, Laine and Ramsey 1998, McAlister pers. comm.). The Matagorda Peninsula and Christmas Bay tracts owned by the Texas General Land Office also contain good examples of this community, but future management of these tracts has not been determined (Grimes pers. comm.). Some unprotected examples are threatened by beachfront commercial development.

Suggested Priority for Further Protection of Community: Fairly Low

41. Gulf cordgrass saline grasslands.

Synonyms: Gulf Cordgrass Series (Diamond 1993); Gulf Cordgrass Saturated Herbaceous Alliance, Gulf Cordgrass Seasonally Flooded Temperate Herbaceous Alliance (Weakley et al. 2000).

Description: Gulf cordgrass dominates large areas of "high" marsh (not inundated by normal tides) and saline prairies with high water tables along the entire Gulf coast. Other species that may be codominant include seashore paspalum, knotroot bristlegrass, bluestems, and dropseeds (Shiflet 1963, Fleetwood 1973, Scifres et al. 1980, Pilko and Assoc. 1999).

Status: This community has probably spread into disturbed areas of former upland grassland. Gulf cordgrass-dominated prairies are widespread and very extensively protected, with more than 45,000 acres in parks and refuges (TPWD 1996; USFWS 1996; Lange, McAlister, and Walther pers. comm.).

Suggested Priority for Further Protection of Community: Low

42a. Intermediate marshes.

Synonyms: Marshhay Cordgrass-Olney Three-Square-Leafy Three-Square (McMahan et al. 1984); Marshhay Cordgrass Series, in part (Diamond 1993);

Saltmeadow Cordgrass Seasonally Flooded Herbaceous Alliance, in part (Weakley et al. 2000).

Description: "Intermediate" marshes may be defined as somewhat fresher than surrounding brackish marshes but with higher salinity than saline prairies or freshwater habitats. Common emergent species include seashore paspalum, Olney bulrush (replaced by American bulrush on the lower coast), marshhay cordgrass, giant bulrush, coffee bean, coastal water-hyssop, spikesedges, Virginia marsh-mallow, and floating-leaved aquatic plants in open water (Pilko and Assoc. 1999). Common reed has invaded sites of various salinities as well as colonizing spoil banks and ditches.

Status: Large areas of intermediate and brackish marsh are protected, with excellent examples at Matagorda Island, Anahuac, McFaddin, and San Bernard National Wildlife Refuges, the adjacent Sea Rim State Park and J. D. Murphree WMA, Lower Neches WMA, Peach Point WMA, Guadalupe Delta WMA, and other sites. Protected acreage exceeds 100,000 acres, much of it in good condition (TPWD 1996; USFWS 1996; Lange, Walther pers. comm.).

Suggested Priority for Further Protection of Community: Low

42b. Brackish marshes.

Synonyms: Marshhay Cordgrass-Olney Three-Square-Leafy Three-Square (McMahan et al. 1984); Saltgrass-Cordgrass Series; Marshhay Cordgrass Series, in part (Diamond 1993); Saltmeadow Cordgrass Seasonally Flooded Herbaceous Alliance; Saltmeadow Cordgrass-(Saltgrass) Tidal Herbaceous Alliance; Groundsel-tree-Maritime Marsh-elder Tidal Shrubland Alliance; Olney Threesquare Semipermanently Flooded Herbaceous Alliance; Black Needlerush Tidal Herbaceous Alliance, in part; Beaked Ditch-grass Permanently Flooded-Tidal Temperate Herbaceous Alliance (Weakley et al. 2000).

Description: Marshes between the landward edge of tidal influence and the reach of storm tides (salinities between .5 and 2 percent) occur throughout the Texas coast. The most important emergent species associated with brackish conditions include marshhay cordgrass, saltgrass, and saltmarsh bulrush, with gulfdune

paspalum, seashore paspalum, Olney bulrush, spikesedges, seepweeds, and sea ox-eye often present. Saltgrass may be dominant in lower marsh; stands of black needlerush may occur in brackish marshes as well as in fresher and more saline marshes. Higher margins are often occupied by eastern baccharis and bigleaf sumpweed, usually within a matrix of cordgrasses. Also present in this community are annual saltmarsh aster, yellow deer-pea, cordgrasses, and other marsh plants. Submergent aquatics in brackish water include algae, burheads, rushes, common poolmat, and wigeon-grass (Penfound and Hathaway 1938, Shiflet 1963, USFWS et al. 1990, White and Paine 1992, Pilko and Assoc. 1999, Weakley et al. 2000, Walther pers. comm.).

Status: Baccharis, saltcedar, and other shrubs may invade. A large amount of brackish marsh is protected, with good examples at Brazoria, San Bernard, Big Boggy, McFaddin, Matagorda Island, and Texas Point National Wildlife Refuges (USFWS 1996; Walther, Neaville, Lange, McAlister pers. comm.)

Suggested Priority for Further Protection of Community: Low

43. Sea ox-eye saline marsh.

Synonyms: Seaside Ox-eye Tidal Shrubland Alliance (Weakley et al. 2000).

Description: Sea ox-eye daisy grows as a subdominant species on bands of saline marsh or flats coastwide, especially on the lower Gulf coast where it may grow in monospecific stands covering hundreds of acres or with maritime saltwort, shoregrass and other species (Johnston 1955).

Status: Flats dominated by sea ox-eye occur at Lower Rio Grande Valley, Laguna Atascosa, Aransas and other refuges (USFWS 1987, Best pers. comm.).

This community is widespread and apparently not threatened.

Suggested Priority for Further Protection of Community: Low

44. Glasswort-saltwort hypersaline estuarine flats.

Synonyms: Glasswort-Saltwort Series (Diamond 1993); Saltwort Tidal Dwarf-shrubland Alliance; Perennial Glasswort-(Inland Saltgrass, Saltmarsh Cordgrass)

Tidal Dwarf-shrubland Alliance; Key Grass Tidal Herbaceous Alliance; Gulf Cordgrass Tidal Herbaceous Alliance, in part (Weakley et al. 2000).

Description: Periodically inundated flats subject to evaporation of salt water (e.g. high tide or storm tide zones) occur around coastal bay margins, in washover areas, and along shores of barrier islands. These flats may be sparsely vegetated with very salt-tolerant species, including maritime saltwort, glasswort, shoregrass, seepweeds, sea ox-eye, Gulf cordgrass, Carolina wolfberry, camphor daisy, beach carpet, and saltgrass. Bands of shoregrass grow along upper margins of tidal flats and grade into brackish marshes (Lonard et al. 1978, Drawe et al. 1981).

Status: This community is abundant along bays and beaches on the Gulf coast and occurs at many refuges and parks, including Matagorda Island National Wildlife Refuge and State Park, Boca Chica WMA, Mustang Island State Park, and others. Total protected acreage is 7,000 acres or more (TPWD 1996, USFWS et al. 1990, USFWS 1997, Judd et al. 1997). Some sites may be threatened by residential and industrial development on bay shores and barrier islands.

Suggested Priority for Further Protection of Community: Fairly Low

45. Tidal salt marshes.

Synonyms: *Spartina alterniflora* consociates; *Distichlis* consociates, in part (Penfound and Hathaway 1938); Smooth Cordgrass-Marsh Saltgrass-Sea Ox-eye Marsh (McMahan et al. 1984); Smooth Cordgrass Series (Diamond 1993); Saltmarsh Cordgrass Tidal Herbaceous Alliance, Saltgrass Tidal Herbaceous Alliance (Weakly et al. 2000).

Description: Bay and estuary margins inundated by daily tidal fluctuation will only support plants tolerant of high salinities (2-5 percent). Smooth cordgrass is often dominant, especially from Nueces County north, forming pure stands along estuarine margins and in tidal marshes. Saltgrass, black needlerush, and saltmarsh bulrush may also be important. Tidal marshes commonly adjoin vegetated saline flats containing glassworts, saltwort, shoregrass, and other species (Shiflet 1963, Penfound and Hathaway 1938, White and Paine 1992).

Though plant diversity is low, smooth cordgrass marshes support rich fauna and are nursery areas for commercial fish and crustacean species.

Status: Despite extensive protection and restoration efforts, cordgrass marshes have decreased by more than 50 percent due to development (USFWS 1979). More than 30,000 acres are protected, with high-quality examples at Aransas, Matagorda Island, San Bernard, Brazoria, and Texas Point National Wildlife Refuges, Galveston Island and Sea Rim State Parks, and the Bolivar Flats Shorebird Sanctuary (TPWD 1996; Texas General Land Office 1998; Burkett pers. comm.). The Matagorda Peninsula tract owned by the General Land Office also contains excellent examples of cordgrass marsh, but future management of the property has not been decided (Grimes pers. comm.)

Suggested Priority for Further Protection of Community: Fairly Low

46. Black mangrove tidal shrub marsh.

Synonyms: Black Mangrove Series (Diamond 1993); Black Mangrove Tidal Shrubland (Weakley et al. 2000).

Description: Intertidal bay margins or flats on the lower Texas coast may support stands of black mangrove, usually as a low shrub. Cordgrasses or halophilic forbs are usually present. The extent and stature of black mangrove in Texas is limited by winter freezes. Extensive stands around Aransas Pass in Nueces County and Matagorda Island in Calhoun County are somewhat transient, but occurrences in the Laguna Madre system have persisted since the freeze event of 1989 (Lonard, White pers. comm.). In the absence of freezes, other mangrove species take root and grow in washover areas (Patterson pers. comm.).

Status: The status of black mangrove in Texas is variable due to climatic variation. The best stands (including large specimens) are located at the mouth of the Rio Grande in the Lower Rio Grande Valley National Wildlife Refuge and around South Bay, which is designated as a state coastal preserve. These sites are potentially threatened by oil spills in coastal bays (White pers. comm.).

Suggested Priority for Further Protection of Community: Fairly High

47. Beaches and active coastal dunes.

Synonyms: Seaoats-Seacoast Bluestem Grassland, in part (McMahan et al. 1984); Sea Oats-Bitter Panicum Series (Diamond 1993); Cenicilla-Beach Morning Glory Series (Diamond et al. 1987), Railroad-vine Herbaceous Alliance, Sea Oats Temperate Herbaceous Alliance (Weakley et al. 2000).

Description: Beaches extend the entire length of the Texas coast, either on the mainland or on barrier islands (which are uninterrupted, except by channels and cuts, south of the Colorado River). Beaches and active dunes on barrier islands are usually sparsely vegetated. Colonizing plants on primary dunes may include sea oats, morning-glories, bitter panicum, beach-tea, sea-purslanes, sea rocket, partridge pea, beach evening-primrose, sea-lavender, and coastal dropseed. Leeward sides of beach dunes often support lush growth of seacoast bluestem, sea oats, marshhay cordgrass, camphor daisy, gulfdune paspalum, camphor weed, leafless cressa, and other graminoids and forbs (Judd et al. 1977, Lonard et al. 1978, Drawe et al. 1981, Carls et al. 1991).

Status: Beaches are owned by the state of Texas, but dunes on barrier islands are private and many have been densely developed. However, more than 150 miles of beachfront are protected in Matagorda Island, McFaddin and San Bernard National Wildlife Refuges, Padre Island National Seashore, Mustang Island and Sea Rim State Parks, Boca Chica WMA, and other areas, containing approximately 10,000 acres of dunes and grasslands (TPWD 1996; USFWS et al. 1990; USFWS 1997, 1999).

Suggested Priority for Further Protection of Community: Medium

48. Wind-tidal algal flats.

Synonyms: Blue-green Algae Wind-Tidal Flat Nonvascular Alliance (Weakley et al. 2000).

Description: Wind-tidal sand and mud flats occur around all coastal bays but are most extensive in the Laguna Madre system. After inundation by storm tides,

flats support blooms of cyanobacteria and are important feeding grounds for shorebirds including the endangered piping plover (Elliott pers. comm.).

Status: Areas of tidal flats are protected in Padre Island National Seashore, Mustang Island, Bolivar Flats Shorebird Sanctuary, Lower Rio Grande Valley National Wildlife Refuge (the Boca Chica tract) and other preserves (Laine and Ramsey 1998, Texas General Land Office 1998).

Suggested Priority for Further Protection of Community: Fairly Low

49. Estuarine seagrass beds.

Synonyms: Manatee-grass Permanently Flooded Tidal Herbaceous Alliance, Shoal-grass Permanently Flooded Tidal Herbaceous Alliance, Turtle-grass Permanently Flooded Tidal Herbaceous Alliance, Tufted Seagrass Permanently Flooded Tidal Herbaceous Alliance (Weakley et al. 2000).

Description: Seagrasses grow throughout shallow waters of most coastal bays, most extensively in the Laguna Madre, Redfish Bay, Aransas Bay, and Baffin Bay, and are crucial habitat areas for estuarine fauna (Texas General Land Office 1998). Shoal-grass is the most widespread species, with turtle-grass and manatee-grass common in slightly deeper water (10-12 feet) and wigeon-grass growing in inshore or brackish environments (Weakley et al. 2000).

Status: Submerged lands are owned by the state of Texas. Areas of seagrasses are subject to dredging, damage from boat traffic, and changes in extent and composition due to climatic fluctuations.

Suggested Priority for Further Protection of Community: Fairly Low (Note: all examples are in state ownership)

Table 6. Conservation areas in the Gulf Coastal Prairies and Marshes, with types of vegetation occurring within each area.

Conservation Area and Manager	Vegetation Types Occurring in Area	Acreage of Area	Source
Anahuac National Wildlife Refuge (USFWS)	33 (25%),39 (5%),41 (8%),42a (43%),42b (14%),45 (2%)	34,233	USFWS 1996
Aransas National Wildlife Refuge (USFWS)	33 and 35 (40%), 36 (1%),37,38,39,41, 44,45 (>7%)	89,503 (USFWS), 24,893 (lease)	McAlister pers. comm.
Armand Bayou Nature Center and State Coastal Preserve (Harris County, City of Pasadena, GLO/TPWD, Rice University, University of Houston)	15a,33 (25%),42b,45	2,402	Brown 1985, Smeins and Diamond 1986
Atkinson Island State WMA (TPWD)	42b (48%),45 (25%)	152	TPWD 1996
Attwater's Prairie Chicken National Wildlife Refuge (USFWS)	19,33 (80%),37,38	9,199	Rosignol pers. comm.
Austin's Woods Units, San Bernard NWR (USFWS, 5 tracts)	16,19,37,39	3,200	Lange pers. comm.
Big Boggy National Wildlife Refuge (USFWS, conservation easement)	33 (7%),39 (6%),41 (12%),42a and 42b (30%),44 (1%),45 (19%)	4,216 (USFWS); 310 (easement)	USFWS 1997/1999, Lange pers. comm.
Bolivar Flats Shorebird Sanctuary (HAS)	44,45 (30%),47 (10%),48	729	Burkett pers. comm.
Boy Scout Woods Bird Sanctuary, Cypress Pond and Smith Oaks Bird Sanctuary (HAS/TNC)	34 (30%)	181 (HAS) 170 (TNC)	Burkett pers. comm.
Brazoria National Wildlife Refuge (USFWS), Christmas Bay State Coastal Preserve (GLO), Follets Island (GLO), Slop Bowl Marsh (TNC)	33 (16%),39 (5%),40 (<1%),41 (12%),42a and 42b (24%),44,45 (10%),47 (<1%),49	43,840 (USFWS), 485 (land) (GLO), 220 (TNC)	TPWD 1996; USFWS 1997,1999; Lange pers. comm.
Brazos Bend State Park (TPWD)	19 (2%),32,33 (8%),37 (25%),38,39 (12%)	4,897	TPWD 1978, TPWD 1996
Candy Abshier State WMA (TPWD)	34 (18%),38,41 (40%)	207	TPWD 1996
Challenger 7 Memorial Park (Harris County)	35 (2%),41 (<10%)	part of 320	Boyd pers. comm.
Frost Deen Preserve (GBF)	33,38,41,42a,42b, 44,45	35	Green pers. comm.

Galveston Island State Park (TPWD)	38 (5%),40 (74%),42b (3%),44,45 (15%),47 (<1%)	1,959	TPWD 1996
Goliad State Historical Park (TPWD)	26 (25%),55 (20%)	144	TPWD 1996
Goose Island State Park (TPWD)	35 (15%),38 (7%),44 (6%),45 (6%)	447	TPWD 1996
Guadalupe Delta State WMA (TPWD)	19,39,41,42a,42b	6,777	Ortego pers. comm.
Intracoastal Property (HAS)	45	66	Burkett pers. comm.
Jesse Jones Nature Center (Harris County)		225	
Lower Neches State WMA (TPWD)	4 (9%),37 (<1%),39 (13%),42a (75%)	3,077 (land)	TPWD 1996
Mad Island State WMA (TPWD) and Clive Runnels Family Mad Island Marsh Preserve (TNC)	33,36,39,41 (44%),42a,44,45	7,281 (TPWD) 7,048 (TNC)	TPWD 1996, Dumesnil pers. comm.
Matagorda Island State Park, WMA and National Wildlife Refuge (USFWS/TPWD/ GLO)	36 (<1%),38 and 39 (6%?),40 and 41 (33%),42b,44,45 (19%?),47 (3%),49 (10%)	56,668	USFWS et al. 1990, McAlister pers. comm.
Matagorda Peninsula tract (GLO)	40 (20%),42b (20%), 45 (50%),47 (10%)	6,942	TPWD 1996
McFaddin National Wildlife Refuge (USFWS and conservation easement), Sea Rim State Park and J.D. Murphree State WMA (TPWD)	33 (<1%),38 (<1%),39 (1%), 41,42a,42b,44,45 (<1%),47	48,431 (USFWS) and 7,749 (easement), 24,366 (TPWD)	TPWD 1996; Walther pers. comm.
Moody National Wildlife Refuge (USFWS conservation agreement)	Not available	3,517	
Moussa Property (HAS)	14	13	Burkett pers. comm.
Mustang Island State Park (TPWD)	40 (50%),44 (25%),47 (15%),48 (10%)	3,700	TPWD 1996
Nannie M. Stringfellow State WMA (TxDOT/TPWD)	16 (15%),19,37 (50%),39 (20%)	3,552	Lange pers. comm.
North Deer Island (HAS)	36	7.6	Burkett pers. comm.
Padre Island National Seashore (NPS)	38 and 39 (16%),40 (10%),42a,44,47 (5%),48 (22%),49 (20%?)	83,381 (land) and 44,982 (water)	Laine and Ramsey 1998

Peach Point State WMA (TPWD)	29,33,37,38,39,41,42a, 42b,44,45,47	14,811	TPWD 1996, Ortego pers. comm.
Pierce Marsh Preserve (GBF/TNC)	41,42b,45,48	985 and 1,361	Green pers. comm.
Redhead Pond State WMA (TPWD/TNC)	41,42b,49	37	TPWD 1996
Rich Sanctuary (GBF)	33,39,43,45	167	Green pers. comm.
Sabine Pass Battleground State Park (TPWD)	42a (28%)	54	TPWD 1996
San Bernard National Wildlife Refuge (USFWS)	26 (2%),33 (2%),39 (4%),41 (26%),42a and 42b (25%),44, 45 (19%),47 (1%),49	27,414	USFWS 1997,1999; Lange pers. comm.
San Jacinto Battleground State Historical Park (TPWD)	42b (1%),45 (10%)	1,000	TPWD 1996
Shamrock Island Preserve (TNC/GLO)	49	110	
South Padre Island (TNC)	38,40,47,48	24,532	Judd et al. 1977
Stephen F. Austin State Historical Park (TPWD)	50 (43%)	664	TPWD 1996
Sweetwater Tract (GBF)	38,41,42b,45,48	458	Green pers. comm.
Texas Point National Wildlife Refuge (USFWS)	38 and 39 (<1%),41 (8%),42a (2%),42b and 45 (65%?),48,49	8,952	Diamond and Smeins 1986, Walther pers. comm.
Varner-Hogg Plantation State Historical Park (TPWD)	37 (15%)	66	TPWD 1996
Welder Flats State Coastal Preserve (GLO)	48,49	1,480	
Welder Wildlife Refuge (Rob and Bessie Welder Wildlife Foundation)	33,53a,55,64	6,800	Drawe et al. 1978
Total: 596,341 acres (6.4 percent of region)			
Abbreviations of Managing Entities: USFWS=U.S. Fish and Wildlife Service TNC=Nature Conservancy of Texas GLO=Texas General Land Office HAS=Houston Audubon Society TPWD=Texas Parks and Wildlife Dept. GBF=Galveston Bay Foundation			