DESCRIPTIONS OF SYSTEMS, MAPPING SUBSYSTEMS, AND VEGETATION TYPES FOR TEXAS

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The following descriptions cover the systems that have been identified for the legend for all the phases of the Ecological Systems Classification and Mapping Project in support of the Texas Comprehensive Wildlife Conservation Strategy for the Texas Parks and Wildlife Department. Many of these descriptions were drafted from System descriptions available from NatureServe (http://www.natureserve.org/explorer/). Most System descriptions were modified, and all Vegetation Type descriptions were generated from discussions regarding these cover types. These brief narratives generally focus on 'typical' type concepts, and mapped vegetation types often circumscribe more variation on the ground than what is described here. For each system, a number of cover types, or "Vegetation Types" were described. A common name is given for each Vegetation Type, and this name is used in the table of contents and for the map legend. Additionally, a second name is provided which more directly ties the Vegetation Type to the system of which it is a part. A numeric identifier is also provided. This identifier represents the identifier used by NatureServe for the system. For the Vegetation Type, a digit suffix is provided to distinguish the various cover types within the system. In parentheses directly following the common name of the Vegetation Type, a number is provided. This number represents the numeric code used to track the Vegetation Types during the mapping process.

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Forests, Woodlands and Savannas

Bastrop Lost Pines Forest and Woodland (original Name: East-central Texas Plains Pine Forest and Woodland)
Identifier: CES205.896

Geology: Sandy Eocene formations, such as Carrizo, Sparta, and Queen City formations are most frequently associated with this system, though it may also occur on the Reklaw Formation and other adjacent formations.
Landform: Dissected uplands.
Soils: Sandy soils characterize this system with typical Ecological Sites including Deep Sand, Sandy, and Sandy Loam being frequently associated. It may also occupy gravelly sites, associated with more recent geologic strata.

Description: This system is dominated by *Pinus taeda* (loblolly pine), often with *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) present to co-dominant. *Quercus incana* (bluejack oak), *Quercus margarettae* (sand post oak), *Carya texana* (black hickory), *Ulmus crassifolia* (cedar elm), *Celtis* spp. (hackberry), and *Juniperus virginiana* (eastern redcedar) may also be present. *Vaccinium arboreum* (farkleberry) is a frequent shrub component of the system. Other shrub and woody vine species that may be present include *Sideroxylon lanuginosum* (gum bumelia), *Callicarpa americana* (American beautyberry), *Ilex vomitoria* (yaupon), *Toxicodendron radicans* (poison-ivy), *Rhus aromatica* (fragrant sumac), *Smilax bona-nox* (saw greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis* spp. (grape). A grassy herbaceous layer may be present with *Schizachyrium scoparium* (little bluestem) commonly encountered, but other species including *Andropogon gerardii* (big bluestem), *Nassella leucotricha* (Texas wintergrass), *Sporobolus junceus* (pineywoods dropseed), *Paspalum plicatulum* (brownseed paspalum), *Paspalum setaceum* (thin paspalum), *Aristida* spp. (threeawn), *Sporobolus clandestinus* (rough dropseed), *Digitaria cognata* (fall witchgrass), *Dichanthelium oligosanthes* var. *scribnerianum* (Scribner panicgrass), and *Dichanthelium oligosanthes* (fewflower panicgrass). Forbs are conspicuous and include *Heterotheca subaxillaris* (camphor weed), *Euphorbia corollata* (flowering spurge), *Monarda citriodora* (lemon beebalm), *Galactia volubilis* (downy milkpea), *Liatris aspera* (rough gayfeather), *Brazoria truncata* (bluntsepal brazoria), *Diodia teres* (rough buttonweed), and many others. Local accumulations of pine needles result in a patchy distribution of herbaceous cover. This system bears some resemblance to pine woodlands and forests further to the east, and may represent a western, more xeric, outlier of these similar systems.

VEGETATION TYPES:

Bastrop Lost Pines: Loblolly Pine Forest (101)
Bastrop Lost Pines Loblolly Pine Forest and Woodland
Identifier: CES205.896.1 **MoRAP Code:** 101
Description: This vegetation type is characteristic of the system, with clear dominance of *Pinus taeda* (loblolly pine). *Vaccinium arboreum* (farkleberry) may form a conspicuous

understory, with *Schizachyrium scoparium* (little bluestem) as a common herbaceous dominant. Oak species, such as *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) may be present in the canopy, but pines dominate. In some cases, areas mapped as this vegetation type may be dominated by *Juniperus virginiana* (eastern redcedar).

Bastrop Lost Pines: Loblolly Pine - Oak Forest (103)

Bastrop Lost Pines Loblolly Pine – Oak Forest and Woodland

Identifier: CES205.896.3 **MoRAP Code:** 103

Description: This vegetation type represents the transition from strictly *Pinus taeda* (loblolly pine) dominated sites to those more characteristic of the surrounding post oak savanna. As such, *Quercus stellata* (post oak), and to a lesser extent, *Quercus marilandica* (blackjack oak) are significant components of the canopy, though *Pinus taeda* (loblolly pine) remains a co-dominant canopy species. *Carya texana* (black hickory), *Ulmus crassifolia* (cedar elm), and *Celtis laevigata* (sugar hackberry) may be conspicuous deciduous elements in the canopy. *Juniperus virginiana* (eastern redcedar) may also be present, co-dominant, or sometimes dominant on sites mapped as this vegetation type.

Bastrop Lost Pines: Loblolly Pine Slope Forest (121)

Bastrop Lost Pines Loblolly Pine Slope Forest

Identifier: CES205.896.11 **MoRAP Code:** 121

Description: This vegetation type occupies slopes greater than twenty percent and likely represents a more mesic and closed canopy representation of the Bastrop Lost Pines Loblolly Pine Forest. As such, the canopy is dominated by *Pinus taeda* (loblolly pine), with *Quercus stellata* (post oak), *Ulmus* spp. (elms), *Juniperus virginina* (eastern redcedar) and *Quercus marilandica* (blackjack oak) also present, but as minor components of the canopy. This forest is often found on the Sandstone Hill ecoclass. Differentiation from the surrounding upland forests based on species composition will be problematic. The shrub and herbaceous layer is less well-developed than in the surrounding uplands, due to the more closed nature of the canopy. Since *Juniperus virginiana* (eastern redcedar) in the canopy also results in coniferous evergreen canopy, forests dominated by this species may be mapped as this vegetation type.

Bastrop Lost Pines: Loblolly Pine - Oak Slope Forest (123)

Bastrop Lost Pines Loblolly Pine-Oak Slope Forest

Identifier: CES205.896.14 **MoRAP Code:** 123

Description: This vegetation type on slopes greater than twenty percent is a minor mapped type in this system. The overstory canopy is co-dominated by the coniferous evergreens *Pinus taeda* (loblolly pine) and/or *Juniperus virginiana* (eastern redcedar) and deciduous oaks such as *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak). *Ulmus* spp. (elms) and *Celtis laevigata* (sugar hackberry) are also common components of the overstory. This vegetation type is often found on the Sandstone Hill ecoclass.

One interesting small patch (20 – 80 acres) community that may be embedded within this mapped type occurs below the highest occurrences of the Sandylands types of the Post Oak Savanna region. This community occurs where sandhills make contact with sandy loam

and sandy clay associated with the Recklaw Formation. It is an infrequent to rare community, mostly found on south and southeast facing slopes, and dominated by *Pinus taeda* (loblolly pine), *Quercus nigra* (water oak), *Nyssa sylvatica* (black gum), *Ilex opaca* (American holly), *Morella cerifera* (wax-myrtle), and *Callicarpa americana* (American beautyberry). The herbaceous layer of this community is dominated by *Rhynchospora glomerata* (cluster beakrush), *Eleocharis torilis* (twisted spikerush), *Andropogon virginicus* (broomsedge bluestem), *Chasmanthium laxum* (slender woodoats), *Dichanthelium scoparium* (velvet panicgrass), and *Pterideum aquilinum* (bracken fern). Well-developed understory seep forest flora occurs on mid and lower slopes within this type, with spring runs, spongy muck, and in some cases, quaking conditions. These seepage areas are dominated by *Woodwardia virginica* (Virginia chain fern), *Woodwardia areolata* (chain fern), *Triadenum virginicum* (Virginia St. Johnswort), *Osmunda regalis* var. *spectabilis* (royal fern), and *Osmunda cinnamomaea* (cinnamon fern), though the latter two species are rare in this landscape. This restricted community may be found in Bastrop, Lee, and Gonzales counties (lacking *Pinus taeda* (loblolly pine) in Gonzales County and therefore not mapped in this vegetation type there). Representative occurrences can be found at Hoppy Spring (Bastrop State Park) and Yegua Knobs Preserve (Bastrop/Lee County).

Bastrop Lost Pines: Hardwood Slope Forest (124)

Bastrop Lost Pines Deciduous Slope Forest
Identifier: CES205.896.16 **MoRAP Code:** 124
Description: This is a very minor component of the system, occurring on slopes greater than 20% and dominated by hardwood species such as *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Ulmus crassifolia* (cedar elm), *Ulmus americana* (American elm), and *Celtis laevigata* (sugar hackberry). This vegetation type is similar to Post Oak Savanna: Oak / Hardwood Slope Forest of the surrounding landscape.

Central and South Texas Coastal Fringe Forest and Woodland
Identifier: CES203.464

Geology: This system occupies Holocene eolian sands of the South Texas Sand Sheet and sands of the Pleistocene Ingleside Barrier, which is mapped as Barrier Island and Beach Deposits of the Beaumont Formation.
Landform: Generally level to gently rolling landscape. Some dunes to a height of more than 15 meters (50 feet) occur, adding significant relief to the regions. Low swales and round pothole wetlands typify low landscape positions, and significant drainage systems (in the form of streams) are generally lacking.
Soils: Sands, particularly deep sands typify this system.

Description: This *Quercus fusiformis* (plateau live oak) dominated system occupies deep sands resulting from eolian deposits of Holocene and Pleistocene age. Ridge and swale topography characterizes these sites, with some large (up to 15 m tall) vegetated dunes present. In addition to forest and woodland, open stands grading into surrounding grasslands occur, as well as dense shrublands dominated (almost to the exclusion of other species) by running clones of *Quercus*

fusiformis (plateau live oak). Northern expressions, occurring on Ingleside Barrier sands from Calhoun to Kleberg County, differ somewhat from southern expressions, occurring on the South Texas Sand Sheet from southern Kleberg, Kenedy, and northern Willacy counties west to Brooks County. These latitudinal expressions differ somewhat in composition, but the transition is subtle and the general character of the system remains relatively unchanged. The association CEGL007785 *Quercus fusiformis – Prosopis glandulosa* var. *glandulosa / Malvaviscus arboreus* var. *drummondii* Forest can be referred to the southern expression, while CEGL002117 *Quercus fusiformis – Persea borbonia* Forest represents the northern expression. The system occurs within a matrix of deep sand grasslands, but also as large patch forests and woodlands. Depending on the overstory canopy and the development of the shrub layer, the herbaceous cover may resemble the surrounding grasslands, at least in composition. Herbaceous species present may include *Schizachyrium littorale* (seacoast bluestem), *Paspalum monostachyum* (gulfdune paspalum), *Paspalum plicatulum* (brownseed paspalum), *Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (Indiangrass), *Elionurus tripsacoides* (Pan American balsamscale), *Trachypogon spicatus* (crinkleawn), *Acalypha radians* (cardinal's feather), *Argythamnia mercurialina* (tall wild-mercury), *Chamaecrista flexuosa* (partridge pea), *Cnidoscolus texanus* (Texas bull-nettle), *Croton argyranthemus* (silverleaf croton), *Froelichia floridana* (Florida snake-cotton), *Galactia canescens* (hoary milkpea), *Eriogonum multiflorum* (heartsepal wildbuckwheat), *Rhynchosia americana* (American snoutbean), *Stillingia sylvatica* (queen's delight), *Helianthemum georgianum* (Georgia sunrose), *Zornia bracteata* (bracted zornia), and *Thelesperma nuecense* (Nueces greenthread). In northern expressions, *Persea borbonia* (redbay) is a conspicuous component of the subcanopy, and may reach the canopy, along with *Quercus hemisphaerica* (coastal laurel oak), *Quercus marilandica* (blackjack oak), and *Celtis laevigata* (sugar hackberry). A relatively continuous shrubby understory may be dominated by species such as *Callicarpa americana* (American beautyberry), *Malvaviscus arboreus* (Turk's cap), and, in the north *Ilex vomitoria* (yaupon), or the shrub layer may not be well-developed. Other woody species in the understory may include *Zanthoxylum hirsutum* (tickle-tongue), *Condalia hookeri* (brasil), *Ziziphus obtusifolia* (lotebush), *Zanthoxylum fagara* (colima), *Forestiera angustifolia* (desert olive), *Diospyros texana* (Texas persimmon), and in the north, *Vaccinium arboreum* (farkleberry), *Erythrina herbacea* (coralbean), and *Morella cerifera* (wax-myrtle). The epiphytes *Tillandsia recurvata* (ballmoss) and *Tillandsia usneoides* (Spanish moss) are commonly encountered, with *Tillandsia bailey* (Bailey's ballmoss) less commonly found, and only in the south. *Vitis mustangensis* (mustang grape) is a conspicuous woody vine throughout, while northern expressions may also contain *Ampelopsis arborea* (peppervine), *Smilax bona-nox* (saw greenbrier), and *Toxicodendron radicans* (poison ivy). The southern occurrences of this deep sand live oak woodland and forest have some woody and herbaceous species more characteristic of the south Texas plains. Most conspicuously, live oak woodland margins in the south have an open overstory co-dominated by *Prosopis glandulosa* (honey mesquite). Mesquite occurs, but to a less conspicuous extent, in the northern portions of the system. Pothole ponds and swales accumulate water through percolation from adjacent sands, and are characterized by the presence of numerous sedges including *Cyperus* spp. (flatsedges), *Eleocharis* spp. (spikerushes), *Fimbristylis caroliniana* (Carolina fimbry), *Fuirena scirpoidea* (southern umbrellasedge), *Fuirena simplex* (western umbrellasedge), *Rhynchospora* spp. (beaksedges), *Schoenoplectus erectus* ssp. *raynalii* (sharp-scale bulrush), *Schoenoplectus saximontanus* (Rocky Mountain bulrush), and *Schoenoplectus pungens* var. *longispicatus* (common threesquare). Other species commonly encountered in these wetlands include *Andropogon glomeratus* (bushy bluestem), *Spartina patens*

(marshhay cordgrass), *Echinodorus berteroi* (common burhead), *Hydrocotyle bonariensis* (largeleaf pennywort), *Juncus* spp. (rushes), *Mikania scandens* (climbing hemp-weed), *Nymphaea elegans* (tropical royalblue waterlily), *Phyla lanceolata* (lanceleaf frogfruit), *Sagittaria longiloba* (longlobe arrowhead), and *Typha domingensis* (southern cattail).

VEGETATION TYPES:

Coastal and Sandsheet: Deep Sand Live Oak Forest and Woodland (6402)

Texas Coastal Fringe Deep Sand Live Oak Forest and Woodland
Identifier: CES203.464.2 **MoRAP Code:** 6402
Description: This broadleaf evergreen system is dominated by *Quercus fusiformis* (plateau live oak) in the overstory. This constitutes the typical woodland of the system and generally conforms to the system description.

Coastal and Sandsheet: Deep Sand Live Oak - Mesquite Woodland (6403)

Texas Coastal Fringe Deep Sand Live Oak–Mesquite Forest and Woodland
Identifier: CES203.464.3 **MoRAP Code:** 6403
Description: *Quercus fusiformis* (plateau live oak) and *Prosopis glandulosa* (honey mesquite) share dominance in the canopy of this type. It is best developed on the South Texas Sandsheet where it occurs on the margin of live oak forest and woodland. Shrubs typical of South Texas, such as *Condalia hookeri* (brasil), *Zanthoxylum fagara* (colima), *Diospyros texana* (Texas persimmon), and *Ziziphus obtusifolia* (lotebush) are also commonly encountered in this type.

Coastal and Sandsheet: Deep Sand Live Oak Shrubland (6405)

Texas Coastal Fringe Deep Sand Live Oak Shrubland
Identifier: CES203.464.5 **MoRAP Code:** 6405
Description: This evergreen shrubland is dominated by low-stature *Quercus fusiformis* (plateau live oak) which sometimes forms extensive clones locally known as running live oak. These shrublands are often found in juxtaposition with live oak forest and woodland. Other shrub species, such as *Morella cerifera* (wax-myrtle), *Ilex vomitoria* (yaupon), and *Baccharis* spp. (baccharis), may be present.

Coastal and Sandsheet: Deep Sand Live Oak Swale Marsh (6407)

Texas Coastal Fringe Deep Sand Live Oak Swale Marsh
Identifier: CES203.464.7 **MoRAP Code:** 6407
Description: Potholes and swales within the **Deep Sand Live Oak Forest and Woodland** accumulate moisture seasonally, and are typically dominated by various sedge species, including *Cyperus* spp. (flatsedges), *Eleocharis* spp. (spikerushes), *Fimbristylis* spp. (fimbrys), *Fuirena* spp. (umbrellasedges), *Rhynchospora* spp. (beaksedges), and *Schoenoplectus* spp. (bulrushes).

Crosstimbers Oak Forest and Woodland
Identifier: CES205.682

Geology: The eastern occurrences of this system are associated with sandy members of the Cretaceous Woodbine Formation, while western occurrences occupy soils derived from the sands of the Cretaceous Trinity Group (such as Paluxy, Antler, and Twin Mountain-Travis Peak Sands). Further west, in the fringe of the Western Crosstimbers, the system occurs on more rugged, rocky and gravelly sites derived from Pennsylvanian formations.

Landform: Gently rolling, moderately dissected uplands, and irregular plains becoming more rugged in the western fringe of the distribution of this system.

Soils: Sands or sandy loams, some with a claypan, are characteristic of this system. Ecological Sites typical of the eastern expressions include Sandy Loam, Tight Sandy Loam, Claypan Prairie, Sandstone Hill, and Sandy. Those more typical of the western expressions include Sandy Loam, Loamy Sand, Tight Sandy Loam, Sandy, Rocky Hill, and Clay Loam.

Description: This system is generally described as a savanna or woodland dominated by *Quercus stellata* (post oak) and/or *Quercus marilandica* (blackjack oak) and occurring in southwest-northeast trending bands separated by the Grand Prairie. Other species in the canopy may include *Ulmus crassifolia* (cedar elm), *Quercus fusiformis* (plateau live oak), *Celtis laevigata* (sugar hackberry), and *Juniperus virginiana* (eastern redcedar). The understory may have been historically dominated by *Schizachyrium scoparium* (little bluestem), but current understory composition may be largely determined by land use history and grazing pressure. In the east, where precipitation is greater, tallgrass species such as *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans* (Indiangrass) may be important components of the understory, or occupy prairie patches. In the drier west, shortgrass species such as *Bouteloua dactyloides* (buffalograss) become more conspicuous. Other graminoid species that may be present include *Schizachyrium scoparium* (little bluestem), *Paspalum setaceum* (fringeleaf paspalum), *Sporobolus compositus* (tall dropseed), *Bouteloua curtipendula* (sideoats grama), *Bouteloua hirsuta* (hairy grama), *Bouteloua rigidiseta* (Texas grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Nassella leucotricha* (Texas wintergrass), and *Aristida* spp. (threeawn). Non-native species such as *Bromus catharticus* (rescuegrass), *Cynodon dactylon* (bermudagrass) and *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) frequently dominate the herbaceous layer. With the disruption of a natural fire cycle, branching of overstory species may be continuous to near ground level, reducing light penetration and leading to reduced herbaceous cover. The shrub layer may contain species such as *Smilax bona-nox* (greenbrier), *Rhus glabra* (smooth sumac), *Rhus trilobata* (skunkbush sumac), *Crataegus* spp. (hawthorn), and *Symphoricarpos orbiculatus* (coral-berry). Sites dominated by *Prosopis glandulosa* (mesquite), sometimes with *Ziziphus obtusifolia* (lotebush) as a common shrub component, are particularly common to the west. Juniper (including *Juniperus virginiana* (eastern redcedar), *Juniperus ashei* (Ashe juniper), and *Juniperus pinchotii* (redberry juniper), depending on the site) dominated sites are also frequently encountered. Prairie openings and inclusions tend to occur on tighter soils.

The Eastern Crosstimbers occupy a relatively narrow band, approximately 20 miles wide running from McLennan County in the south to the Red River. The Western Crosstimbers is a broader belt,

running from about Callahan County in the south, north and east to Montague County. The Western Crosstimbers can further be divided into the Main Belt which has developed on soils derived from the Cretaceous Trinity Group sands, and the more westerly Fringe which has developed on the more rugged and rocky/gravelly sites derived from Pennsylvanian formations.

VEGETATION TYPES:

Crosstimbers: Live Oak Forest and Woodland (502)

Crosstimbers Live Oak Forest and Woodland
Identifier: CES205.682.2 **MoRAP Code:** 502
Description: This vegetation type is a relatively uncommon component of the system, generally occurring in the eastern Crosstimbers on calcareous substrates. Overstory is dominated by *Quercus fusiformis* (plateau live oak), with *Quercus stellata* (post oak), *Ulmus crassifolia* (cedar elm), *Prosopis glandulosa* (mesquite), and *Juniperus ashei* (Ashe juniper) also present as minor components of the canopy. In some areas it may be difficult to distinguish occurrences of this vegetation type from occurrences of Edwards Plateau Limestone Savanna and Woodland (CES303.660) representing outliers of that system.

Crosstimbers: Post Oak - Juniper Woodland (503)

Crosstimbers Oak-Juniper Forest and Woodland
Identifier: CES205.682.4 **MoRAP Code:** 503
Description: Sites co-dominated by Juniperus species (*Juniperus virginiana* (eastern redcedar) to the north and east, and *Juniperus pinchotii* (redberry juniper) and *Juniperus ashei* (Ashe juniper) elsewhere are frequently encountered. Such sites, thought to result from disruption in the fire regime, may have *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) as co-dominants in the canopy. The dense canopy cover by cedars often results in limited light penetration and the consequent reduction in herbaceous cover. In central and southern portions of the Crosstimbers, areas over limestone substrate that are mapped as this type may be dominated by *Quercus buckleyi* (Texas oak), *Quercus fusiformis* (plateau live oak), and *Juniperus ashei* (Ashe juniper). *Ulmus crassifolia* (cedar elm) and *Celtis laevigata* (sugar hackberry) may also important canopy species.

Crosstimbers: Post Oak Woodland (504)

Crosstimbers Oak Forest and Woodland
Identifier: CES205.682.6 **MoRAP Code:** 504
Description: This vegetation type represents the typical occurrence dominated by the usual *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak), with other canopy species such as *Carya texana* (black hickory), *Ulmus crassifolia* (cedar elm), *Quercus fusiformis* (plateau live oak), *Juniperus virginiana* (eastern redcedar), and *Celtis laevigata* (sugar hackberry) present. The overstory may be relatively closed, resulting in reduced herbaceous cover. In some situations, *Prosopis glandulosa* (mesquite) may be relatively dense. Grass species, particularly *Schizachyrium scoparium* (little bluestem), are present in the understory, and may form prairie openings in the woodland.

Crosstimbers: Savanna Grassland (507)

Crosstimbers Savanna Grassland
Identifier: CES205.682.9 **MoRAP Code:** 507
Description: This is a primarily herbaceous vegetation type, representing the graminoid dominated component of the savanna as it occurs within this system. Occurrences tend to occur on tighter soils (such as on Clay Loam, Clayey Upland, Claypan Prairie, and Claypan Savanna ecoclasses), but are often dependant on appropriate land management (such as prescribed fire and/or brush control) that ensures reduced woody cover. Woody canopy represents less than 25% cover. Historically, *Schizachyrium scoparium* (little bluestem) likely dominated these grasslands, but current composition may be largely determined by landuse history and grazing pressure. In the east, where precipitation is greater, tallgrass species such as *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans* (Indiangrass) may be important components. In the drier west, shortgrass species such as *Bouteloua dactyloides* (buffalograss) become more conspicuous. Other graminoid species that may be present include *Schizachyrium scoparium* (little bluestem), *Nassella leucotricha* (Texas wintergrass), *Paspalum setaceum* (fringeleaf paspalum), *Sporobolus compositus* (tall dropseed), *Bouteloua curtipendula* (sideoats grama), *Bouteloua hirsuta* (hairy grama), *Bouteloua rigidiseta* (Texas grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Aristida* spp. (threeawn). Non-native species such as *Cynodon dactylon* (bermudagrass), *Bromus arvensis* (Japanese brome), *Bromus tectorum* (cheatgrass), and *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) are often significant components. It may be difficult to distinguish occurrences of this vegetation type from occurrences of **Southeastern Great Plains Tallgrass Prairie (CES205.685)** to the east and **Central Mixedgrass Prairie (CES303.659)** to the west. *Prosopis glandulosa* (mesquite) is a common shrub in this type, and some areas have fairly dense mesquite cover.

Crosstimbers: Juniper Slope Forest (521)

Crosstimbers Juniper Slope Forest
Identifier: CES206.682.11 **MoRAP Code:** 521
Description: This is a very minor component of the system, occupying slopes greater than twenty percent and dominated by *Juniperus ashei* (Ashe juniper), *Juniperus virginiana* (eastern redcedar), or less commonly, *Juniperus pinchotii* (redberry juniper). This vegetation type is mapped in the southern part of the Western Crosstimbers, where it is frequently associated with slopes on calcareous substrates. These occurrences might be more appropriately considered outliers of Edwards Plateau: Ashe Juniper Slope Forest.

Crosstimbers: Hardwood - Juniper Slope Forest (523)

Crosstimbers Deciduous-Juniper Slope Forest
Identifier: CES206.682.14 **MoRAP Code:** 523
Description: Forests occupying slopes greater than twenty percent with canopies co-dominated by deciduous hardwood species (such as *Quercus stellata* (post oak), *Quercus buckleyi* (Texas oak), *Quercus marilandica* (blackjack oak), *Ulmus crassifolia* (cedar elm)) and juniper species (including *Juniperus pinchotii* (redberry juniper), *J. virginiana* (eastern redcedar), or *J. ashei* (Ashe juniper), depending on the site)). On some mesic slopes on limestones or chalks of the northern Crosstimbers, and into the Blackland Prairie, *Quercus*

shumardii (Shumard oak) and *Quercus muehlenbergii* (chinkapin oak) may become the co-dominants in the vegetation type. The overstory canopy tends to be more closed than the upland counterparts, and shrub and herbaceous cover is consequently reduced. Occurrences of this type in the southern part of the Western Crosstimbers frequently occupy slopes on calcareous substrates and may be more appropriately considered as Edwards Plateau Slope forest.

Crosstimbers: Oak - Hardwood Slope Forest (524)

Crosstimbers Deciduous Slope Forest
Identifier: CES206.682.16 **MoRAP Code:** 524
Description: These relatively closed canopy forests on slopes (greater than twenty percent) are dominated in the overstory by deciduous species, primarily oaks such as *Quercus stellata* (post oak), *Quercus muehlenbergii* (chinkapin oak), *Quercus marilandica* (blackjack oak), and *Quercus buckleyi* (Texas oak). *Ulmus crassifolia* (cedar elm), *Sideroxylon lanuginosum* (gum bumelia), *Celtis laevigata* (sugar hackberry), and/or *Celtis laevigata* var. *reticulata* (netleaf hackberry) may also be common in the canopy. These slopes are frequently associated with the Sandstone Hill, Bouldery Hill, or Rocky Hill ecoclasses, with the substrate often derived from underlying sandstones. Evergreen species such as *Quercus fusiformis* (plateau live oak) and *Juniperus* sp. (juniper) may be present, but relatively minor components. On some calcareous slope in the northern part of the Crosstimbers, and into the Blackland Prairie region, *Quercus shumardii* (Shumard oak) and *Quercus muehlenbergii* (chinkapin oak) may dominate or co-dominate, with *Quercus muehlenbergii* (chinkapin oak) tending to dominate drier sites and *Quercus shumardii* (Shumard oak) dominating more mesic sites. On such mesic sites dominated by *Quercus shumardii* (Shumard oak), subdominants may include *Quercus muehlenbergii* (chinkapin oak), *Quercus macrocarpa* (bur oak), *Celtis* sp. (hackberry), and *Ulmus rubra* (slippery elm).

Crosstimbers: Sandyland Oak Woodland (534)

Crosstimbers Sandyland Oak Woodland
Identifier: CES205.682.26 **MoRAP Code:** 534
Description: This vegetation type represents system occurrences that occupy particularly sandy sites (typically Deep Sand, Sand Hill, and perhaps some Sandy ecoclasses), often associated with Paluxy and Antlers Sand or alluvial or eolian deposits. Differentiation of this vegetation type is currently theoretical in anticipation that these sites may be sufficiently distinct to require a separate vegetation type, however field data is largely lacking. These sites are likely dominated by *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak). *Quercus margarettae* (sand post oak) may be present in this vegetation type, and sites should be sampled to verify, especially in Eastland and Comanche counties on Antlers Sand or sandstone members of the Twin Mountains Formation. *Carya texana* (black hickory), *Ulmus crassifolia* (cedar elm), and *Celtis laevigata* (sugar hackberry) may be well-represented in the overstory.

East-Central Texas Plains Post Oak Savanna and Woodland
Identifier: CES205.679

Geology: Typical on sedimentary formations of Tertiary age, including Eocene sands such the Queen City, Sparta, and Carrizo Sands, as well as the Wilcox and Claiborne groups. The system also occupies other Teritary formations such as the Goliad and Willis, as well as portions of the Quaternary Willis Formation.

Landform: This system occupies gently rolling to hilly topography. It is moderately dissected by drainages.

Soils: This system usually occurs on sandy to sandy loam soils, often with a marked clay subsurface horizon. Soils of this system are generally Alfisols, and are typically acidic to neutral. Typical Ecological Sites include Claypan Savannah, Claypan Prairie, Sandy Loam, Sandy, and Deep Sand.

Description: This system represents a transition from the woodlands and forests of East Texas to the prairies to the west, specifically the Blackland Prairie. Savannas and woodlands are typically dominated by *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), and *Carya texana* (black hickory). Large areas of woodland, particularly in the south and east, are dominated or co-dominated by *Quercus fusiformis* (plateau live oak) or *Quercus virginiana* (coastal live oak, east of the Brazos River). Other species, such as *Quercus incana* (bluejack oak) (on more xeric sites), *Ulmus alata* (winged elm), *Ulmus crassifolia* (cedar elm), *Quercus nigra* (water oak), *Juniperus virginiana* (eastern redcedar), *Celtis laevigata* (sugar hackberry), and *Prosopis glandulosa* (mesquite), can also be present in the overstory. To the east, *Quercus falcata* (southern red oak), *Quercus nigra* (water oak), *Liquidambar styraciflua* (sweetgum), *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), and *Carya alba* (mockernut hickory) may be conspicuous in the overstory. Shrubs may attain significant cover in the understory, with species including *Ilex vomitoria* (yaupon) (often dominant), *Callicarpa americana* (American beautyberry), *Sideroxylon lanuginosum* (gum bumelia), *Crataegus* spp. (hawthorn), *Ilex decidua* (possumhaw), *Toxicodendron radicans* (poison ivy), *Smilax bona-nox* (saw greenbrier), *Juniperus virginiana* (eastern redcedar), and *Symphoricarpos orbiculatus* (coral-berry). To the south, this system grades into vegetation more characteristic of south Texas, with *Quercus fusiformis* (plateau live oak) and *Prosopis glandulosa* (honey mesquite) becoming the primary overstory components, and shrubs of south Texas such as *Acacia rigidula* (blackbrush), *Forestiera angustifolia* (desert olive), *Condalia hookeri* (brasil), *Colubrina texensis* (Texas hogplum), *Eysenhardtia texana* (Texas kidneywood), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), and *Diospyros texana* (Texas persimmon) becoming increasingly conspicuous understory components. To the east, *Vaccinium arboreum* (farkleberry), *Morella cerifera* (wax-myrtle), *Diospyros virginiana* (common persimmon), and *Cornus florida* (flowering dogwood) may be common components of the understory. On some sites, *Ilex vomitoria* (yaupon) can form nearly continuous, sometimes impenetrable, dense shrub layer. Mid- and tallgrass species including *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Panicum virgatum* (switchgrass) are frequent in the understory where light penetration supports herbaceous cover, and also form prairie patches within the savanna, particularly on tighter soils. Other grasses present include *Andropogon gerardii* (big bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Paspalum*

plicatulum (brownseed paspalum) (to the south), *Nassella leucotricha* (Texas wintergrass), *Dichanthelium* spp. (rosette grasses), *Aristida* spp. (threeawn), and *Sporobolus cryptandrus* (sand dropseed). Non-native grass species such as *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Paspalum notatum* (bahiagrass), and *Cynodon dactylon* (bermudagrass) may dominate some sites. Forbs are often conspicuous, and may include species such as *Croton capitatus* (hog croton), *Gaillardia pulchella* (Indian blanket), *Monarda punctata* (spotted beebalm), *Rudbeckia hirta* (blackeyed Susan), *Phlox drummondii* (Drummond phlox), *Commelina erecta* (erect dayflower), *Acalypha radians* (cardinal's feather), *Verbesina virginica* (frostweed), *Aphanostephus skirrhobasis* (lazy daisy), *Froelichia gracilis* (slender snake cotton), *Cnidoscolus texanus* (Texas bull-nettle), and many others.

Drought, grazing, and fire are the primary natural processes that affect this system. Much of this system has been impacted by conversion to improved pasture or crop production. Overgrazing and fire suppression have led to increased woody cover on most extant occurrences and the invasion of some areas by problematic brush species such as *Juniperus virginiana* (eastern redcedar) (to the north) and *Prosopis glandulosa* (honey mesquite) (to the south).

VEGETATION TYPES:

Post Oak Savanna: Live Oak Motte and Woodland (602)

East-central Texas Plains Live Oak Motte and Woodland
Identifier: CES205.679.2 **MoRAP Code:** 602
Description: *Quercus fusiformis* (plateau live oak) or *Quercus virginiana* (coastal live oak) may dominate sites within the Post Oak Savanna. *Quercus stellata* (post oak) may be present in these woodlands, but typically only as a minor component of the canopy, or it may be completely absent. These occurrences become more common and may occupy large areas in the southeastern part of this region, but occur elsewhere as well. In the western portion of the Post Oak Savanna, occurrences tend to occupy Claypan Savannah and Claypan Prairie ecoclasses, though this cover type is less common than others within these soil types. *Ilex vomitoria* (yaupon), *Callicarpa americana* (American beautyberry), *Smilax bona-nox* (saw greenbrier), *Sideroxylon lanuginosum* (gum bumelia), *Toxicodendron radicans* (poison ivy), *Vitis mustangensis* (mustang grape), *Diospyros texana* (Texas persimmon), and *Zanthoxylum clava-herculis* (Hercules' club) may be present in the shrub layer. To the south, *Acacia rigidula* (blackbrush), *Colubrina texensis* (Texas hogplum), *Eysenhardtia texana* (Texas kidneywood), *Forestiera angustifolia* (desert olive), and *Zanthoxylum fagara* (colima) may form a conspicuous shrub layer. *Schizachyrium scoparium* (little bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Nassella leucotricha* (Texas wintergrass) are among the many species of grass that may be present in the herbaceous layer, though many sites may have *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Paspalum notatum* (bahiagrass), or *Cynodon dactylon* (bermudagrass) as herbaceous dominants.

Post Oak Savanna: Post Oak - Redcedar Motte and Woodland (603)
East-central Texas Plains Post Oak-Eastern Redcedar Motte and Woodland
Identifier: CES205.679.4 **MoRAP Code:** 603
Description: Occurrences of this woodland are dominated by *Quercus stellata* (post oak) and/or *Quercus fusiformis* (plateau live oak), with *Juniperus virginiana* (eastern redcedar) as either a co-dominant of the overstory or as a conspicuous dominant of the shrub layer. This vegetation type is particularly well-represented on disturbed sites, particularly where fire is excluded. Dynamics described in Ecological Site Descriptions for Claypan Savannah, Sandy Loam, and Sandy sites in the Post Oak Savanna include this vegetation type in the Oak Scrub-Shrubland Community or the Post Oak - Elm Woodland Community. These communities result from the lack of fire and the presence of heavy continuous grazing. This vegetation type may sometimes be incorrectly mapped as Post Oak / Yaupon Motte and Woodland. The shrub layer may be dominated by *Juniperus virginiana* (eastern redcedar), but *Ilex vomitoria* (yaupon) may also be conspicuous. The herbaceous layer is often poorly developed, due to the closed nature of the canopy, resulting in the reduced potential for the development of fine fuels and the consequent maintenance of the redcedar dominance through lack of fire. *Pinus taeda* (loblolly pine) may be in the overstory near the Bastrop Lost Pines ecoregion.

Post Oak Savanna: Post Oak - Live Oak Motte and Woodland (633)
East-central Texas Plains Post Oak – Live Oak Motte and Woodland
Identifier: CES205.679.33 **MoRAP Code:** 633
Description: This mixed woodland type is typically dominated by *Quercus fusiformis* (plateau live oak) and *Quercus stellata* (post oak). *Prosopis glandulosa* (honey mesquite), *Celtis laevigata* (sugar hackberry), and *Ulmus crassifolia* (cedar elm) are also commonly encountered in the overstory. *Ilex vomitoria* (yaupon), *Callicarpa americana* (American beautyberry), *Prosopis glandulosa* (honey mesquite), and *Acacia farnesiana* (huisache) are commonly encountered in the shrub layer. Southern occurrences may have species such as *Condalia hookeri* (brasil), *Diospyros texana* (Texas persimmon), and *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear) as significant components of the shrub layer. Herbaceous cover is typically low.

Post Oak Savanna: Post Oak Motte and Woodland (604)
East-Central Texas Plains Post Oak Motte and Woodland
Identifier: CES205.679.6 **MoRAP Code:** 604
Description: This vegetation type generally represents the deciduous woodland component of the system. The typical occurrence is dominated by *Quercus stellata* (post oak), with *Quercus marilandica* (blackjack oak) and/or *Quercus fusiformis* (plateau live oak) (particularly in the south) also present. *Carya texana* (black hickory) may be a significant component of the overstory, particularly on deep sands. Depending on site history and edaphic conditions, other species may be present in the overstory or may be better represented as shrubs. Such species as *Celtis laevigata* (sugar hackberry), *Prosopis glandulosa* (honey mesquite), *Quercus nigra* (water oak), *Diospyros virginiana* (eastern persimmon), *Juniperus virginiana* (eastern redcedar), *Ulmus alata* (winged elm), and *Ulmus crassifolia* (cedar elm) are often overstory components, and are often stunted (< 12 m in height). The shrub layer includes species such as *Callicarpa americana* (American

beautyberry), *Ilex decidua* (possumhaw), *Ilex vomitoria* (yaupon), *Sideroxylon lanuginosum* (gum bumelia), *Smilax bona-nox* (saw greenbrier), *Symphoricarpos orbiculatus* (coral-berry), *Vaccinium arboreum* (farkleberry), and *Zanthoxylum clava-herculis* (Hercules' club). Herbaceous components are often represented by components of the surrounding prairies, primarily *Schizachyrium scoparium* (little bluestem), but also *Sorghastrum nutans* (Indiangrass), *Andropogon gerardii* (big bluestem), and, to the south and east, *Paspalum plicatulum* (brownseed paspalum). Other grass species may include *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Elymus canadensis* (Canada wildrye), *Panicum virgatum* (switchgrass), *Paspalum floridanum* (Florida paspalum), *Paspalum setaceum* (thin paspalum), *Sporobolus compositus* (tall dropseed), and *Tridens flavus* (purpletop).

Post Oak Savanna: Post Oak - Yaupon Motte and Woodland (613)

East-central Texas Plains Post Oak-Yaupon Motte and Woodland

Identifier: CES205.679.7 **MoRAP Code:** 613

Description: Many occurrences of this common vegetation type may have an exceedingly dense shrub layer dominated by *Ilex vomitoria* (yaupon). Such occurrences are conspicuous and widespread where lack of fire and heavy continuous grazing have allowed this woody species to dominate. The overstory is dominated by *Quercus stellata* (post oak). *Juniperus virginiana (*eastern redcedar) or, in southern occurrences *Quercus fusiformis* (plateau live oak) may also be present. Dynamics described in Ecological Site Descriptions for Claypan Savannah, Sandy Loam, and Sandy sites in the Post Oak Savanna include this mapping system in the Oak Scrub-Shrubland Community. The dense shrub layer is generally dominated by *Ilex vomitoria* (yaupon), almost to the exclusion of other shrub species, and the closed shrub canopy limits the development of a significant herbaceous layer. Near the Bastrop Lost Pines region, *Pinus taeda* (loblolly pine) may be an important overstory tree.

Post Oak Savanna: Savanna Grassland (607)

East-central Texas Plains Post Oak Savanna Grassland

Identifier: CES205.679.9 **MoRAP Code:** 607

Description: This vegetation type represents the herbaceous expression of the overall system, which is a mosaic of woody and herbaceous cover types as suggested by reference to a savanna. These grasslands are often dominated by mid- and tallgrass species often present in the understory of woody expressions of the system. Dominant species include *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Panicum virgatum* (switchgrass). Other grasses present include *Andropogon gerardii* (big bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Paspalum plicatulum* (brownseed paspalum) (to the south), *Nassella leucotricha* (Texas wintergrass), and *Sporobolus cryptandrus* (sand dropseed). Non-native grass species such as *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Paspalum notatum* (bahiagrass), *Panicum coloratum* (kleingrass), *Dichanthium annulatum* (Kleberg bluestem), and *Cynodon dactylon* (bermudagrass) may dominate some sites. These grasslands may be difficult to differentiate in areas of transition to Blackland Prairie or Coastal Prairie. Claypan Savannah and Claypan Prairie ecoclasses may support occurrences of this vegetation type, particularly where land management practices including prescribed fire and other forms of brush management are implemented.

Post Oak Savanna: Live Oak Shrubland (605)

East-central Texas Plains Live Oak Shrubland
Identifier: CES205.679.5 **MoRAP Code:** 605
Description: These evergreen shrublands often occur on sandy soils in the vicinity of live oak woodlands. They are dominated by the shrub form of *Quercus fusiformis* (plateau live oak, often referred to locally as running live oak) that may represent clones forming dense, more or less continuous, shrub canopy with occasional emergent live oaks. Some sites may also have other shrub species such as *Ilex vomitoria* (yaupon), *Acacia rigidula* (blackbrush), and/or *Condalia hookeri* (brasil). The closed shrub canopy limits the development of the herbaceous layer.

Post Oak Savanna: Redcedar Slope Forest (621)

East-central Texas Plains Eastern Redcedar Slope Woodland and Forest
Identifier: CES205.679.11 **MoRAP Code:** 621
Description: Uncommon, relatively closed canopy woodland or forest on slopes greater than twenty percent and dominated by *Juniperus virginiana* (eastern redcedar). This type often occupies the Sandstone Hill ecoclass and is often associated with areas near the contact of the Reklaw Formation and the Carrizo Sand.

Post Oak Savanna: Oak - Redcedar Slope Forest (623)

East-central Texas Plains Oak – Eastern Redcedar Slope Woodland and Forest
Identifier: CES205.679.14 **MoRAP Code:** 623
Description: Uncommon forest on slopes greater than twenty percent with the canopy co-dominated by oak species (such as *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), and *Quercus shumardii* (Shumard oak)) and *Juniperus virginiana* (eastern redcedar). *Ulmus crassifolia* (cedar elm) may also be present to common in the canopy. This type occurs in areas near the Red River on soils of the Shallow and Sandy Loam ecoclasses in Grayson and Fannin counties, as well further south on various soils between Milam and Gonzales counties (in Phase 1). Near the Bastrop Lost Pines region, *Pinus taeda* (loblolly pine) may be an important overstory species.

Post Oak Savanna: Live Oak Slope Forest (622)

East-central Texas Plains Live Oak Slope Forest and Woodland
Identifier: CES205.679.22 **MoRAP Code:** 622
Description: This broad-leaved evergreen forest or woodland is mapped on slopes greater than 20% and is dominated by *Quercus fusiformis* (plateau live oak), though hardwood species may also occur in the canopy.

Post Oak Savanna: Post Oak - Live Oak Slope Forest (643)

East-central Texas Plains Post Oak – Live Oak Slope Forest and Woodland
Identifier: CES205.679.43 **MoRAP Code:** 643
Description: This woodland of mixed broad-leaved evergreen and deciduous overstory is dominated by *Quercus stellata* (post oak) and *Quercus fusiformis* (plateau live oak) and occupies slopes greater than 20%.

Post Oak Savanna: Oak - Hardwood Slope Forest (624)

Identifier: CES205.679.16 **MoRAP Code:** 624

Description: This deciduous forest vegetation type is found on slopes greater than twenty percent along the Red River and its tributaries, as well as on slopes from Milam to Gonzales counties and elsewhere. Slopes on calcareous substrates along the Red River may be dominated by species such as *Quercus muehlenbergii* (chinkapin oak), *Quercus shumardii* (Shumard oak), *Ulmus americana* (American elm), and *Ulmus crassifolia* (cedar elm). In the south, slopes are generally not on calcareous substrate and *Quercus muehlenbergii* (chinkapin oak) is lacking. On these sites, slopes may be dominated by *Quercus stellata* (post oak), *Ulmus crassifolia* (cedar elm), *Ulmus americana* (American elm), *Quercus marilandica* (blackjack oak) and *Celtis laevigata* (sugar hackberry) and less commonly *Quercus shumardii* (Shumard oak). This vegetation type is poorly understood, and may be compositionally quite similar to surrounding woodlands. The greater topographic relief associated with this system results in more mesic conditions leading to the development of denser overstory canopy.

Edwards Plateau Dry-Mesic Slope Forest and Woodland
Identifier: CES303.656

Geology: Found on limestone (primarily Creatceous or Pennsylvanian) slopes within the Edwards Plateau and adjacent ecoregions, including the Carbonate Cross Timbers in the Palo Pinto County area and the Callahan Divide. Cuestas of cretaceous chalk in the Blackland Prairie and calcareous slopes of the Crosstimbers may also be occupied by this system.

Landform: Slopes generally greater than 20 percent.

Soils: Stones and boulders are conspicuous on the soil surface. Soils are generally dark clay to clay loam and shallow. Steep Rocky and Steep Adobe Ecological Sites may be associated with this system.

Description: This system occurs on dry to mesic, middle slopes of the rolling uplands and escarpments of the Edwards Plateau and similar sites. The canopy is typically dominated or co-dominated by deciduous trees, including *Quercus buckleyi* (Texas oak), *Quercus laceyi* (Lacey oak), *Quercus sinuata* var. *breviloba* (white shin oak), *Fraxinus texensis* (Texas ash), *Ulmus crassifolia* (cedar elm), *Prunus serotina* ssp. *eximia* (escarpment black cherry), *Juglans major* (Arizona walnut), and/or *Celtis laevigata* var. *reticulata* (netleaf hackberry). *Quercus fusiformis* (plateau live oak) and *Juniperus ashei* (Ashe juniper) are often present and are sometimes co-dominant with deciduous species of this system. Canopy closure is variable, and this system can be expressed as forests or woodlands. The shrub layer may be well-represented, especially where the overstory canopy is discontinuous. Species such as *Aesculus pavia* var. *flavescens* (red buckeye), *Cercis canadensis* var. *texensis* (Texas redbud), *Forestiera pubescens* (elbowbush), *Ungnadia speciosa* (Mexican buckeye), *Ceanothus herbaceus* (Jersey tea), *Frangula caroliniana* (Carolina buckthorn), *Sophora secundiflora* (Texas mountain-laurel), *Viburnum rufidulum* (rusty blackhaw), *Rhus* spp. (sumac), *Vitis* spp. (grape), and *Garrya ovata* (silktassel) may be present in the shrub layer. With the large amount of exposed rock, frequent accumulation of leaf litter, and significant canopy closure, herbaceous cover is generally sparse, with *Carex planostachys* (cedar sedge) often present. Woodland forbs such as *Tinantia anomala* (widowstears), *Chaptalia texana*

(silver-puff), *Nemophila phacelioides* (baby blue-eyes), *Salvia roemeriana* (cedar sage), *Lespedeza texana* (Texas lespedeza), and various ferns may also be present, if patchy. Grasses such as *Schizachyrium scoparium* (little bluestem) and *Bouteloua* spp. (gramas) may occur, typically scattered and patchy.

VEGETATION TYPES:

Edwards Plateau: Ashe Juniper Slope Forest (901)
Edwards Plateau Ashe Juniper Dry-Mesic Slope Forest and Woodland
Identifier: CES303.656.1 **MoRAP Code:** 901
Description: Forest or woodland of slopes generally greater than 20 percent on steep rocky sites with coniferous evergreen canopy cover. The canopy of these sites is dominated by *Juniperus ashei* (Ashe juniper), but usually with *Quercus fusiformis* (plateau live oak) and a deciduous component present (often *Quercus buckleyi* (Texas oak), *Quercus sinuata* var. *breviloba* (white shin oak), or *Quercus laceyi* (Lacey oak), at least). The canopy is usually relatively closed and the sites are rocky, resulting in a sparse and depauperate shrub and herbaceous layer. However, *Juniperus ashei* (Ashe juniper) may also form a somewhat dense layer to within a meter of the forest floor. *Sophora secundiflora* (Texas mountain-laurel), *Diospyros texana* (Texas persimmon), *Mahonia trifoliolata* (agarito), *Mimosa borealis* (fragrant mimosa), *Quercus sinuata* var. *breviloba* (white shin oak), and *Sideroxylon lanuginosum* (gum bumelia) may also be components of the shrub layer. These juniper dominated slopes tend to be drier, and may be more frequent on slopes with south and west aspects.

Edwards Plateau: Live Oak Slope Forest (902)
Edwards Plateau Live Oak Dry-Mesic Slope Forest and Woodland
Identifier: CES303.656.2 **MoRAP Code:** 902
Description: Forest or woodland dominated by *Quercus fusiformis* (plateau live oak) and occupying generally rocky sites on slopes greater than 20 percent. *Juniperus ashei* (Ashe juniper) is typically present, and may be particularly conspicuous as an understory component. Deciduous species such as *Quercus buckleyi* (Texas oak), *Quercus sinuata* var. *breviloba* (white shin oak), *Quercus laceyi* (Lacey oak), *Ulmus crassifolia* (cedar elm), and others may also be present in the canopy. These sites tend to be drier than similar sites that are dominated by a mix of deciduous species in the canopy. The shrub layer is variable and may contain small individuals of the canopy species, as well as species such as *Sophora secundiflora* (Texas mountain-laurel), *Diospyros texana* (Texas persimmon), *Sideroxylon lanuginosum* (gum bumelia), and *Mahonia trifoliolata* (agarito). Relatively closed canopy, rocky substrate, and significant litter layer results in a sparse herbaceous layer.

Edwards Plateau: Oak - Ashe Juniper Slope Forest (903)
Edwards Plateau Oak-Ashe Juniper Dry-Mesic Slope Forest and Woodland
Identifier: CES303.656.4 **MoRAP Code:** 903
Description: Forests or woodlands on steep rocky slopes, co-dominated by *Juniperus ashei* (Ashe juniper) and deciduous species such as *Quercus buckleyi* (Texas oak), *Quercus laceyi* (Lacey oak), *Quercus muehlenbergii* (chinkapin oak), and *Quercus sinuata* var. *breviloba* (white shin oak). Other deciduous hardwood species such as *Ulmus crassifolia*

(cedar elm), *Juglans major* (Arizona walnut), *Prunus serotina* var. *eximia* (escarpment black cherry), *Celtis reticulata* (netleaf hackberry), and *Fraxinus texensis* (texas ash) may also be present to common. *Quercus fusiformis* (plateau live oak) is also frequently conspicuous in the canopy. These sites are intermediate in dryness between juniper dominated slopes and those dominated by deciduous hardwood species. *Juniperus ashei* (Ashe juniper) may reach large sizes on such slopes. The shrub layer is variable but may be well-developed within canopy gaps. Species in the shrub layer may include *Sophora secundiflora* (Texas mountain-laurel), *Forestiera pubescens* (elbowbush), *Ugnadia speciosa* (Mexican buckeye), *Diospyros texana* (Texas persimmon), *Aesculus pavia* var. *flavescens* (red buckeye), *Cercis canadensis* var. *texensis* (Texas redbud), *Sideroxylon lanuginosum* (gum bumelia), and others. The herbaceous layer is generally sparse and depauperate.

Edwards Plateau: Oak - Hardwood Slope Forest (904)
Edwards Plateau Deciduous Dry-Mesic Slope Forest and Woodland
Identifier: CES303.656.6 **MoRAPCode:** 904
Description: Forest or woodland on slopes generally greater than 20 percent on steep rocky sites with significant deciduous canopy cover. These sites tend to be somewhat more mesic than similar sites dominated by evergreen canopy. The overstory may be diverse, with species such as *Quercus buckleyi* (Texas oak), *Quercus laceyi* (Lacey oak), *Quercus sinuata* var. *breviloba* (white shin oak), *Quercus muehlenbergii* (chinkapin oak), *Ulmus crassifolia* (cedar elm), *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Fraxinus texensis* (Texas ash), *Prunus serotina* var. *eximia* (escarpment black cherry), *Juglans major* (Arizona walnut), and others. This system may occupy slopes on cretaceous limestone or chalk occurring north and east of the Edwards Plateau. In these situations, *Quercus shumardii* (Shumard oak), *Quercus muehlenbergii* (chinkapin oak), *Ulmus rubra* (slippery elm), and/or *Juglans nigra* (black walnut) may be present in the canopy, and may represent significant components of it. *Quercus fusiformis* (plateau live oak) and *Juniperus ashei* (Ashe juniper) may be present, often reaching large size under these conditions. Species such as *Aesculus pavia* var. *flavescens* (red buckeye), *Cercis canadensis* var. *texensis* (Texas redbud), *Cornus drummondii* (rough-leaf dogwood), *Forestiera pubescens* (elbowbush), *Ungnadia speciosa* (Mexican buckeye), *Ceanothus herbaceus* (Jersey tea), *Frangula caroliniana* (Carolina buckthorn), *Viburnum rufidulum* (rusty blackhaw), *Vitis* spp. (grape), and *Garrya ovata* (silktassel) tend to occur in the shrub layer more frequently in this vegetation type than in the evergreen vegetation types of this system. Though dense canopy, rocky substrate, and significant litter accumulation results in a sparse herbaceous layer, forbs such as *Tinantia anomala* (widowstears), *Chaptalia texana* (silver-puff), *Nemophila phacelioides* (baby blue-eyes), *Salvia roemeriana* (cedar sage), *Lespedeza texana* (Texas lespedeza), and various ferns may be present, if patchy.

Edwards Plateau Limestone Savanna and Woodland
Identifier: CES303.660

Geology: Primarily found on Cretaceous limestones of the Edwards Plateau and Limestone (also referred to as Lampasas) Cutplain, but also associated with Pennsylvanian limestones of the Palo Pinto Formation and Winchell, Ranger, Home Creek Limestone in the vicinity of Palo Pinto County, as well as on Cretaceous chalk formations in the Northern Blackland Prairie and Cretaceous limestones of the Western Crosstimbers and Rolling Plains.

Landform: Rolling to level topography, often on plateau tops, but also on gentle slopes.

Soils: Generally loams, clay loams, or clays, often with limestone parent material apparent. Low Stony Hill, Adobe, Clay Loam, and Shallow Ecological Sites are commonly associated with this system.

Description: This upland system forms the matrix vegetation type of the Edwards Plateau. It is typified by a mosaic of evergreen oak and juniper forests, woodlands and savannas over shallow soils of rolling uplands and adjacent upper slopes within the Edwards Plateau and some adjacent ecoregions where limestone is present. Significant open areas dominated by grasses may resemble prairies, and such open occurrences may grade into prairie types to the west (shortgrass prairie), northwest (Central mixedgrass), north (Southeastern Great Plains tallgrass), and east (Blackland). Species such as *Quercus fusiformis* (plateau live oak) or *Juniperus ashei* (Ashe juniper) often dominate the canopy of this system. Other canopy species may include *Quercus buckleyi* (Texas oak), *Quercus laceyi* (Lacey oak, in the southwestern part of the Edwards Plateau), *Ulmus crassifolia* (cedar elm), *Fraxinus texensis* (Texas ash), *Quercus sinuata* var. *breviloba* (white shin oak), and *Quercus vaseyana* (Vasey shin oak) (especially in the western part of the region). *Pinus remota* (paper-shell pinyon) and *Juniperus pinchotii* (redberry juniper) may dominate or be a component of the canopy to the southwest and west of the region. The shrub layer may be fairly well-developed, containing overstory species, as well as species such as *Diospyros texana* (Texas persimmon), *Mahonia trifoliolata* (agarito), *Sophora secundiflora* (Texas mountain-laurel), *Prosopis glandulosa* (honey mesquite), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), and *Cylindropuntia leptocaulis* (tasajillo). Many uplands have mottes of *Quercus fusiformis* (plateau live oak) punctuating a generally grass dominated landscape, forming what has been referred to as a motte-savanna. The understory can contain various graminoid species, including *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Bothriochloa barbinodis* (cane bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Nassella leucotricha* (Texas wintergrass), *Sorghastrum nutans* (Indiangrass), *Hilaria belangeri* (curlymesquite), *Bouteloua dactyloides* (buffalograss), *Andropogon gerardii* (big bluestem), *Bouteloua hirsuta* (hairy grama), *Bouteloua rigidiseta* (Texas grama), *Muhlenbergia reverchonii* (seep muhly), *Muhlenbergia lindheimeri* (Lindheimer muhly), *Aristida purpurea* (purple threeawn), and/or *Carex planostachys* (cedar sedge). The composition of the grassland component is driven by grazing, fire, and climate. Shortgrass species such as *Bouteloua dactyloides* (buffalograss) and *Hilaria belangeri* (curlymesquite) are favored under heavy continuous grazing and/or dry climate (to the west), while mid- and tallgrasses are favored under more mesic conditions, more well-developed soils, and well-managed grazing. The herbaceous stratum is often dominated by non-native grass species, especially *Bothriochloa ischaemum* var.

songarica (King Ranch bluestem). Some disturbed areas on hard-bedded limestone of the western plateau are now dominated by mesquite woodland. Natural mesquite woodlands are believed to have occurred on the deeper soils of adjacent riparian systems.

VEGETATION TYPES:

Edwards Plateau: Ashe Juniper Motte and Woodland (1101)

Edwards Plateau Limestone Ashe Juniper Motte and Woodland
Identifier: CES303.660.1 **MoRAP Code:** 1101
Description: These relatively closed woodlands are very common on uplands on limestone in the Edwards Plateau and adjacent ecoregions. *Juniperus ashei* (Ashe juniper) is the clear dominant in the canopy and a conspicuous component of the shrub layer as well. *Juniperus virginiana* (eastern redcedar) may be present in the canopy to the northeast, while *Juniperus pinchotii* (redberry juniper) may be present to the west. Occurrences containing thick stands of juniper are sometimes referred to as "cedar breaks." Some sites mapped as this type may actually be dominated by *Pinus remota* (paper-shell pinyon), though *Juniperus ashei* (Ashe juniper) or *Juniperus pinchotii* (redberry juniper) are often present in the canopy as well. Pinyon woodlands tend to occur on relatively xeric sites and have a sparse herbaceous layer with species such as *Bouteloua curtipendula* (sideoats grama), *Hilaria belangeri* (curlymesquite), *Erioneuron pilosum* (hairy tridens), and others. *Quercus fusiformis* (plateau live oak) is often a significant component in the canopy, and other species such as *Quercus buckleyi* (Texas oak), *Quercus sinuata* var. *breviloba* (white shin oak), *Quercus vaseyana* (Vasey shin oak), *Quercus laceyi* (Lacey oak), *Ulmus crassifolia* (cedar elm), and *Celtis* spp. (hackberry) may also be common. The shrub layer may be dense and dominated by *Juniperus ashei* (Ashe juniper), but *Mahonia trifoliolata* (agarito), *Diospyros texana* (Texas persimmon), *Prosopis glandulosa* (honey mesquite), and other species may be present. Dense canopy cover often leads to a sparse to nearly absent herbaceous layer, sometimes with only *Carex planostachys* (cedar sedge) present.

Edwards Plateau: Live Oak Motte and Woodland (1102)

Edwards Plateau Limestone Live Oak Motte and Woodland
Identifier: CES303.660.2 **MoRAP Code:** 1102
Description: These relatively closed woodlands are common throughout the Edwards Plateau and adjacent ecoregions on limestone. *Quercus fusiformis* (plateau live oak) dominates the overstory, however other species such as *Quercus sinuata* var. *breviloba* (white shin oak), *Ulmus crassifolia* (cedar elm), *Quercus buckleyi* (Texas oak), *Celtis* spp. (hackberry), *Quercus laceyi* (Lacey oak), *Quercus stellata* (post oak), and *Quercus vaseyana* (Vasey shin oak) may also be present to common. *Juniperus ashei* (Ashe juniper) and/or *Juniperus pinchotii* (redberry juniper) may be present in the canopy and shrub layer, but are not typically dominant. The shrub layer is generally patchy and may include species such as *Diospyros texana* (Texas persimmon), *Prosopis glandulosa* (honey mesquite), *Mahonia trifoliolata* (agarito), *Opuntia engelmannii* (prickly pear), and *Opuntia leptocaulis* (tasajillo), as well as small individuals of the overstory species. Cover of the herbaceous layer may be high, but sparse if woody cover is high, with species including *Schizachyrium scoparium* (little bluestem), *Bouteloua* spp. (grama), *Nassella leucotricha* (Texas wintergrass), *Aristida* spp. (threeawn), and *Carex planostachys* (cedar sedge). Fires

in this system tend to remove shrub species (especially *Juniperus ashei* (Ashe juniper)), but the overstory typically remains intact. Openings between mottes are typically grass dominated with the same species that occur as understory components in the woodlands.

Edwards Plateau: Deciduous Oak - Evergreen Motte and Woodland (1103)
Edwards Plateau Limestone Deciduous-Evergreen Motte and Woodland
Identifier: CES303.660.4 **MoRAP Code:** 1103
Description: These woodlands are intermediate between those strongly dominated by the evergreen components *Juniperus ashei* (Ashe juniper) and *Quercus fusiformis* (plateau live oak) and those dominated by deciduous components, particularly oaks such as *Quercus buckleyi* (Texas Oak), *Quercus sinuata* var. *breviloba* (white shin oak), and *Quercus laceyi* (Lacey oak). Other deciduous overstory species that may be present include *Ulmus crassifolia* (cedar elm) and *Celtis* sp. (hackberry). The understory of these sites is similar to that of the related woodlands with shrub species such as *Diospyros texana* (Texas persimmon), *Mahonia trifoliata* (agarito), *Sophora secundiflora* (Texas mountain-laurel), *Prosopis glandulosa* (honey mesquite), and *Opuntia engelmannii* (prickly pear), and relatively sparse herbaceous layer typically dominated by graminoid species common to the surrounding upland sites such as *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Schizachyrium scoparium* (little bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Dichanthelium* sp. (rosette grass), *Bouteloua* sp. (grama), *Nassella leucotricha* (Texas wintergrass) and others.

Edwards Plateau: Oak - Hardwood Motte and Woodland (1104)
Edwards Plateau Limestone Deciduous Motte and Woodland
Identifier: CES303.660.5 **MoRAP Code:** 1104
Description: While *Quercus buckleyi* (Texas oak), *Celtis* spp. (hackberries), and *Ulmus crassifolia* (cedar elm) are significant elements of the canopy of nearby slope forests and woodlands, they may also dominate upland sites. Other deciduous species, such as *Quercus sinuata* var. *breviloba* (white shin oak), *Celtis laevigata* (sugar hackberry), *Prosopis glandulosa* (mesquite), and *Quercus stellata* (post oak), may also occupy the canopy, with lesser amounts of evergreen components, such as *Quercus fusiformis* (live oak) and *Juniperus ashei* (Ashe juniper), present. These sites with dominant deciduous canopies on upland Ecological Sites (such as Low Stony Hill, Shallow, and Adobe) are less commonly encountered than woodlands dominated by some mix of an evergreen canopy.

Edwards Plateau: Post Oak Motte and Woodland (1114)
Edwards Plateau Limestone Post Oak Motte and Woodland
Identifier: CES303.660.6 **MoRAP Code:** 1114
Description: These woodlands and mottes tend to occur on Redland Ecological Sites, but may also be found on sandy benches. On the Edwards Plateau, Redland sites are often associated with cherty or siliceous members of limestone formations such as Edwards Limestone, Tanyard, Gorman, and Honeycut Formations. Sandy Cretaceous formations (such as Hensell Sand) may also harbor this vegetation type. These situations provide slightly more acidic conditions relative to the surrounding landscape. The overstory tends to be open and dominated by *Quercus stellata* (post oak), though *Quercus marilandica* (blackjack oak), *Quercus fusiformis* (plateau live oak), *Ulmus crassifolia* (cedar elm),

Juniperus ashei (Ashe juniper), and *Quercus buckleyi* (Texas oak) may also be present. The shrub layer is patchy and may contain small individuals of the canopy species as well as other species. The herbaceous layer is often dominated by *Schizachyrium scoparium* (little bluestem), *Nassella leucotricha* (Texas wintergrass), *Bouteloua curtipendula* (sideoats grama), and other species, but may be dominated by the non-native *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem). In areas of transition to the Crosstimbers (such as in the Limestone Cut Plain and Carbonate Cross Timbers), it may be difficult to distinguish this system from Crosstimbers Oak Forest and Woodland.

Edwards Plateau: Savanna Grassland (1107)
Edwards Plateau Limestone Savanna Grassland
Identifier: CES303.660.9 **MoRAP Code:** 1107
Description: Uplands of the Edwards Plateau are frequently described as a mosaic of woodlands, shrublands, and grasslands. Areas with reduced woody cover may occupy sites of considerable size, depending on the land use history, management, and fire history. While these sites have sometimes been referred to as prairies, they are more appropriately considered a part of the savanna mosaic. Grasslands in areas transitioning to regions with a prairie matrix (such as the northwestern transitions to shortgrass prairie, northern transitions to mixedgrass prairie, and northeastern and eastern transitions to tallgrass prairie), may closely resemble and be difficult to distinguish from these prairie types. *Schizachyrium scoparium* (little bluestem), *Arisitida purpurea* (purple threeawn), *Nassella leucotricha* (Texas wintergrass), and *Bouteloua curtipendula* (sideoats grama) are common dominants on these sites, but *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) and/or *Cynodon dactylon* (bermudagrass) frequently dominate or are significant components. Numerous other grass species, including *Aristida* sp. (threeawn), *Bothriochloa barbinodis* (cane bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Sorghastrum nutans* (Indiangrass), *Bouteloua hirsuta* var. *pectinata* (tall grama), *Bouteloua trifida* (red grama), *Bouteloua rigidiseta* (Texas grama), *Bouteloua hirsuta* (hairy grama), *Erioneuron pilosum* (fluffgrass), *Hilaria belangeri* (curly mesquite), and many others may be present or dominate these sites. Open, gentle slopes underlain by Glen Rose Limestone often maintain grasslands that are often dominated by *Bouteloua pectinata* (tall grama) and *Muhlenbergia reverchonii* (seep muhly). Sites under heavy, continuous grazing, or sites with thin or xeric soils tend to be dominated by shortgrass species such as *Bouteloua dactyloides* (buffalograss), *Hilaria belangeri* (curly mesquite), or *Erioneuron pilosum* (fluffgrass). Numerous forb species are also present in the herbaceous layer. Woody cover constitutes less than 25% of the canopy and is made up of various species including, but not limited to, *Prosopis glandulosa* (mesquite), *Juniperus ashei* (Ashe juniper), *Mahonia trifoliolata* (agarito), *Quercus sinuata* var. *breviloba* (white shin oak), *Quercus fusiformis* (plateau live oak), *Diospyros texana* (Texas persimmon), *Ziziphus obtusifolia* (lotebush), and/or *Sophora secundiflora* (Texas mountain-laurel).

Edwards Plateau Mesic Canyon (not mapped)
Identifier: CES303.038

Geology: Associated with lower Cretaceous limestones of the Edwards Plateau, often on the Glen Rose or related formations.

Landform: This system occurs on lower slopes (toe slopes) and onto the margins of adjacent valleys of small drainages. Occurrences are generally found in steep canyons where insolation is minimal, or on lower positions on north facing slopes.

Soils: Rich loams, often very rocky, with little soil development. Steep Rocky Ecological Site, in part.

Description: Currently this system is not mapped individually, but will occur as inclusions within mapped Edwards Plateau slope, riparian, or floodplain forests. Its presence at lower slope positions make it transitional between slope and riparian/floodplain systems. This system is largely endemic to the Edwards Plateau ecoregion and occurs on canyon bottoms, mesic lower slopes and steep canyons, primarily in the Southern Balcones Escarpment, but also in the Eastern Balcones Escarpment (also on the Limestone Cutplain). This system also includes areas of cliff faces and lower slopes of boxed canyons occurring as narrow, sometimes long bands in areas often with seeps where moisture is consistently more available than on adjacent slopes. The tree canopy is generally closed. Common components include *Ulmus crassifolia* (cedar elm), *Juglans major* (Arizona walnut), *Quercus buckleyi* (Texas oak), *Quercus laceyi* (Lacey oak), *Prunus serotina* var. *eximia* (escarpment black cherry) (becoming less common to the north), *Fraxinus texensis* (Texas ash) (dominant in the northeastern plateau), *Quercus muehlenbergii* (chinkapin oak), *Tilia americana* (American basswood), and *Acer grandidentatum* (bigtooth maple). Canyon bottoms may have scattered *Quercus macrocarpa* (bur oak). Substrate (limestone) and topographic position (north and east aspects and lower slopes) are the dominant characteristics of this system. Small seepage areas may be identified as the Edwards Plateau Cliff system, and are often dominated by *Adiantum capillus-veneris* (maiden-hair fern), with *Thelypteris ovata* var. *lindheimeri* (Lindheimer's maidenfern) on nearby moist habitats. Fire probably plays little role in the system, while grazing and browsing (by native as well as exotic ungulates) may play an important role in recruitment and understory composition. Adjacent, drier slopes are usually dominated by various *Quercus* species and *Juniperus ashei* (Ashe juniper). Woodlands and forests downslope of occurrences of this system may be well-developed riparian woodlands, small stringers of *Platanus occidentalis* (American sycamore), or this system may occupy the lowest topographic positions along extremely small, rocky drainages.

VEGETATION TYPES:

Edwards Plateau Bigtooth Maple Mesic Canyon (not mapped)
Identifier: CES303.038.1 **MoRAP Code:** not mapped
Description: This vegetation type occupies the most mesic sites and is characterized by the presence of *Acer grandidentatum* (bigtooth maple). *Quercus muehlenbergii* (chinkapin oak) is a common associate, along with *Prunus serotina* var. *eximia* (escarpment black cherry), *Juglans major* (Arizona walnut), and other deciduous species. Overstory is usually

a closed canopy. Mesic indicators such as *Aquilegia canadensis* (wild columbine) and *Clematis texensis* (scarlet clematis) may be present. This system is found throughout the range of the system.

Edwards Plateau Mixed Deciduous Mesic Canyon (not mapped)

Identifier: CES303.038.2 **MoRAP Code:** not mapped

Description: Occurrences are somewhat drier than the similar Bigtooth Maple sites, and lack *Acer grandidentatum* (bigtooth maple). Sites are characterized by the presence of a relatively closed canopy of deciduous hardwoods, including *Quercus muehlenbergii* (chinkapin oak), *Q. buckleyi* (Texas oak), *Q. laceyi* (Lacey oak), *Prunus serotina* var. *eximia* (escarpment black cherry), *Juglans major* (Arizona walnut), and *Ulmus rubra* (slippery elm).

Llano Uplift Acidic Forest, Woodland, and Glade
Identifier: CES303.657

Geology: Intrusive igneous bedrock of Precambrian age.

Landform: Granite hills rising from a gently rolling landscape that is moderately dissected by drainages.

Soils: Generally sandy loams, with gravelly soils common. Soils are generally acidic and coarse, resulting from weathering of the underlying granite. Many areas of exposed bedrock are present. Most frequently encountered Ecological Sites include Shallow Granite, Sandy Loam, Red Savannah, Gravelly Sandy Loam, Shallow Ridge, Granite Gravel, Sandstone Hill, and Granite Hill.

Description: It comprises a mosaic of vegetation types, including closed-canopy forests, open woodlands, savannas and sparsely vegetated rock outcrops. Common trees include *Quercus marilandica* (blackjack oak), *Quercus fusiformis* (plateau live oak), *Quercus stellata* (post oak), *Carya texana* (black hickory), *Ulmus crassifolia* (cedar elm), and *Prosopis glandulosa* (mesquite). *Juniperus ashei* (Ashe juniper) may be present, but is much less common than in the surrounding landscape. Subcanopy species may include *Diospyros texana* (Texas persimmon), *Aloysia gratissima* (whitebrush), *Ungnadia speciosa* (Mexican buckeye), *Ziziphus obtusifolia* (lotebush), *Eysenhardtia texana* (Texas kidneywood), *Aesculus glabra* var. *arguta* (Ohio buckeye), *Opuntia engelmannii* (prickly pear), *Yucca elata* (palmilla), *Nolina texana* (sacahuista), and *Opuntia leptocaulis* (tasajillo). Grasslands may be dominated by *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), *Panicum virgatum* (switchgrass), *Bouteloua hirsuta* (hairy grama), *Bouteloua curtipendula* (sideoats grama), *Nassella leucotricha* (Texas wintergrass), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Plantago wrightiana* (Wright plantain). Granitic glades and barrens are sparsely vegetated by crustose and foliose lichens, several ferns and fern allies, and cacti. This system also includes small (up to 16 m in diameter) shallow depressions that hold rainwater and support wetland flora including the Texas endemic, *Isoetes lithophila* (rock quillwort).

VEGETATION TYPES:

Llano Uplift: Live Oak Woodland (1602)
Llano Uplift Acidic Live Oak Forest and Woodland
Identifier: CES303.657.2 **MoRAP Code:** 1602
Description: Canopy conspicuously dominated by *Quercus fusiformis* (plateau live oak), this vegetation type forms the common forest and woodland cover in the uplift area. *Juniperus ashei* (Ashe juniper) may be present but generally occurs at lower cover than is typical of the surrounding limestones. *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Ulmus crassifolia* (cedar elm), and *Carya texana* (black hickory) may also be present in the canopy, but *Quercus fusiformis* (plateau live oak) clearly dominates. *Diospyros texana* (Texas persimmon), *Aloysia gratissima* (whitebrush), *Mahonia trifoliolata* (agarito), *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), *Prosopis glandulosa* (mesquite), and *Opuntia engelmannii* (prickly pear) are common shrubs in the understory. *Schizachyrium scoparium* (little bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Bouteloua hirsuta* (hairy grama), and *Bouteloua curtipendula* (sideoats grama) are common constituents of the herbaceous layer. *Schizachyrium scoparium* (little bluestem) is a common dominant. Some areas may be dominated by *Prosopis glandulosa* (mesquite), often with thick understory shrubs of *Aloysia gratissima* (whitebrush).

Llano Uplift: Post Oak Woodland (1604)
Llano Uplift Acidic Deciduous Forest and Woodland
Identifier: CES303.657.6 **MoRAP Code:** 1604
Description: Forests and woodlands not dominated by *Quercus fusiformis* (plateau live oak) (though it is often present), are generally dominated by *Quercus stellata* (post oak), with *Quercus marilandica* (blackjack oak) and *Carya texana* (black hickory) also present to co-dominant. *Ulmus crassifolia* (cedar elm) and *Celtis laevigata* (sugar hackberry) may also be important components of the canopy. Shrubs and herbaceous cover are similar to those of the live oak woodland.

Llano Uplift Acidic Glade (not mapped)
Identifier: CES303.657.3 **MoRAP Code:** not mapped
Description: Openings on exposed granitic outcrops are common throughout the region. They are characterized by foliose and crustose lichens representing the most significant cover. Cover is very sparse, but may include *Selaginella peruviana* (peruvian spikemoss), *Selaginella arenicola* ssp. *riddellii* (Riddell's spikemoss), *Selaginella wrightii* (Wright's spikemoss), *Cheilanthes* spp. (lipfern), *Pellaea* spp. (cliffbrake), *Woodsia obtusa* (common woodsia), *Sedum nuttallianum* (yellow stonecrop), *Plantago wrightiana* (Wright plantain), *Allium canadense* (Canada garlic), *Hypericum* spp. (St. John's-wort), *Agrostis* spp. (bentgrass), *Vulpia octoflora* (sixweeks fescue), *Spermolepis inermis* (spreading scaleseed), *Lepidium* spp. (peppergrass), and *Tripogon spicatus* (American fiveminute grass). Small depressions in the granite may hold water and have unique floristic elements associated with them.

Llano Uplift: Mesquite / Whitebrush Shrubland (1606)
Llano Uplift Acidic Deciduous Shrubland
Identifier: CES303.657.8 **MoRAP Code:** 1606
Description: On disturbed sites *Prosopis glandulosa* (mesquite) may dominate the canopy, forming a woodland overstory or, more commonly, representing a shrub layer. *Quercus fusiformis* (plateau live oak) may be present. Shrubs may form dense cover under the sparse canopy of mesquite. Species in the shrub layer commonly include *Aloysia gratissima* (whitebrush), *Ziziphus obtusifolia* (lotebush), *Opuntia engelmannii* (prickly pear), *Colubrina texensis* (Texas colubrina), and *Diospyros texana* (Texas persimmon). Some areas of high shrub abundance are clearly dominated by *Aloysia gratissima* (whitebrush) or *Ziziphus obtusifolia* (lotebush) in the shrub layer.

Llano Uplift: Grassland (1607)

Llano Uplift Acidic Grassland
Identifier: CES303.657.9 **MoRAP Code:** 1607
Description: These relatively small patch grasslands may be dominated by native species such as *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Bouteloua hirsuta* (hairy gramma), *Aristida* spp. (threeawn species), and/or *Nassella leucotricha* (Texas wintergrass). Scattered trees (typically *Quercus fusiformis* (plateau live oak) or *Quercus stellata* (post oak) may be present, as well as scattered shrubs (particularly *Prosopis glandulosa* (mesquite), *Diospyros texana* (Texas persimmon), or *Aloysia gratissima* (whitebrush)). Frequently non-native grass species such as *Cynodon dactylon* (bermudagrass) or *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) dominate the herbaceous layer.

Madrean Encinal
Identifier: CES305.795

Geology: This system may occur on various substrates including Permian limestones of Guadalupe Mountains, Tertiary igneous formations, and sandstone formation, and even colluvial/alluvial substrates at middle elevations in mountainous areas of the Trans-Pecos.
Landform: Mountain slopes and rolling uplands in mountainous areas.
Soils: This system may occur on a wide range of soils, often rocky or gravelly, derived from limestone, sandstone, or igneous parent material. It may also occur on loams and alluvial surfaces.

Description: This system sometimes co-occurs with the Madrean Pinyon-Juniper Woodland and also grades into the Madrean Lower Montane Pine-Oak Forest and Woodland at higher elevations. It may replace the pinyon-juniper woodland at lower elevations and grade into desert grasslands, desert shrublands or montane chaparral. These lower elevation occurrences tend to be more open woodlands and savannas. Oak species typically dominate these woodlands with species such as *Quercus grisea* (gray oak), *Quercus emoryi* (Emory oak), *Quercus hypoleucoides* (silverleaf oak), *Quercus arizonica* (Arizona white oak), and/or *Quercus rugosa* (netleaf oak). On limestone, *Quercus mohriana* (Mohr's shin oak) may be common. Various pine and juniper species, such as

Juniperus deppeana (alligator juniper), *Pinus cembroides* (Mexican pinyon pine), *Pinus edulis* (pinyon pine, in the Guadalupe Mountains region), may be conspicuous elements of the canopy. This system may be present as a shrubland, closed woodland, or open woodland. In addition to the oak, pine, and juniper species, other shrubs that may be encountered include *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), *Mimosa dysocarpa* (velvetpod mimosa), *Rhus trilobata* (skunkbush sumac), and *Cercocarpus montanus* (mountain mahogany). *Viguiera stenoloba* (skeleton-leaf golden eye), *Parthenium incanum* (mariola), and other species common to the deserts of lower elevations may be present to common. *Nolina texana* (Texas sacahuista), *Dasylirion leiophyllum* (smooth sotol), *Opuntia imbricata* (tree cholla), and *Agave* spp. (agaves) are commonly encountered. The herbaceous layer is typically dominated by graminoids such as *Muhlenbergia emersleyi* (bull muhly), *Bouteloua curtipendula* (sideoats grama), *Bouteloua gracilis* (blue grama), *Bouteloua hirsuta* (hairy grama), *Bouteloua eriopoda* (black grama), *Piptochaetium fimbriatum* (pinyon ricegrass), and *Heteropogon contortus* (tanglehead), but this layer may be sparse.

VEGETATION TYPES:

Trans-Pecos: Gray Oak Savanna and Woodland (10702)

Madrean Evergreen Encinal
Identifier: CES305.795.1 **MoRAP Code:** 10702
Description: This type is an oak woodland dominated by evergreen oaks.

Trans-Pecos: Mixed Oak Savanna and Woodland (10703)

Madrean Encinal
Identifier: CES305.795.2 **MoRAP Code:** 10703
Description: Oaks of various species may dominate these woodlands.

Madrean Juniper Savanna
Identifier: CES301.730

Geology: Associated with various substrates including limestones, sandstones, igneous formations, and alluvial/colluvial surfaces.
Landform: This system typically occupies foothills and lower slopes of mountains. Such situations may often be rolling landscapes, and are sometimes on gentle slopes to level surfaces.
Soils: The soils occupied by the system vary from gravelly, to shallow to loamy soils. It may also occur on rocky slopes of limestone or igneous parent material.

Description: This system often co-occurs with the Madrean Pinyon-Juniper Woodland, but often occupies slightly lower elevations. It is similar to that system but lacks pinyon as a dominant, though some pinyon species (*Pinus cembroides* (Mexican pinyon pine), *Pinus edulis* (pinyon pine), or *Pinus remota* (paper-shell pinyon pine)) may be present. One of several juniper species may be the dominant overstory, including *Juniperus monosperma* (one-seeded juniper), *Juniperus pinchotii* (redberry juniper), *Juniperus coahuilensis (rose-fruited juniper)*, or *Juniperus deppeana* (alligator juniper). The system may occur with junipers forming a shrubland, or as a closed

woodland, or, more commonly, as an open woodland. *Nolina texana* (Texas sacahuista), *Dasylirion leiophyllum* (smooth sotol), and *Yucca* spp. (yuccas) are commonly encountered. This system typically gives way at lower elevations to grassland, with species such as *Bouteloua gracilis* (blue grama), *Bouteloua curtipendula* (sideoats grama), *Bouteloua eriopoda* (black grama), *Muhlenbergia emersleyi* (bull muhly), and *Muhlenbergia setifolia* (curlyleaf muhly) commonly encountered in the herbaceous layer.

VEGETATION TYPE:

Trans-Pecos: Juniper Savanna and Woodland (10805)

Madrean Juniper Savanna
Identifier: CES301.730
Description: As described for system.

Madrean Lower Montane Pine - Oak Forest and Woodland
Identifier: CES305.796

Geology: Tertiary igneous substrates are commonly encountered with this system in the Davis Mountains region, but the system may also occur on sandstone and limestone substrates, such as in the Guadalupe Mountains region.

Landform: This system occupies the relatively rugged slopes of the mountainous areas of the Trans-Pecos, but may also occupy gently rolling landscapes at higher elevations.

Soils: Often rocky soils derived from igneous and sedimentary substrates, but also mountain loams.

Description: This system occurs at higher elevations of the Davis, Chisos, and Guadalupe Mountains than the Madrean Pinyon – Juniper Woodland. It is typically dominated by *Pinus ponderosa* (ponderosa pine) [or *Pinus arizonica* (Arizona pine) in the Chisos], but oak species such as *Quercus emoryi* (Emory oak), *Quercus grisea* (gray oak), *Quercus x pauciloba* (wavyleaf oak), and *Quercus gambelii* (Gambel oak) may be present to codominant. The subcanopy and shrub layer are typically not dense and may include species of the canopy as well as *Quercus hypoleucoides* (silverleaf oak), *Juniperus deppeana* (alligator juniper), *Cercocarpus montanus* (mountain mahogany), *Holodiscus dumosus* (rockspirea), *Symphoricarpos* spp. (snowberries), *Nolina* spp. (sacahuista), *Cylindropuntia imbricata* (tree cholla), and *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa). *Pinus cembroides* (Mexican pinyon pine), and in the Guadalupe Mountains, *Pinus edulis* (pinyon pine), becomes a common component, particularly at the lower elevational limits of this type and in more xeric situations. The herbaceous layer is typically dominated by graminoids including *Piptochaetium fimbriatum* (pinyon ricegrass), *Muhlenbergia emersleyi* (bull muhly), *Muhlenbergia pauciflora* (New Mexican muhly), *Bouteloua curtipendula* (sideoats grama), *Bouteloua gracilis* (blue grama), *Bouteloua hirsuta* (hairy grama), *Bothriochloa barbinodis* (cane bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Andropogon gerardii* (big bluestem), *Blepharoneuron tricholepis* (pine dropseed), *Koeleria macrantha* (junegrass), *Hesperostipa neomexicana* (New Mexico feathergrass), *Heteropogon contortus* (tanglehead), *Muhlenbergia montana* (mountain muhly), *Muhlenbergia dubia* (pine muhly), *Muhlenbergia rigida* (purple muhly), *Eragrostis intermedia* (plains lovegrass), *Panicum*

bulbosum (bulb panicum), *Schizachyrium cirratum* (Texas bluestem), and *Schizachyrium scoparium* (little bluestem).

VEGETATION TYPES:

Trans-Pecos: Ponderosa/Arizona Pine Woodland (10901)

Madrean Lower Montane Pine Woodland
Identifier: CES305.796.1 **MoRAP Code:** 10901
Description: Woodlands dominated by *Pinus ponderosa* (ponderosa pine), though oaks, junipers, and pinyon pines may be common.

Trans-Pecos: Ponderosa/Arizona Pine - Oak Woodland (10903)

Madrean Lower Montane Pine - Deciduous Oak Woodland
Identifier: CES305.796.2 **MoRAP Code:** 10903
Description: Woodlands co-dominated by *Pinus ponderosa* (ponderosa pine) and oak species such as *Quercus emoryi* (Emory oak), *Quercus gambelii* (Gambel oak), and *Quercus grisea* (gray oak).

Trans-Pecos: Mountain Evergreen Oak - Pine Shrubland (10905)

Madrean Lower Montane Pine – Evergreen Oak Shrubland
Identifier: CES305.796.3 **MoRAP Code:** 10905
Description: Shrublands representing young growth of the *Pinus ponderosa* (ponderosa pine) and *Quercus* spp. (oak) dominated woodlands. *Pinus cembroides* (Mexican pinyon pine) and *Juniperus deppeana* (alligator juniper) may be common components of the shrubland.

Trans-Pecos: Mountain Grassland (10907)

Madrean Lower Montane Savanna Grassland
Identifier: CES305.796.3 **MoRAP Code:** 10907
Description: This savanna represents the open, grassy interstices of the pine woodlands of higher elevations. Mid-height grasses such as *Piptochaetium fimbriatum* (pinyon ricegrass), *Muhlenbergia emersleyi* (bull muhly), *Muhlenbergia pauciflora* (New Mexican muhly), *Bouteloua curtipendula* (sideoats grama), *Heteropogon contortus* (tanglehead), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Bouteloua gracilis* (blue grama) are common dominants.

Madrean Mesic and Canyon Forest and Woodland

Identifier: Not Yet Described

Geology: Various geological strata of the Trans-Pecos mountains, particularly limestone and igneous formations. The system often occupies local alluvium, both fine and coarse, and sometimes Quaternary alluvium as mapped.

Landform: Montane canyons and stream terraces.

Soils: Canyon (Mountain Savannah), Foothill Slope, Draw, Limestone Canyon, Mountain Loam, Limestone Hill and Mountain, and Igneous Hill and Mountain Ecological Sites.

Description: Formerly, this previously undescribed system had components that may have been included in the Madrean Lower Montane Pine-Oak Forest and Woodland, Madrean Upper Montane Conifer-Oak Forest and Woodland, North American Desert Lower Montane Riparian Woodland and Shrubland, or Rocky Mountain Bigtooth Maple Ravine Woodland. These woodlands occur in canyons and along streams, sometimes occupying benches, terraces, and adjacent lower slopes with coarse, rocky substrate. The canopy may be variously dominated by a number of coniferous, broad-leaved evergreen, and deciduous components depending on phytogeography, elevation, and availability of groundwater. Canopy species may include *Pseudotsuga menziesii* (Douglas-fir, lacking in the Davis Mountains), *Pinus ponderosa* var. *scopulorum* (ponderosa pine), *Pinus arizonica* var. *stormiae* (Arizona pine, in the Chisos Mountains), *Pinus cembroides* (Mexican pinyon pine), *Pinus edulis* (pinyon pine, in the Guadalupe Mountains), *Cupressus arizonica* (Arizona cypress), *Juniperus deppeana* (alligator juniper), *Juniperus flaccida* (weeping juniper, in the Chisos Mountains), *Quercus emoryi* (Emory oak), *Quercus rugosa* (netleaf oak), *Quercus hypoleucoides* (silverleaf oak), *Quercus graciliformis* (Chisos oak), *Quercus gravesii* (Chisos red oak), *Quercus muehlenbergii* (chinkapin oak), and *Quercus grisea* (gray oak). Species such as *Ungnadia speciosa* (Mexican buckeye), *Acer grandidentatum* (bigtooth maple), *Fraxinus velutina* (velvet ash), *Prunus serotina* var. *virens* (southwestern chokecherry), *Arbutus xalapensis* (Texas madrone), *Ostrya knowltonii* (western hop-hornbeam, in the Guadalupe Mountains), and/or *Ostrya virginiana* var. *chisosensis* (Big Bend hop-hornbeam, in the Chisos Mountains) may be present in more mesic situations, such as perennial water sources. Shrubs that may be present include *Salvia regla* (mountain sage), *Juglans microcarpa* (little walnut), *Nolina erumpens* (foothill nolina), *Dasylirion leiophyllum* (smooth sotol), *Agave havardiana* (Havard agave), *Agave parryi* ssp. *neomexicana* (New Mexico agave), *Mahonia haematocarpa* (red barberry), *Garrya ovata* (eggleaf silktassel), *Ceanothus greggii* (desert Ceanothus), *Crataegus tracyi* (mountain hawthorn), *Cercocarpus montanus* (mountain mahogany), *Sambucus nigra* ssp. *cerulea* (blue elderberry), *Frangula betulifolia* (birchleaf buckthorn), *Philadelphus* spp. (mockorange), and *Vitis arizonica* (canyon grape). The herbaceous layer is patchy with species such as *Piptochaetium fimbriatum* (pinyon ricegrass), *Bouteloua curtipendula* (sideoats grama), *Poa strictiramea* (Chisos bluegrass), *Muhlenbergia rigida* (purple muhly), *Muhlenbergia emersleyi* (bull muhly), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Schizachyrium scoparium* (little bluestem).

VEGETATION TYPES:

Trans-Pecos: Montane Mesic and Canyon Pine - Juniper Forest (11201)

Madrean Mesic and Canyon Coniferous Forest

Identifier: Not Yet Described **MoRAP Code:** 11201

Description: Canyon and mesic slope woodlands dominated by coniferous evergreen species of *Pinus* spp. (pines), *Juniperus* spp. (junipers), *Pseudotsuga menziesii* (Douglas-fir), and/or *Cupressus arizonica* (Arizona cypress).

Trans-Pecos: Montane Mesic and Canyon Hardwood – Pine - Juniper Forest (11203)

Madrean Mesic and Canyon Mixed Evergreen and Deciduous Forest
Identifier: Not Yet Described **MoRAP Code:** 11203
Description: Woodlands co-dominated by coniferous evergreen species and broad-leaved evergreen and deciduous hardwoods including *Quercus* sp. (oaks), *Acer grandidentatum* (bigtooth maple), and possibly other species.

Trans-Pecos: Montane Mesic and Canyon Hardwood Forest (11204)

Madrean Mesic and Canyon Hardwood Forest
Identifier: Not Yet Described **MoRAP Code:** 11204
Description: Forests and woodlands dominated by deciduous hardwoods such as *Acer grandidentatum* (bigtooth maple), *Quercus muehlenbergii* (chinkapin oak), *Quercus gravesii* (Chisos red oak), and *Fraxinus velutina* (velvet ash). Coniferous evergreen and broad-leaved evergreen are often present in the canopy.

Trans-Pecos: Montane Mesic and Canyon Evergreen Shrubland (11205)

Madrean Mesic and Canyon Evergreen Shrubland
Identifier: Not Yet Described **MoRAP Code:** 11205
Description: Shrublands often mixed within a woodland or forest matrix and dominated by coniferous evergreen and/or broad-leaved evergreen species, often species represented in the canopy of the evergreen forest and woodland.

Trans-Pecos: Montane Mesic and Canyon Shrubland (11206)

Madrean Mesic and Canyon Deciduous Shrubland
Identifier: Not Yet Described **MoRAP Code:** 11206
Description: Shrublands often mixed within a woodland or forest matrix and dominated by deciduous shrub and small tree species.

Madrean Pinyon - Juniper Woodland
Identifier: CES305.797

Geology: Mainly occupies Tertiary igneous substrates, including rhyolitic and tuff formations, as well as Permian and Cretaceous limestones. Other substrates such as sandstone and colluvium are also found associated with this system.
Landform: Rugged to gently rolling landscapes of hills and mountains at intermediate elevations.
Soils: The system typically occupies Igneous Hill and Mountain as well as Limestone Hill and Mountain ecoclasses, but may occur on various other ecoclasses, including Limestone Hill, Mountain Loam, Foothill Slope, Igneous Divide, Shallow, Sandstone Hill and Mountain, and others.

Description: This system occurs in the hills and mountains of the Trans-Pecos as well as in Mexico, New Mexico, and Arizona. Soils, often derived from igneous or limestone parent material (but other substrates are encountered) in Texas, are generally dry and rocky on rugged to gently rolling mountain slopes, foothills, and hills. This system can present as shrublands, open woodlands, or closed woodlands. Pinyon pines and junipers typically dominate, but oaks may co-

dominate some occurrences and are often present. Pine species typical of the canopy include *Pinus cembroides* (Mexican pinyon pine), *Pinus edulis* (pinyon, primarily in the Guadalupe and Sierra Diablo Mountains), or *Pinus remota* (paper-shell pinyon). Junipers codominating with the pines include *Juniperus deppeana* (alligator juniper), *Juniperus pinchotii* (redberry juniper), *Juniperus monosperma* (one-seeded juniper), or *Juniperus coahuilensis (rose-fruited juniper)*. Oaks, which may be present to codominant with pines and junipers, include *Quercus grisea* (gray oak), *Quercus mohriana* (Mohr's shin oak), *Quercus emoryi* (Emory oak), and/or *Quercus gravesii* (Chisos red oak). In woodlands, the understory may have a well-developed shrub layer, often of the species in the canopy but also sometimes including species such as *Cercocarpus montanus* (mountain mahogany), *Rhus trilobata* (skunkbush sumac), and *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa). The herbaceous layer of woodlands or shrublands are typically dominated by graminoids, and may include species such as *Bouteloua curtipendula* (sideoats grama), *Bouteloua gracilis* (blue grama), *Bouteloua hirsuta* (hairy grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Muhlenbergia pauciflora* (New Mexican muhly), *Muhlenbergia setifolia* (curlyleaf muhly), *Nassella tenuissima* (finestem needlegrass), *Piptochaetium fimbriatum* (pinyon ricegrass), and *Muhlenbergia emersleyi* (bull muhly). In Culberson County, the pine (*Pinus edulis*) and juniper (*Juniperus monosperma*) show the relationship of this system to other pinyon-juniper systems to the north, but other components of these occurrences recommend the relationship to the Madrean system.

VEGETATION TYPES:

Trans-Pecos: Pinyon - Juniper Woodland (11101)

Madrean Pinyon - Juniper Woodland
Identifier: CES305.797.1 **MoRAP Code:** 11101
Description: This woodland phase of the system may have an open to closed canopy at a height greater than 4 meters. Pinyon pines and junipers dominate the canopy, though oaks may be present.

Trans-Pecos: Pinyon - Juniper Shrubland (11105)

Madrean Pinyon - Juniper Shrubland
Identifier: CES305.797.2 **MoRAP Code:** 11105
Description: The shrubland phase of the system is similar or identical in composition, but is characterized by lower stature representatives of the pinyon pines and junipers which dominate the canopy. Canopy height is generally greater than 2 meters but less than 4 meters, and canopy cover can be open to closed.

Trans-Pecos: Pinyon – Juniper - Oak Woodland (11111)

Madrean Pinyon – Juniper - Oak Woodland
Identifier: CES305.797.3 **MoRAP Code:** 11111
Description: Woodlands that have oak species such as *Quercus grisea* (gray oak), *Quercus mohriana* (Mohr's shin oak), *Quercus emoryi* (Emory oak), and/or *Quercus gravesii* (Chisos red oak) co-dominant with pinyon pines and juniper in the canopy.

Madrean Upper Montane Conifer - Oak Forest and Woodland

Identifier: CES305.798

Geology: On Permian limestone in the Guadalupe Mountains. In the Chisos Mountains, this system primarily occurs on Tertiary igneous formations and associated colluvial and alluvial deposits from these formations.

Landform: High mountain slopes and flats and rolling topography at mountain summits of the Guadalupe and Chisos Mountains.

Soils: Victorio-Lorenz-Rock outcrop complex of the Guadalupe Mountains, and Igneous Hill and Mountain soils of the Chisos Mountains.

Description: This system is limited in Texas to the highest mountain areas of the Guadalupe and Chisos Mountains, but is lacking from high elevations of the Davis Mountains. The characteristic dominants of the system are *Pseudotsuga menziesii* (Douglas-fir) and *Pinus strobiformis* (southwestern white pine), though *Pinus ponderosa* (ponderosa pine), *Juniperus* spp. (junipers) and *Pinus cembroides* (Mexican pinyon pine) or *Pinus edulis* (pinyon pine) may also be present to common. Oak species, including *Quercus emoryi* (Emory oak), *Quercus hypoleucoides* (silverleaf oak), *Quercus grisea* (gray oak), and *Quercus gambelii* (Gambel oak) may be present to co-dominant. The shrub and subcanopy is typically sparse and generally dominated by species from the canopy. In some areas, *Quercus gambelii* (Gambel oak) may form dense shrub patches. The herbaceous layer is typically dominated by graminoids, including species such as *Festuca arizonica* (Arizona fescue), *Muhlenbergia pauciflora* (New Mexican muhly), *Piptochaetium fimbriatum* (pinyon ricegrass), *Blepharoneuron tricholepis* (pine dropseed), *Koeleria macrantha* (junegrass), and *Poa fendleriana* (mutton bluegrass).

VEGETATION TYPES:

Trans-Pecos: High Mountain Conifer Forest and Woodland (12601)

Madrean Upper Montane Conifer Forest and Woodland
Identifier: CES305.798.1 **MoRAP Code:** 12601
Description: This type is dominated by conifers such as *Pseudotsuga menziesii* (Douglas fir), *Pinus strobiformis* (southwestern white pine), *Pinus ponderosa* (ponderosa pine), *Pinus arizonica* (Arizona pine, in the Chisos Mountains), and/or *Juniperus* spp. (junipers).

Trans-Pecos: High Mountain Mixed Conifer - Oak Forest and Woodland (12603)

Madrean Upper Montane Conifer - Oak Forest and Woodland
Identifier: CES305.798.2 **MoRAP Code:** 12603
Description: Occurrences are codominated by conifers such as *Pseudotsuga menziesii* (Douglas fir), *Pinus strobiformis* (southwestern white pine), and other pine and juniper species, as well as oak species such as *Quercus emoryi* (Emory oak), *Quercus grisea* (gray oak), *Quercus hypoleucoides* (silverleaf oak), and *Quercus gambelii* (Gambel oak).

Trans-Pecos: High Mountain Evergreen Shrubland (12605)

Madrean Upper Montane Conifer Shrubland
Identifier: CES305.798.3 **MoRAP Code:** 12605
Description: Shrublands at high elevations, typically within a matrix of other vegetation types within the system and dominated by young individuals of the canopy species.

Rocky Mountain Aspen Forest and Woodland (Not Mapped)
Identifier: CES306.813

Geology: High elevations on Permian limestone (Guadalupe Mountains) and igneous substrates (Davis and Chisos Mountains).
Landform: High mountain slopes, valleys and ridges.
Soils: Various.

Description: This system occurs at high elevations of the Guadalupe, Davis, and Chisos Mountains. It typically occurs as small patches within the higher elevation conifer systems present in each of the ranges. *Populus tremuloides* (quaking aspen) dominate the stands, which are maintained by disturbance, but may also occupy talus slopes for extended periods. These patches are considered relictual remnants in this southwestern extension of this more commonly encountered type further north.

VEGETATION TYPE:

Rocky Mountain: Aspen Woodland (Not Mapped)

Rocky Mountain Aspen Forest and Woodland
Identifier: CES306.813 **MoRAP Code:** Not Mapped
Description: As described for system.

West Gulf Coastal Plain Chenier and Upper Texas Coast Fringe Forest and Woodland
Identifier: CES203.466

Geology: This system occupies Quaternary deposits associated with migrating shorelines, shell ridges, and coastal salt domes. The Ingleside Barrier strandplain, an ancient barrier ridge composed of deep sands and occurring well inland of the current Gulf shoreline, may have occurrences of this system associated with it.
Landform: Most occurrences occupy ridges formed from sediments deposited along ancient shorelines. These ridges, which often parallel the coast and are composed of coarse material such as sand or shell, may be up to 3 meters above mean sea level. Some occurrences occupy coastal salt domes, which may rise 30 meters above the surrounding landscape.
Soils: Soils are typically entisols of coarse textured material, either sand or shell. The Ecological Site Description, which may be related to this system, is the Coastal Sand ecoclass.

Description: This woodland occupies sand and shell ridges which resulted from ancient abandoned beach ridges. It may also be found on salt domes near the coast. Typically these forests and woodlands are dominated by *Quercus virginiana* (coastal live oak), however other species such as *Celtis laevigata* (sugar hackberry) and *Quercus nigra* (water oak) may be present to co-dominant in the canopy. Other species such as *Liquidambar styraciflua* (sweetgum), *Carya illinoinensis* (pecan), *Diospyros virginiana* (common persimmon), *Fraxinus pennsylvanica* (green ash), and *Magnolia grandiflora* (southern magnolia) may also be present in the canopy. The understory is often patchy but may include species such as *Ilex vomitoria* (yaupon), *Callicarpa americana* (American beautyberry), *Zanthoxylum clava-herculis* (Hercules-club pricklyash), *Crataegus viridis* (green hawthorn), *Sabal minor* (dwarf palmetto), *Morella cerifera* (wax-myrtle), and/or *Sideroxylon lanuginosum* (gum bumelia). Woody vines present in this system include *Vitis mustangensis* (Mustang grape), *Parthenocissus quinquefolia* (Virginia creeper), *Campsis radicans* (trumpet creeper), and *Toxicodendron radicans* (poison ivy). The two epiphytes, *Tillandsia usneoides* (Spanish moss) and *Pleopeltis polypodioides* (resurrection fern), may be commonly encountered in this system. The herbaceous layer is usually sparse, but may include species such as *Schizachyrium scoparium* (little bluestem), *Sanicula canadensis* (Canada snakeroot), *Malvaviscus arboreus* var. *drummondii* (Drummond turk's cap), *Elephantopus carolinianus* (leafy elephantfoot), and *Oplismenus hirtellus* (basketgrass). Areas that were mapped tended to represent wetter areas than are typical of this type, with species such as *Quercus phellos* (willow oak) and *Quercus laurifolia* (laurel oak) conspicuous in the canopy. *Triadica sebifera* (Chinese tallow) and *Ligustrum sinense* (Chinese privet) may be important non-native invaders into this system.

VEGETATION TYPES:

Chenier Plain: Live Oak Fringe Forest (5502)

West Gulf Coastal Plain Chenier and Upper Texas Coast Coastal Live Oak Fringe Forest and Woodland
Identifier: CES203.466.2 **MoRAP Code:** 5502
Description: Occurrences of this type are dominated by *Quercus virginiana* (coastal live oak). About 3% of this system was mapped as this type.

Chenier Plain: Mixed Live Oak / Deciduous Hardwood Fringe Forest (5503)

West Gulf Coastal Plain Chenier Upper Texas Coast Mixed Live Oak – Deciduous Fringe Forest and Woodland
Identifier: CES203.466.3 **MoRAP Code:** 5503
Description: This represent**s** the mixed deciduous – evergreen vegetation type for this system.

Chenier Plain: Hardwood Fringe Forest (5504)

West Gulf Coastal Plain Chenier and Upper Texas Coast Hardwood Fringe Forest and Woodland
Identifier: CES203.466.4 **MoRAP Code:** 5504
Description: This represents the deciduous vegetation type for this system. Evergreen species may be present, but the deciduous component is the clear dominant.

West Gulf Coastal Plain Mesic Hardwood Forest
Identifier: CES203.280

Geology: Distributed on Tertiary formations, from the Willis formation in the south, northward through Eocene formations.

Landform: Fairly restricted to rugged landscapes. Often occupies lower slope positions and adjacent steep slopes, where topographic position results in moisture accumulation and lower solar insolation. These sites may occur adjacent to bottomlands, but on more well-drained soils and/or slightly higher topographic positions.

Soils: Can occur on various soil textures, from sands to clays. These soils are often characterized by moderate to high fertility and moisture retention. Soil texture, fertility, and acidity may be controlling factors in determining the species composition of occurrences of this system.

Description: This system typically occurs in fairly rugged landscapes on ravines, steep slopes and low landscape positions, often near streams. Soils characteristically have relatively high moisture retention. They can be moderately fertile, acidic to circumneutral, loams to sands, or may be more nutrient rich, somewhat calcareous, tighter soils (clays and clay loams). Sites often have significant litter accumulations. Southern expressions of this system may have *Fagus grandifolia* (American beech) and *Magnolia grandiflora* (southern magnolia) as conspicuous to dominant components of the overstory where conditions are more mesic. Northern expressions fall outside of the range of these two species. The overstory canopy is generally dominated by deciduous hardwoods including *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Liquidambar styraciflua* (sweetgum), and *Quercus nigra* (water oak). *Acer rubrum* (red maple), *Quercus hemisphaerica* (upland laurel oak), *Quercus shumardii* (Shumard oak), *Quercus pagoda* (cherrybark oak), *Acer barbatum* (southern sugar maple), *Fraxinus americana* (white ash), and *Carya alba* (mockernut hickory) may also be conspicuous in the canopy. *Pinus taeda* (loblolly pine), and to a lesser extent, *Pinus echinata* (shortleaf pine) may be present to co-dominant in the overstory. An understory of species such as *Ilex opaca* (American holly), *Ulmus alata* (winged elm), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (American hop-hornbeam), *Carpinus caroliniana* (American hornbeam), and/or *Acer leucoderme* (chalk maple) is often present. The shrub layer is typically limited, giving the forest an open aspect. Species in the shrub layer may include *Callicarpa americana* (American beautyberry), *Ilex vomitoria* (yaupon), *Arundinaria gigantea* (giant cane), and *Viburnum acerifolium* (maple-leaf viburnum). *Vitis rotundifolia* (muscadine grape), *Smilax* spp. (greenbriers), and *Parthenocissus quinquefolia* (Virginia creeper) are commonly encountered woody vines. Some occurrences on more calcareous substrates lack *Magnolia grandifolia* (southern magnolia) and may contain species such as *Tilia americana* (American basswood) and *Styrax* spp. (snowbells) and may have a rich, more calciphilic, vernal forb flora. Such species as *Podophyllum peltatum* (mayapple), *Arisaema dracontium* (green dragon), *Arisaema triphyllum* (jack-in-the-pulpit), *Sanguinaria canadensis* (bloodroot), *Erythronium* spp. (trout lilies), *Trillium* spp. (trilliums), and *Polygonatum biflorum* (great Solomon's seal) may dominate the aspect of the forest understory in the early spring. Later in the year, these species become inconspicuous and are replaced by species such as *Chasmanthium sessiliflorum* (narrowleaf woodoats), *Mitchella repens* (partridgeberry), *Sanicula canadensis* (Canada snakeroot), *Carex* spp. (caric sedges), and *Dichanthelium* spp. (rosette

grasses). Ferns, such as *Woodwardia* spp. (chain fern), *Osmunda cinnamomea* (cinnamon fern), *Athyrium filix-femina* ssp. *asplenioides* (Asplenium ladyfern), and *Polystichum acrostichoides* (Christmas fern), may be conspicuous. The mesic nature of sites occupied by this system, along with the topography of the sites, and the limited fine fuel production in the system, results in reduced fire frequency.

VEGETATION TYPES:

Pineywoods: Northern Mesic Pine / Hardwood Forest (3303)

West Gulf Coastal Plain Northern Mesic Pine-Hardwood Mixed Forest
Identifier: CES203.280.3 **MoRAP Code:** 3303
Description: Approximately 11% of this system is mapped as this mixed deciduous evergreen forest. It occupies areas north of the range of *Fagus grandifolia* (American beech), and is co-dominated by *Pinus taeda* (loblolly pine) and/ or *Pinus echinata* (shortleaf pine) and various deciduous hardwoods including *Quercus alba* (white oak), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum), and others as described above.

Pineywoods: Northern Mesic Hardwood Forest (3304)

West Gulf Coastal Plain Northern Mesic Hardwood Forest
Identifier: CES203.280.4 **MoRAP Code:** 3304
Description: The majority (~62%) of the system is mapped as the primarily deciduous forest type. It occupies areas north of the range of *Fagus grandifolia* (American beech), and is dominated by hardwood species as described above. *Pinus taeda* (loblolly pine) and/or *Pinus echinata* (shortleaf pine) may be present, but do not form conspicuous elements of the canopy.

Pineywoods: Southern Mesic Pine / Hardwood Forest (3403)

West Gulf Coastal Plain Southern Mesic Pine-Hardwood Mixed Forest
Identifier: CES203.280.13 **MoRAP Code:** 3403
Description: About 8% of the system is mapped as this mixed forest type. Occurrences lie within the range of *Fagus grandifolia* (American beech), and it and *Magnolia grandiflora* (southern magnolia) may be present to dominant. *Pinus taeda* (loblolly pine) and/or *Pinus echinata* (shortleaf pine) share dominance with deciduous canopy species as described above.

Pineywoods: Southern Mesic Hardwood Forest (3404)

West Gulf Coastal Plain Southern Mesic Hardwood Forest
Identifier: CES203.280.14 **MoRAP Code:** 3404
Description: About 19% of the system is mapped as this deciduous forest type. Occurrences lie within the range of *Fagus grandifolia* (American beech), and it and *Magnolia grandiflora* (southern magnolia) may be present to dominant. Other deciduous canopy species may dominate some occurrences, and pines may also be present.

West Gulf Coastal Plain Pine-Hardwood Forest

Identifier: CES203.378

Geology: This system is widespread and forms the matrix of the West Gulf Coastal Plain of Texas and therefore occurs on numerous Cenozoic sedimentary formations and some Cretaceous formations of the Mesozoic era. These formations range from sandstone, shale, alluvium, and conglomerate, to marl, with glauconitic formations (Weches) and tuffaceous formations (Catahoula) present.

Landform: The system occurs over a wide variety of landforms, with drier expressions occurring on hilltops and ridges. It occupies slopes and lower landscape positions, where conditions are more mesic, and composition of the system varies across these gradients.

Soils: Numerous soil types are occupied by this system, but are generally alfisols or ultisols. Soils most commonly encountered are sands and loams.

Description: This upland system forms the matrix over much of the West Gulf Coastal Plain. This is particularly the case outside of the range of *Pinus palustris* (longleaf pine). Within the range of *Pinus palustris* (longleaf pine), the historical matrix was often dominated by that species and should be mapped as West Gulf Coastal Plain Upland Longleaf Pine Forest and Woodland (CES203.293). However, given the current patchy distribution of *Pinus palustris* (longleaf pine), the prevalence of plantings of *Pinus taeda* (loblolly pine) and *Pinus elliottii* (slash pine), and the difficulty in identifying the system on the basis of remote-sensing data, we chose to include occurrences of this more restricted system within the West Gulf Coastal Plain Pine-Hardwood Forest. The system occupies a range of topographic and edaphic conditions, replaced by other systems in areas where unique abiotic conditions result in occurrences of other, more restricted, systems. Typical pines that dominate these sites are *Pinus taeda* (loblolly pine) and *Pinus echinata* (shortleaf pine), though *Pinus palustris* (longleaf pine) may also be present to dominant, within its range. Historically, *Pinus echinata* (shortleaf pine) dominated drier sites, especially to the north. *Pinus taeda* (loblolly pine) was less dominant than in the current landscape, and occupied less dry sites and became more conspicuous to the south. Seventy-five percent or more of the canopy of some occurrences may be occupied by pines, often *Pinus taeda* (loblolly pine). Typical deciduous hardwoods conspicuous in this system include *Liquidambar styraciflua* (sweetgum), *Carya texana* (black hickory), *Quercus stellata* (post oak), *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Quercus nigra* (water oak), *Ulmus alata* (winged elm), *Ulmus crassifolia* (cedar elm), and *Nyssa sylvatica* (blackgum). Some sites may be primarily deciduous, with 75% or more of the canopy cover occupied by hardwoods. *Ilex vomitoria* (yaupon), saplings and seedlings of overstory species, *Callicarpa americana* (American beautyberry), *Morella cerifera* (wax-myrtle), *Vaccinium arboreum* (farkleberry), and *Cornus florida* (flowering dogwood) commonly occupy the shrub layer, which may be well-developed, with understory canopy cover to 40% or more. Woody vines in this system may be conspicuous and often include *Smilax bona-nox* (saw greenbrier), *Vitis* spp. (grape, often *Vitis rotundifolia* (muscadine grape)), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (poison ivy). The herbaceous layer is generally sparse (often < 20% cover), with *Schizachyrium scoparium* (little bluestem), *Chasmanthium laxum* (slender woodoats), *Chasmanthium sessiliflorum* (narrowleaf woodoats), and *Pteridium aquilinum* (brackenfern) often present to dominant. Forests with dense tree cover

(especially evergreen cover), have reduced shrub and herbaceous cover. Herbaceous cover may be additionally limited by dense litter accumulation. Few occurrences of this system can be considered old growth, and much of the system, as it is mapped, constitutes pine plantations or sites recovering from previous logging. *Pinus elliottii* (slash pine) may be used in some plantations.

VEGETATION TYPES:

Pineywoods: Pine Forest or Plantation (3001)

West Gulf Coastal Plain Dry-Mesic Pine Forest
Identifier: CES203.378.1 **MoRAP Code:** 3001
Description: This represents the typical type for the system where the canopy is dominated by pines. Many sites actually represent pine plantations and managed forests, and discriminating between natural pine forest and plantation is problematic using our mapping methods. More than half of the area mapped for this system is represented by this vegetation type, and *Pinus taeda* (loblolly pine) predominates.

Pineywoods: Pine - Hardwood Forest and Plantation (3003)

West Gulf Coastal Plain Dry-Mesic Pine-Hardwood Mixed Forest
Identifier: CES203.378.3 **MoRAP Code:** 3003
Description: Less commonly encountered type with mixed evergreen/deciduous canopy cover, not occupying dry landscape positions such as hilltops and ridgetops. This is typically managed forest of *Pinus taeda* (loblolly pine), with various hardwood species co-dominant in the canopy.

Pineywoods: Upland Hardwood Forest (3004)

West Gulf Coastal Plain Dry-Mesic Upland hardwood Forest
Identifier: CES203.378.4 **MoRAP Code:** 3004
Description: This is a commonly encountered vegetation type of the system, making up about a third of the areal extent of the system. It is dominated by deciduous hardwoods, but may (and often does) have some cover of pine, usually *Pinus taeda* (loblolly pine).

Pineywoods: Dry Pine Forest or Plantation (3011)

West Gulf Coastal Plain Dry Pine Forest
Identifier: CES203.378.11 **MoRAP Code:** 3011
Description: This is the pine dominated vegetation type that occupies high landscape positions, such as hilltops and ridgetops. Relative to *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine) tends to be better represented in this drier landscape position. Hardwood species of drier sites, such as *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Liquidambar styraciflua* (sweetgum), and/or *Carya texana* (black hickory) may be present.

Pineywoods: Dry Pine - Hardwood Forest and Plantation (3013)

West Gulf Coastal Plain Dry Pine-Hardwood Mixed Forest
Identifier: CES203.378.13 **MoRAP Code:** 3013
Description: This vegetation type occupies high landscape positions and has a mixed deciduous/evergreen canopy.

Pineywoods: Dry Upland Hardwood Forest (3014)

West Gulf Coastal Plain Dry Upland Hardwood Forest
Identifier: CES203.378.14 **MoRAP Code:** 3014
Description: This vegetation type has a deciduous dominated canopy and occupies high landscape positions.

West Gulf Coastal Plain Sandhill Oak and Shortleaf Pine Forest and Woodland
Identifier: CES203.056

Geology: Generally associated with Eocene sand formations such as Carrizo, Sparta, and Queen City sands. Also found on sands derived from the Pliocene Willis formation.
Landform: Generally found on high, convex landscape positions, such as hilltops and ridgetops.
Soils: Deep sands of soils such as the Betis, Darco, Letney, Tehran, Tonkawa, and other grossarenic or psammentic soils.

Description: This system occupies deep sands on generally high, convex landforms, and often displays a relatively open overstory canopy. It may occur as pine dominated woodlands, with *Pinus palustris* (longleaf pine) dominating some sites within the range of this species, and *Pinus echinata* (shortleaf pine) dominating areas where *Pinus palustris* (longleaf pine) is absent. In the current landscape, *Pinus taeda* (loblolly pine) is a common and sometimes dominant pine species. Pines may co-dominate along with deciduous species, or the canopy may be dominated by oak and other deciduous species such as *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Quercus incana* (bluejack oak), *Quercus falcata* (southern red oak), *Quercus margarettae* (sand post oak), and *Carya texana* (black hickory). Other deciduous trees present may include *Sassafras albidum* (sassafras), *Liquidambar styraciflua* (sweetgum), and *Quercus nigra* (water oak). The shrub stratum can be fairly well-developed, and includes shorter individuals of canopy species in addition to such species as *Callicarpa americana* (American beautyberry), *Ilex vomitoria* (yaupon), *Vaccinium arboreum* (farkleberry), *Rhus aromatica* (fragrant sumac), *Asimina parviflora* (dwarf pawpaw), *Cornus florida* (flowering dogwood), and *Smilax bona-nox* (saw greenbrier). The herbaceous layer may be quite well-developed or relatively patchy (with areas of bare sandy soil exposed). Commonly encountered species include *Schizachyrium scoparium* (little bluestem), *Pteridium aquilinum* (brackenfern), *Aristida desmantha* (curly threeawn), *Ambrosia psilostachya* (western ragweed), *Cnidoscolus texanus* (Texas bull-nettle), *Rudbeckia hirta* (blackeyed susan), *Dichanthelium dichotomum* (cypress panicgrass), *Pityopsis graminifolia* (narrowleaf silkgrass), *Croton argyranthemus* (silverleaf croton), *Tragia urticifolia* (nettleleaf noseburn), *Froelichia floridana* (Florida snake-cotton), *Matelea cynanchoides* (creeping milkvine), *Opuntia humifusa* (eastern pricklypear), *Sporobolus junceus* (pineywoods dropseed), *Triplasis purpurea* (purple sandgrass), *Bulbostylis ciliatifolia* (capillary hairsedge), *Chamaecrista fasciculata* (partridge pea), *Berlandiera pumila* (soft greeneyes), *Commelina erecta* var. *angustifolia* (narrowleaf dayflower), *Stylisma pickeringii* (bigpod bonamia), *Tradescantia reverchonii* (Reverchon spiderwort), *Rhynchosia* spp. (snoutbeans), *Tephrosia* spp. (tephrosia), and *Yucca louisianensis* (Gulf Coast yucca). Accurate mapping of this system proved problematic, because this system does not occur on all areas where the typical deep sands are mapped. Mapping only areas of high landscape position (the method used in this effort) tended to under-represent the system as it occurs on the landscape.

VEGETATION TYPES:

Pineywoods: Sandhill Pine Woodland (3201)

West Gulf Coastal Plain Sandhill Pine Forest and Woodland
Identifier: CES203.056.1 **MoRAP Code:** 3201
Description: Occurrences dominated by pines, including *Pinus palustris* (longleaf pine) in the south, *Pinus echinata* (shortleaf pine), and *Pinus taeda* (loblolly pine). *Pinus taeda* (loblolly pine) has become more prevalent in current landscapes. About 46% of the system is mapped as this type.

Pineywoods: Sandhill Oak / Pine Woodland (3203)

West Gulf Coastal Plain Mixed Oak – Pine Forest and Woodland
Identifier: CES203.056.3 **MoRAP Code:** 3203
Description: Occurrences having a mixed canopy, co-dominated by pines and usually oaks. This is a minor component of the system as mapped.

Pineywoods: Sandhill Oak Woodland (3204)

West Gulf Coastal Plain Sandhill Oak Forest and Woodland
Identifier: CES203.056.4 **MoRAP Code:** 3204
Description: Canopy usually dominated by oak species, but pine and other canopy species such as *Carya texana* (black hickory) and *Liquidambar styraciflua* (sweetgum) may also be present.

Pineywoods: Sandhill Grassland or Shrubland (3207)

West Gulf Coastal Plain Sandhill Grassland and Shrubland
Identifier: CES203.056.7 **MoRAP Code:** 3207
Description: Occurrences where canopy cover is exceedingly sparse, giving rise to an open aspect, with shrub and herbaceous cover dominating. Graminoids such as *Schizachyrium scoparium* (little bluestem) dominate, but the diversity of forbs may be high. About 18% of the system is mapped as this vegetation type.

West Gulf Coastal Plain Upland Longleaf Pine Forest and Woodland (not mapped)
Identifier: CES 203.293

Geology: Found on sedimentary Pleistocene formations (particularly the Bentley formation), to formations of the Tertiary period (particularly the Catahoula and Wilcox formations). Historically, this system was more widely distributed on older, more inland formations of the Eocene and Paleocene epochs.

Landform: Occupying topography ranging from rolling uplands, to hills and ridges such as those associated with the Kisatchie Wold (or Kisatche Cuesta) and the Sabine Uplift.

Soils: Usually associated with coarse textured, well-drained, ultisols and alfisols, including loams, sandy loams, loamy sands, and sands, though occurrences may also be found to lesser extent on tighter soils such as clay loams.

Description: This system once occupied extensive areas of east Texas, but is presently limited in extent and difficult to map using remote-sensing. Small remnants of this once extensive forest type are encountered in Angelina, Jasper, Newton, and other nearby counties in Texas. We did not attempt to map it, and chose to include any occurrences of this system in the West Gulf Coastal Plain Pine-Hardwood Forest. It was characterized by relatively open-canopied woodlands dominated by *Pinus palustris* (longleaf pine) with an herbaceous layer often dominated by graminoids. It often occupied gently rolling uplands with coarse-textured, well-drained soils. *Pinus echinata* (shortleaf pine) may be a significant component of some of the stands. *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Quercus incana* (bluejack oak), *Pinus taeda* (loblolly pine), *Liquidambar styraciflua* (sweetgum), and *Nyssa sylvatica* (blackgum) may also be common components of the canopy or subcanopy. Occurrences that are less frequently burned may develop a significant shrub layer with species including *Callicarpa americana* (American beautyberry), *Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), *Morella cerifera* (wax-myrtle), *Ilex vomitoria* (yaupon), *Rhus copallinum* (flameleaf sumac), and *Toxicodendron radicans* (poison ivy). Instances with a more optimal fire return interval will retain a more open understory with a grassy aspect. The herbaceous layer is often dominated by grass species such as *Schizachyrium scoparium* (little bluestem), *Schizachyrium tenerum* (slender bluestem), *Sporobolus junceus* (pineywoods dropseed), *Nassella leucotricha* (Texas wintergrass), *Andropogon ternarius* (splitbeard bluestem), *Dichanthelium* spp. (rosette grasses), *Andropogon virginicus* (broomsedge bluestem). *Pteridium aquilinum* (brackenfern) may be locally abundant, forming a continuous ground cover. Forbs may be diverse in the herbaceous layer, including species such as *Pityopsis graminifolia* (narrowleaf silkgrass), *Solidago odora* (fragrant goldenrod), *Tephrosia* spp. (tephrosias), *Euphorbia corollata* (flowering spurge), *Croton argyranthemus* (silverleaf croton), *Vernonia texana* (Texas ironweed), *Alophia drummondii* (celestials), *Lespedeza virginica* (slender lespedeza), *Aristolochia reticulata* (netleaf pipevine), *Rhynchosia reniformis* (kidneyleaf snoutbean), *Stylosanthes biflora* (pencilflower), *Liatris elegans* (pink-scale gayfeather). With prolonged absence of fire, hardwoods and *Pinus taeda* (loblolly pine) may come to dominate the system.

West Gulf Coastal Plain Stream Terrace Sandyland Longleaf Pine Woodland (not mapped)
Identifier: CES203.891

Geology: This system is associated with coarse, Quaternary alluvial deposits, in the vicinity of Pleistocene surfaces.
Landform: Terraces adjacent to creeks and rivers where thick sand deposits develop.
Soils: Deep to very deep sands occurring on stream terraces. This may include psamments or psammentic soils such as the Bienville, Alaga, Turkey, or Tonkawa when they occur on the appropriate landform.

Description: This system is relatively xeric vegetation, even though it occurs on terraces adjacent to, or within, floodplains. This is the case because the soils are deep and well-drained sands (often alluvial deposits), with low moisture retention and high permeability. *Pinus palustris* (longleaf pine) may form a discontinuous and sparse overstory, along with species such *Quercus incana*

(bluejack oak), *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Pinus echinata* (shortleaf pine), and *Carya texana* (black hickory). Where fire is excluded, the oaks become denser. *Pinus palustris* (longleaf pine) is absent from some instances. *Pinus elliottii* (slash pine) and *Pinus taeda* (loblolly pine) may be present to common in the current landscape. Depending on fire history, the shrub layer may be somewhat well-developed with species such as *Vaccinium arboreum* (farkleberry), *Sideroxylon lanuginosa* (gum bumelia), *Persea borbonia* (redbay), and *Ilex vomitoria* (yaupon). The herbaceous layer is usually sparse, with exposed sand and foliose lichens dominating the aspect of the sites. Species such as *Aristida desmantha* (curly threeawn), *Bulbostylis ciliatifolia* (capillary hairsedge), *Carex tenax* (wire sedge), *Cnidoscolus texanus* (Texas bull-nettle), *Cyperus grayioides* (Illinois flatsedge), *Dichanthelium dichotomum* (cypress panicgrass), *Froelichia floridana* (Florida snake-cotton), *Opuntia humifusa* (eastern pricklypear), *Polanisia erosa* (large clammyweed), *Schizachyrium scoparium* (little bluestem), and *Yucca louisianensis* (Gulf Coast yucca) may be present in the herbaceous layer. *Phlox nivalis* ssp. *texensis* (Texas trailing phlox) and *Gaillardia aestivalis* var. *winkleri* (Winkler's firewheel) are two rare taxa associated with this system. This system is floristically similar to other sandhill longleaf pine systems, but the landform of occurrences makes this system unique.

Shrublands

Chihuahuan Creosotebush Desert Scrub

Identifier: CES302.731

Geology: Generally occurs on alluvial/colluvial gravel flats.
Landform: Flat to gently rolling landforms occupying outwash plains and basins between mountain ranges.
Soil: Typically occurs on gravelly soils.

Description: This system typically occurs on flat and gently rolling landforms, often on gravelly alluvial plains occupying outwash plains and those on intermountain basins. *Larrea tridentata* (creosotebush) is usually the clear dominant, though species such as *Parthenium incanum* (mariola), *Acacia constricta* (whitethorn acacia), *Flourensia cernua* (tarbush), and/or *Prosopis glandulosa* (honey mesquite) may be present. On some sites, particularly hot desert sites at low elevations, succulents such as *Fouquieria splendens* (ocotillo), *Agave lechuguilla* (lechuguilla), *Yucca torreyi* (Torrey's yucca), *Opuntia* spp. (pricklypears), and *Echinocereus* spp. (hedgehog cacti) may be conspicuous.

VEGETATION TYPES:

Trans-Pecos: Sparse Creosotebush Scrub (8200)

Chihuahuan Sparse Creosotebush Desert Scrub
Identifier: CES302.731.1 **MoRAP Code:** 8200
Description: This type occupies areas of the intermontane basin plains with low vegetative cover, often with significant desert pavement under a sparse canopy of almost monotypic *Larrea tridentata* (creosotebush).

Trans-Pecos: Creosotebush Scrub (8205)

Chihuahuan Creosotebush Desert Scrub
Identifier: CES302.731.2 **MoRAP Code:** 8205
Description: This is the typical expression for the system occupying large areas of the intermontane basins and with *Larrea tridentata* (creosotebush) as the clear, often monotypic dominant.

Trans-Pecos: Creosotebush - Succulent Scrub (8206)

Chihuahuan Sparse Creosotebush - Succulent Desert Scrub
Identifier: CES301.731.3 **MoRAP Code:** 8206
Description: This vegetation type occurs on dissected gravelly flats at low elevation, in the hot desert of the southern Trans-Pecos. Vegetated cover is usually fairly low and is dominated by *Larrea tridentata* (creosotebush), *Fouquieria splendens* (ocotillo), and other succulents.

Chihuahuan Mixed Desert and Thornscrub

Identifier: CES302.734

Geology: This system is particularly well-developed on limestone, but can occur on various other substrates.

Landform: Occupying limestone hills and slopes, gravel-capped ridges and slopes, as well as hills and slopes of igneous and sandstone substrates.

Soils: Rocky soils of Igneous Hill and Mountain, Limestone Hill and Mountain and other ecoclasses.

Description: In this Chihuahuan Desert of Texas, this ecological system is widely distributed and often occupies footslopes and hilly landforms of limestones, sandstones, and igneous strata, though it is best developed on limestones. This shrubland can occur in proximity to Apacherian – Chihuahuan Semi-Desert Grassland and Steppe, Chihuahuan Creosotebush Desert Scrub, and/or Chihuahuan Succulent Desert Scrub. *Larrea tridentata* (creosotebush), *Parthenium incanum* (mariola), *Condalia ericoides* (javelina bush), *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), *Yucca torreyi* (Torrey's yucca), *Acacia constricta* (whitethorn acacia), *Agave lechuguilla* (lechuguilla), *Dasylirion leiophyllum* (smooth sotol), *Viguiera stenoloba* (skeleton-leaf golden eye), *Leucophyllum* spp. (cenizo), and *Prosopis glandulosa* (honey mesquite) are often present to dominant, but numerous shrub species may be present. It differs from Chihuahuan Creosotebush Desert Scrub in having a diversity of shrub species present and is not a nearly monotypic stand of *Larrea tridentata* (creosotebush). Herbaceous cover is generally low with species such as *Bouteloua eriopoda* (black grama), *Bouteloua ramosa* (chino grama), *Bouteloua curtipendula* (sideoats grama), *Bouteloua trifida* (red grama), *Aristida purpurea* (purple threeawn), *Dasyochloa pulchella* (fluffgrass), and *Muhlenbergia setifolia* (curlyleaf muhly).

VEGETATION TYPE:

Trans-Pecos: Mixed Desert Shrubland (8306)

Chihuahuan Mixed Desert and Thornscrub
Identifier: CES302.734.1 **MoRAP Code:** 8306
Description: As described for system.

Chihuahuan Mixed Salt Desert Scrub

Identifier: CES301.017

Geology: Quaternary alluvium.
Landform: Depressional basins and river floodplains.
Soils: Salty desert grassland, Salty Clay Fan, and Salty Bottomland ecological sites.

Description: This system usually occurs as an open-canopied shrubland surrounding saline basins, alluvial fans, and the salty bottomlands along the Pecos River. Substrates are fine-textured, alluvial, and saline. Species making up the often relatively sparse vegetative cover include *Atriplex*

canescens (four-wing saltbush), *Allenrolfea occidentalis* (pickle-weed), *Suaeda suffrutescens* (desert seepweed), *Cylindropuntia leptocaulis* (tasajillo), *Prosopis glandulosa* var. *torreyana* (western honey mesquite), *Isocoma pluriflora* (southern Jimmy-weed), *Sesuvium verrucosum* (winged sea purslane), *Koeberlinia spinosa* (allthorn), *Atriplex acanthocarpa* (tubercled saltbush), *Flourensia cernua* (tarbush), and *Ziziphus obtusifolia* (lotebush). Non-native halophiles such as *Salsola tragus* (prickly Russian thistle), *Alhagi maurorum* (camelthorn), *Peganum harmala* (African rue), and *Tamarix* spp. (saltcedars) are commonly encountered to dominant. Graminoids commonly found, and sometimes constituting significant cover, include *Sporobolus airoides* (alkali sacaton), *Sporobolus wrightii* (big sacaton), *Distichlis spicata* (saltgrass), *Trichloris crinita* (false Rhodes grass), *Pappophorum bicolor* (pink pappusgrass), *Pleuraphis mutica* (tobosa), and *Scleropogon brevifolius* (burrograss).

VEGETATION TYPES:

Trans-Pecos: Salty Desert Scrub (10406)

Chihuahuan Mixed Salt Desert Scrub
Identifier: CES301.017.1 **MoRAP Code:** 10406
Description: Saline sites with significant shrub cover of species mentioned above.

Trans-Pecos: Salty Desert Grassland (10407)

Chihuahuan Mixed Salt Desert Grassland
Identifier: CES301.017.1 **MoRAP Code:** 10407
Description: Saline sites with significant graminoid cover of species mentioned above and lacking, or having sparse, shrub canopy cover.

Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub
Identifier: CES302.737

Geology: Aeolian sands associated with the Salt Basin west of the Guadalupe Mountains and the Hueco Bolson east of El Paso.
Landform: Rolling sand hills and hummocky sandy flats.
Soils: Sand Hill and Deep Sand Ecological Sites.

Description: This system includes shrubby sites on coppice dunes associated with aeolian sands of the Trans-Pecos, often resulting from degradation of grasslands of the North American Warm Desert Active and Stabilized Dunes or the Chihuahuan Sandy Plains Semi-Desert Grassland. *Prosopis glandulosa* (honey mesquite) and *Artemisia filifolia* (sand sage) are the commonest dominants, but other woody species include *Yucca elata* (soaptree yucca), *Cylindropuntia imbricata* (tree cholla), *Atriplex canescens* (four-wing saltbush), and *Ephedra* spp. (mormon-tea). Herbaceous species of the adjacent grasslands are common.

VEGETATION TYPE:

Trans-Pecos: Desert Deep Sand and Dune Scrub (10607)

Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub
Identifier: CES302.737 **MoRAP Code:** 10607
Description: As described for system.

Chihuahuan Succulent Desert Scrub

Identifier: CES302.738

Geology: Typically associated with limestones, but can also be found on gravels, igneous and sandstone substrates.

Landform: Often on rocky or gravelly slopes.

Soils: Rocky or gravelly sites derived from limestone, calcareous gravel deposits, sandstone or igneous. Igneous Hill and Mountain, Limestone Hill and Mountain, Sandstone Hill, Limestone Hill, Gravelly, and similar ecoclasses may be occupied by this system.

Description: This system typically occupies dry slopes with significant exposed rock (typically limestone) or gravel. Shrub species such as *Larrea tridentata* (creosotebush), *Parthenium incanum* (mariola), *Viguiera stenoloba* (skeleton-leaf golden eye) (agarito), and *Forestiera angustifolia* (desert olive) may be present, but succulents such as *Yucca torreyi* (Torrey's yucca), *Dasylirion texanum* (Texas sotol), *Agave lechuguilla* (lechuguilla), *Fouquieria splendens* (ocotillo), *Dasylirion leiophyllum* (smooth sotol), *Euphorbia antisyphilitica* (candelilla), and *Opuntia* spp. (pricklypears) are conspicuous and are the aspect dominants. Overall cover is generally low and bare rock is easily visible in most occurrences. Herbaceous cover is low with grasses such as *Bouteloua eriopoda* (black grama), *Bouteloua ramosa* (chino grama), and *Bouteloua curtipendula* (sideoats grama) sometimes present. Fern and fern allies such as *Astrolepis* spp. (cloakferns), *Cheilanthes* spp. (lipferns) and *Selaginella lepidophylla* (resurrection plant) are often common.

VEGETATION TYPE:

Trans-Pecos: Succulent Desert Scrub (8406)

Chihuahuan Succulent Desert Scrub
Identifier: CES302.738.1 **MoRAP Code:** 8406
Description: As described for system.

Edwards Plateau Limestone Shrubland
Identifier: CES303.041

Geology: Often on massive limestone such as Edwards or related formations.
Landform: This system may occur on plateaus, or slopes, and may often form a discontinuous band around a plateau edge as it breaks into the adjacent slope.
Soils: Soils are characterized by Shallow or Very Shallow Ecological Sites, but may also be found on Low Stony Hill Ecological Sites.

Description: This system may be represented by extensive continuous shrub cover, or occur as a discontinuous shrubland, often with scattered emergent overstory trees. *Quercus sinuata* var. *breviloba* (white shin oak), *Quercus fusiformis* (plateau live oak), and/or *Juniperus ashei* (Ashe juniper) may be important components of the system. In the west, *Pinus remota* (paper-shell pinyon) may also contribute to a scattered emergent overstory. Shrub cover may be dominated by these species, or may be represented as an assemblage of a rather diverse array of species including *Rhus virens* (evergreen sumac), *Rhus lanceolata* (prairie sumac), *Cercis canadensis* var. *texensis* (Texas redbud), *Forestiera pubescens* (elbowbush), *Forestiera reticulata* (netleaf forestiera), *Ungnadia speciosa* (Mexican buckeye), *Sophora secundiflora* (Texas mountain-laurel), *Diospyros texana* (Texas persimmon), *Salvia ballotiflora* (mejorana), *Mimosa borealis* (fragrant mimosa), *Condalia hookeri* (brasil), *Rhus trilobata* (skunkbush sumac), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), and *Mahonia trifoliolata* (agarito). This system also includes *Quercus mohriana* (Mohr's shin oak) or *Quercus vaseyana* (Vasey shin oak) dominated shrublands that are more common to the west. Herbaceous cover may be patchy and is generally graminoid with species including *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Bouteloua rigidiseta* (Texas grama), *Bouteloua trifida* (red grama), *Hilaria belangeri* (curlymesquite), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Nassella leucotricha* (Texas wintergrass), *Erioneuron pilosum* (hairy tridens), *Aristida* spp. (threeawn), and others. Disturbances such as fire may be important processes maintaining this system. However, it appears to persist on thin-soiled sites. To the west, semi-arid conditions result in the replacement of upland woodlands with shrublands. *Juniperus pinchotii* (redberry juniper) increasingly replaces *Juniperus ashei* (Ashe juniper) in this semi-arid region, and shrubs such as *Prosopis glandulosa* (honey mesquite), *Leucophyllum frutescens* (cenizo), *Acacia berlandieri* (guajillo), *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), and *Condalia viridis* (green condalia) become increasingly common. Succulents such as *Dasylirion texanum* (Texas sotol), *Nolina texana* (Texas sacahuista), and *Agave lechuguilla* (lechuguilla) also become increasingly common. In these situations, sometimes large patches are dominated by grasses such as *Bouteloua trifida* (red grama), *Bouteloua curtipendula* (sideoats grama), *Hilaria belangeri* (curlymesquite), *Eroneuron pilosum* (hairy tridens), *Tridens muticus* (slim tridens), and *Nassella leucotricha* (Texas wintergrass). Interestingly, non-native grasses such as *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) are less frequently encountered as dominants of occurrences in the semi-arid west, than in less xeric sites to the east. As conditions become more xeric to the west, this system transitions to shrublands more characteristic of the Chihuahuan Desert region, often with conspicuous increases in succulents such as *Dasylirion texanum* (Texas sotol), *Nolina texana* (Texas sacahuista), *Agave lechuguilla* (lechuguilla), and even *Fouquieria splendens* (ocotillo). To

the south, the system transitions to the shrublands of shallow soils characteristic of the South Texas Plains, with shrubs such as *Leucophyllum frutescens* (cenizo), *Acacia berlandieri* (guajillo), and *Acacia rigidula* (blackbrush). Southern Val Verde County represents a particularly confusing mosaic of these three types.

VEGETATION TYPES:

Edwards Plateau: Ashe Juniper / Live Oak Shrubland (1205)
Edwards Plateau Limestone Evergreen Shrubland and Shrub Motte
Identifier: CES303.041.7 **MoRAP Code:** 1205
Description: This is a commonly encountered type of shrub cover on the Edwards Plateau. It is usually dominated by *Juniperus ashei* (Ashe juniper), often to the almost total exclusion of other species. If other species are present, *Quercus fusiformis* (plateau live oak), *Quercus vaseyana* (Vasey shin oak), *Quercus mohriana* (Mohr's shin oak), *Sophora secundiflora* (Texas mountain-laurel), *Mahonia trifoliolata* (agarito), and/or *Rhus virens* (evergreen sumac) contribute to the evergreen cover of this shrubland. Deciduous shrub species, including *Rhus lanceolata* (prairie sumac), *Cercis canadensis* var. *texensis* (Texas redbud), *Diospyros texana* (Texas persimmon), *Prosopis glandulosa* (honey mesquite), and *Forestiera* spp. (elbowbush) may also be present but never dominant. Areas mapped as this system may, in some cases, lack significant cover of *Juniperus ashei* (Ashe juniper) and these sites are dominated by broad-leaved evergreen shrubs. Monotypic stands of *Quercus fusiformis* (plateau live oak) (occupying the shrub layer) are relatively uncommon. A sparse overstory canopy of *Juniperus ashei* (Ashe juniper), *Quercus fusiformis* (plateau live oak), *Pinus remota* (paper-shell pinyon), *Prosopis glandulosa* (mesquite), *Quercus sinuata* var. *breviloba* (white shin oak), *Quercus vaseyana* (Vasey shin oak), *Celtis* spp. (hackberry) or other species may sometimes be present. Where deciduous shrubs are present and shrub cover is distributed in a patchy mosaic, such sites may be used by black-capped vireos (*Vireo atricapilla*). Some areas currently mapped as Native Invasive: Juniper Shrubland (generally mapped on deeper soils) may be more appropriately considered as part of this vegetation type. Land use history likely contributes to the extensive nature of this type (including the Native Invasive: Juniper Shrubland on the Edwards Plateau) on the landscape. The unpalatable nature of many of the evergreen shrubs in this vegetation type enhances their proliferation under heavy browsing. The majority of shrublands on the Edwards Plateau is mapped as this vegetation type.

Edwards Plateau: Shin Oak Shrubland (1206)
Edwards Plateau Limestone Deciduous Shrubland and Shrub Motte
Identifier: CES303.041.8 **MoRAP Code:** 1206
Description: *Quercus sinuata* var. *breviloba* (white shin oak) may be the significant dominant in these shrublands, sometimes forming nearly monotypic stands. *Quercus fusiformis* (plateau live oak), *Juniperus ashei* (Ashe juniper), and other broad-leaved evergreen shrub species may be common components, but are not dominant. Scattered individuals of these species may be emergent as trees (along with other species such as *Celtis* spp. (hackberry), *Prosopis glandulosa* (mesquite), *Pinus remota* (paper-shell pinyon), *Quercus buckleyi* (Texas oak)) and form a sparse overstory canopy. At some sites, *Quercus sinuata* var. *breviloba* (white shin oak) is uncommon or lacking and other

deciduous shrubs dominate. Such species as *Diospyros texana* (Texas persimmon), *Cercis canadensis* var. *texensis* (Texas redbud), *Prosopis glandulosa* (honey mesquite), *Mahonia trifoliolata* (agarito), *Forestiera pubescens* (elbowbush), *Forestiera reticulata* (netleaf forestiera), *Rhus lanceolata* (prairie sumac), *Condalia hookeri* (brasil), *Rhus trilobata* (skunkbush sumac), *Ungnadia speciosa* (Mexican buckeye), and/or *Mimosa borealis* (fragrant mimosa) may be significant components. These shrublands may be surrounded by grassland, or may transition to adjacent woodland. Where these shrublands are patchy, they may represent appropriate habitat for black-capped vireos (*Vireo atricapilla*). To the south, this shrubland may transition to vegetation more commonly encountered in the South Texas Plains, with shrub species such as *Leucophyllum frutescens* (cenizo), *Acacia berlandieri* (guajillo), *Jatropha dioica* (leatherstem), and *Salvia ballotiflora* (shrubby blue sage).

Edwards Plateau: Ashe Juniper / Live Oak Slope Shrubland (1225)

Edwards Plateau Limestone Evergreen Slope Shrubland

Identifier: CES303.041.17 **MoRAP Code:** 1225

Description: This shrubland resembles the Edwards Plateau: Ashe Juniper / Live Oak Shrubland, but occurs on slopes of greater than twenty percent and often occupies Steep Rocky and Steep Adobe ecoclasses. *Rhus virens* (evergreen sumac) and/or *Garrya ovata* var. *lindheimeri* (Lindheimer's silktassel) may be more commonly encountered in this vegetation type. A sparse overstory of *Juniperus ashei* (Ashe juniper) and/or *Quercus fusiformis* (plateau live oak) may be present. Southern expressions may also have shrub components such as *Acacia berlandieri* (guajillo), *Jatropha dioica* (leatherstem), *Salvia ballotiflora* (shrubby blue sage), *Ungnadia speciosa* (Mexican buckeye), and *Acacia rigidula* (blackbrush).

Edwards Plateau: Shin Oak Slope Shrubland (1226)

Edwards Plateau Limestone Deciduous Shrubland

Identifier: CES303.041.18 **MoRAP Code:** 1226

Description: This shrubland resembles Edwards Plateau: Shin Oak Shrubland, but occurs on slopes greater than twenty percent. As with the occurrences off of slopes, *Quercus sinuata* var. *breviloba* (white shin oak) may not be dominant. *Nolina texana* (Texas sacahuista), *Acacia roemeriana* (Roemer's acacia), *Salvia ballotiflora* (mejorana), *Ungnadia speciosa* (Mexican buckeye), and *Eysenhardtia texana* (Texas kidneywood) may be more commonly encountered on slopes than in non-slope deciduous shrublands.

Edwards Plateau: Juniper Semi-arid Shrubland (1215)

Edwards Plateau Limestone Semi-arid Juniper Shrubland

Identifier: CES303.041.19 **MoRAP Code:** 1215

Description: This shrubland is commonly encountered on the western portions of the Edwards Plateau and is dominated by *Juniperus pinchotii* (redberry juniper) or *Juniperus ashei* (Ashe juniper) shrubs. A sparse overstory canopy of *Juniper* sp. (juniper), *Quercus fusiformis* (plateau live oak), *Pinus remota* (papershell pinyon), and/or *Prosopis glandulosa* (honey mesquite) may be present. Other shrub species commonly encountered include *Prosopis glandulosa* (honey mesquite), *Berberis trifoliolata* (agarito), *Diospyros texana* (Texas persimmon), *Leucophyllum frutescens* (cenizo), and *Acacia berlandieri*

(guajillo). *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear) and *Dasylirion texanum* (Texas sotol) are commonly encountered succulents.

Edwards Plateau: Deciduous Semi-arid Shrubland (1216)

Edwards Plateau Semi-arid Deciduous Shrubland
Identifier: CES303.041.20 **MoRAP Code:** 1216
Description: This shrubland occurs within the more arid regions of the western portions of the Edwards Plateau. Donimant shrub species within this type include *Diospyros texana* (Texas persimmon), *Prosopis glandulosa* (honey mesquite), *Quercus vaseyana* (Vasey shin oak), *Quercus sinuata* var. *breviloba* (white shin oak), *Salvia ballotiflora* (shrubby blue sage), *Berberis trifoliolata* (agarito), *Condalia* sp. (condalia), *Sophora secundiflora* (Texas mountain-laurel), and *Acacia berlandieri* (guajillo). Succulents, including *Dasylirion texanum* (Texas sotol), *Nolina texana* (Texas sacahuista), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), and *Agave lechuguilla* (lechuguilla), are commonly encountered in the driest, rockiest situations. *Juniperus pinchotii* (redberry juniper), *Juniperus ashei* (Ashe juniper) and/or *Quercus fusiformis* (plateau live oak), may be present, but sites are dominated by deciduous shrubs.

Edwards Plateau: Juniper Semi-arid Slope Shrubland (1235)

Edwards Plateau Limestone Semi-arid Juniper Slope Shrubland
Identifier: CES303.041.21 **MoRAP Code:** 1235
Description: This shrubland occurs on slopes greater than 20% in the western portions of the Edwards Plateau. They are dominated by *Juniperus pinchotii* (redberry juniper) and/or *Juniperus ashei* (Ashe juniper), but often have other deciduous shrub components (see **Juniper Semi-arid Shrubland**).

Edwards Plateau: Deciduous Semi-arid Slope Shrubland (1236)

Edwards Plateau Limestone Semi-arid Deciduous Slope Shrubland
Identifier: CES303.041.22 **MoRAP Code:** 1236
Description: Shrublands of the western portion of the Edwards Plateau occurring on slopes greater than 20% and dominated by deciduous shrub species as described for **Deciduous Semi-arid Shrubland**.

Edwards Plateau: Semi-arid Grassland (1207)

Identifier: CES303.041.23 **MoRAP Code:** 1207
Description: These grasslands form the interstices of the shrubland matrix of the western portion of the Edwards Plateau, sometimes occurring as extensive areas with reduced cover of woody and succulent species (though scattered individuals of woody species of the system may be present). Grasses such as *Aristida purpurea* (purple threeawn), *Bouteloua trifida* (red grama), *Bouteloua curtipendula* (side-oats grama), *Hilaria belangeri* (curlymesquite), *Erioneuron pilosum* (hairy tridens), *Tridens muticus* (slim tridens), *Nassella leucotricha* (Texas wintergrass), and/or *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem) are common dominants.

Western Great Plains Sandhill Steppe
Identifier: CES303.671

Geology: Within the Phase 1 area, this system is apparently restricted to thick sandy deposits in the Seymour Formation (a Pleistocene formation formed from ancient channel deposits of the Clear Fork of the Brazos River).
Landform: On rolling to level uplands.
Soils: Within the Phase 1 area, this system is restricted to Deep Sand, Sand Hills or Sandy ecological site.

Description: Shrub cover may be variable, ranging from about 15 to 90% canopy cover. *Artemisia filifolia* (sand sage) or *Quercus havardii* (Havard's shin oak) may dominate or co-dominate the shrub layer, but *Prosopis glandulosa* (mesquite), *Rhus trilobata* (skunkbush sumac), or *Prunus angustifolia* (Chickasaw plum) may also be conspicuous. Shrub cover may sometimes be sufficient to greatly reduce the cover of herbaceous species in the understory. At some sites, shrub cover may be low and herbaceous cover is typically dominated by grass species such *Schizachyrium scoparium* (little bluestem) and *Sporobolus cryptandrus* (sand dropseed).

VEGETATION TYPE:

High Plains: Shinnery Shrubland (2806)
Western Great Plains Sandhill Steppe
Identifier: CES303.671.8 **MoRAP Code:** 2806
Description: As described for the system.

Llano Estacado Caprock Escarpment and Breaks Shrubland and Steppe
Identifier: CES303.725

Geology: May occur on various surfaces that are sufficiently resistant to erosion to form breaks or escarpments. This includes sedimentary deposits such as sandstones, limestones, or shales, or less frequently, igneous formations such as basalt. Breaks associated with the Permian Blaine Formation may have gypsum exposed or influencing the vegetation.
Landform: Breaks and escarpments including slopes and nearby uplands, sometimes associated with canyons or drainages, but not necessarily. The system occupies slopes, but may continue over transitions to more level sites upslope and downslope.
Soils: May occur on various soils, as well as on sites where little soil development has occurred. Rough Breaks Ecological Sites are characteristic of this system, but other sites such as Rocky Hill, Shallow, and Gravelly Ecological Sites may also be occupied by this system.

Description: This system is closely related to, and may overlap with the previously described system Southwestern Great Plains Canyon System (CES303.665), though the currently considered system is not confined strictly to canyons. The physiognomic character of occurrences ranges from sparsely vegetated to shrubland, to sparse woodland. Bare ground is often conspicuous and

herbaceous cover is usually dominated by mid- to shortgrasses such as *Aristida purpurea* (purple threeawn), *Bouteloua curtipendula* (sideoats grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Bouteloua gracilis* (blue grama), *Bouteloua hirsuta* (hairy grama), and *Schizachyrium scoparium* (little bluestem). Forbs, including species such as *Artemisia ludoviciana* (western mugwort), *Thelesperma filifolium* (slender greenthread), *Calylophus* sp. (sundrops), *Chaetopappa ericoides* (heath least-daisy), *Krameria lanceolata* (trailing ratany), *Zinnia grandiflora* (plains zinnia), and *Melampodium leucanthum* (plains blackfoot), may also be present. Shrub canopy may be dense, with some species reaching tree stature, and on some sites forming sparse woodland. Shrub and tree species include *Juniperus pinchotii* (redberry juniper), *Juniperus ashei* (Ashe juniper), *Prosopis glandulosa* (honey mesquite), *Rhus trilobata* (skunkbush sumac), *Rhus microphylla* (littleleaf sumac), *Dalea formosa* (feather dalea), *Ziziphus obtusifolia* (lotebush), *Ephedra antisyphilitica* (joint-fir), *Artemisia filifolia* (sand sage), *Mahonia trifoliolata* (agarito), *Cercocarpus montanus* (true mountain mahogany), *Quercus mohriana* (Mohr's shin oak), and *Gutierrezia sarothrae* (broom snakeweed). Occurrences over gypsiferous formations (such as the Permian Blaine Formation) are mapped separately, though they are compositionally very similar to the typical type. Some species that may suggest the presence of gypsum influence include *Nama stevensii* (Stevens' fiddleleaf), *Calylophus berlandieri* (Berlandier's evening primrose), *Phacelia integrifolia* (gyp phacelia), *Thelesperma megapotamicum* (Navajo tea), and *Haploesthes greggii* (false broomweed), but these species may or may not be present at all sites. The gyp breaks tend to have sparser shrub canopy, reduced herbaceous cover, and more visible bare ground, sometimes with exposed gypsum strata visible.

VEGETATION TYPE:

Rolling Plains: Breaks Canyon (2100)

Llano Estacado Caprock Escarpment and Sparsely Vegetated Breaks
Identifier: CES303.725.0 **MoRAP Code:** 2100
Description: Areas of the breaks and canyons that lack significant vegetative cover.

Rolling Plains: Gyp Breaks Canyon (2110)

Llano Estacado Caprock Escarpment and Sparsely Vegetated Gyp Breaks
Identifier: CES303.725.10 **MoRAP Code:** 2110
Description: Areas of breaks and canyons occurring on, or influenced by, gypsiferous formations and lacking significant vegetative cover.

Rolling Plains: Breaks Deciduous Shrubland (2106)

Llano Estacado Caprock Escarpment and Breaks Deciduous Shrubland
Identifier: CES303.725.1 **MoRAP Code:** 2106
Description: As described for the system.

Rolling Plains: Gyp Breaks Deciduous Shrubland (2116)

Llano Estacado Caprock Escarpment and Breaks Gyp Deciduous Shrubland
Identifier: CES303.725.11 **MoRAP Code:** 2116
Description: Deciduous shrublands associated with breaks associated with gypsiferous formations. These shrublands are compositionally very similar to Rolling Plains: Breaks Deciduous Shrubland but are often somewhat less dense, have a sparser herbaceous layer,

and bare ground beneath the shrub layer is more conspicuous. Some species that may be present to indicate the gyp nature of a site include *Nama stevensii* (Stevens' fiddleleaf), *Calylophus berlandieri* (Berlandier's evening primrose), *Phacelia integrifolia* (gyp phacelia), *Thelesperma megapotamicum* (Navajo tea), and *Haploesthes greggii* (false broomweed).

Rolling Plains: Breaks Evergreen Shrubland (2105)

Llano Estacado Caprock Escarpment and Breaks Evergreen Shrubland
Identifier: CES303.725.2 **MoRAP Code:** 2105
Description: As described for the system, but shrub cover with significant amounts of evergreen species such as *Juniperus pinchotii* (redberry juniper) or, to a lesser extent, *Juniperus ashei* (Ashe juniper).

Rolling Plains: Breaks Grassland (2107)

Llano Estacado Caprock Escarpment and Breaks Steppe Grassland
Identifier: CES303.725.3 **MoRAP Code:** 2107
Description: This type has reduced shrub canopy cover and is typically dominated by graminoids, including *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Pleuraphis mutica* (tobosa), *Bouteloua dactyloides* (buffalograss), and *Tridens muticus* (slim tridens).

Rolling Plains: Gyp Breaks Grassland (2117)

Llano Estacado Caprock Escarpment and Breaks Gyp Steppe Grassland
Identifier: CES303.725.13 **MoRAP Code:** 2117
Description: Similar to Rolling Plains: Breaks Grassland but occupying substrate with some gyp influence. Herbaceous cover is typically somewhat reduced with more exposed bare earth, sometimes with gypsum strata visible at the surface. Composition typically resembles the Rolling Plains: Breaks Grassland, though species such as *Nama stevensii* (Stevens' fiddleleaf), *Calylophus berlandieri* (Berlandier's evening primrose), *Phacelia integrifolia* (gyp phacelia), *Thelesperma megapotamicum* (Navajo tea), and *Haploesthes greggii* (false broomweed) may be present.

Madrean Oriental Chaparral

Identifier: CES302.031

Geology: Various formations at higher elevations of the mountains of West Texas, including the Permian limestones of the Guadalupe Mountain region, Tertiary igneous formations, and sedimentary formations including limestone and sandstone elsewhere.
Landform: Montane slopes
Soils: Rocky and gravelly slopes, often with little soil development.

Description: This system occurs at elevations above desert shrublands on dry rocky habitats of foothills, mountains, and canyons. It often occurs at elevations coincident with the occurrence of Madrean Encinal and Madrean coniferous woodlands, but typically occupies more xeric sites, often with steeper slopes and less soil development. Shrub cover is typically moderate to dense.

Oak species such as *Quercus grisea* (gray oak), *Quercus vaseyana* (Vasey shin oak), *Quercus pungens* (sandpaper oak), *Quercus x pauciloba* (wavyleaf oak), *Quercus turbinella* (scrub oak), *Quercus mohriana* (Mohr's shin oak), and *Quercus gambelii* (Gambel oak) occurring as shrubs may be present to dominant making distinguishing this system from Madrean Encinal sometimes difficult. Other shrub species that are commonly encountered to dominant, include *Cercocarpus montanus* (mountain mahogany), *Pinus cembroides* (Mexican pinyon pine) or *Pinus edulis* (pinyon pine, in the Guadalupe Mountain region), *Ceanothus greggii* (desert ceanothus), *Fallugia paradoxa* (Apache plume), *Rhus virens* (evergreen sumac), *Garrya wrightii* (Wright's silktassel), *Aloysia wrightii* (Wright's beebrush), *Juniperus pinchotii* (redberry juniper), *Chrysactinia mexicana* (damianita), *Fraxinus greggii* (little-leaf ash), and *Viguiera stenoloba* (skeleton-leaf golden eye). *Dasylirion leiophyllum* (smooth sotol), *Nolina texana* (Texas sacahuista), *Agave lechuguilla* (lechuguilla), and *Opuntia engelmannii* var. *engelmannii* (Engelmann pricklypear) are frequently encountered. Herbaceous cover is patchy and bare rock is frequently visible. Graminoids dominate the herbaceous layer with species such as *Bouteloua curtipendula* (sideoats grama), *Bouteloua hirsuta* (hairy grama), *Muhlenbergia emersleyi* (bull muhly), *Muhlenbergia pauciflora* (New Mexican muhly), *Muhlenbergia setifolia* (curlyleaf muhly), *Achnatherum lobatum* (littleawn needlegrass), *Muhlenbergia dubia* (pine muhly), and *Heteropogon contortus* (tanglehead).

VEGETATION TYPES:

Trans-Pecos: Evergreen Chaparral (11005)

Madrean Oriental Deciduous Chaparral
Identifier: CES302.031.1 **MoRAP Code:** 11005
Description: Shrublands dominated by evergreen species that may include *Quercus mohriana* (Mohr's shin oak), *Quercus pungens* (sandpaper oak), *Quercus vaseyana* (Vasey shin oak), *Quercus turbinella* (scrub oak), and *Rhus virens* (evergreen sumac).

Trans-Pecos: Deciduous Chaparral (11006)

Madrean Oriental Evergreen Chaparral
Identifier: CES302.031.2 **MoRAP Code:** 11006
Description: Shrublands dominated by deciduous species.

Rocky Mountain Gambel Oak - Mixed Montane Shrubland
Identifier: CES306.818

Geology: Primarily limestone formations of the mountains.
Landform: Slopes and rolling landforms of the Trans-Pecos mountains.
Soils: Limestone Hill and Mountain and High Montane Conifer Ecological Sites.

Description: High mountain shrublands dominated by the deciduous oak species *Quercus gambelii* (Gambel oak). This species often forms nearly monotypic shrublands, but other species present may include *Cercocarpus montanus* (mountain mahogany), *Robinia neomexicana* (New Mexico locust), *Symphoricarpos oreophilus* (mountain snowberry), and *Rhus trilobata*

(skunkbush sumac). These shrubland patches represent southern outliers of the extensive and diverse system further north.

VEGETATION TYPE:

Trans-Pecos: Rocky Mountain Gambel Oak - Mixed Shrubland (12306)

Rocky Mountain Gambel Oak - Mixed Montane Shrubland
Identifier: CES306.818 **MoRAP Code: 12306**
Description: As described for system.

Tamaulipan Calcareous Thornscrub
Identifier: CES301.986

Geology: Ridge or plateau forming hard calcareous substrates such as caliche of the Goliad Formation or Uvalde Gravel.
Landform: Typically ridges high on the landscape, sometimes rolling or relatively level plateaus.
Soils: Shallow, Shallow Ridge or Gravelly Ridge Ecological Sites.

Description: This shrubland typically occupies xeric, rocky uplands on calcareous substrates including limestone, caliche (such as those of the Goliad Formation), calcareous gravels, and calcareous sandstone of south Texas and northeastern Mexico. Soils are usually thin, and sites are most frequently dominated by shrubs between 0.5 and 2 m in height. Shrub canopy can be dense (to about 90%), or sparser where rocky exposures reduce substrate for rooting. A sparse overstory, usually <4 m in height, may be present and composed of species such as *Prosopis glandulosa* (honey mesquite) and, in the south, *Ebenopsis ebano* (Texas ebony), *Cordia boissieri* (anacahuita), and/or *Helietta parvifolia* (baretta). *Quercus fusiformis* (plateau live oak) may form a relatively open canopy in areas in the northeastern part of the South Texas Plains. The shrub layer may be heavily dominated by *Leucophyllum frutescens* (cenizo), *Acacia berlandieri* (guajillo), and/or *Acacia rigidula* (blackbrush). More commonly, a diverse array of shrubs is present, including these three in addition to several of the following species: *Salvia ballotiflora* (shrubby blue sage), *Eysenhardtia texana* (Texas kidneywood), *Guaiacum angustifolium* (guayacan), *Sophora secundiflora* (Texas mountain-laurel), *Mahonia trifoliolata* (agarito), *Ephedra antisyphilitica* (joint-fir), *Sideroxylon celastrinum* (la coma), *Jatropha dioica* (leatherstem), *Bernardia myricifolia* (oreja de raton), *Karwinskia humboldtiana* (coyotillo), *Aloysia macrostachya* (vara dulce), *Condalia spathulata* (knifeleaf condalia), *Croton incanus* (Torrey croton), *Koeberlinia spinosa* (allthorn), *Acacia schaffneri* (huisachillo), *Forestiera angustifolia* (desert olive), *Celtis ehrenbergiana* (granjeno), *Diospyros texana* (Texas persimmon), *Cylindropuntia leptocaulis* (tasajillo), *Krameria ramosissima* (calderona), *Yucca treculeana* (Spanish dagger), and others. More southerly occurrences may also contain *Lippia graveolens* (redbrush lippia), *Helietta parvifolia* (baretta), *Gochnatia hypoleuca* (chomonque), *Croton humilis* (low croton), *Ebenopsis ebano* (Texas ebony), and/or *Mortonia greggii* (afinador). The herbaceous layer may be somewhat well-developed, but often bare rock is easily visible through the layer. Many sites are now dominated by non-native grasses, particularly *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) and/or *Pennisetum ciliare* (buffelgrass). Other grasses are often shortgrasses,

with species such as *Bouteloua rigidiseta* (Texas grama), *Bouteloua hirsuta* (hairy grama), *Bouteloua dactyloides* (buffalograss), *Hilaria belangeri* (curlymesquite), *Aristida purpurea* (purple threeawn), *Bouteloua curtipendula* (sideoats grama), and *Setaria leucopila* (plains bristlegrass) present. Forbs and subshrubs are conspicuous in the herbaceous layer and include species such as *Tiquilia canescens* (oreja de perro), *Thamnosma texana* (Texas desert-rue), *Galphimia angustifolia* (narrowleaf thryallis), *Polygala alba* (white milkwort), *Cordia podocephala* (cluster cordial) , *Acourtia runcinata* (peonia), *Dalea aurea* (golden dalea), *Calliandra conferta* (Rio Grande stickpea), *Chamaecrista greggii* (Gregg's senna), *Heliotropium torreyi* (Torrey heliotrope), *Melampodium cinereum* (blackfoot daisy), *Hymenopappus scabiosaeus* (old plainsman), *Desmanthus velutinus* (velvet bundleflower), *Calylophus hartwegii* (Hartweg evening primrose), *Simsia calva* (awnless bush sunflower), *Hermannia texana* (Mexican mallow), *Macrosiphonia lanuginosa* var. *macrosiphon* (plateau rocktrumpet), *Viguiera stenoloba* (skeletonleaf goldeneye), *Stenaria nigricans* (prairie bluets), *Thymophylla pentachaeta* (fire-hair dogweed), *Wedelia hispida* (hairy zexmania), and *Meximalva filipes* (violet sida). Down slope from these sites, soil development increases, soils tend to be tight, a more well-developed overstory of *Prosopis glandulosa* (honey mesquite) becomes prominent, and species such as *Castela erecta* (amargosa) and *Ziziphus obtusifolia* (lotebush) increase in cover relative to other species.

VEGETATION TYPES:

South Texas: Shallow Live Oak Motte and Woodland (7202)

Tamaulipan Calcareous Live Oak Motte and Woodland
Identifier: CES301.986.2 **MoRAP Code:** 7202
Description: Sites in the northern part of the South Texas Plains where *Quercus fusiformis* (plateau live oak) dominates the overstory. Various shrub species of the system may dominate the understory.

South Texas: Shallow Shrubland (7204)

Tamaulipan Calcareous Shrubland
Identifier: CES301.986.4 **MoRAP Code:** 7204
Description: Typical shrublands of ridges and caliche plateaus with moderate shrub cover and sometimes a sparse overstory canopy.

South Texas: Shallow Dense Shrubland (7205)

Tamaulipan Calcareous Dense Shrubland
Identifier: CES301.986.5 **MoRAP Code:** 7205
Description: Dense shrublands often dominated by species such as *Acacia rigidula* (blackbrush), *Leucophyllum frutescens* (cenizo), and *Acacia berlandieri* (guajillo).

South Texas: Shallow Sparse Shrubland (7207)

Tamaulipan Calcareous Sparse Shrubland
Identifier: CES301.986.7 **MoRAP Code:** 7207
Description: Sites on calcareous ridges and plateaus where shrub canopy is sparse. These sites are often managed pasture, with species such as *Pennisetum ciliare* (buffelgrass), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), or *Cynodon dactylon* (bermudagrass).

Tamaulipan Lomas

Identifier: CES301.462

Geology: Quaternary windblown deposits identified as clay dunes (Qcd).

Landform: Round, elliptic, or crescent-shaped topographic highs, often within a matrix of low flats influenced by wind-driven tides.

Soils: Often associated with the Coastal Ridge Ecological Site, such as Point Isabel clay loam and Lalinda fine sandy loam.

Description: This system occupies clay dunes (lomas) along the lower Texas coast (and somewhat inland) and adjacent Mexico. These often develop from deposition of windblown fine sediments, resulting in elevated landforms within a matrix of tidal flats. These are typically fairly dense to extremely dense shrublands, often 2-4 meters in height, and dominated by species such as *Ebenopsis ebano* (Texas ebony), *Citharexylum berlandieri* (negrito), *Leucophyllum frutescens* (cenizo), *Yucca treculeana* (Spanish dagger), *Jatropha dioica* (leatherstem), *Acacia rigidula* (blackbrush), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer prickly pear), *Prosopis glandulosa* (honey mesquite), *Sideroxylon celastrinum* (la coma), *Forestiera angustifolia* (desert olive), *Celtis ehrenbergiana* (granjeno), *Guaiacum angustifolium* (guayacan), *Karwinskia humboldtiana* (coyotillo), *Castela erecta* (amargosa), *Zanthoxylum fagara* (colima), *Phaulothamnus spinescens* (snake-eyes), and *Ziziphus obtusifolia* (lotebush). There may be scattered emergent trees of *Ebenopsis ebano* (Texas ebony) and *Prosopis glandulosa* (honey mesquite) forming a sparse woodland. Within these shrublands, the herbaceous layer is typically not well-developed, however the non-native *Urochloa maximum* (guineagrass), may be conspicuous. A grassland, often dominated by *Sporobolus wrightii* (big sacaton), occupies the margins of these clay dunes, as they grade downslope into the surrounding salty flats. These margins may also contain *Sporobolus pyramidatus* (whorled dropseed), *Monanthochloe littoralis* (shoregrass), and *Spartina spartinae* (Gulf cordgrass). Other somewhat halophytic species, such as *Maytenus phyllanthoides* (gutta-percha) and *Prosopis reptans* (tornillo) may also occupy these dunes. The proximity of many of these dunes to active tidal fluctuations and salt spray also influences species composition at these sites.

VEGETATION TYPES:

South Texas: Loma Evergreen Shrubland (7305)

Tamaulipan Loma Evergreen Shrubland

Identifier: CES301.462.5 **MoRAP Code:** 7305

Description: Clay dunes where the shrub layer is dense and may contain a preponderance of evergreen shrubs such as *Ebenopsis ebano* (Texas ebony), *Yucca treculeana* (Spanish dagger), and *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear). However, in this subtropical region, many species retain their leaves throughout the winter and only lose their leaves during drought.

South Texas: Loma Deciduous Shrubland (7306)

Tamaulipan Loma Deciduous Shrubland
Identifier: CES301.462.6 **MoRAP Code:** 7306
Description: Clay dunes where the shrub layer is less dense and has a reduced amount of evergreen components.

South Texas: Loma Grassland (7307)

Tamaulipan Loma Grassland
Identifier: CES301.462.6 **MoRAP Code:** 7307
Description: These grass dominated sites often occupy the edges of shrublands and are frequently dominated by *Sporobolus wrightii* (big sacaton), *Spartina spartinae* (Gulf cordgrass), *Setaria leucopila* (plains bristlegrass), *Monanthochloe littorale* (shoregrass), and/or others. *Urochloa maximum* (guineagrass) may be a conspicuous non-native.

Tamaulipan Mixed Deciduous Thornscrub
Identifier: CES301.983

Geology: Well-represented on the Eocene Claiborne and Jackson Groups and the Pleistocene Beaumont Formation, but also found on various other formations.
Landform: On gently rolling to nearly level sites, sometime interdigitated with calcareous ridges and low lying drainages and bottomlands.
Soils: Clay, Clay Flat, and Clay Loam Ecological Sites are the typical soils for this system, though it may occur on a variety of other tight soils.

Description: This shrubland is differentiated from Tamaulipan Savanna Grassland as it occupies tighter soils, as opposed to the sandier soils of the savanna grassland. The sites are often lower in the landscape compared to nearby savanna grassland or Tamaulipan Calcareous Shrubland, but would be considered uplands as they are distant from bottomland soils and drainages, and are not well-developed woodlands typical of the lowest landscape positions. To a large degree, all of these systems share numerous shrub species, but show subtle differences in relative dominance. However, this system generally occurs as a closed shrubland or low woodland, usually lacking a purely open herbaceous component. Soils are clays, clay loams, and clay flats and are often calcareous or alkaline to varying degrees. Some sites are highly saline, and these sites are occupied by Tamaulipan Saline Shrubland, but transitions between the systems may be subtle. *Prosopis glandulosa* (honey mesquite) is very often a conspicuous component of the canopy, sometimes reaching to 6 m in height. This canopy may be dense, but given the open nature of the canopy of individual *Prosopis glandulosa* (honey mesquite), significant solar radiation reaches the lower strata. *Acacia farnesiana* (huisache), *Celtis ehrenbergiana* (granjeno), *Ebenopsis ebano* (Texas ebony), and *Celtis laevigata* (sugar hackberry) may also be components of the canopy, but *Prosopis glandulosa* (honey mesquite) usually dominates. The overstory canopy may be open with only scattered emergent trees over a dense shrub layer at 1 to 3 m in height. Depending on land use history, the shrub understory may be limited to a few species such as *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), *Ziziphus obtusifolia* (lotebush), or *Celtis ehrenbergiana* (granjeno) on relatively recently cleared sites. On more mature sites, a diverse assemblage of species such as *Acacia rigidula* (blackbrush), *Castela erecta* (amargosa), *Malpighia glabra*

(Barbados cherry), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), *Cylindropuntia leptocaulis* (tasajillo), *Ziziphus obtusifolia* (lotebush), *Celtis ehrenbergiana* (granjeno), *Lycium berlandieri* (Berlandier wolfberry), *Forestiera angustifolia* (desert olive), *Guaiacum angustifolium* (guayacan), *Diospyros texana* (Texas persimmon), *Amyris texana* (Texas torchwood), *Karwinskia humboldtiana* (coyotillo), *Havardia pallens* (tenaza), *Phaulothamnus spinescens* (snake-eyes), *Schaefferia cuneifolia* (desert yaupon), *Condalia hookeri* (brasil), and *Zanthoxylum fagara* (colima) may occur. *Leucophyllum frutescens* (cenizo) and *Acacia berlandieri* (guajillo) may be present, but occur as scattered individuals as opposed to dominating the aspect of the community as they sometimes do on some shallow-soiled calcareous sites. However, like some shallow-soiled calcareous sites, *Acacia rigidula* (blackbrush) is the aspect dominant of the shrub layer. The herbaceous layer is usually fairly sparse. Currently, the herbaceous layer may actually be dense with the non-native grass *Urochloa maximum* (guineagrass). Other non-native species, such as *Pennisetum ciliare* (buffelgrass), *Cynodon dactylon* (bermudagrass), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), and *Dichanthelium annulatum* (Kleberg bluestem), may also be present to dominant. Native grasses, such as *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Trichloris* spp. (false Rhodes grasses), and *Pappophorum bicolor* (pink pappusgrass), may be present.

VEGETATION TYPES:

South Texas: Clayey Live Oak Motte and Woodland (7002)

Tamaulipan Clayey Live Oak Motte and Woodland
Identifier: CES301.983.2 **MoRAP Code:** 7002
Description: Sites along the northern edge of the South Texas Plains on clayey substrates where *Quercus fusiformis* (plateau live oak) dominates the overstory. The understory is often dominated by numerous shrub species.

South Texas: Clayey Mesquite Mixed Shrubland (7004)

Tamaulipan Clayey Mesquite Mixed Shrubland
Identifier: CES301.983.4 **MoRAP Code:** 7004
Description: Sites often with a sparse to dense overstory of *Prosopis glandulosa* (honey mesquite). Numerous shrub species occupy the understory, including *Acacia farnesiana* (huisache), *Acacia rigidula* (blackbrush), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), and *Celtis ehrenbergiana* (granjeno).

South Texas: Clayey Blackbrush Mixed Shrubland (7005)

Tamaulipan Clayey Blackbrush Mixed Shrubland
Identifier: CES301.983.5 **MoRAP Code:** 7004
Description: Sites are typically dominated by a dense canopy of *Acacia rigidula* (blackbrush), but these sites may have numerous species in the canopy, including *Prosopis glandulosa* (honey mesquite), *Celtis ehrenbergiana* (granjeno), *Condalia hookeri* (brasil), and *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear). These shrublands may be tall (to 2 or more meters in height) making them resemble dense woodlands.

Tamaulipan Saline Thornscrub
Identifier: Previously Undescribed System

Geology: Frequently associated with the Yegua Formation or the Jackson Group.
Landform: Gently rolling to low flats, sometimes dissected by minor drainages.
Soils: Most saline sites are within the Saline Clay and Saline Clay Loam Ecological Site.

Description: This system is an open shrubland on sites where soil salinity is particularly high on saline clays such as Montell saline clays, Maverick, and Catarina soils. Soils mapped as saline clay or saline clay loam, but where soil salinity is not extreme, will be occupied by Tamaulipan Mixed Deciduous Shrubland. Often, Tamaulipan Calcareous Shrubland occurs upslope of this system. This system is often on level flats to gently rolling landscapes, and soils may have a veneer of gravel over the clay. *Prosopis glandulosa* (honey mesquite) usually forms a scattered emergent canopy less than 5 m in height, creating an overstory canopy cover of around 10%. Shrubs and subshrubs, such as *Varilla texana* (saladillo), *Castela erecta* (amargosa), *Acacia rigidula* (blackbrush), *Atriplex canescens* (four-wing saltbush), *Isocoma coronopifolia* (goldenweed), *Condalia spathulata* (knifeleaf condalia), *Jatropha dioica* (leatherstem), *Suaeda* spp. (seepweeds), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer prickly pear), *Cylindropuntia leptocaulis* (tasajillo), *Xylothamia palmeri* (South Texas ericameria), *Tiquilia canescens* (oreja de perro), and *Prosopis reptans* (tornillo), are conspicuous elements of the relatively open shrubland (20 to 70% canopy cover). Patchy grasses typify the herbaceous layer, with such species as *Hilaria belangeri* (curly mesquite), *Sporobolus pyramidatus* (whorled dropseed), *Pappophorum bicolor* (pink pappusgrass), *Bouteloua dactyloides* (buffalograss), *Bouteloua trifida* (red grama), and occasionally *Monanthochloe littoralis* (shoregrass). Forbs such as *Billieturnera helleri* (Billieweed), *Chamaesyce albomarginata* (white-lip matspurge), *Heliotropium curassavicum* (seaside heliotrope), and *Thymophylla pentachaeta* (parralena), may be present and conspicuous. Cacti are sometimes well-represented in the ground layer, including species such as *Echinocereus reichenbachii* var. *fitchii* (Fitch's hedgehog cactus), *Escobaria emskoetteriana* (Robert's foxtail-cactus), *Mammillaria heyderi* (Heyder's nipple-cactus), *Sclerocactus scheeri* (fishhook cactus), *Echinocactus texensis* (horse crippler), and *Thelocactus setispinus* (twisted rib cactus).

VEGETATION TYPE:

South Texas: Salty Thornscrub (6806)
Tamaulipan Saline Thornscrub
Identifier: **MoRAP Code:** 6806
Description: As described for system.

Tamaulipan Savanna Grassland

Identifier: CES301.985

Geology: On thinner eolian sands on the western side of the South Texas Sand Sheet, and other sandy sites such as those of the Eocene sands of the Carrizo, Queen City, and Sparta Formations. Also found associated with other formations, such as Oakville Sandstone and other formations producing sandy residuum.

Landform: Level to gently rolling sites.

Soils: Sandy to sandy loam sites, such as those of the Sandy, Loamy Sand and Sandy Loam Ecological Sites.

Description: This system occurs on sandy soils, including sandy, sandy loam, and loamy sands. It is typically dominated by *Prosopis glandulosa* (honey mesquite) in the overstory, and the overstory may be sparse, giving the aspect of an open grassland, with scattered trees and shrubs. Or, more commonly, the system occurs as shrub-dominated patches within a grassy matrix, with an emergent canopy to about 6 or more meters in height of *Prosopis glandulosa* (honey mesquite) and sometimes other species, such as *Ebenopsis ebano* (Texas ebony) or *Celtis ehrenbergiana* (granjeno). Sometimes the overstory canopy is well-developed and would be considered woodland. These patches often coalesce to form significant expanses of shrubland. Sites with somewhat tighter soils tend to have a denser shrub stratum, while deep sands and sandy sites tend to be more open, often with sizeable areas lacking significant shrub cover and dominated by a primarily graminoid herbaceous layer. The shrub component of woody patches or shrublands is commonly dominated by species such as *Zanthoxylum fagara* (Colima), *Condalia hookeri* (brasil), *Celtis ehrenbergiana* (granjeno), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), *Diospyros texana* (Texas persimmon), *Colubrina texensis* (Texas hogplum), *Cylindropuntia leptocaulis* (tasajillo), and *Acacia farnesiana* (huisache). *Prosopis glandulosa* (honey mesquite) is almost always present, and is often dominant to co-dominant and occupies the highest canopy position (sometimes sharing that position with few other species), sometimes to 6 m in height. Numerous other species may also occur in the shrub layer, including but not limited to *Schaefferia cuneifolia* (desert yaupon), *Mahonia trifoliolata* (agarito), *Forestiera angustifolia* (desert olive), *Lycium berlandieri* (Berlandier wolfberry), *Aloysia gratissima* (whitebrush), *Salvia ballotiflora* (shrubby blue sage), and *Ziziphus obtusifolia* (lotebush). The diversity of the shrub layer is significantly influenced by land use history, with recently cleared areas sometimes being represented by a near monoculture of *Prosopis glandulosa* (honey mesquite) in the overstory, *Pennisetum ciliare* (buffelgrass) in the herbaceous layer, and *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear) as the most conspicuous component of the shrub layer. The herbaceous layer is typically dominated by graminoids and may be quite dense (60 to 100% cover). Grasses, such as *Schizachyrium scoparium* (little bluestem), *Schizachyrium littorale* (seacoast bluestem), *Chloris cucullata* (hooded windmillgrass), *Paspalum monostachyum* (gulfdune paspalum), *Paspalum plicatulum* (brownseed paspalum), *Elionurus tripsacoides* (Pan American balsamscale), *Bouteloua rigidiseta* (Texas grama), *Urochloa ciliatissima* (fringed signalgrass), *Heteropogon contortus* (tanglehead), *Eragrostis secundiflora* (red lovegrass), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Trichloris pluriflora* (multiflower false Rhodes grass), *Aristida* spp. (threeawns), *Sporobolus cryptandrus* (sand dropseed), and/or *Dichanthelium* spp. (rosette grasses)

commonly dominate or co-dominate the herbaceous layer. Forbs are also common, including species such as *Gaillardia pulchella* (Indian blanket), *Eriogonum multiflorum* (heartsepal wildbuckwheat), *Croton* spp. (croton), *Cnidoscolus texana* (Texas bull-nettle), *Aphanostephus skirrhobasis* (lazy daisy), *Rudbeckia hirta* (blackeyed Susan), *Verbesina encelioides* (cowpen daisy), *Clematis drummondii* (old man's beard), *Cynanchum barbigerum* bearded shallow-wort), *Thymophylla pentachaeta* (parralena), *Justicia pilosella* (hairy tubetongue), *Nama jamaicense* (fiddleleaf nama), *Monarda punctata* (spotted beebalm), *Palafoxia texana* (Texas palafoxia), *Florestina tripteris* (white palafoxia), *Zornia bracteata* (bracted zornia), *Croptilon divaricatum* (scratch-daisy), *Rhynchosia americana* (American snoutbean), and *Wedelia texana* (hairy zexmania), though some of these species are restricted to the sandiest sites.

VEGETATION TYPES:

South Texas: Sandy Live Oak Motte and Woodland (7102)

Tamaulipan Sandy Live Oak Motte and Woodland
Identifier: CES301.985.2 **MoRAP Code:** 7102
Description: Sandy sites along the northern edge of the South Texas Plains where *Quercus fusiformis* (plateau live oak) dominates the canopy. *Prosopis glandulosa* (honey mesquite), *Celtis ehrenbergiana* (granjeno), *Zanthoxylum fagara* (colima), and various other species may dominate the understory and/or shrub layer.

South Texas: Sandy Mesquite / Evergreen Woodland (7103)

Tamaulipan Sandy Mesquite–Evergreen Woodland
Identifier: CES301.985.3 **MoRAP Code:** 7103
Description: Woodlands on sandy sites in the southern part of the South Texas Plains where the canopy is co-dominated by *Prosopis glandulosa* (honey mesquite) and *Ebenopsis ebano* (Texas ebony). A diverse shrub layer is often present.

South Texas: Sandy Mesquite Woodland and Shrubland (7104)

Tamaulipan Sandy Mesquite Woodland
Identifier: CES301.985.4 **MoRAP Code:** 7104
Description: Woodlands or shrublands on sandy substrate where *Prosopis glandulosa* (honey mesquite) and *Acacia farnesiana* (huisache) dominate the overstory. Other species, including *Celtis ehrenbergiana* (granjeno) may also occur in the canopy. A diverse shrub layer may also be present, with species such as *Diospyros texana* (Texas persimmon), *Zanthoxylum fagara* (colima), *Condalia hookeri* (brasil), *Acacia rigidula* (blackbrush) and others.

South Texas: Sandy Mesquite Dense Shrubland (7105)

Tamaulipan Sandy Mesquite Dense Shrubland
Identifier: CES301.985.5 **MoRAP Code:** 7105
Description: Dense shrublands on sandy substrates. These shrublands may have *Prosopis glandulosa* (honey mesquite) in the overstory, though the height of the upper layer is typically less than 5 m in height. Numerous other shrub species form the dense shrub canopy.

South Texas: Sandy Mesquite Savanna Grassland (7107)

Tamaulipan Savanna Grassland
Identifier: CES301.985.7 **MoRAP Code:** 7107
Description: Grass dominated sandy sites, sometimes with a sparse or patchy overstory of *Prosopis glandulosa* (honey mesquite) or other species. *Schizachyrium scoparium* (little bluestem), *Schizachyrium littorale* (seacoast bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and other native species may dominate these grasslands, or non-native species such as *Cynodon dactylon* (bermudagrass), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), or *Pennisetum ciliare* (buffelgrass) may dominate.

Western Great Plains Sandhill Steppe
Identifier: CES303.671

Geology: Eolian or alluvial sand deposits.
Landform: On rolling to level uplands.
Soils: This system is restricted to Deep Sand, Sand Hills or Sandy ecological sites.

Description: Shrub cover may be variable, ranging from about 15 to 90% canopy cover. *Artemisia filifolia* (sand sage) or *Quercus havardii* (Havard's shin oak) may dominate or co-dominate the shrub layer, but *Prosopis glandulosa* (mesquite), *Rhus trilobata* (skunkbush sumac), or *Prunus angustifolia* (Chickasaw plum) may also be conspicuous or sometimes dominate the layer. Shrub cover may sometimes be sufficient to greatly reduce the cover of herbaceous species in the understory. A sparse overstory canopy may be present with species such as *Prosopis glandulosa* (honey mesquite), *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Quercus stellata* (post oak), and *Sapindus saponaria* var. *drummondii* (western soapberry) present. Occasionally overstory canopy is well-developed and include these species, as well as tree stature representatives of *Quercus havardii* (Havard's shin oak) or *Prosopis glandulosa* (honey mesquite). At some sites, shrub cover may be low and herbaceous cover is typically dominated by grass species such as *Schizachyrium scoparium* (little bluestem) and *Sporobolus cryptandrus* (sand dropseed). Herbaceous cover also includes forbs such as *Aphanostephus ramosissimus* (plains lazy daisy), *Gaillardia pulchella* (Indian blanket), *Dimorphocarpa candicans* (Palmer's spectaclepod), *Oenothera grandis* (largeflower eveningprimrose), and *Eriogonum annuum* (annual wildbuckwheat).

VEGETATION TYPE:

High Plains: Active Sand Dunes (2800)

Western Great Plains Sandhill Dunes
Identifier: CES303.671.0 **MoRAP Code:** 2800
Description: Areas on deep sand and sandhill site types lacking significant vegetative cover.

High Plains: Sandy Shinnery Shrubland (2806)

Western Great Plains Sandy Shinnery Shrubland
Identifier: CES303.671.8 **MoRAP Code:** 2806
Description: Shrublands of sandy substrates but not on deep sand or sandhills, though these sites may be nearby. *Quercus havardii* (Havard's shin oak) is typically dominant but other shrub species are commonly encountered.

High Plains: Sandhill Shinnery Duneland (2816)

Western Great Plains Sandhill Shinnery Shrubland
Identifier: CES303.671.18 **MoRAP Code:** 2816
Description: Shrubland on deep sand or sandhill sites where *Quercus havardii* (Havard's shin oak) is the dominant or at least makes up a significant portion of the cover. Other shrub species are also commonly encountered.

High Plains: Sandy Deciduous Shrubland (2805)

Western Great Plains Sandy Deciduous Shrubland
Identifier: CES303.671.7 **MoRAP Code:** 2805
Description: Shrublands on sandy substrates but not on deep sand or sandhills, though these sites may be nearby. Common species dominating the sites are *Artemisia filifolia* (sand sage), *Prosopis glandulosa* (honey mesquite), *Prunus angustifolia* (Chickasaw plum), and/or *Rhus trilobata* (skunkbush sumac). *Quercus havardii* (Havard's shin oak) may be present, but is typically not dominant.

High Plains: Sandhill Deciduous Shrubland (2810)

Western Great Plains Sandhill Deciduous Shrubland
Identifier: CES303.671.17 **MoRAP Code:** 2810
Description: Shrublands on deep sand or sandhill sites that typically lack *Quercus havardii* (Havard's shin oak) as the dominant, though this species may be present. Species such as *Artemisia filifolia* (sand sage), *Prunus angustifolia* (Chickasaw plum), *Prosopis glandulosa* (honey mesquite), *Sapindus saponaria* var. *drummondii* (western soapberry), and *Rhus trilobata* (skunkbush sumac) dominate the shrub layer.

High Plains: Deep Sand Woodland (2804)

Western Great Plains Sandhill Woodland
Identifier: CES303.671.1 **MoRAP Code:** 2804
Description: Deciduous woodlands occurring on deep sands or sandhills or nearby sandy soils. These woodlands may be dominated by species such as *Sapindus saponaria* var. *drummondii* (western soapberry), *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Quercus havardii* (Havard's shin oak), *Quercus stellata* (post oak), or a hybrid of these two oak species.

Herbaceous Vegetation

Apacherian-Chihuahuan Semi-Desert Grassland and Steppe
Identifier: CES302.735

Geology: Occurs on various substrates, typically not occupying fine alluvium, but may occur on alluvial outwash slopes. This system may occur on igneous, limestone, and sandstone.
Landform: At lower elevations on mountain slopes and continuing onto lower bajadas.
Soils: Typically on rocky soils derived from limestone, igneous, and sandstone substrates.

Description: This grassland system sometimes occurs in association with Chihuahuan Mixed Desert and Thornscrub and may have shrubs of that system present. The herbaceous layer may be dense, but typically much bare ground or rock is visible. Graminoids dominate the layer with species such as *Bouteloua eriopoda* (black grama), *Bouteloua curtipendula* (sideoats grama), *Muhlenbergia setifolia* (curlyleaf muhly), *Bouteloua ramosa* (chino grama), *Muhlenbergia porteri* (bush muhly), *Bouteloua barbata* (sixweeks grama), *Dasyochloa pulchella* (fluffgrass), *Digitaria californica* (Arizona cottontop), and *Aristida* spp. (threeawns). On some slopes, species such as *Dasylirion leiophyllum* (smooth sotol), *Nolina texana* (Texas sacahuista), *Opuntia engelmannii* (Engelmann pricklypear), *Agave lechuguilla* (lechuguilla), *Yucca torreyi* (Torrey's yucca) and/or *Fouquieria splendens* (ocotillo) may be conspicuous, though scattered elements. *Nolina* spp. (sacahuista) and *Dasylirion* spp. (sotol) may dominate some sites, especially on limestone slopes. If significant areas dominated by shrubs are encountered, these sites are likely mapped as Chihuahuan Mixed Desert and Thornscrub, Chihuahuan Succulent Desert Scrub, or Chihuahuan Creosotebush Desert Scrub depending on composition. Shrub species that may be encountered in these grasslands include *Larrea tridentata* (creosotebush), *Parthenium incanum* (mariola), *Viguiera stenoloba* (skeleton-leaf golden eye), *Acacia constricta* (whitethorn acacia), *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), *Condalia ericoides* (javelina bush), and many others.

VEGETATION TYPE:

Trans-Pecos: Hill and Foothill Grassland (10207)

Apacherian-Chihuahuan Semi-Desert Grassland and Steppe
Identifier: CES302.735.1 **MoRAP Code:** 10207
Description: Grasslands as described for system. *Dasylirion leiophyllum* (smooth sotol) and/or *Nolina texana* (Texas sacahuista) may be present but occur as widely scattered individuals.

Central Mixedgrass Prairie
Identifier: CES303.659

Geology: Typical of various sedimentary formations of the Rolling Plains.
Landform: Gently rolling uplands.
Soils: Generally on loams and clay loams. Often on Ecological Sites such as Clay Slopes, Loamy Prairie, Clayey Upland, Claypan Prairie, Sandy Loam, and Clay Loam.

Description: Central Mixedgrass Prairie represents the common prairie type in the Rolling Plains. This prairie often has *Schizachyrium scoparium* (little bluestem) as a dominant, with *Nassella leucotricha* (Texas wintergrass), *Bouteloua curtipendula* (sideoats grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Bouteloua hirsuta* (hairy grama), *Bouteloua gracilis* (blue grama), *Bouteloua dactyloides* (buffalograss), *Andropogon gerardii* (big bluestem), *Pascopyrum smithii* (western wheatgrass), *Aristida purpurea* (purple threeawn), *Sporobolus cryptandrus* (sand dropseed), and *Pleuraphis mutica* (tobosa) also commonly encountered. Grazing tends to favor shortgrass species such as *Bouteloua dactyloides* (buffalograss) and *Bouteloua gracilis* (blue grama). Sandy soils may be similar, but typically have greater cover of *Sporobolus cryptandrus* (sand dropseed) and forbs such as *Eriogonum annuum* (annual wildbuckwheat), *Heterotheca canescens* (gray goldaster), *Dimorphocarpa candicans* (Palmer's spectaclepod), and *Gaillardia pulchella* (Indian blanket). This system is frequently invaded by juniper (primarily *Juniperus pinchotii* (redberry juniper)), *Ziziphus obtusifolia* (lotebush), and *Prosopis glandulosa* (mesquite), and sandier sites may contain some *Artemisia filifolia* (sand sage) and *Quercus havardii* (Havard's shin oak).

VEGETATION TYPE:

Rolling Plains: Mixedgrass Prairie (307)

Central Mixedgrass Prairie
Identifier: CES303.659.9 **MoRAP Code:** 307
Description: Grassland dominated by species such as *Schizachyrium scoparium* (little bluestem), *Nassella leucotricha* (Texas wintergrass), *Bouteloua curtipendula* (sideoats grama), and *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem). This type typically occupies loam, clay loams, or sandy loams.

Rolling Plains: Mixedgrass Sandy Prairie (317)

Central Mixedgrass Sandy Prairie
Identifier: CES303.659.10 **MoRAP Code:** 317
Description: Similar to Rolling Plains: Mixedgrass Prairie (307) but occupying sandy sites and typically with greater cover of *Sporobolus cryptandrus* (sand dropseed) and forbs such as *Eriogonum annuum* (annual wildbuckwheat), *Heterotheca canescens* (gray goldaster), *Dimorphocarpa candicans* (Palmer's spectaclepod), and *Gaillardia pulchella* (Indian blanket). Shrubs such as *Artemisia filifolia* (sand sage), *Prosopis glandulosa* (honey mesquite), and *Quercus havardii* (Havard's shin oak) may be encountered.

Central Texas Coast River Terrace Sandyland Grassland

Identifier: Previously Undescribed System

Geology: This system occurs on Quaternary alluvium of stream deposited sands.

Landform: Terraces and benches representing local highs within the level and ridge and swale topography of river floodplains.

Soils: Deep sands (typically > 1 meter (3 feet) in depth). The ecological site type is characterized as Sand Hill on soils such as Sarita-Falfurrias fine sands, but other coarse, deep sand sites on river terraces are also occupied by this system.

Description: This system occurs on deep sands on the terraces of rivers and streams of the coastal prairie from Austin to Refugio Counties. These sites are typically dominated by graminoids including species such as *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), *Paspalum plicatulum* (brownseed paspalum), and *Andropogon gerardii* (big bluestem). Other grass species that may be present to dominant include *Paspalum setaceum* (thin paspalum), *Trachypogon spicatus* (crinkleawn), *Paspalum monostachyum* (gulfdune paspalum), *Elionurus tripsacoides* (Pan American balsamscale), *Cenchrus spinifex* (common sandbur), *Eragrostis secundiflora* (red lovegrass), *Aristida* spp. (threeawns), and *Triplasis purpurea* (purple sandgrass). Characteristic forbs of the system include *Aphanostephus skirrhobasis* (lazy daisy), *Heterotheca subaxillaris* (camphor weed), *Cnidoscolus texanus* (Texas bullnettle), *Stillingia sylvatica* (queen's delight), *Gaillardia aestivalis* (prairie gaillardia), *Croton argyranthemus* (silverleaf croton), *Acalypha radians* (cardinal's feather), *Croton parksii* (Park's croton), *Croton capitatus* (hog croton), *Phyllanthus abnormis* (sand leaf-flower), *Physalis cinerascens* (smallflower groundcherry), *Helianthus argophyllus* (silverleaf sunflower), *Verbesina encelioides* (cowpen daisy), *Eriogonum multiflorum* (heartsepal wildbuckwheat), *Froelichia floridana* (Florida snake-cotton), *Croptilon divaricatum* (scratch-daisy), *Diodia teres* (poor joe), *Polanisia erosa* (large clammyweed), and *Chamaecrista fasciculata* (partridge pea). *Prosopis glandulosa* (honey mesquite) is a common woody invader on these sites, but other woody species such as *Zanthoxylum fagara* (colima), *Celtis ehrenbergiana* (granjeno), and the uncommon *Prunus texana* (Texas peachbush) may also be present.

VEGETATION TYPE:

Coastal Plain: Terrace Sandyland Grassland (7907)

Central Texas Coast River Terrace Sandyland Grassland

Identifier: **MoRAP Code:** 7907

Description: As described for system.

Chihuahuan Gypsophilous Grassland and Steppe
Identifier: CES302.732

Geology: Extensive occurrences associated with the Permian Castile Formation and alluvium within evaporative bolsons. The system also occupies scattered occurrences of exposed gypsite and alluvium of evaporative ponds and swales receiving deposition from eroding gypsiferous formations.
Landform: Rolling uplands with minor erosional scarps as well as level basins and drainages.
Soils: Gyp, gyp hills, vegetated gypsum dunes, gyp upland and gyp (desert grassland) ecoclasses.

Description: Occurrences may be sparsely vegetated, grassy, or shrublands. Also included here are the gypsum dunes. Sites occupied by this system may be rolling and erosional uplands, as well as alluvium of basins and drainages. Gypsophilous species are frequently encountered, including *Sporobolus nealleyi* (gypgrass), *Bouteloua breviseta* (gyp grama), *Tiquilia hispidissima* (rough coldenia), *Nama carnosum* (sand nama), *Sartwellia flaveriae* (threadleaf glowwort), *Gaillardia multiceps* (onion blanket-flower), *Anulocaulis* spp. (ringstems) and *Selinocarpus* spp. (moonpods). Other species that may be encountered include *Atriplex canescens* (four-wing saltbush), *Ephedra torreyana* (Torrey jointfir), *Calylophus hartwegii* (Hartweg evening primrose), *Poliomintha incana* (hoary rosemary-mint), *Yucca torreyi* (Torrey's yucca), *Sporobolus airoides* (alkali sacaton), *Scleropogon brevifolius* (burrograss), *Prosopis glandulosa* (honey mesquite), *Larrea tridentata* (creosotebush), *Condalia ericoides* (javelina bush), and *Sporobolus cryptandrus* (sand dropseed). This system includes the gypsum dunes which range from sparsely vegetated to scattered shrubs with patchy herbaceous cover. In addition to many of the species above, the composition of the dunes includes *Artemisia filifolia* (sand sage), *Psorothamnus scoparius* (broom pea), *Poliomintha incana* (hoary rosemary-mint), *Dalea lanata* (wooly dalea), *Andropogon hallii* (sand bluestem), *Sporobolus giganteus* (giant dropseed), *Dimorphocarpa wislizeni* (spectaclepod), *Tidestromia lanuginosa* (wooly tidestromia), *Krameria lanceolata* (trailing ratany), *Mentzelia* spp. (blazingstar), and *Yucca elata* (soaptree yucca).

VEGETATION TYPES:

Trans-Pecos: Gyp Barrens (10300)
Chihuahuan Gyp Barrens
Identifier: CES302.732.1 **MoRAP Code:** 10300
Description: Sparsely vegetated gyp sites.

Trans-Pecos: Gyp Shrubland (10306)
Chihuahuan Gypsophilous Shrubland
Identifier: CES302.732.2 **MoRAP Code:** 10306
Description: Gyp sites with significant shrub cover with species including *Atriplex canescens* (four-wing saltbush), *Prosopis glandulosa* (honey mesquite), *Larrea tridentata* (creosotebush), *Condalia ericoides* (javelina bush), *Yucca torreyi* (Torrey's yucca), and/or *Ephedra torreyana* (Torrey jointfir).

Trans-Pecos: Gyp Grassland (10307)

Chihuahuan Gypsophilous Grassland
Identifier: CES302.732.3 **MoRAP Code:** 10307
Description: Gyp sites with sparse shrub layer and with herbaceous layer present, including herbaceous species mentioned in the system description.

Trans-Pecos: Gyp Dune (10310)

Chihuahuan Gypsum Dunes
Identifier: CES302.732.4 **MoRAP Code:** 10310
Description: In addition to other species mentioned for the system, the composition of the dunes includes *Artemisia filifolia* (sand sage), *Psorothamnus scoparius* (broom pea), *Poliomintha incana* (hoary rosemary-mint), *Dalea lanata* (wooly dalea), *Andropogon hallii* (sand bluestem), *Sporobolus giganteus* (giant dropseed), *Achnatherum hymenoides* (Indian ricegrass), *Dimorphocarpa wislizeni* (spectaclepod), *Tidestromia lanuginosa* (wooly tidestromia), *Krameria lanceolata* (trailing ratany), *Mentzelia* spp. (blazingstar), and *Yucca elata* (soaptree yucca).

Chihuahuan Loamy Plains Desert Grassland

Identifier: CES302.061

Geology: Primarily occurs on Quaternary alluvium. Included in this system are also grasslands that occupy other formation at higher elevations of mountain foothills. These grasslands may occupy various sedimentary and igneous substrates.
Landform: Level intermountain basins as well as level to gently rolling landforms on the foothills.
Soils: Loamy soils. The foothill grasslands often occupy Shallow Ecological Sites over Perdiz Conglomerate, but may also occur on gravelly sites.

Description: Currently this system (as considered for Phase 5) includes two somewhat distinct grassland types. These grasslands occupy loams of the intermountain basins, and also represent foothill grasslands that occupy shallow soils at the basin edges. These types are often closely juxtaposed and share graminoid composition but differ in abiotic sites, aspect, and invading shrubs. The loamy grasslands are dominated by species such as *Bouteloua gracilis* (blue grama), *Bouteloua curtipendula* (sideoats grama), *Bouteloua eriopoda* (black grama), *Pleuraphis mutica* (tobosa), *Scleropogon brevifolius* (burrograss), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Bothriochloa barbinodis* (cane bluestem), and *Dasyochloa pulchella* (fluffgrass). These grasslands occur in extensive level plains with deep soils. *Prosopis glandulosa* (honey mesquite) is the common shrub invader. Other shrubs present to dominant as invaders include *Larrea tridentata* (creosotebush), *Flourensia cernua* (tarbush), and *Mimosa aculeaticarpa* var. *biuncifera* (catclaw). The foothill grasslands are of similar composition with respect to grasses, but occupy rolling landscapes at slightly higher elevations and are on shallow soils. *Condalia ericoides* (javelina bush), *Juniperus* spp. (junipers), and *Acacia constricta* (whitethorn acacia) are common invaders.

VEGETATION TYPES:

Trans-Pecos: Loamy Plains Grassland (8807)

Chihuahuan Loamy Plains Desert Grassland
Identifier: CES302.061.1 **MoRAP Code:** 8807
Description: This grassland occupies level, deep loams of intermountain basins and is frequently invaded by *Prosopis glandulosa* (honey mesquite), *Larrea tridentata* (creosotebush), and *Flourensia cernua* (tarbush).

Trans-Pecos: Shallow Plains Grassland (8817)

Chihuahuan Loamy Plains Foothill Desert Grassland
Identifier: CES302.061.2 **MoRAP Code:** 8817
Description: This grassland occupies rolling uplands with shallow soils and is frequently invaded by *Condalia ericoides* (javelina bush), *Juniperus* spp. (junipers), and *Acacia constricta* (whitethorn acacia).

Chihuahuan Sandy Plains Semi-Desert Grassland
Identifier: CES302.736

Geology: Aeolian sand, sometimes as a thin veneer over surrounding formations, such as caliche, and sandstone.
Landform: Often level plains and mesas to gently rolling.
Soils: Sandy, loamy sand, and shallow sandy loam soils.

Description: This grassland or steppe occurs on sandy plains throughout the Trans-Pecos and into the arid southern portions of the High Plains. The herbaceous layer is often dominated by grasses such as *Bouteloua eriopoda* (black grama), *Sporobolus flexuosus* (mesa dropseed), *Sporobolus cryptandrus* (sand dropseed), *Muhlenbergia arenicola* (sand muhly), *Sporobolus airoides* (alkali sacaton), *Cenchrus spinifex* (common sandbur), and *Aristida purpurea* (purple threeawn). Species such as *Prosopis glandulosa* (honey mesquite), *Yucca elata* (soaptree yucca), *Yucca campestris* (plains yucca), *Yucca torreyi* (Torrey's yucca), and *Larrea tridentata* (creosotebush) may occur as a scattered woody component. The non-native species *Eragrostis lehmanniana* (Lehmann lovegrass) and *Eragrostis barrelieri* (Mediterranean lovegrass) are frequently found in this system.

VEGETATION TYPE:

Trans-Pecos: Sandy Desert Grassland (10507)

Chihuahuan Sandy Plains Semi-Desert Grassland
Identifier: CES302.736 **MoRAP Code:** 10507
Description: As described for system.

Chihuahuan – Sonoran Desert Bottomland and Swale Grassland
Identifier: CES302.746

Geology: Typically on Quaternary alluvium, but may be local in nature and mapped within various geological formations.
Landform: Generally found on local topographic lows that may be associated with a drainage or may occur as basins or swales.
Soils: Found on tight soils, typically Clay Flat Ecological Sites.

Description: This system is named based on the regions (Chihuahuan and Sonoran Deserts) where it is best developed and occupies significant areas, however it does occur well outside these regions, at least as far north and east as the Rolling Plains of Texas. The system typically occurs in local topographic lows that may be associated with drainages, or may represent swales or basins, but typically receives run-off from the surrounding landscape. Soils are generally clayey, and in some cases the shrink-swell characteristics of the soil may limit the development of woody species. *Pleuraphis mutica* (tobosa) is generally the clear dominant, though other species such as *Panicum obtusum* (vine-mesquite), *Sporobolus airoides* (alkali sacaton), and *Pascopyrum smithii* (western wheatgrass) may be present. *Prosopis glandulosa* (mesquite) may be present, and in some cases may develop into a significant canopy. The system often occupies the Clay Flat Ecological Site.

VEGETATION TYPE:

Southwest: Mesquite - Tobosa Grassland (406)

Chihuahuan – Sonoran Desert Bottomland and Swale Mesquite Grassland
Identifier: CES302.746.1 **MoRAP Code:** 406
Description: Swales and low basins with tight soils where *Prosopis glandulosa* (honey mesquite) forms a significant canopy over a grassland often dominated by *Pleuraphis mutica* (tobosa).

Southwest: Tobosa Grassland (407)

Chihuahuan – Sonoran Desert Bottomland and Swale Grassland (Tobosa Swales)
Identifier: CES302.746.9 **MoRAP Code:** 407
Description: Grass dominated swales and basins with tight soils. This type is often dominated by *Pleuraphis mutica* (tobosa).

East-Central Texas Plains Xeric Sandyland
Identifier: CES205.897

Geology: Associated with Eocene sand formations, particularly Carrizo Sands, but also Queen City and Sparta Sands.
Landform: High topographic positions, along with rapidly draining soils, results in conditions that only briefly retain surface moisture.
Soils: Deep sands typify this system.

Description: This small patch system is typically an open, herbaceous-dominated sand "prairie," sometimes with open, oak-dominated woodlands. Species such as *Quercus incana* (bluejack oak), *Quercus margarettae* (sand post oak), *Quercus stellata* (post oak), and *Carya texana* (black hickory) (often stunted) occur in the usually sparse overstory. Invasion by *Ilex vomitoria* (yaupon) is frequent in the absence of fire. Other woody plants that may be encountered include *Juniperus virginiana* (eastern redcedar), *Rhus aromatica* (fragrant sumac), *Vaccinium arboreum* (farkleberry), *Viburnum rufidulum* (rusty blackhaw), *Rhus copallinum* (flameleaf sumac), and *Cornus florida* (flowering dogwood). The herbaceous layer may be sparse, often with exposed sand, *Cladonia* spp. (foliose lichens), and species such as *Aristida desmantha* (curly threeawn), *Brazoria truncata* (bluntsepal brazoria), *Cnidoscolus texanus* (Texas bull-nettle), *Dichanthelium* spp. (rosette grass), *Sporobolus junceus* (pineywoods dropseed), *Froelichia floridana* (Florida snake-cotton), *Hymenopappus artemisiifolius* (old plainsman), *Lechea* spp. (pinweed), *Loeflingia squarrosa* (spreading loeflingia), *Opuntia humifusa* (eastern pricklypear), *Paronychia drummondii* (Drummond nailwort), *Polanisia erosa* (large clammyweed), *Schizachyrium scoparium* (little bluestem), *Monarda punctata* (spotted beebalm), *Senecio ampullaceus* (Texas groundsel), *Sorghastrum elliottii* (slender Indiangrass), *Stylisma pickeringii* (bigpod bonamia), *Tetragonotheca* spp. (nerve-ray), *Gaillardia amblyodon* (maroon gaillardia), *Rhynchosia americana* (American snoutbean), *Zornia bracteata* (bracted zornia), and *Triplasis purpurea* (purple sandgrass). Species such as *Cyperus grayoides* (Illinois flatsedge), *Penstemon murrayanus* (cupleaf penstemon), *Selaginella arenicola* ssp. *riddellii* (sand spikemoss), *Tradescantia reverchonii* (Reverchon spiderwort), and *Yucca louisianensis* (Gulf Coast yucca) may be present, but primarily to the east, while *Tephrosia lindheimeri* (Lindheimer goat-rue) and *Rhynchosia americana* (American snoutbean) are frequently encountered to the south. Texas endemics, such as *Brazoria truncata* var. *pulcherrima* (Centerville brazos-mint), *Rhododon ciliatus* (Texas sandmint), and *Hymenopappus carrizoanus* (Carrizo Sands woollywhite), may be found in this system.

VEGETATION TYPES:

Post Oak Savanna: Sandylands Woodland and Shrubland (706)

East-central Texas Plains Xeric Sandyland Woodland and Shrubland
Identifier: CES205.897.6 **MoRAP Code:** 706
Description: As described for the system, but overstory dominated by the woody species described. This may be a common condition, especially where fire is excluded.

Post Oak Savanna: Sandylands Grassland (707)

East-central Texas Plains Xeric Sandyland Herbaceous Vegetation
Identifier: CES205.897.9 **MoRAP Code:** 707
Description: As described for the system, but lacking significant woody component. This vegetation type is representative of the system in good condition, with a fire cycle more consistent with the presumed natural cycle.

Southeastern Great Plains Tallgrass Prairie
Identifier: CES205.685

Geology: Lower Cretaceous formations, including various limestones, sands (such as from the Paluxy and Antlers formations), and clays (such as from the Walnut formation).

Landform: In contrast to Blackland Prairie, surfaces are flat rather than undulating, and valley slopes are angular rather than rounded. The "cuesta" landforms with gentle slopes leading up to relatively abrupt escarpments are characteristic of this portion of the Southeastern Great Plains Tallgrass Prairie.

Soils: Soils of the Southeastern Great Plains Tallgrass Prairie in Texas differ from those of the Southern Blackland Prairie in being browner in color and containing more rock fragments, though much of the region occupied by this prairie is included in the Blackland Ecological Site. Clay Loam, Sandy Loam, Shallow, and Claypan Prairie are also significant Ecological Sites for this system. Soils of this area are more frequently characterized as Mollisols, as opposed to the Vertisols more characteristic of the Blackland Prairie. Calcareous clays are commonly encountered.

Description: *Schizachyrium scoparium* (little bluestem) tends to dominate sites of this system, with *Bouteloua curtipendula* (sideoats grama) as another significant component. Other grasses that are frequently present include *Nassella leucotricha* (Texas wintergrass), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Aristida* spp. (threeawn), *Andropogon gerardii* (big bluestem), *Bouteloua dactyloides* (buffalograss), *Sporobolus compositus* (tall dropseed), *Bouteloua hirsuta* (hairy grama), *Sorghastrum nutans* (Indiangrass), *Muhlenbergia reverchonii* (seep muhly), *Chloris verticillata* (tumble windmillgrass), and *Erioneuron pilosum* (hairy tridens). Forbs species such as *Symphyotrichum ericoides* (heath aster), *Ambrosia psilostachya* (western ragweed), *Tragia ramosa* (catnip noseburn), *Amphiachyris dracunculoides* (common broomweed), *Dyschoriste linearis* (narrowleaf dyschoriste), *Salvia texana* (Texas sage), *Oenothera* spp. (evening primrose), *Stenaria nigricans* var. *nigricans* (prairie bluets), *Lindheimera texana* (Texas star), *Thelesperma* spp. (greenthread), *Dalea* spp. (prairie clover), and *Psoralidium* spp. (scurfpea) may be encountered. Occurrences often contain and are sometimes dominated by the non-native grass *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) and/or *Cynodon dactylon* (bermudagrass). Significant areas of this system remain within the Grand Prairie of Texas.

VEGETATION TYPE:

Grand Prairie: Tallgrass Prairie (2007)

Southeastern Great Plains Tallgrass Prairie
Identifier: CES205.685.9 **MoRAP Code:** 2007
Description: As described for the system.

Southern Rocky Mountain Montane-Subalpine Grassland (Not Mapped)
Identifier: CES306.824

Geology: Tertiary volcanic formations of the Davis Mountains and Permian limestone of the Guadalupe Mountains.
Landform: Limited in distribution to high elevation side slopes and local level plains.
Soils: Loams of high mountains.

Description: The occurrences of this system in Texas represent southern outliers of this system and are small patches in high elevations of the Guadalupe, Chisos, and Davis Mountains. These occurrences may be dominated by *Festuca arizonica* (Arizona fescue), *Bouteloua gracilis* (blue grama), and *Blepharoneuron tricholepis* (pine dropseed). *Muhlenbergia montana* (mountain muhly), *Koeleria micrantha* (junegrass), *Allium cernuum* (nodding onion), *Silene laciniata* ssp. *greggii* (Gregg's campion), *Commelina dianthifolia* (birdbill dayflower) may be present.

Tamaulipan Caliche Grassland
Identifier: CES301.989

Geology: This system occurs on sites that have a relatively thin veneer of eolian sand over caliche substrate. Such sites occur on the edge of the South Texas Sand Sheet where it overlies caliche of the Goliad Formation.
Landform: These grasslands occur on relatively level sites atop the Goliad formation.
Soils: Shallow sands and sandy loams, sometimes red sandy loams, over caliche substrate.

Description: This system is described from the vicinity of Loreto in Tamaulipas, Mexico, but the conditions of sand veneer over caliche outcrop may also be present on the edge of the sandsheet where it passes over the Goliad Formation in northern Hidalgo and Starr Counties. Soils are a reddish sandy loam about 0.3 m in depth or less. Such sites may currently be occupied by non-native grasses such as *Pennisetum ciliare* (buffelgrass) and *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), though invasion by these species is not observed in Mexican occurrences (Chris Best, pers. obs.). These grasslands are known to occur within a mosaic of calcareous shrublands. Johnston (1963) describes them as grassland patches (the largest of which are 50 to 100 acres in extent) within a matrix of shrubland. Grasses often dominate sites, including species such as *Schizachyrium littorale* (seacoast bluestem), *Aristida purpurea* (purple threeawn), *Bouteloua hirsuta* (hairy grama), *Elionurus tripsacoides* (Pan American balsamscale), *Trachypogon spicatus* (crinkleawn), *Heteropogon contortus* (tanglehead), *Bouteloua curtipendula* (sideoats grama), *Tridens texanus* (Texas tridens), and *Tridens muticus* (slim tridens). *Brachiaria ophryodes* and *Bouteloua radicosa* (purple grama) are also noted from occurrences in Mexico. Shrubs and sub-shrubs are scattered and sometimes coalesce into larger areas, and include species such as *Calliandra conferta* (Rio Grande stickpea), *Krameria ramosissima* (calderona), *Calliandra biflora* (twoflower stickpea), *Chamaecrista greggii* (Gregg's senna), and *Macrosiphonia lanuginosa* (plateau rocktrumpet). Perennial forbs are conspicuous and include species such as

Heliotropium confertifolium (leafy heliotrope), *Melampodium cinereum* (blackfoot daisy), *Simsia calva* (awnless bush sunflower), *Acalypha radians* (cardinal's feather), *Cnidoscolus texanus* (Texas bull-nettle), *Galphimia angustifolia* (narrowleaf thryallis), *Hermannia texana* (Mexican mallow), *Croton capitatus* (hog croton), *Rhynchosia americana* (American snoutbean), and *Dalea nana* (dwarf dalea). Scattered shrubs that may be present include *Prosopis glandulosa* (honey mesquite), *Zanthoxylum fagara* (colima), *Cordia boissieri* (anacahuita), and *Condalia hookeri* (brasil).

VEGETATION TYPE:

South Texas: Caliche Grassland (6707)

Tamaulipan Caliche Grassland
Identifier: CES301.989 **MoRAP Code:** 6707
Description: As described for system.

Texas Blackland Tallgrass Prairie
Identifier: CES205.684

Geology: Cretaceous shales, marls and limestones, such as those of the Pecan Gap Chalk, Marlbrook Marl, Eagle Ford, Gober Chalk, and Austin Chalk Formations, and Taylor, and Navarro Groups, as well as portions of the Eocene Midway Group and Wilcox formation. Also, Miocene formations (Fleming and Oakville Sandstone formations) underlie the southern outlier of Blackland prairie recognized as the Fayette Prairie.

Landform: Flat to gently rolling and dissected by drainages, with the most significant ridges associated with harder chalk formations.

Soils: Typically Vertisols, but this system may occupy Mollisols or Alfisols in limited parts of its distribution. The system generally occurs on calcareous clays, but may also occur on loams, clay loams, or even sandy clay loams.

Description: Currently, only remnants of this system exist, with most of the historical distribution replaced by crop production or improved pasture. *Schizachyrium scoparium* (little bluestem) is the most ubiquitous component of occurrences of this system. *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans* (Indiangrass) are also common dominants. Other species commonly encountered include *Bouteloua curtipendula* (sideoats grama), *Carex microdonta* (smalltooth sedge), *Sporobolus compositus* (tall dropseed), *Nassella leucotricha* (Texas wintergrass), *Bothriochloa laguroides* spp. t*orreyana* (silver bluestem), *Eriochloa sericea* (silky cupgrass), *Paspalum floridanum* (Florida paspalum), and *Tridens strictus* (longspike tridens). Forbs commonly encountered in this system include *Symphyotrichum ericoides* (heath aster), *Stenaria nigricans* var. *nigricans* (prairie bluets), *Helianthus maximiliani* (Maximilian sunflower), *Rudbeckia hirta* (blackeyed Susan), *Bifora americana* (prairie bishop), *Acacia angustissima* var. *hirta* (prairie acacia), *Desmanthus illinoensis* (Illinois bundleflower), and many more. Perhaps more commonly encountered species include *Croton monanthogynus* (doveweed), *Amphiachyris dracunculoides* (annual broomweed), and *Asclepias* spp. (milkweeds). Lowland sites and swales are often dominated by *Tripsacum dactyloides* (eastern gamagrass) and *Panicum virgatum* (switchgrass).

VEGETATION TYPE:

Blackland Prairie: Disturbance or Tame Grassland (207)

Texas Blackland Tallgrass Disturbance or Tame Grassland
Identifier: CES205.684.9 **MoRAP Code: 207**
Description: Very little intact Blackland prairie remains within the region, so grasslands that are mapped in the region are assumed to primarily consist of disturbance or tame grasslands. Non-native grasses such as *Cynodon dactylon* (bermudagrass), *Panicum coloratum* (kleingrass), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) and *Sorghum halepense* (Johnsongrass) are frequently encountered. Weedy forbs such as *Ambrosia psilostachya* (western ragweed) and *Amphiachyris dracunculoides* (common broomweed) are often present. *Prosopis glandulosa* (honey mesquite) or *Acacia farnesiana* (huisache) are often present and may be fairly dense. Important native grasses may include *Schizachyrium scoparium* (little bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Sorghastrum nutans* (Indiangrass), *Nassella leucotricha* (Texas wintergrass), *Bouteloua hirsuta* (hairy grama), and *Aristida* spp. (threeawn species).

Texas Coast Dune and Coastal Grassland
Identifier: CES203.465

Geology: Eolian deep sands and Pleistocene barrier island and beach deposits of the Beaumont formation. This includes deep sands well inland on the South Texas Sand Sheet.
Landform: Primary and secondary dunes, as well as relatively level areas, on the mainland where deep sands are deposited. Significant local topography, in the form of swales and pothole wetlands, may be present but are excluded from this system. But, significant surface drainages are generally scarce.
Soils: Deep or coastal sands.

Description: This system includes upland, grass-dominated vegetation on deep sands. Dunes are often dominated by *Uniola paniculata* (sea oats), with other species such as *Croton punctatus* (Gulf croton), *Panicum amarum* (bitter panicum), *Ipomoea pes-caprae* (goat-foot morning-glory), *Ipomoea imperati* (beach morning-glory), *Tidestromia lanuginosa* (wooly tidestromia), *Cakile* spp. (searocket), and *Sesuvium portulacastrum* (shoreline seapurslane) also present. Upland grasslands are often dominated by *Schizachyrium littorale* (seacoast bluestem) and *Paspalum monostachyum* (gulfdune paspalum). Numerous other species, such as *Sorghastrum nutans* (Indiangrass), *Paspalum plicatulum* (brownseed paspalum), *Muhlenbergia capillaris* (Gulf muhly), *Cenchrus spinifex* (common sandbur), *Elionurus tripsacoides* (Pan American balsamscale), *Eragrostis secundiflora* (red lovegrass), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Heteropogon contortus* (tanglehead), *Andropogon glomeratus* (bushy bluestem), *Spartina patens* (marshhay cordgrass), and *Dichanthelium* spp. (rosette grasses) may also be common. Numerous forbs, including such species as *Heterotheca subaxillaris* (camphor weed), *Croton* spp. (crotons), *Chamaecrista fasciculata* (partridge pea), *Rayjacksonia phyllocephala* (camphor daisy), *Physalis* spp. (groundcherries), *Helianthus argophyllus* (silverleaf sunflower), *Gaillardia pulchella* (Indian blanket), *Solidago sempervirens* (seaside goldenrod), *Baptisia* spp.

(wild-indigos), *Indigofera miniata* (scarlet-pea), *Eriogonum multiflorum* (heartsepal wildbuckwheat), *Conoclinium betonicifolium* (betonyleaf thoroughwort), and *Rudbeckia hirta* (blackeyed Susan) are also commonly encountered. Some woody species are found in the system, but typically make up very little cover. Cover of woody species is limited, but may include *Baccharis* spp. (baccharis), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), *Morella cerifera* (wax-myrtle), *Quercus fusiformis* (plateau live oak), *Quercus virginiana* (coastal live oak), and stunted *Prosopis glandulosa* (honey mesquite). Non-native woody species such as *Tamarix* spp. (salt cedars), *Schinus terebinthifolius* (Brazilian peppertree), and *Triadica sebifera* (Chinese tallow) may be present to dominant. Small areas may have sufficient woody cover to be mapped as a shrubland.

VEGETATION TYPES:

Active Sand Dune (6200)

Texas Coast Dune and Coastal Grassland Active Dune
Identifier: CES203.465.1 **MoRAP Code:** 6200
Description: These are barren to sparsely vegetated deep sands where active sand movement is occurring. These sites may sometimes be 15 m or more in height and offer the greatest degree of topographic relief in the region.

Coastal and Sandsheet: Dune and Coastal Grassland (6307)

Texas Coast Dune and Coastal Deep Sand Grassland
Identifier: CES203.465.7 **MoRAP Code:** 6307
Description: As described for herbaceous portions of the system.

Coastal and Sandsheet: Deep Sand Shrubland (6306)

Texas Coast Dune and Coastal Deep Sand Shrubland
Identifier: CES203.465.6 **MoRAP Code:** 6306
Description: Small areas within deep coastal sands may be dominated by shrub species such as *Baccharis* spp. (baccharis), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), *Prosopis glandulosa* (honey mesquite), *Morella cerifera* (wax-myrtle), *Iva frutescens* (shrubby sumpweed), or the non-native *Schinus terebinthifolius* (Brazilian peppertree).

Texas Saline Coastal Prairie

Identifier: CES203.543

Geology: Principally on the Pleistocene Beaumont Formation.

Landform: Mostly level or very gently undulating landform, typically near the coast. These sites may be inundated by saltwater during storm surges. Pimple mounds may lend some local topographic variation to the otherwise level surface.

Soils: Very deep, somewhat poorly to poorly drained with high salinity and/or sodicity, at least at some depth. These may be loams or clays. These soils may be saturated from local rainfall or, occasionally from storm surges.

Description: This system occupies saline soils, generally near-coast, on level topography of the Beaumont Formation. Sites may be nearly monotypic stands of *Spartina spartinae* (Gulf cordgrass). Other gramimoids that may be present to abundant include *Schizachyrium scoparium* (little bluestem), *Andropogon glomeratus* (bushy bluestem), *Panicum virgatum* (switchgrass), *Muhlenbergia capillaris* (Gulf muhly), or *Sporobolus indicus* (rat-tail smutgrass). *Spartina patens* (marshhay cordgrass), *Aristida oligantha* (oldfield threeawn), *Paspalum hartwegianum* (Hartweg paspalum), *Sporobolus virginicus* (seashore dropseed), *Paspalum vaginatum* (seashore paspalum), and *Distichlis spicata* (saltgrass) may be common, particularly on lower, somewhat wetter sites. Forbs are generally uncommon, but may include species such as *Borrichia frutescens* (sea ox-eye daisy), *Solidago sempervirens* (seaside goldenrod), *Iva angustifolia* (narrowleaf sumpweed), *Euthamia* spp. (goldentops), or other species more common to the non-saline soils nearby, or the salt marsh that may also be nearby. Microtopographic highs in the form of pimple mounds often have species more characteristic of less saline adjacent habitats. Shrubby species may invade the prairie, commonly including species such as *Iva frutescens* (shrubby sumpweed), *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Lycium carolinianum* (Carolina wolfberry), *Tamarix* sp. (salt cedar), and *Baccharis halimifolia* (baccharis).

VEGETATION TYPES:

Gulf Coast: Salty Prairie (2207)

Texas Saline Herbaceous Coastal Prairie
Identifier: CES203.543.7 **MoRAP Code:** 2207
Description: Occurrences of the system lacking significant shrub cover.

Gulf Coast: Salty Shrubland (2206)

Texas Saline Shrub Coastal Prairie
Identifier: CES203.543.6 **MoRAP Code:** 2206
Description: Occurrences of the system where shrubs, such as those listed above, have dominated the site.

Texas Saline Inland Prairie

Identifier: Previously Undescribed System

Geology: This system often occurs on Quaternary alluvium, sometimes juxtaposed with Eocene deposits of the Jackson Group or Yegua Formation.
Landform: Relatively level sites, typically within floodplains.
Soils: Soils are often mapped as the Salty Prairie Ecological Site type.

Description: This typically herbaceous system occupies soils of relatively high salinity. In contrast to Texas Saline Coastal Prairie, soil salinity of sites occupied by this system result from deposition of salts from the surrounding landscape into alluvial sites where repeated flooding and evaporation bring salts to the surface. *Spartina spartinae* (Gulf cordgrass) typically dominates these sites, sometimes to the near exclusion of other species. Other species that may be encountered include *Sporobolus virginicus* (seashore virginicus), *Distichlis spicata* (saltgrass), *Monanthochloe littoralis* (shoregrass), *Paspalidium geminatum* (Egyptian paspalidium), *Chloracantha spinosa*

(spiny aster), *Coreopsis tinctoria* (plains coreopsis), *Heliotropium curassavicum* (seaside heliotrope), *Isocoma drummondii* (Drummond goldenweed), *Borrichia frutescens* (sea ox-eye daisy), and *Helianthus ciliaris* (blue-weed). Shrubs such as *Prosopis glandulosa* (honey mesquite), *Prosopis reptans* (tornillo), *Lycium carolinianum* (Carolina wolfberry), and *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear) may be present. Occasionally shrubs, particularly *Prosopis glandulosa* (honey mesquite), may gain sufficient cover to be mapped as a shrubland. Dense stands of *Chloracantha spinosa* (spiny aster), *Isocoma drummondii* (Drummond goldenweed), or *Borrichia frutescens* (sea ox-eye daisy) may also be mapped as shrubland, and these sites may also have a sparse overstory of *Prosopis glandulosa* (honey mesquite).

VEGETATION TYPES:

Inland: Salty Flat (2400)

Texas Saline Inland Flat
Identifier: **MoRAP Code:** 2400
Description: Inland saline sites that are unvegetated or sparsely vegetated are mapped as this type.

Inland: Salty Prairie (2407)

Texas Saline Inland Prairie
Identifier: **MoRAP Code:** 2407
Description: This is the typical herbaceous type often dominated by *Spartina spartinae* (Gulf cordgrass).

Inland: Salty Prairie Shrubland (2406)

Texas Saline Inland Prairie Shrubland
Identifier: **MoRAP Code:** 2406
Description: This type may have significant cover of *Prosopis glandulosa* (honey mesquite). Or, in some cases, dense cover of *Chloracantha spinosa* (spiny aster), *Isocoma drummondii* (Drummond goldenweed), or *Borrichia frutescens* (sea ox-eye daisy) may be mapped as this type.

Texas-Louisiana Coastal Prairie

Identifier: CES203.550

Geology: This system is generally coincident with the distribution of the Pleistocene Beaumont and Lissie Formations.

Landform: Usually on level to gently rolling landscapes, with slopes generally less than 5%. Microtopography plays an important role in local variation in the system, with ridges, swales, mounds, depressions, mima (or pimple) mounds, and gilgai leading to a mosaic of drier and wetter plant communities.

Soils: Non-saline Vertisols, Alfisols, and (less extensively) Mollisols. Vertisols are often characterized by gilgai, resulting from shrink-swell attributes of the montmorillonitic clays of which they are composed. The Alfisols have a loamy surface with clayey subsoils.

Description: This mid- to tallgrass prairie occupies Pleistocene surfaces of the Texas and Louisiana coast, on non-saline soils of level to gently rolling topography. It is dominated by graminoid species, such as *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), *Paspalum plicatulum* (brownseed paspalum), *Panicum virgatum* (switchgrass), *Andropogon gerardii* (big bluestem), *Sporobolus compositus* (tall dropseed), *Paspalum setaceum* (thin paspalum), *Fimbristylis puberula* (hairy fimbry), *Dichanthelium oligosanthes* (fewflower panicgrass), *Rhynchospora* spp. (beaksedges), *Paspalum floridanum* (Florida paspalum), *Muhlenbergia capillaris* (Gulf muhly), *Tridens strictus* (longspike tridens), *Bouteloua curtipendula* (sideoats grama), *Andropogon glomeratus* (bushy bluestem), and *Tripsacum dactyloides* (eastern gamagrass). *Axonopus* spp. (carpetgrasses), *Sporobolus indicus* (rat-tail smutgrass), *Andropogon virginicus* (broomsedge bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Nassella leucotricha* (Texas wintergrass) may be particularly noticeable on over-grazed sites. Non-native graminoids that may be conspicuous to dominant components include *Cynodon dactylon* (bermudagrass), *Cyperus entrerianus* (deep-rooted sedge), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Dichanthium* spp. (old world bluestems), *Lolium perenne* (Italian ryegrass), *Schedonorus phoenix* (tall fescue), *Paspalum notatum* (bahiagrass), and *Paspalum dilatatum* (dallisgrass). Forbs that may often be encountered include *Liatris* spp. (gayfeathers), *Sabatia campestris* (meadow pink), *Ambrosia psilostachya* (western ragweed), *Euphorbia bicolor* (snow-on-the-prairie), *Solidago* spp. (goldenrods), *Rudbeckia hirta* (blackeyed Susan), *Ruellia humilis* (low wild petunia), *Asclepias viridis* (green milkweed), *Chamaecrista fasciculata* (partridge pea), *Helianthus angustifolius* (narrowleaf sunflower), *Euthamia* spp. (goldentops), *Ratibida columnifera* (Mexican hat), *Symphyotrichum ericoides* (heath aster), *Silphium laciniatum* (compassplant), *Baptisia* spp. (wild indigos), *Iva angustifolia* (narrowleaf sumpweed), *Eryngium yuccifolium* (button snakeroot), *Boltonia diffusa* (smallhead doll's daisy), and *Neptunia lutea* (yellow neptunia). Woody species may invade this typically herbaceous vegetation, including *Rosa bracteata* (Macartney rose), *Acacia farnesiana* (huisache), *Triadica sebifera* (Chinese tallow), *Baccharis halimifolia* (baccharis), *Celtis laevigata* (sugar hackberry), and *Prosopis glandulosa* (honey mesquite).

VEGETATION TYPE:

Gulf Coast: Coastal Prairie (5207)

Texas-Louisiana Coastal Prairie
Identifier: CES203.550 **MoRAP Code:** 5207
Description: As described for system.

West Gulf Coastal Plain Southern Calcareous Prairie

Identifier: CES203.379

Geology: Primarily associated with the Fleming Formation, a calcareous clay/sandstone of Miocene age. The Cook Mountain Formation, a marly Eocene formation, may also give rise to clays that support this system.

Landform: Occurs on upper slopes and broad uplands in gently undulating landscapes.

Soils: Circumneutral to moderately alkaline, vertic soils such as Ferris, Houston Black, or Wiergate clays.

Description: This graminoid-dominated system occurs within a landscape generally dominated by forest and woodland. It occupies deep vertic soils with circumneutral surface pH, a condition uncommon in the landscape of predominantly acidic, forested soils. Occurrences may reflect a relationship to the blackland prairie further to the west, within the Fayette Prairie, and some consider these small patch prairies to be outliers of the Blackland Tallgrass Prairie**.** The system may be dominated by species such as *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Bouteloua curtipendula* (sideoats grama), *Andropogon gerardii* (big bluestem), *Nassella leucotricha* (Texas wintergrass), *Paspalum pubiflorum* (hairyseed paspalum), and *Panicum virgatum* (switchgrass). Non-native grasses such as *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Bromus arvensis* (Japanese brome), *Cynodon dactylon* (bermudagrass), and/or *Lolium perenne* (Italian ryegrass) may be conspicuous to dominant. Other herbaceous species that may be encountered include *Acacia angustissima* (prairie acacia), *Carex cherokeensis* (Cherokee sedge), *Croton monanthogynus* (doveweed), *Neptunia* sp. (neptunia), *Carex microdonta* (smalltooth sedge), *Grindelia lanceolata* (Gulf gumweed), *Rudbeckia missouriensis* (Missouri coneflower), *Rudbeckia hirta* (blackeyed susan), *Indigofera miniata* (scarlet-pea), *Arnoglossum plantagineum* (groovestem Indian plantain), *Euphorbia bicolor* (snow-on-the-prairie), *Dalea* spp. (prairieclovers), *Coreopsis tinctoria* (plains coreopsis), *Eustoma exaltatum* (tall prairie gentian), and *Symphyotrichum* spp. (asters). Various woody species from the surrounding landscape, including *Pinus taeda* (loblolly pine), *Ulmus alata* (winged elm), *Liquidambar styraciflua* (sweetgum), *Juniperus virginiana* (eastern redcedar), *Crataegus spathulata* (littlehip hawthorn), *Crataegus crus-galli* (cockspur hawthorn), *Sideroxylon lanuginosum* (gum bumelia), and others, may invade these prairies. Non-native woody species, such as *Rosa bracteata* (Macartney rose), may also invade. This may be a result of long-term fire suppression.

VEGETATION TYPE:

Pineywoods: Southern Calcareous Mixedgrass Prairie (4407)

West Gulf Coastal Plain Southern Calcareous Prairie
Identifier: CES203.379 **MoRAP:** 4407
Description: As described above.

Western Great Plains Sand Prairie
Identifier: CES303.670

Geology: Aeolian sands.
Landform: Rolling dunes and level sandy plains.
Soils: Deep sand, sand hills, and adjacent sandy soils.

Description: This represents far southern outliers of this system which is best developed in Nebraska and South Dakota, and may in fact be a different system. These grasslands occupy deep sands and sandhills and are dominated by species such as *Sporobolus giganteus* (giant dropseed), *Sporobolus cryptandrus* (sand dropseed), *Andropogon hallii* (sand bluestem), *Andropogon*

gerardii (big bluestem), *Schizachyrium scoparium* (little bluestem), *Paspalum setaceum* (thin paspalum), *Calamovilfa gigantea* (big sandreed), and *Cenchrus spinifex* (common sandbur). Some woody species may be present, including *Artemisia filifolia* (sand sage) and *Quercus havardii* (Havard's shin oak).

VEGETATION TYPE:

High Plains: Sand Prairie (8007)
Identifier: CES303.670 **MoRAP Code:** 8007
Description: As described for system.

Western Great Plains Shortgrass Prairie
Identifier: CES303.672

Geology: This widespread system occurs on various geologic formations.
Landform: Often on level to gently rolling uplands.
Soils: Within Phase 1, this system occurs on Rough Breaks, Shallow Clay, Very Shallow, and Very Shallow Clay Ecological Sites.

Description: This system is better developed and more widespread to the north and west of Phase 1, and occurs sporadically on the western edge of Phase 1. *Bouteloua dactyloides* (buffalograss) and *Bouteloua gracilis* (blue grama) are common dominants. Other species that may be present include *Aristida purpurea* (purple threeawn), *Bouteloua curtipendula* (sideoats grama), *B. hirsuta* (hairy grama), *B. rigidiseta* (Texas grama), *Erioneuron pilosum* (fluffgrass), *Hilaria belangeri* (curlymesquite), and *Pascopyrum smithii* (western wheatgrass). Shrub cover is generally low, but may include species such as *Acacia greggii* (catclaw), *Rhus microphylla* (littleleaf sumac), *Rhus trilobata* (skunkbush sumac), *Dalea formosa* (feather dalea), *Mahonia trifoliolata* (agarito), *Juniperus* sp. (juniper), and *Prosopis glandulosa* (mesquite). Forbs such as *Calylophus* sp. (sundrops), *Melampodium leucanthum* (plains blackfoot), *Krameria lanceolata* (trailing ratany), and others are often present. *Gutierrezia sarothrae* (broom snakeweed) may be present with significant cover, especially on sites with intense and continuous grazing. In this, the southeastern most expression of the system, it tends to occur on sites with soils providing relatively dry conditions such as Shallow Clay, Very Shallow, and Very Shallow Clay Ecological Sites.

VEGETATION TYPE:

High Plains: Shortgrass Prairie (2907)
Western Great Plains Shortgrass Prairie
Identifier: CES303.672.9 **MoRAP Code:** 2907
Description: As described for system.

Sparsely Vegetated

Edwards Plateau Carbonate Glades and Barrens (not mapped)
Identifier: CES303.655

Geology: Non-slope forming members of the Glen Rose formation, or areas of massive limestones such as Edwards Limestone.
Landform: Usually level to gently sloping uplands on plateau tops, or level benches between slopes in stair step topography.
Soils: Very shallow soils, sometimes very little soil development over rocky substrates.

Description: These are generally small patch occurrences with very sparse herbaceous cover, sometimes with occasional scattered shrubs. These sites generally co-occur with savannas, representing the shallowest soils sites, often on exposed or near-exposed limestone. They may occur as bands with adjacent grasslands, shrublands, or open woodlands. Herbaceous cover may include species such as *Chaetopappa bellidifolia* (hairy leastdaisy), *Evax prolifera* (rabbit's tobacco), *Croton monanthogynus* (prairie-tea), *Sedum nuttallianum* (yellow stonecrop), *Sedum pulchellum* (widowscross), *Sporobolus vaginiflorus* (poverty dropseed), *Centaurium texense* (Texas centaury), *Spermolepis inermis* (spreading scaleseed), *Chamaesyce serpens* (matted sandmat), *Heliotropium tenellum* (pasture heliotrope), *Lesquerella* spp. (bladderpod), and others.

A possible outlier (the system occurring well outside the ecoregion within which it is normally found) of this system consists of small patch occurrences of very sparse herbaceous cover found on very shallow soils over chalk outcrops in isolated locales of North Texas (Gober, Annona, Austin Chalk and Pecan Gap formation). Species include *Bouteloua rigidiseta* (Texas grama), *Sedum pulchellum* (Texas sedum), *Sporobolus vaginiflorus* (poverty dropseed), *Nostoc commune* (nostoc), *Penstemon cobaea* (white beardtongue), and *Lesquerella* spp. (bladderpod). Adjacent woodlands or savannas on thin-soiled chalk ridges may contain *Quercus shumardii* (Shumard oak), *Quercus muehlenbergii* (chinkapin oak), *Celtis* sp. (hackberry), *Cornus drummondii* (roughleaf dogweed), *Viburnum rufidulum* (rusty blackhaw), *Fraxinus texensis* (Texas ash), and others.

Edwards Plateau Cliff
Identifier: CES303.653

Geology: Hard-bedded limestones.
Landform: Vertical or near vertical rock faces, sometimes alternating with slope forming limestone members.
Soils: Little to no soil development. Some soil accumulating on ledges and in crevices.

Description: Some of these sites may be mesic, accumulating moisture from nearby slopes in crevices within the limestone substrate, and seeps may be present. They often occur as long narrow

bands. Composition and cover on these cliff faces is a function of aspect, canopy cover provided by surrounding systems, local climate, and moisture available from the underlying geologic formation. Seeps and mesic sites may have fairly dense cover of *Adiantum capillus-veneris* (maiden-hair fern) with patches of *Thelypteris ovata* var. *lindheimeri* (Lindheimer's maidenfern) present. More xeric sites often have significant shrub cover, with species such as *Buddleja racemosa* (Texas butterflybush), *Ungnadia speciosa* (Mexican buckeye), *Diospyros texana* (Texas persimmon), *Ageratina havanensis* (shrubby boneset), *Garrya ovata* ssp. *lindheimeri* (Lindheimer's silktassel), *Bernardia myricifolia* (southwest bernardia), *Philadelphus* spp. (mock-orange), *Styrax* spp. (snowbell), and *Toxicodendron radicans* ssp. *eximium* (poison ivy). Herbaceous species that may be present include *Salvia roemeriana* (cedar sage), *Penstemon baccharifolius* (baccharisleaf beardtongue), *Schoenus nigricans* (black sedge), *Chaetopappa bellidifolia* (least daisy), *Perityle* spp. (rockdaisy), and ferns in the genera *Asplenium*, *Astrolepis*, *Cheilanthes*, and *Pellaea*. Sparse grasses including *Bouteloua hirsuta* (hairy grama), *Bouteloua rigidiseta* (Texas grama), and *Aristida oligantha* (oldfield threeawn) may be present. These cliffs often serve as refugia from herbivores.

VEGETATION TYPES:

Edwards Plateau: Wooded Cliff / Bluff (806)

Edwards Plateau Wooded Cliff / Bluff
Identifier: CES303.654 **MoRAP Code:** 806
Description: Same as system description.

Edwards Plateau: Barren or Grassy Cliff / Bluff (807)

Edwards Plateau Barren or Grassy Cliff / Bluff
Identifier: CES303.654.0 **MoRAP Code:** 807
Description: This vegetation type generally lacks significant vegetative cover due to the limited potential for soil development on such steep surfaces. These cliffs or bluffs may have development of some lichen and patchy grass clumps in limited areas where soil can remain stable. Sparse shrubs and herbaceous cover (with species suggested in the system description) may be present.

Gulf Coast Chenier Coastal Beach
Identifier: CES203.544

Geology: Recent deposits of sand resulting from ongoing coastal sediment transport, and more commonly clays remaining on Gulf margin after longshore transport of sand off of the sites.
Landform: Gently sloping towards the gulf, with some development of foreshore dunes. Beaches in this part of the Texas coast tend to be eroding and narrow.
Soils: Clays and sands.

Description: Narrow margin of mostly unvegetated sands receiving frequent inundation, erosion, or sediment deposition from eolian processes. The topography is low, and the substrate is dynamic, leading to reduced vegetation development. Sparse herbaceous cover may be encountered with species such as *Cakile* spp. (searocket), *Distichlis spicata* (saltgrass), *Sesuvium* spp. (sea

purslanes), *Spartina patens* (marshhay cordgrass), *Ipomoea pes-caprae* (goat-foot morning-glory), and *Ipomoea imperati* (beach morning-glory).

VEGETATION TYPE:

Chenier: Beach (6000)
Identifier: CES203.544 **MoRAP Code:** 6000
Description: As described for system.

North American Warm Desert Active and Stabilized Dunes
Identifier: CES302.744

Geology: Quaternary aeolian sand deposits associated with the Hueco Bolson and the Salt Basin.
Landform: Rolling dunes and sandy level plains.
Soils: Sand Hills and Deep Sand Ecological Sites.

Description: This system occupies the deep sands adjacent to the Salt Basin west of the Guadalupe Mountains, and the Hueco Basin along the Rio Grande. These sands are characterized by sparsely vegetated active dunes as well as stabilized dunes colonized by species such as *Sporobolus giganteus* (giant dropseed), *Sporobolus flexuosus* (mesa dropseed), *Sporobolus cryptandrus* (sand dropseed), *Sporobolus contractus* (spike dropseed), *Bouteloua eriopoda* (black grama), *Schizachyrium scoparium* (little bluestem), *Aristida purpurea* (purple threeawn), *Prosopis glandulosa* (honey mesquite), *Psorothamnus scoparius* (broom pea), *Artemisia filifolia* (sand sage), *Yucca elata* (soaptree yucca), *Croton dioicus* (grassland croton), *Dimorphocarpa wislizeni* (spectaclepod), *Helianthus petiolaris* (plains sunflower), *Palafoxia sphacelata* (rayed palafoxia), *Heliotropium convolvulaceum* (bindweed heliotrope), *Eriogonum annuum* (annual wildbuckwheat), *Tripterocalyx carneus* (winged sandpuffs), *Amsonia tomentosa* var. *stenophylla* (wooly bluestar), *Proboscidea althaeifolia* (devilshorn), and *Ipomopsis wrightii* (leafy skyrocket).

VEGETATION TYPE:

Trans-Pecos: Sand Dune (11300)
North American Warm Desert Active Dune
Identifier: CES302.744.1 **MoRAP Code:** 11300
Description: Sparsely vegetated sites on deep sand.

Trans-Pecos: Desert Deep Sand and Dune Grassland (11307)
North American Warm Desert Stabilized Dune
Identifier: CES302.744.2 **MoRAP Code:** 11307
Description: Stabilized dune with primarily herbaceous cover, though some woody species may be present.

North American Warm Desert Badland
Identifier: CES302.743

Geology: Shale and mudstones commonly provide parent material
Landform: Rolling topography with some abrupt erosional scarps and gullies.
Soils: Clays, often forming clay hills in hot desert environments.

Description: This system is sparsely vegetated to unvegetated on fine-textured soils where high rates of erosion, high temperatures and evaporation, and low precipitation preclude the development of significant vegetative cover. These sites are highly erosional and occupy rolling landscapes frequently cut by drainages.

VEGETATION TYPE:

Trans-Pecos: Desert Badland (11400)

North American Warm Desert Badland
Identifier: CES302.743 **MoRAP Code:** 11400
Description: As described for system.

North American Warm Desert Bedrock Cliff and Outcrop
Identifier: CES302.745

Geology: This system is well-developed on massive Cretaceous and Permian limestones, but also occupies igneous and sandstone formations.
Landform: Rock faces with slopes greater than 80%.
Soils: Very little to no soil development.

Description: This sparsely vegetated system occupies steep rock faces of the massive limestones and other substrates of the region. Some of these cliffs may be 100's of feet tall. Vegetation is typically restricted to crevices, although crustose lichens may be well-represented.

VEGETATION TYPE:

Trans-Pecos: Cliff and Outcrop (10100)

North American Warm Desert Bedrock Cliff and Outcrop
Identifier: CES.302.745.1 **MoRAP Code:** 10100
Description: As described for system.

North American Warm Desert Pavement
Identifier: CES302.750

Geology: Often Quaternary alluvium and colluvium.
Landform: Level to gently rolling surfaces.
Soils: Gravelly sites.

Description: Unvegetated to very sparsely vegetated sites on level to gently rolling, gravelly landscapes. These sites are often characterized by harsh, high temperature conditions often leading to the development of gravels coated with "desert varnish." This system may occur on alluvial flats or the level portions of bajada fans at low elevations. *Larrea tridentata* (creosotebush) often occurs as widely scattered shrubs.

VEGETATION TYPE:

Trans-Pecos: Desert Pavement (11800)
North American Warm Desert Pavement
Identifier: CES302.750 **MoRAP Code:** 11800
Description: As described for system.

North American Warm Desert Volcanic Rockland
Identifier: CES302.754

Geology: Tertiary extrusive igneous formations, including tuff, basalt, and rhyolite.
Landform: Usually talus slopes, but also relatively level rocky and boulder sites.
Soils: Soil is generally lacking or reduced to small pockets within the rock matrix.

Description: Very sparsely vegetated sites (<10% cover) on rocky or boulder strewn slopes and flats where the rock material is volcanic in origin. Scattered individuals of species such as *Larrea tridentata* (creosotebush), *Fouquieria splendens* (ocotillo), *Jatropha dioica* (leatherstem), *Prosopis glandulosa* (honey mesquite), *Yucca torreyi* (Torrey's yucca), and cacti such as *Echinocereus* spp. (hedgehog cacti) and *Opuntia rufida* (blind pricklypear) may be present.

VEGETATION TYPE:

Trans-Pecos: Desert Volcanic Rockland (12100)
North American Warm Desert Volcanic Rockland
Identifier: CES302.754 **MoRAP Code:** 2100
Description: As described for system.

South Texas Salt and Brackish Tidal Flats
Identifier: CES301.461

Geology: Recent wind-distributed coastal sands. Tidal fluctuations and wind continue to redistribute these sands.
Landform: Extensive, very gentle slopes (nearly flat).
Soils: Coastal sands.

Description: This system occurs on flats influenced by tidal fluctuations in water level, primarily driven by winds rather than by diurnal or semidiurnal tidal fluctuations. Due to the nearly level condition of these flats, small fluctuations in tidal level may result in extensive changes in inundation patterns. These flats are typically associated with hypersaline bay waters of the Laguna Madre. Some sites may have sparse vegetation consisting of *Salicornia bigelovii* (dwarf glasswort), *Salicornia depressa* (Virginia glasswort), *Batis maritima* (saltwort), *Suaeda linearis* (annual seepweed), *Sesuvium portulacastrum* (shoreline seapurslane), *Monanthochloe littoralis* (shoregrass), and/or *Distichlis spicata* (saltgrass), but are typically unvegetated or covered by a layer of *Lyngbya* spp. (blue-green algae). The development of vast areas dominated by *Lyngbya* spp. (blue-green algae) occurs with appropriate frequency and duration of inundation. Higher flats may be too dry to support the algae, and at lower elevation, flats may remain inundated for extended periods. Occasionally flats (usually not those supporting extensive blue-green algae) may develop a substantial herbaceous cover, especially during years of increased rainfall. Development of significant areas of marsh grasses such as *Spartina patens* (marshhay cordgrass) or *Spartina alterniflora* (smooth cordgrass) is generally lacking. Scattered individuals of *Avicennia germinans* (black mangrove) occur within these flats.

VEGETATION TYPES:

South Texas: Wind Tidal Flats (6600)

South Texas Salt and Brackish Wind Tidal Flats
Identifier: CES301.461.1 **MoRAP Code:** 6600
Description: These flats are typically unvegetated, and lack significant development of *Lyngbya* spp. (blue-green algae) on their surface. Some sites may develop substantial herbaceous cover, but typically they are unvegetated or very sparsely vegetated with species mentioned in the system description.

South Texas: Algal Flats (6610)

South Texas Salt and Brackish Algal Flats
Identifier: CES301.461.2 **MoRAP Code:** 6610
Description: Flats dominated by *Lyngbya* spp. (blue-green algae). This algal mat covers the surface of vast areas and greatly enhances the productivity of these tidal flats.

South-Central Saline Glade
Identifier: CES203.291

Geology: In some cases, this system may be associated with inland salt domes when the proximity of such a structure to the surface produces high salinity in the surface soils. Otherwise, surface geology of various formations may contain sufficient alkalinity such that leaching from particular members of these formations gives rise to such conditions.
Landform: These sites are often associated with streams or drainages, sometimes occurring on terraces.
Soils: Soils are characterized by high levels of exchangeable sodium and low permeability with reduced soil aeration. Some soils may be Glossic Natraqualfs.

Description: While apparently not well-represented in Texas, the search for *Geocarpon minima* (tinytim) has led investigators to identify some areas that may be characterized as this system. One area mapped as this system, near Grand Saline in Van Zandt County, may not be a good representative of this system. This site does have alkaline soils and is characterized by halophytic species, and generally lacks woody vegetation. The site appears to more closely resemble an inland salt marsh, with extensive areas dominated by *Distichlis spicata* (saltgrass) and lower, wetter areas dominated by *Schoenoplectus* sp. (bulrush). Shrubs that may occur in patches within this system include *Baccharis halimifolia* (baccharis), *Iva angustifolia* (narrowleaf sumpweed), and *Tamarix* sp. (salt cedar). Some sites may be relatively sparsely vegetated and intermixed as a mosaic with surrounding woodlands containing species such as *Quercus stellata* (post oak), *Quercus similis* (bottomland post oak), *Ulmus crassifolia* (cedar elm), *Quercus nigra* (water oak), and *Pinus taeda* (loblolly pine). Other herbaceous species that may be encountered include *Coreopsis tinctoria* (plains coreopsis), *Sporobolus vaginiflorus* (poverty dropseed), *Distichlis spicata* (saltgrass), *Diodia teres* (rough buttonweed), *Houstonia* spp. (bluets), *Isolepis carinata* (keeled bulrush), *Phemeranthus parviflorus* (prairie flameflower), *Plantago* spp. (plantains), *Krigia occidentalis* (western dwarf dandelion), and *Aristida* spp. (threeawns).

VEGETATION TYPE:

Pineywoods: Saline Glade (4207)
South-Central Herbaceous Saline Glade
Identifier: CES203.291 **MoRAP Code:** 4207
Description: As described for system.

Southeastern Great Plains Cliff
Identifier: ZZZ.ZZZ

Geology: Often associated with steep bluffs forming along riparian corridors. The geology typically consists of Pennsylvanian and Cretaceous sandstones and Cretaceous limestones.
Landform: Steep cliffs and bluffs (slope greater than 100%) generally found along drainages, particularly the Brazos River and its tributaries.

Soils: Sandstone Hill, Steep Adobe, Steep Rocky are typical ecoclasses associated with this system.

Description: This system can express itself as wooded or sparsely vegetated. When wooded, the system likely resembles the surrounding Crosstimbers slope forests. The overstory may be dominated entirely be deciduous hardwoods, or be dominated by *Juniperus ashei* (Ashe juniper) or *Juniperus virginiana* (eastern redcedar), or have canopy with a mixture of deciduous and evergreen components.

VEGETATION TYPES:

Central Texas: Wooded Cliff / Bluff (1706)

Southeastern Great Plains Wooded Cliff or Bluff
Identifier: ZZZ.ZZZ.6 **MoRAP Code:** 1706
Description: Cliffs or bluffs with significant overstory canopy resembling that of surrounding slope forest.

Central Texas: Barren or Grassy Cliff/Bluff (1707)

Southeastern Great Plains Barren or Grassy Cliff or Bluff
Identifier: ZZZ.ZZZ.9 **MoRAP Code:** 1707
Description: Cliffs or bluffs lacking a woody overstory. These bluffs are typically so steep as to preclude the development of significant soils, making the herbaceous layer patchy or lacking. The majority of this system is mapped as this vegetation type.

Tamaulipan Saline Lake

Identifier: Previously Undescribed System

Geology: Mostly mapped on the edge of the sandsheet over the Goliad Formation. Quaternary clay dunes (Qcd) are sometimes nearby.
Landform: Broad, gently sloping, interior draining basins.
Soils: Highly saline sands or sandy loams.

Description: These saline lakes are interior draining basins, receiving runoff from the surrounding landscape. Solution of salts from parent material, deposition from runoff, and subsequent evaporation has lead to a highly saline situation. Sites may be unvegetated or have sparse vegetation. Some areas at very slightly higher landscape positions in the basin are dominated by halophytic grasses such as *Sporobolus airoides* (alkali sacaton), *Distichlis spicata* (saltgrass), *Sporobolus pyramidatus* (whorled dropseed), and *Monanthochloe littorale* (shoregrass). Other halophytic forbs and sub-shrubs may also be present, including *Borrichia frutescens* (sea ox-eye daisy), *Batis maritima* (saltwort), *Salicornia* spp. (glassworts), *Atriplex matamorensis* (Matamoros saltbush), *Sesuvium portulacastrum* (shoreline seapurslane), and *Suaeda linearis* (annual seepweed).

VEGETATION TYPES:

South Texas: Saline Lake Flats (7700)

Tamaulipan Saline Lake Flats
Identifier: **MoRAP Code:** 7700
Description: Unvegetated or very sparsely vegetated lake margin.

South Texas: Saline Lake Grassland (7707)

Tamaulipan Saline Lake Grassland
Identifier: **MoRAP Code:** 7707
Description: Sites along the margin of saline lakes where grasses, forbs, and subshrubs have sufficient cover to be mapped as vegetated.

Texas Coastal Beach
Identifier: CES203.463

Geology: Recent sands deposited by Gulf currents and distributed by on-shore winds. These sands are redistributed by waters of bays interior to the barrier islands.
Landform: Very gently sloping and restricted to the margins of the Gulf of Mexico as well as interior bays. This type may be mapped into the unvegetated portions of the foredunes.
Soils: Recently deposited sands.

Description: This system represents unvegetated to sparsely vegetated sandy shorelines adjacent to the Gulf of Mexico and bays interior to the barrier islands. Species such as *Ipomoea pes-caprae* (goat-foot morning-glory), *Ipomoea imperati* (beach morning-glory), *Cakile* spp. (searockets), and *Tidestromia lanuginosa* (espanta vaquero) provide sparse vegetative cover. These areas generally lie near mean sea level and are often found between foredunes and tidal waters. In the case of beaches along bay margins, an active dune system is generally lacking and beaches lie between tidal waters and near-shore vegetation. As they are mapped, this system would include sparsely vegetated coppice dunes and even low foredunes. This system is dependent on highly dynamic coastal geomorphology.

VEGETATION TYPE:

Coastal: Beach (6100)

Texas Coastal Beach
Identifier: CES203.463 **MoRAP Code:** 6100
Description: As described for system.

West Gulf Coastal Plain Catahoula Barrens

Identifier: CES203.364

Geology: Restricted to surface outcrops of the Oligocene Catahoula geologic formation, an often tuffaceous sandstone.

Landform: Generally level to gently undulating (but sometimes steep), with surface or near surface exposure of the underlying sandstone bedrock.

Soils: Shallow loams, such as Browndell –Rock outcrop. Soils may contain montmorillonitic clays. These thin soils can be extremely xeric during dry periods, but can also be saturated during wetter months.

Description: Vegetation associated with thin soils over the tuffaceous sandstone of the Catahoula formation is primarily herbaceous. But where the soil is deeper, or fire is excluded for long periods, it can display significant woody cover, with usually stunted representatives of species such as *Pinus palustris* (longleaf pine), *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), and *Carya texana* (black hickory) dominating the canopy. Shrubs may form a patchy, discontinuous layer with species such as *Ilex vomitoria* (yaupon), *Morella cerifera* (wax-myrtle), *Vaccinium arboreum* (farkleberry), *Forestiera ligustrina* (elbowbush), *Gelsemium sempervirens* (Carolina jessamine), and *Crataegus* spp. (hawthorns) commonly encountered. Maintenance of fire in the landscape will reduce woody cover in these sites, with herbaceous dominated sites displaying increased species richness. On open sites, there may be exposed patches of bedrock or mineral soils, or areas of patchy cover of foliose and/or fruticose lichens. Open sites may have significant herbaceous cover, usually dominated by graminoid species such as *Schizachyrium scoparium* (little bluestem), *Sporobolus clandestinus* (rough dropseed), *Sporobolus silveanus* (Silveus' dropseed), *Schizachyrium tenerum* (slender bluestem), *Tridens strictus* (longspike tridens), *Scleria* spp. (nutrush), and/or *Aristida* spp. (threeawns). *Bigelowia nuttallii* (Nuttall's rayless golden-rod), *Plantago* spp. (plantains), *Minuartia drummondii* (Drummond sandwort), *Chaetopappa asteroides* (common leastdaisy), *Lechea san-sabeana* (San Saba pinweed), *Sabatia campestris* (meadow pink), *Croton michauxii* (narrowleaf rushfoil), *Croton monanthogynus* (doveweed), *Krameria lanceolata* (trailing ratany), *Selaginella arenicola* ssp. *riddellii* (Riddell's spikemoss), *Phemeranthus parviflorus* (prairie flameflower), and a variety of other herbaceous species may also be present. Several sensitive species are associated with this system, including *Schoenolirion wrightii* (Texas sunnybell), *Spiranthes parksii* (Navasota ladies'-tresses), and *Liatris tenuis* (slender gayfeather). This system typically occurs as small patches and many occurrences were likely missed by the current mapping effort.

VEGETATION TYPES:

Pineywoods: Catahoula Herbaceous Barrens (4307)

West Gulf Coastal Plain Catahoula Herbaceous Barrens

Identifier: CES203.365.7 **MoRAP Code:** 4307

Description: Sites with no or, more commonly, scattered woody canopy.

Pineywoods: Catahoula Woodland or Shrubland Barrens (4305)

West Gulf Coastal Plain Catahoula Wooded Barrens
Identifier: CES203.365.5 **MoRAP Code:** 4305
Description: These sites have greater woody cover with the tree and shrub species mentioned above. The herbaceous cover of this type is more likely to contain species such as *Chasmanthium sessiliflorum* (narrowleaf woodoats), *Ranunculus fascicularis* (prairie buttercup), and *Piptochaetium avenaceum* (blackseed needlegrass), along with other herbaceous species common to the system. Lack of fire tends to lead to closing of the woody canopy and a reduction in diversity in the herbaceous layer.

West Gulf Coastal Plain Weches Glade

Identifier: CES203.277

Geology: Associated with outcrops of glauconitic shales of the Eocene Weches Formation.
Landform: Occupies slopes on rolling to relatively steep uplands, sometimes on minor scarp slopes of outcrops.
Soils: Frequently associated with the Trawick-Bub complex.

Description: Vegetation restricted to outcrops of the Weches Formation in San Augustine, Sabine, and Nacogdoches counties, where it occupies generally shallow soils that oscillate between very dry and saturated (during winter and early spring). These are small patch occurrences and are therefore difficult to map using our methodology. Edaphic constraints tend to restrict the growth of woody species, though as soil depth increases, so does woody plant development. Outcrops may be exposed as a result of natural erosion on slopes or may be a result of human-induced openings. This primarily herbaceous system is characterized by species such as *Sedum pulchellum* (yellow stonecrop), *Clinopodium arkansanum* (Ozark savory), *Minuartia patula* (Pitcher's sandwort), *Minuartia drummondii* (Drummond sandwort), *Valerianella radiata* (beaked cornsalad), *Isoetes butleri* (Butler's quillwort), and *Allium drummondii* (Drummond wild-garlic). Other herbaceous species that may be present include *Erigeron* sp. (fleabane), *Desmanthus illinoensis* (Illinois bundleflower), *Croton monanthogynus* (doveweed), *Dalea* sp. (prairie clover), *Houstonia* spp. (bluets), *Nassella leucotricha* (Texas wintergrass), *Bouteloua curtipendula* (sideoats grama), *Eleocharis* spp. (spikerushes), *Sporobolus vaginiflorus* (poverty dropseed), *Thelesperma filifolium* (slender greenthread), and *Arnoglossum plantagineum* (groovestem Indian plantain). Sites may contain non-native species, including *Cynodon dactylon* (bermudagrass), *Lolium perenne* (Italian ryegrass), *Schedonorus phoenix* (tall fescue), *Lonicera japonica* (Japanese honeysuckle), and *Trifolium* spp. (clovers). Some woody species that may be present include *Juniperus virginiana* (eastern redcedar), *Pinus taeda* (loblolly pine), *Liquidambar styraciflua* (sweetgum), *Ligustrum sinense* (Chinese privet), *Rosa bracteata* (Macartney rose), *Cornus drummondii* (roughleaf dogwood), *Sideroxylon lanuginosum (*gum bumelia), and other species common to the surrounding landscape. Two rare species, *Lesquerella pallida* (white bladderpod) and *Leavenworthia aurea* var. *texana* (Texas golden gladecress), are associated with this system.

VEGETATION TYPES:

Pineywoods: Weches Shrub Glade (4106)

West Gulf Coastal Plain Weches Shrub Glade
Identifier: CES203.277.6 **MoRAP Code:** 4106
Description: Sites that have been invaded by woody species as described above.

Pineywoods: Weches Herbaceous Glade (4107)

West Gulf Coastal Plain Weches Herbaceous Glade
Identifier: CES203.277.7 **MoRAP Code:** 4107
Description: Sites lacking significant woody cover.

Western Great Plains Cliff and Outcrop
Identifier: CES303.665

Geology: Various formations that tend to be less erodible, including limestone and sandstone.
Landform: Areas of high topographic relief, typically with slopes greater than 80%, including along river breaks and escarpments.
Soils: Very little soil development except on shelves and in cracks and crevices.

Description: This system often consists of sparsely vegetated bare rock on slopes greater than 80%. Rocky outcrops can be composed of sandstone, limestone, or other less erodible substrates. Vegetation is typically restricted to shelves, cracks, and crevices where soil can accumulate. Common species in this system include short shrubs such as *Rhus trilobata* and mixedgrass such as *Bouteloua curtipendula*. Wind erosion and drought are the processes that dominate this system.

VEGETATION TYPES:

High Plains: Cliff (3100)

Western Great Plains Sparsely Vegetated Cliff and Outcrop
Identifier: CES303.665.1 **MoRAP Code:** 3100
Description: Sparsely vegetated occurrences of the system.

High Plains: Wooded Cliff (3104)

Western Great Plains Wooded Cliff and Outcrop
Identifier: CES303.665.4 **MoRAP Code:** 3104
Description: Shrublands and woodlands, usually spare and low in stature that occupy these sites.

Woody Wetlands and Riparian

Central Texas Coastal Prairie Riparian

Identifier: Previously Undescribed System

Geology: Beaumont or Lissie Formations.

Landform: Upland drainages accumulating flow from surrounding, mostly level landscape. These drainages are typically erosional, sometimes incised, and rarely accrete significant alluvial deposition.

Soils: Various uplands soils. By definition, this system does not occupy bottomland ecological site types.

Description: This system represents vegetation bordering upland drainages where alluvial deposition is minimal. These sites, however, occupy locally low landscape positions and accumulate moisture from the surrounding landscape. Forested sites typically have a deciduous canopy with species such as *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), *Carya illinoinensis* (pecan), *Salix nigra* (black willow), *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), and/or *Quercus nigra* (water oak). *Quercus fusiformis* (plateau live oak) may share, or sometimes dominate, the canopy. The shrub layer may be well-developed and include species such *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Diospyros texana* (Texas persimmon), *Condalia hookeri* (brasil), *Ziziphus obtusifolia* (lotebush), and/or *Aloysia gratissima* (whitebrush). Some areas may lack a significant overstory and be mapped as shrublands of these species. The herbaceous layer may contain species such *Elymus virginicus* (Virginia wild-rye), *Chasmanthium latifolium* (creek oats), *Calyptocarpus vialis* (straggler daisy), *Verbesina virginica* (frostweed), and *Chloracantha spinosa* (spiny aster).

VEGETATION TYPES:

Coastal Bend: Riparian Live Oak Forest (4602)

Central Texas Coastal Prairie Riparian Live Oak Forest and Woodland

Identifier: **MoRAP Code:** 4602

Description: About 12% of this system is composed of this type, where *Quercus fusiformis* (plateau live oak) or, in some cases *Ehretia anacua* (anacua), dominates the overstory.

Coastal Bend: Riparian Live Oak / Hardwood Forest (4603)

Central Texas Coastal Prairie Riparian Live Oak–Deciduous Forest and Woodland

Identifier: **MoRAP Code:** 4603

Description: Forests or woodlands where canopy dominance is shared by broadleaf evergreen species such as *Quercus fusiformis* (plateau live oak) or *Ehretia anacua* (anacua), and deciduous species such as *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm) and others.

Coastal Bend: Riparian Hardwood Forest (4604)

Central Texas Coastal Prairie Riparian Deciduous Forest and Woodland
Identifier: **MoRAP Code:** 4604
Description: As described for the system, where deciduous canopy species predominate.

Coastal Bend: Riparian Evergreen Shrubland (4605)

Central Texas Coastal Prairie Riparian Evergreen Shrubland
Identifier: **MoRAP Code:** 4605
Description: Upland drainages where shrubs such as *Ilex vomitoria* (yaupon), *Zanthoxylum fagara* (colima), *Rosa bracteata* (Macartney rose), or *Acacia farnesiana* (huisache) dominate. *Celtis laevigata* (sugar hackberry), *Celtis ehrenbergiana* (granjeno), and *Prosopis glandulosa* (honey mesquite) are often present.

Coastal Bend: Riparian Deciduous Shrubland (4606)

Central Texas Coastal Prairie Riparian Deciduous Shrubland
Identifier: **MoRAP Code:** 4606
Description: Primarily disturbance shrublands of upland drainages dominated by species such as *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), small *Celtis laevigata* (sugar hackberry), *Salix nigra* (black willow), or *Cephalanthus occidentalis* (common buttonbush).

Coastal Bend: Riparian Grassland (4607)

Central Texas Coastal Prairie Riparian Herbaceous Vegetation
Identifier: **MoRAP Code:** 4607
Description: Sites on upland drainages that often represent managed grasslands dominated by *Cynodon dactylon* (bermudagrass), *Paspalum notatum* (bahiagrass), or *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem).

Coastal Bend: Riparian Herbaceous Wetland (4617)

Central Texas Coastal Prairie Riparian Herbaceous Wetland
Identifier: **MoRAP Code:** 4617
Description: Herbaceous dominated wetlands along upland drainages.

Central Texas Coastal Prairie River Floodplain

Identifier: Previously Undescribed System

Geology: Typically occupying Quaternary alluvium adjacent to the Beaumont or Lissie Formations.

Landform: Terraces and margins of large creeks and rivers of the central coast including Tres Palacios Creek and the lower reaches of the Lavaca, Navidad, Guadalupe, San Antonio, and Nueces Rivers, as well as the Aransas and Mission Rivers.

Soils: Bottomland ecological site types, including loamy, clayey, and sandy sites.

Description: This system occupies bottomland soils along the coastal portions of the Navidad, Lavaca, Guadalupe, San Antonio, Mission, Aransas, and Nueces Rivers (and their tributaries) as

they cross the prairie surface of the Lissie and Beaumont Formations. The extent of floodplain forest along the Mission and Aransas rivers is somewhat limited. Those rivers that continue upstream beyond these Pleistocene formations transition to forests of the Southeastern Great Plains Floodplain system. The Nueces River shares some affinity with the Tamaulipan Floodplain system to the south, and drainages further to the south and west of the Nueces, as well as the Nueces upstream of the prairie formations are attributed to that system. Floodplain systems north and east of the Navidad River are attributed to the Columbia Bottomlands Forest and Woodland system. This system is characterized by a woodland and forest dominated by species such as *Celtis laevigata* (sugar hackberry), *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Ulmus crassifolia* (cedar elm), *Carya illinoinensis* (pecan), *Ulmus americana* (American elm), *Prosopis glandulosa* (honey mesquite), and *Fraxinus berlandieriana* (Mexican ash) or *Fraxinus pennsylvanica* (green ash). Mixed deciduous / evergreen canopy may include *Quercus fusiformis* (plateau live oak) and *Ehretia anacua* (anacua) as significant components of the overstory. Sites dominated by *Quercus fusiformis* (plateau live oak) typically occur on less saturated sites such as slightly elevated situations. Less common species in the canopy may include *Acer negundo* (boxelder), *Gleditsia triacanthos* (honey locust), *Quercus macrocarpa* (bur oak), *Populus deltoides* (eastern cottonwood), *Platanus occidentalis* (American sycamore), *Morus rubra* (red mulberry), and *Acacia farnesiana* (huisache). Some wetter sites may be dominated by *Salix nigra* (black willow) or, less commonly, *Taxodium distichum* (baldcypress). *Acer negundo* (boxelder), *Sapindus saponaria* var. *drummondii* (western soapberry), *Ungnadia speciosa* (Mexican buckeye) and saplings of the overstory species may form a subcanopy. The shrub layer is often not well-developed, and contains species such as *Sabal minor* (dwarf palmetto), *Ilex vomitoria* (yaupon), *Ilex decidua* (possumhaw), *Diospyros texana* (Texas persimmon), *Sideroxylon lanuginosum* (gum bumelia), *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Condalia hookeri* (brasil), and/or *Cornus drummondii* (roughleaf dogwood). *Sabal minor* (dwarf palmetto) or *Ilex vomitoria* (yaupon) may sometimes form a dense shrub understory. Some sites may represent dense shrublands dominated by *Cephalanthus occidentalis* (common buttonbush) or *Forestiera acuminata* (swamp privet), with a sparse overstory. Vines are commonly encountered, including species such as *Ampelopsis arborea* (peppervine), *Vitis mustangensis* (mustang grape), *Smilax bona-nox* (saw greenbrier), *Toxicodendron radicans* (poison ivy), and *Campsis radicans* (trumpet creeper). The ground layer can be well-developed and often dominated by graminoids, including *Carex cherokeensis* (Cherokee sedge), *Carex crus-corvi* (crowfoot sedge), *Elymus virginicus* (Virginia wildrye), *Phanopyrum gymnocarpon* (savannah panicum), *Chasmanthium latifolium* (creek oats), *Leersia* spp. (cutgrasses), *Paspalum langei* (rustyseed paspalum), *Panicum obtusum* (vine mesquite) *Tripsacum dactyloides* (eastern gamagrass), *Carex bulbostylis* (narrowleaf sedge), *Carex tetrastachya* Britton's sedge, *Oplismenus hirtellus* (basketgrass), and *Dichanthelium sphaerocarpon* (roundseed panicgrass). Forbs, such as *Malvaviscus arboreus* var. *drummondii* (Drummond Turk's cap), *Chloracantha spinosa* (spiny aster), *Verbesina virginica* (frostweed), *Calyptocarpus vialis* (straggler daisy), *Commelina erecta* (erect dayflower), *Allium canadense* var. *canadense* (Canada wild onion), *Myosotis macrosperma* (scorpion weed), *Nemophila phacelioides* (baby blue-eyes), and the somewhat rare *Tauschia texana* (Texas tauschia) and *Spigelia texana* (Texas pinkroot), may also be found in these woodlands. *Chloracantha spinosa* (spiny aster) may sometimes form large, nearly monotypic in aspect, stands. Wetter, herbaceous dominated sites occur in these floodplains and may contain species such as *Cyperus* spp. (flatsedges), *Eleocharis* spp. (spikerushes), *Zizaniopsis miliacea* (Texas millet), *Paspalum denticulatum* (longtom), and *Typha domingensis* (southern cattail). The non-native *Triadica sebifera* (Chinese tallow) may be

present to dominant in the canopy of occurrences of this system. Non-native grasses such as *Cynodon dactylon* (bermudagrass), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Urochloa maximum* (guineagrass), and *Sorghum halepense* (Johnsongrass) may also be present and sometimes dominate the ground layer to the exclusion of other species.

VEGETATION TYPES:

Coastal Bend: Floodplain Live Oak Forest (4502)

Central Texas Coastal Prairie River Floodplain Live Oak Forest and Woodland
Identifier: **MoRAP Code:** 4502
Description: As described for the system, but with the canopy dominated by *Quercus fusiformis* (plateau live oak).

Coastal Bend: Floodplain Live Oak / Hardwood Forest (4503)

Central Texas Coastal Prairie River Floodplain Live Oak–Hardwood Forest and Woodland
Identifier: **MoRAP Code:** 4503
Description: Forests containing a mix of deciduous and broadleaf evergreen in the canopy. Broadleaf evergreen species include *Quercus fusiformis* (plateau live oak) and *Ehretia anacua* (anacua).

Coastal Bend: Floodplain Hardwood Forest (4504)

Central Texas Coastal Prairie River Floodplain Deciduous Forest and Woodland
Identifier: **MoRAP Code:** 4504
Description: As described for the system with primarily deciduous hardwoods in the canopy. Almost 45% of the system is mapped as this type.

Coastal Bend: Floodplain Evergreen Shrubland (4505)

Central Texas Coastal Prairie River Floodplain Evergreen Shrubland
Identifier: **MoRAP Code:** 4505
Description: Evergreen shrublands on floodplains with species such as *Sabal minor* (dwarf palmetto), *Rosa bracteata* (Macartney rose), *Zanthoxylum fagara* (colima), *Ehretia anacua* (anacua), *Baccharis halimifolia* (eastern baccharis), and *Acacia farnesiana* (huisache).

Coastal Bend: Floodplain Deciduous Shrubland (4506)

Central Texas Coastal Prairie River Floodplain Deciduous Shrubland
Identifier: **MoRAP Code:** 4506
Description: Shrublands dominated by species such as *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Cephalanthus occidentalis* (common buttonbush), *Forestiera acuminata* (swamp privet), and/or *Cornus drummondii* (roughleaf dogwood). Some sites mapped as this type may be dominated by *Chloracantha spinosa* (spiny aster). *Celtis laevigata* (sugar hackberry) and *Ulmus crassifolia* (cedar elm) are common within this type.

Coastal Bend: Floodplain Grassland (4507)

Central Texas Coastal Prairie River Floodplain Herbaceous Vegetation
Identifier: **MoRAP Code:** 4507
Description: More than 22% of this system is mapped as this type, though most sites represent managed pasture and may be dominated by species such as *Cynodon dactylon* (bermudagrass), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), and *Paspalum notatum* (bahiagrass).

Coastal Bend: Floodplain Herbaceous Wetland (4517)

Central Texas Coastal Prairie River Floodplain Herbaceous Wetland
Identifier: **MoRAP Code:** 4517
Description: Herbaceous wetlands typically dominated by sedges, wetland grasses, such as *Paspalum denticulatum* (longtom) or *Zizaniopsis miliacea* (Texas millet), and wetland forbs such as *Polygonum* spp. (smartweeds).

Columbia Bottomlands Forest and Woodland

Identifier: Previously Undescribed System

Geology: On extensive Quaternary alluvium along rivers and major drainages, but also found on adjacent Beaumont and Lissie Formations.

Landform: On the level to gently rolling uplands of the coastal prairie and floodplains. Significant local topographic relief associated with terraces, depressions, levees and swales of the floodplains of the lower Colorado, Brazos, and San Bernard Rivers and their major tributaries.

Soils: Primarily on the Clayey or Loamy Bottomland ecological site types, but also found on blackland and claypan soils within the basin.

Description: This system occurs on Quaternary alluvium and adjacent Pleistocene terraces (Beaumont and Lissie Formations) along the Brazos, San Bernard, and Colorado Rivers (as they pass through these Pleistocene formations), and adjacent streams such as Oyster Creek, Caney Creek, and Linnville Bayou. Chocolate Bayou represents the eastern extent of this system as the forest grades into systems more closely resembling the West Gulf Coastal Plain Small Stream and River Forest system to the northeast. Tres Palacios Creek represents the southwestern limit of this system, as floodplains further south and west share closer affinity to coastal rivers such as the Mission and Aransas. This system occupies a generally level landscape, punctuated by a series of swales, depressions, and natural levees. Much of the flooding experienced by this system results from seasonal precipitation and tropical storms, not from over-bank flooding. Over-bank flooding is infrequent, occurring about every 15 to 25 years (M. Lange, Pers. Comm.). Soils are frequently clayey bottomlands (such as Pledger or Brazoria clays) or loamy bottomlands (such as those of the Asa or Norwood series). This system expresses a range of communities along a moisture gradient ranging from the wettest sites along stream margins and depressions, to somewhat drier sites on ridges and natural levees. Herbaceous communities and open water typically characterize the wettest sites, with species such as *Eleocharis quadrangulata* (squarestem spikesedge), *Sagittaria graminea* (grassy arrowhead), *Sagittaria platyphylla* (delta arrowhead), *Ludwigia* spp. (water-primroses), *Saururus cernuus* (lizard's tail), *Azolla caroliniana* (Carolina mosquito-fern), and

Lemna obscura (little duckweed). Such very wet sites may have *Taxodium distichum* (baldcypress) and *Salix nigra* (black willow) in the overstory, or may be shrub swamps dominated by *Cephalanthus occidentalis* (common buttonbush) and/or *Forestiera acuminata* (swamp privet). Sites inundated somewhat less frequently, such as meander scars, abandoned oxbows, and channels, are often dominated in the overstory by species including *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), and *Carya aquatica* (water hickory), while the woody understory of these sites are typically open and may be dominated by *Cephalanthus occidentalis* (common buttonbush) and/or *Forestiera acuminata* (swamp privet). Rarely, *Leitneria floridana* (corkwood) may be a conspicuous component of the shrub layer. Herbaceous cover is often patchy and can include species such as *Phanopyrum gymnocarpon* (savannah panicum), *Echinodorus cordifolius* (heartleaf burhead), *Carex* spp. (carices), *Rhynchospora corniculata* (horned beakrush), *Saururus cernuus* (lizard's tail), *Polygonum punctatum* (water smartweed), *Hygrophila lacustris* (Gulf swampweed), *Boehmeria cylindrica* (false nettle), *Mikania scandens* (climbing hemp-weed), and *Lemna obscura* (little duckweed). Flats and ridges that are only occasionally flooded are often dominated by *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), *Quercus nigra* (water oak), and *Quercus shumardii* (Shumard oak). Shrubs on these sites include *Ilex vomitoria* (yaupon), *Sapindus saponaria* var. *drummondii* (western soapberry), *Malvaviscus arboreus* var. *drummondii* (Drummond Turk's cap), *Symphoricarpos orbiculatus* (coralberry), and *Callicarpa americana* (American beautyberry). *Sabal minor* (dwarf palmetto) and *Carex cherokeensis* (Cherokee sedge) are more abundant on these sites, and other species such as *Toxicodendron radicans* (poison ivy), *Chasmanthium sessiliflorum* (narrowleaf woodoats), *Chasmanthium latifolium* (creek oats), *Calyptocarpus vialis* (straggler daisy), *Oplismenus hirtellus* ssp. *setarius* (basketgrass), and *Polygonum virginianum* (jump seed) may be present. Clay backflats in this landscape may be dominated by *Quercus virginiana* (coastal live oak) and *Carya illinoinensis* (pecan), and *Quercus virginiana* (coastal live oak) may also share dominance with other canopy species on natural levees of these river systems. Blackland soils on the Pleistocene surface (such as those of the Lake Charles series) are often occupied by a forest dominated or co-dominated by *Quercus nigra* (water oak), *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), *Fraxinus pennsylvanica* (green ash), and less frequently *Quercus virginiana* (coastal live oak). The shrub layer on these sites is often well-developed and typically dominated by *Ilex vomitoria* (yaupon), sometimes with *Sabal minor* (dwarf palmetto), *Cornus drummondii* (roughleaf dogwood), and *Prunus caroliniana* (Carolina laurelcherry) also present. Vines are commonly encountered including species such as *Vitis mustangensis* (mustang grape), *Toxicodendron radicans* (poison ivy), *Ampelopsis arborea* (peppervine), and *Berchemia scandens* (Alabama supplejack). *Chasmanthium sessiliflorum* (narrowleaf woodoats), *Carex cherokeensis* (Cherokee sedge), *Carex crus-corvi* (crowfoot sedge), *Urochloa platyphylla* (broadleaf signalgrass), and *Juncus* spp. (rushes) and numerous other species are commonly found in the herbaceous layer. It is unclear whether these typically prairie dominated surfaces are now occupied by woodland and forest due to a disruption in natural fire cycle and disturbance, or whether the unique hydrology or other environmental factors of the Columbia Bottomlands leads to this incongruity. *Tillandsia usneoides* (Spanish moss) is a frequently encountered epiphyte in these forests. Riverside woodlands, along major rivers, have *Platanus occidentalis* (American sycamore) and *Populus deltoides* (eastern cottonwood) in the canopy (David Rosen, Pers. Comm.). The non-native tree *Triadica sebifera* (Chinese tallow) may often be encountered, sometimes as a significant or dominant component of the canopy.

VEGETATION TYPES:

Columbia Bottomlands: Live Oak Forest and Woodland (4702)

Columbia Bottomlands Live Oak Forest and Woodland
Identifier: **MoRAP Code:** 4702
Description: This type typically occupies slightly drier sites on levees and ridges and is dominated by *Quercus virginiana* (coastal live oak). This is the region of transition between *Quercus virginiana* (coastal live oak) and *Quercus fusiformis* (plateau live oak). We refer to live oaks in this section of the coast as *Quercus virginiana* (coastal live oak), though the true taxon, or taxa, is not known.

Columbia Bottomlands: Mixed Evergreen / Hardwood Forest and Woodland (4703)

Columbia Bottomlands Mixed Evergreen–Deciduous Forest and Woodland
Identifier: **MoRAP Code:** 4703
Description: Forest and woodland with the canopy shared between *Quercus virginiana* (coastal live oak) and hardwood species described for the system.

Columbia Bottomlands: Hardwood Forest and Woodland (4704)

Columbia Bottomlands Deciduous Forest and Woodland
Identifier: **MoRAP Code:** 4704
Description: About 47% of the system is represented by this forest and woodland characterized by a deciduous canopy of species described for the system.

Columbia Bottomlands: Evergreen Shrubland (4705)

Columbia Bottomlands Evergreen Shrubland
Identifier: **MoRAP Code:** 4705
Description: Shrublands or sparse woodlands with a well-developed shrub layer with species such as *Ilex vomitoria* (yaupon), *Sabal minor* (dwarf palmetto), *Quercus virginiana* (coastal live oak), *Rosa bracteata* (Macartney rose), or *Baccharis* spp. (baccharis). These shrublands are often the result of disturbance. Areas where cover in the shrub layer is dominated by *Triadica sebifera* (Chinese tallow) may also be mapped as this type. Species such as *Celtis laevigata* (sugar hackberry), *Quercus virginiana* (coastal live oak), and *Salix nigra* (black willow) may also be present.

Columbia Bottomlands: Deciduous Shrubland (4706)

Columbia Bottomlands Deciduous Shrubland
Identifier: **MoRAP Code:** 4706
Description: Shrub dominated sites that may have a sparse woody overstory with species in the shrub layer such as *Cephalanthus occidentalis* (common buttonbush), *Salix nigra* (black willow), *Forestiera acuminata* (swamp privet), and/or *Cornus drummondii* (roughleaf dogwood). *Triadica sebifera* (Chinese tallow) may be a conspicuous component of these shrublands, which often result from disturbance.

Columbia Bottomlands: Grassland (4707)

Columbia Bottomlands Herbaceous Vegetation
Identifier: **MoRAP Code:** 4707
Description: These are herbaceous dominated sites occupying bottomland soils and lacking significant shrub or overstory canopy cover. They are mostly managed grasslands dominated by grasses such as *Cynodon dactylon* (bermudagrass), *Paspalum notatum* (bahiagrass), and *Lolium perenne* (Italian ryegrass).

Columbia Bottomlands: Herbaceous Wetlands (4717)

Columbia Bottomlands Herbaceous Wetlands
Identifier: **MoRAP Code:** 4717
Description: Wetlands dominated by herbaceous species such as *Carex crus-corvi* (crowfoot sedge), other *Carex* spp. (carices), *Eleocharis quadrangulata* (squarestem spikesedge), *Rhynchospora* spp. (beaksedges), *Juncus* spp. (rushes), *Sagittaria* spp. (arrowheads), *Saururus cernuus* (lizard's tail), *Echinodorus cordifolius* (heartleaf burhead), *Typha* spp. (cattails), and/or *Polygonum* spp. (smartweeds).

Columbia Bottomlands: Riparian Live Oak Forest and Woodland (4712)

Columbia Bottomlands Riparian Live Oak Forest and Woodland
Identifier: **MoRAP Code:** 4712
Description: Forests or woodlands along drainages outside of bottomland soils, but within the Columbia Bottomlands landscape, where the canopy is dominated by *Quercus virginiana* (coastal live oak).

Columbia Bottomlands: Riparian Mixed Evergreen / Hardwood Forest and Woodland (4713)

Columbia Bottomlands Riparian Mixed Evergreen–Deciduous Forest and Woodland
Identifier: **MoRAP Code:** 4713
Description: Forests or woodlands along drainages outside of bottomland soils, but within the Columbia Bottomlands landscape, where the canopy is co-dominated by *Quercus virginiana* (coastal live oak) and deciduous species.

Columbia Bottomlands: Riparian Hardwood Forest and Woodland (4714)

Columbia Bottomlands Riparian Deciduous Forest and Woodland
Identifier: **MoRAP Code:** 4714
Description: Forests and woodlands with a deciduous canopy that occupy sites along drainages but outside of bottomland soils.

Columbia Bottomlands: Riparian Evergreen Shrubland (4715)

Columbia Bottomlands Riparian Evergreen Shrubland
Identifier: **MoRAP Code:** 4715
Description: Evergreen shrublands, often resulting from disturbance, that occupy sites along drainages but outside of bottomland soils. Species such as *Baccharis* spp. (baccharis), *Rosa bracteata* (Macartney rose), *Ilex vomitoria* (yaupon), or small *Quercus virginiana* (coastal live oak) sometimes dominate this type. Some sites dominated by *Triadica sebifera* (Chinese tallow) may be mapped as this type.

Columbia Bottomlands: Riparian Deciduous Shrubland (4716)

Columbia Bottomlands Riparian Deciduous Shrubland
Identifier: **MoRAP Code:** 4716
Description: Shrublands dominated by deciduous species along drainages that are outside of bottomland soils and are often the result of disturbance. Species such as *Sapindus saponaria* var. *drummondii* (western soapberry), *Cephalanthus occidentalis* (common buttonbush), *Cornus drummondii* (roughleaf dogwood), or *Sesbania drummondii* (rattlebox sesbania) may be dominant. Disturbed sites may be dominated by *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), or *Triadica sebifera* (Chinese tallow).

Columbia Bottomlands: Riparian Grassland (4727)

Columbia Bottomlands Riparian Herbaceous Vegetation
Identifier: **MoRAP Code:** 4727
Description: These are typically managed grasslands on upland drainages. Most are dominated by non-native species such as *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Cynodon dactylon* (bermudagrass), *Paspalum notatum* (bahiagrass), and *Lolium perenne* (Egyptian ryegrass).

Columbia Bottomlands: Riparian Herbaceous Wetland (4737)

Columbia Bottomlands Riparian Herbaceous Wetland
Identifier: **MoRAP Code:** 4737
Description: Herbaceous wetlands along upland drainages outside of bottomland soils. These wetlands are often dominated by sedges, rushes, and forbs such as *Polygonum* spp. (smartweeds).

Edwards Plateau Floodplain
Identifier: CES303.651

Geology: This system usually occupies Quaternary alluvial deposits often within drainages largely underlain by Cretaceous limestones or drainages that receive outwash from landscapes dominated by these limestones.
Landform: Valley floors of large rivers and perennial streams. This system tends to occupy broad valley bottoms with alluvial deposits on the Edwards Plateau, and rivers and large creeks where outwash from the Edwards Plateau influences the substrate.
Soils: Bottomland soils of various types (Loamy, Clayey, and Sandy).

Description: These are forests and woodlands with a canopy dominated or co-dominated by *Carya illinoinensis* (pecan), *Ulmus crassifolia* (cedar elm), *Ulmus americana* (American elm), *Celtis laevigata* (sugar hackberry), *Celtis laevigata* var. *reticulata* (netleaf hackberry), and/or *Quercus fusiformis* (plateau live oak). *Carya illinoinensis* (pecan) may be more likely to occur in deeper and better-developed alluvial soils. Apparent dominance of *Carya illinoinensis* (pecan) may also be an artifact of preferential harvesting of other species, leaving this species in greater abundance. *Melia azedarach* (chinaberry) is a common non-native tree encountered on floodplains. Other species present may include *Fraxinus texensis* (Texas ash), *Fraxinus pennsylvanica* (green ash),

Juglans major (Arizona walnut), *Quercus macrocarpa* (bur oak), *Quercus buckleyi* (Texas oak), *Acer negundo* (boxelder), *Sapindus saponaria* var. *drummondii* (western soapberry), *Juniperus ashei* (Ashe juniper), *Prosopis glandulosa* (mesquite), and *Platanus occidentalis* (American sycamore). *Quercus stellata* (post oak) may be dominant on sandy soils within the floodplain at some sites. Woody species in the subcanopy may include *Sideroxylon lanuginosum* (gum bumelia), *Ptelea trifoliata* (wafer-ash), *Cornus drummondii* (roughleaf dogwood), *Morus rubra* (red mulberry), *Diospyros texana* (Texas persimmon), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis* spp. (grape), *Smilax bona-nox* (greenbrier), *Baccharis neglecta* (roosevelt-weed), *Malvaviscus arboreus* var. *drummondii* (Turk's cap), *Juniperus ashei* (Ashe juniper), and *Ilex decidua* (possumhaw). The herbaceous layer may be continuous, though relatively sparse, or patchy with species such as *Elymus virginicus* (Virginia wildrye), *Chasmanthium latifolium* (creekoats), *Nassella leucotricha* (Texas wintergrass), *Verbesina virginica* (frostweed), and *Carex* spp. (caric sedge). Some sites lack, or have very sparse, overstory canopies and represent shrublands or grasslands. Shrublands may be dominated by species in the shrub layer of the surrounding woodlands. Other components or dominants may include species such as *Prosopis glandulosa* (mesquite), *Acacia farnesiana* (huisache), *Sapindus saponaria* var. *drummondii* (western soapberry), *Juglans microcarpa* (little walnut), *Mahonia trifoliolata* (agarito), and *Cephalanthus occidentalis* (common buttonbush). Grassland sites are frequently dominated by the non-native species *Cynodon dactylon* (bermudagrass) and/or *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem). Native species that may also be present in (and sometimes dominate) these sites include *Panicum virgatum* (switchgrass), *Andropogon glomeratus* (bushy bluestem), *Elymus virginicus* (Virginia wildrye), *Nassella leucotricha* (Texas wintergrass), *Hordeum pusillum* (little barley), *Tripsacum dactyloides* (eastern gamagrass), *Muhlenbergia lindheimeri* (Lindheimer's muhly), *Carex* spp. (carices), and *Eleocharis* spp. (spikerushes). Floodplain occurrences often include portions that resemble Edwards Plateau Riparian vegetation, especially along stream margins, where *Platanus occidentalis* (sycamore), *Taxodium distichum* (baldcypress), *Juglans microcarpa* (little walnut), *Brickellia* spp. (brickellbush), *Cladium mariscus* ssp. *jamaicense* (saw-grass), and *Panicum virgatum* (switchgrass) are frequently encountered.

VEGETATION TYPES:

Edwards Plateau: Floodplain Ashe Juniper Forest (1001)

Edwards Plateau Floodplain Ashe Juniper Forest and Woodland
Identifier: CES303.651.1 **MoRAP Code:** 1001
Description: As described for system, but *Juniperus ashei* (Ashe juniper) dominates the canopy.

Edwards Plateau: Floodplain Live Oak Forest (1002)

Edwards Plateau Floodplain Live Oak Forest and Woodland
Identifier: CES303.651.2 **MoRAP Code:** 1002
Descriptions: As described for the system, but *Quercus fusiformis* (plateau live oak) dominates the canopy. Deciduous species can be, and frequently are, common in the canopy, but *Quercus fusiformis* (plateau live oak) clearly dominates. *Juniperus ashei* (Ashe juniper) may also be present.

Edwards Plateau: Floodplain Hardwood / Ashe Juniper Forest (1003)

Edwards Plateau Floodplain Mixed Deciduous-Evergreen Forest and Woodland
Identifier: CES303.651.4 **MoRAP Code:** 1003
Description: As described for the system, with a mix of deciduous and evergreen canopy species.

Edwards Plateau: Floodplain Hardwood Forest (1004)

Edwards Plateau Floodplain Deciduous Forest and Woodland
Identifier: CES303.651.6 **MoRAP Code:** 1004
Description: As described for the system, but deciduous species dominate the canopy.

Edwards Plateau: Floodplain Ashe Juniper Shrubland (1005)

Edwards Plateau Floodplain Ashe Juniper Shrubland
Identifier: CES303.651.7 **MoRAP Code:** 1005
Description: *Juniperus ashei* (Ashe juniper) dominated shrublands on floodplains.

Edwards Plateau: Floodplain Deciduous Shrubland (1006)

Edwards Plateau Floodplain Deciduous Shrubland
Identifier: CES303.651.8 **MoRAP Code:** 1006
Description: Shrublands on floodplains dominated by species in the shrub layer of the surrounding woodlands or other species such as *Prosopis glandulosa* (mesquite), *Acacia farnesiana* (huisache), *Juglans microcarpa* (little walnut), *Sapindus saponaria* var. *drummondii* (western soapberry), *Mahonia trifoliolata* (agarito), *Salix nigra* (black willow), and *Cephalanthus occidentalis* (common buttonbush). *Ulmus crassifolia* (cedar elm), *Quercus fusiformis* (plateau live oak), and/or *Celtis laevigata* (sugar hackberry) may be present as a sparse and scattered overstory.

Edwards Plateau: Floodplain Herbaceous Vegetation (1007)

Edwards Plateau Floodplain Herbaceous Vegetation
Identifier: CES303.651.9 **MoRAP Code:** 1007
Description: Grasslands on floodplains, often dominated by *Cynodon dactylon* (bermudagrass) and/or *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem). Native species that may be present, common, or dominant include *Panicum virgatum* (switchgrass), *Andropogon glomeratus* (bushy bluestem), *Elymus virginicus* (Virginia wildrye), *Nassella leucotricha* (Texas wintergrass), *Hordeum pusillum* (little barley), *Tripsacum dactyloides* (eastern gamagrass), *Muhlenbergia lindheimeri* (Lindheimer muhly), and *Chasmanthium latifolium* (creekoats). Scattered *Prosopis glandulosa* (mesquite), *Quercus fusiformis* (plateau live oak), *Celtis laevigata* (sugar hackberry), or other overstory species may be present.

Edwards Plateau: Floodplain Herbaceous Wetland (1017)

Edwards Plateau Floodplain Herbaceous Wetland
Identifier: CES303.651.10 **MoRAP Code:** 1017
Description: Wetlands within floodplains often dominated by *Cladium mariscus* ssp. *jamaicense* (saw-grass), *Eleocharis* spp. (spikerushes), and *Carex* spp. (carices).

Edwards Plateau Riparian
Identifier: CES303.652

Geology: This system usually occupies Quaternary deposits along headwater streams. These may be alluvial or gravel deposits and are often within drainages dominated by limestone or other calcareous substrates on the Edwards Plateau or where substrate is influenced by outwash from the Edwards Plateau.

Landform: Riparian systems occupy small streams, either intermittent or perennial. These sites tend to be in erosional situations, as opposed to broad alluvial depositional sites.

Soils: By definition, this system is mapped in areas upstream of significant development of bottomland soils on soil types of the surrounding uplands.

Description: Riparian vegetation may be characterized as woodlands, shrublands, or herbaceous vegetation. These erosional sites may be gravelly, cobbly, or rocky, and generally occupy the upper reaches of streams. Woodlands may have *Quercus fusiformis* (plateau live oak), *Platanus occidentalis* (American sycamore), *Taxodium distichum* (baldcypress), *Fraxinus texensis* (Texas ash), *Fraxinus pennsylvanica* (green ash), *Ulmus crassifolia* (cedar elm), *Celtis laevigata* (sugar hackberry) (including var. *reticulata*), *Acer negundo* (boxelder), *Prosopis glandulosa* (mesquite), *Quercus buckleyi* (Texas oak), *Juniperus ashei* (Ashe juniper), *Salix nigra* (black willow), and/or *Sapindus saponaria* (western soapberry). Shrub species that may be encountered in the understory of these woodlands (or, in some cases, may form shrublands lacking a significant overstory canopy) include *Juglans microcarpa* (little walnut), *Chilopsis linearis* (desert willow), *Baccharis* spp. (false-willow), *Salix nigra* (black willow), *Juniperus ashei* (Ashe juniper), *Sapindus saponaria* (western soapberry), *Cornus drummondii* (roughleaf dogwood), *Sophora secundiflora* (Texas mountain-laurel), *Sideroxylon lanuginosum* (gum bumelia), *Diospyros texana* (Texas persimmon), *Ungnadia speciosa* (Mexican buckeye), *Prosopis glandulosa* (mesquite), *Cephalanthus occidentalis* (common buttonbush), and/or *Aloysia gratissima* (whitebrush). Substantial patches of herbaceous cover may be present and often include species such as *Andropogon glomeratus* (bushy bluestem), *Panicum virgatum* (switchgrass), *Cladium mariscus* var. *jamaicense* (sawgrass), *Tripsacum dactyloides* (eastern gamagrass), *Setaria scheelei* (southwestern bristlegrass), *Nassella leucotricha* (Texas wintergrass), *Eleocharis* spp. (spikerush), *Brickellia* spp. (brickellbush), *Justicia americana* (American water-willow), *Hydrocotyle* spp. (water penny), and/or *Muhlenbergia lindheimeri* (Lindheimer muhly). Frequently, *Cynodon dactylon* (bermudagrass) and/or *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) dominate these grassland sites. *Sorghum halepense* (Johnson grass) is also a commonly encountered non-native grass. This system includes vegetation along very small streams, reaching upstream to spring heads and runs.

VEGETATION TYPES:

Edwards Plateau: Riparian Ashe Juniper Forest (1401)

Edwards Plateau Riparian Ashe Juniper Forest and Woodland
Identifier: CES303.652.1 **MoRAP Code:** 1401
Description: Forest or woodland on riparian sites dominated by *Juniperus ashei* (Ashe juniper). Otherwise generally fitting the description of forest or woodland occurrences of the system, with some deciduous species and *Quercus fusiformis* (plateau live oak) present in the canopy.

Edwards Plateau: Riparian Live Oak Forest (1402)

Edwards Plateau Riparian Live Oak Forest and Woodland
Identifier: CES303.652.2 **MoRAP Code:** 1402
Description: Forest or woodland on riparian sites dominated by *Quercus fusiformis* (plateau live oak). Otherwise, this vegetation type generally fits the description of forest or woodland occurrences of the system, with some deciduous species and *Juniperus ashei* (Ashe juniper) present in the canopy.

Edwards Plateau: Riparian Hardwood / Ashe Juniper Forest (1403)

Edwards Plateau Riparian Hardwood / Ashe Juniper Forest
Identifier: CES303.652.4 **MoRAP Code:** 1403
Description: Forest or woodland on riparian sites co-dominated by evergreen species (*Juniperus ashei* (Ashe juniper) and/or *Quercus fusiformis* (plateau live oak) and deciduous species as mentioned in the system description.

Edwards Plateau: Riparian Hardwood Forest (1404)

Edwards Plateau Riparian Deciduous Forest and woodland
Identifier: CES303.652.6 **MoRAP Code:** 1404
Description: As described for woodland or forest occurrences of the system, with deciduous species dominating the canopy.

Edwards Plateau: Riparian Ashe Juniper Shrubland (1405)

Edwards Plateau Riparian Ashe Juniper Shrubland
Identifier: CES303.652.7 **MoRAP Code:** 1405
Description: Shrublands on riparian sites dominated by *Juniperus ashei* (Ashe juniper).

Edwards Plateau: Riparian Deciduous Shrubland (1406)

Edwards Plateau Riparian Deciduous Shrubland
Identifier: CES303.652.8 **MoRAP Code:** 1406
Description: Shrublands on riparian sites dominated by one or more of the shrub species mentioned in the system description.

Edwards Plateau: Riparian Herbaceous Vegetation (1407)

Edwards Plateau Riparian Herbaceous Vegetation
Identifier: CES303.652.9 **MoRAP Code:** 1407
Description: Riparian sites dominated by upland herbaceous vegetation as described in the system description.

Edwards Plateau: Riparian Herbaceous Wetland (1417)

Edwards Plateau Riparian Herbaceous Wetland
Identifier: CES303.652.10 **MoRAP Code:** 1417
Description: Riparian sites dominated by wetland herbaceous vegetation as described in the system description.

North American Warm Desert Lower Montane Riparian Woodland
Identifier: CES302.748

Geology: Various geological formations associated with the mountains of the Trans-Pecos, including limestones, sandstones, igneous formations, and alluvial and colluvial deposits.
Landform: Drainages on lower mountain slopes.
Soils: Various soils and sometimes rocky sites lacking any soil development.

Description: This system occupies valleys, drainages, and canyons of lower mountain slopes and foothills. These linear woodlands follow perennial and seasonally intermittent streams and may occur as woodlands or shrublands. Woody species that may be dominant include *Populus fremontii* (Arizona cottonwood), *Populus deltoides* ssp. *wislizeni* (Rio Grande cottonwood), *Juglans major* (Arizona walnut), *Fraxinus velutina* (velvet ash), *Salix gooddingii* (southwestern black willow), *Juglans microcarpa* (little walnut), *Sapindus saponaria* var. *drummondii* (western soapberry), *Ungnadia speciosa* (Mexican buckeye), and *Celtis laevigata* var. *reticulata* (netleaf hackberry). Shrubs may be present in the understory or may form shrublands lacking an overstory canopy or with a sparse emergent canopy. Shrubs commonly encountered include *Baccharis salicifolia* (seepwillow), *Salix gooddingii* (Southwestern black willow), *Fallugia paradoxa* (Apache plume), *Rhus microphylla* (littleleaf sumac), *Cephalanthus occidentalis* (common buttonbush), *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), *Acacia constricta* (whitethorn acacia), *Brickellia californica* (California brickellbush), *Prosopis glandulosa* (honey mesquite), and *Acacia greggii* (catclaw). Some sites with sparse woody overstory may be dominated by grasses such as *Bouteloua curtipendula* (sideoats grama), *Muhlenbergia porteri* (bush muhly), *Distichlis spicata* (saltgrass), *Muhlenbergia rigens* (deergrass), *Sporobolus airoides* (alkali sacaton), *Pleuraphis mutica* (tobosa), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Bouteloua gracilis* (blue grama), and *Aristida* spp. (threeawns).

VEGETATION TYPES:

Trans-Pecos: Lower Montane Riparian Woodland (11704)

North American Warm Desert Lower Montane Riparian Woodland
Identifier: CES302.748 **MoRAP Code:** 11704
Description: Woodlands dominated by species such as *Populus fremontii* (Arizona cottonwood), *Populus deltoides* ssp. *wislizeni* (Rio Grande cottonwood), *Fraxinus velutina* (velvet ash), *Ungnadia speciosa* (Mexican buckeye), and *Celtis laevigata* var. *reticulata* (netleaf hackberry).

Trans-Pecos: Lower Montane Riparian Shrubland (11706)

North American Warm Desert Lower Montane Riparian Shrubland
Identifier: CES302.748.2 **MoRAP Code:** 11706
Description: Shrublands with species such as *Baccharis salicifolia* (seepwillow), *Fallugia paradoxa* (Apache plume), *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), *Cephalanthus occidentalis* (common buttonbush), and *Salix* spp. (willows).

Trans-Pecos: Lower Montane Riparian Grassland (11707)

North American Warm Desert Lower Montane Riparian Grassland
Identifier: CES302.748.3 **MoRAP Code:** 11707
Description: Sites along drainages of lower mountain slopes lacking significant woody cover.

North American Warm Desert Riparian Mesquite Bosque (Not Mapped)
Identifier: CES302.752

Geology: Quaternary alluvium.
Landform: Floodplain.
Soils: Bottomland

Description: Though occurrences of this system have been reported in the Trans-Pecos, none were mapped. The system is reported to occur, or to have historically occurred along the Rio Grande and is/was dominated by *Prosopis glandulosa* (honey mesquite) forming a woodland canopy. Modification of the flood cycle and introduction of *Tamarix* spp. (saltcedars) may have influenced the distribution of this system on the Rio Grande.

North American Warm Desert Riparian Woodland and Shrubland
Identifier: CES302.753

Geology: This system occupies Quaternary Alluvium as well as nearby Cretaceous limestones through which drainages flow.

Landform: Relatively level floodplains and low landscape positions along drainages. Upper portions of these drainages are often flashy, and many are only infrequently and briefly inundated.

Soils: Loamy Bottomland, Salty Bottomland, and Draw are the most frequent Ecological Sites to be occupied by this system.

Description: This system occurs along drainages and floodplains of the larger rivers and drainages of the Trans-Pecos. In addition to the woodland and shrubland expression of this system, sparsely vegetated areas also commonly occur. Sparsely vegetated sites may be mapped on gravel bars, mud flats, or exposed rock within drainages, but may also have sparse woody or herbaceous vegetation including species such as *Brickellia* sp. (brickellbush), *Chilopsis linearis* (desert willow), *Baccharis* sp., (baccharis), *Prosopis glandulosa* (honey mesquite), and *Salvia farinacea* (mealycup sage). The native streamside vegetation along the large drainages is frequently displaced by extensive areas of *Tamarix* sp. (saltcedar) and/or *Arundo donax* (giant reed). Overstory canopy is often not well-developed but contain species such as *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Salix amygdaloides* (peachleaf willow), *Salix gooddingii* (Southwestern black willow), *Prosopis glandulosa* (honey mesquite), *Populus fremontii* (Arizona cottonwood), *Populus deltoides* var. *wislizeni* (Rio Grande cottonwood), *Fraxinus velutina* (velvet ash), and *Sapindus saponaria* var. *drummondii* (western soapberry). Low woodlands and shrublands with species such as *Salix exigua* (Texas sandbar willow), *Baccharis salicifolia* (seepwillow), *Brickellia laciniata* (splitleaf brickellbush), *Chilopsis linearis* (desert willow), *Juglans microcarpa* (little walnut), *Fallugia paradoxa* (Apache plume), and *Celtis ehrenbergiana* (granjeno) are present and sometimes patchy. Flooding and scouring are the dynamic processes most influential in this system.

VEGETATION TYPES:

Trans-Pecos: Riparian Barren (8700)

North American Warm Desert Riparian Sparsely Vegetated
Identifier: CES302.753.01 **MoRAP Code:** 8700
Description: Sparsely vegetated gravel bars, sand bars, or bare rock with scattered individuals or small areas of *Juglans microcarpa* (little walnut), *Chilopsis linearis* (desert willow), *Baccharis* sp. (baccharis), *Brickellia* sp. (brickellbush), or other species.

Trans-Pecos: Riparian Woodland (8704)

North American Warm Desert Riparian Woodland
Identifier: CES302.753.02 **MoRAP Code:** 8704
Description: Woodlands along drainages where the overstory may be composed of species such as *Salix* spp. (willows), *Populus* spp. (cottonwoods), *Sapindus saponaria* var. *drummondii* (western soapberry), *Celtis laevigata* var. *reticulata* (netleaf hackberry), and/or *Prosopis glandulosa* (honey mesquite). Some occurrences mapped as these woodlands may be dominated by *Tamarix* sp. (saltcedar).

Trans-Pecos: Riparian Shrubland (8706)

North American Warm Desert Riparian Shrubland
Identifier: CES302.753.03 **MoRAP Code:** 8706
Description: Shrublands along drainages with species such as *Baccharis* sp. (baccharis), *Brickellia* sp. (brickellbush), *Salix exigua* (desert willow), and *Chilopsis linearis* (desert willow).

North American Warm Desert Wash
Identifier: CES302.755

Geology: Small drainages through various substrates.
Landform: Small drainages.
Soils: Various soil types transected by small drainages.

Description: This system occurs on flashy, intermittently flooded, often dry washes and arroyos on lower mountain slopes, plains, and basins. These drainages are often embedded within a matrix of desert shrublands and/or grasslands. Washes may be sparsely vegetated, rocky, gravelly, or sandy drainageways, to patchy shrublands to almost continuous shrublands along the drainages. Woody species found in and adjacent to these washes include *Acacia greggii* (catclaw), *Brickellia laciniata* (splitleaf brickellbush), *Baccharis salicifolia* (seepwillow), *Chilopsis linearis* (desert willow), *Fallugia paradoxa* (Apache plume), *Rhus microphylla* (littleleaf sumac), *Juglans microcarpa* (little walnut), *Fraxinus greggii* (little-leaf ash), *Leucaena retusa* (littleleaf leadtree), *Dasylirion leiophyllum* (smooth sotol), and *Prosopis glandulosa* (honey mesquite). Scattered individuals of *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Chilopsis linearis* (desert willow), *Salix gooddingii* (southwestern black willow), *Juglans microcarpa* (little walnut), or other species may form a very sparse overstory. Shrubs from the surrounding upland shrubland, such as *Larrea tridentata* (creosotebush), *Viguiera stenoloba* (skeleton-leaf golden eye), *Flourensia cernua* (tarbush) and *Juniperus pinchotii* (redberry juniper) may be commonly encountered.

VEGETATION TYPES:

Trans-Pecos: Desert Wash Barren (8600)

North American Warm Desert Wash Barren
Identifier: CES302.755.1 **MoRAP Code:** 8600
Description: Sparsely vegetated sandy, gravelly, rocky stretches of desert drainages.

Trans-Pecos: Desert Wash Evergreen Shrubland (8605)

North American Warm Desert Wash Evergreen Shrubland
Identifier: CES302.755.2 **MoRAP Code:** 8605
Description: Desert drainages with evergreen shrub cover, with species such as *Juniperus pinchotii* (redberry juniper).

Trans-Pecos: Desert Wash Shrubland (8606)

North American Warm Desert Wash Shrubland
Identifier: CES302.755.3 **MoRAP Code:** 8606
Description: Shrub dominated desert drainages sometimes with a sporadic emergent overstory of scattered trees.

Trans-Pecos: Desert Wash Grassland (8607)

North American Warm Desert Wash Grassland
Identifier: CES302.755.4 **MoRAP Code:** 8607
Description: Grass dominated desert drainages, though grass cover is typically not continuous and gravel, rock, or sand is usually visible. Species present may include *Bouteloua curtipendula* (sideoats grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Sporobolus airoides* (alkali sacaton), *Muhlenbergia porteri* (bush muhly), *Muhlenbergia rigens* (deergrass), *Pleuraphis mutica* (tobosa), and/or *Bouteloua eriopoda* (black grama).

Red River Large Floodplain Forest
Identifier: CES203.065

Geology: Quaternary alluvial deposits.
Landform: Floodplain of the Red River and its major tributaries. Some local topographic variation exists and includes terraces and oxbows.
Soils: Bottomland soils.

Description: This system is somewhat unique to Red River drainage, but shares many of the species common to the West Gulf Coastal Plain Large River Floodplain. *Platanus occidentalis* (American sycamore), *Populus deltoids* (eastern cottonwood), *Salix nigra* (black willow), *Betula nigra* (river birch), *Acer negundo* (boxelder), and *Fraxinus pennsylvanica* (green ash) tend to occupy riverfront sites and newly exposed or disturbed sites. Seasonally flooded portions of the system do occur, and may contain species such as *Quercus lyrata* (overcup oak), *Carya aquatica* (water hickory), *Taxodium distichum* (baldcypress), *Nyssa aquatica* (water tupelo), *Nyssa biflora* (swamp tupelo), *Quercus phellos* (willow oak), *Gleditsia aquatica* (water honeylocust), and *Planera aquatica* (water elm). Less frequently flooded areas may be dominated by numerous hardwood species, such as *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), *Quercus phellos* (willow oak), *Quercus shumardii* (Shumard oak), *Quercus macrocarpa* (bur oak), *Quercus michauxii* (swamp chestnut oak), *Quercus falcata* (southern red oak), *Carya illinoinensis* (pecan), *Celtis laevigata* (sugar hackberry), *Ulmus alata* (winged elm), *Ulmus americana* (American elm), *Ulmus crassifolia* (cedar elm), *Ulmus rubra* (slippery elm), *Gleditsia triacanthos* (common honeylocust), *Nyssa sylvatica* (blackgum), and *Fraxinus pennsylvanica* (green ash). *Juniperus virginiana* (eastern redcedar), *Pinus taeda* (loblolly pine), and, to a lesser extent, *Pinus echinata* (shortleaf pine) may be found in the canopy. A mid-story component may include young individuals of the overstory, as well as species such as *Carpinus caroliniana* (American hornbeam), *Ostrya virginiana* (American hop-hornbeam), *Acer rubrum* (red maple), *Sassafras albidum* (sassafras), *Maclura pomifera* (bois d'arc), and *Morus rubra* (red mulberry). *Cephalanthus occidentalis* (common buttonbush) may dominate some open sites within the

floodplain. In addition to these species, shrubs such as *Crataegus viridis* (green hawthorn), *Crataegus marshallii* (parsley hawthorn), *Callicarpa americana* (American beautyberry), *Ligustrum sinense* (Chinese privet), and *Arundinaria gigantea* (giant cane) may be found in the understory of forests. Numerous woody vines may be encountered, including *Smilax rotundifolia* (common greenbriar), *Brunnichia ovata* (eardrop vine), *Berchemia scandens* (Alabama supplejack), *Lonicera japonica* (Japanese honeysuckle), *Ampelopsis arborea* (peppervine), and *Toxicodendron radicans* (poison ivy). Herbaceous species may be present in the understory of the forest, occur as marshy areas, or occupy herbaceous-dominated sites on areas less frequently flooded. *Saururus cernuus* (lizard's tail), *Nymphaea odorata* (American waterlily), *Rhynchospora* spp. (beaksedges), *Carex* spp. (caric sedges), *Dichanthelium* spp. (rosette grasses), *Chasmanthium* spp. (woodoats), *Juncus* spp. (rushes), *Leersia* sp. (cutgrass), *Geum canadense* (white avens), *Sanicula canadensis* (Canada snakeroot), *Woodwardia areolata* (chain fern), *Mikania scandens* (climbing hemp-weed), and *Polygonum* spp. (smartweeds) are among the herbaceous species that may be commonly encountered in this system.

VEGETATION TYPES:

Red River: Floodplain Hardwood / Evergreen Forest (5103)

Red River Large Floodplain Mixed Evergreen – Deciduous Forest and Woodland
Identifier: CES203.065.3 **MoRAP Code:** 5103
Description: This minor component of the system may represent pine plantations. In the west, these sites have a canopy where *Juniperus virginiana* (eastern redcedar) shares dominance with the hardwoods described for the system.

Red River: Floodplain Hardwood Forest (5104)

Red River Large Floodplain Deciduous Forest and Woodland
Identifier: CES203.065.3 **MoRAP Code:** 5104
Description: This mapped type makes up about half of the area mapped as this system. Dominants include the hardwood species mentioned above for areas not seasonally flooded. This type may have a well-developed mid-story, and some shrub cover. Herbaceous cover may be patchy to almost continuous.

Red River: Floodplain Evergreen Shrubland (5105)

Red River Large River Floodplain Evergreen Shrubland
Identifier: CES203.065.5 **MoRAP Code:** 5105
Description: This is a very minor component of the system and may represent young pine plantations or sites dominated by *Juniperus virginiana* (eastern redcedar).

Red River: Floodplain Deciduous Shrubland (5106)

Red River Large River Floodplain Deciduous Shrubland
Identifier: CES203.065.6 **MoRAP Code:** 5106
Description: This mapped type may represent areas of sparse woodland canopy or young forests recovering from disturbance. Such sites may contain species such as *Salix nigra* (black willow), *Ulmus alata* (winged elm), *Celtis laevigata* (sugar hackberry), *Acer negundo* (boxelder), *Fraxinus pennsylvanica* (green ash), or *Liquidambar styraciflua*

(sweetgum), among others. This type may also represent shrublands dominated by species such as *Cephalanthus occidentalis* (common buttonbush).

Red River: Floodplain Herbaceous Wetland (5107)

Red River Large River Floodplain Herbaceous Wetland
Identifier: CES203.065.7 **MoRAP Code:** 5107
Description: This relatively minor component of the system represents marsh landcover mapped on bottomland soils of the region. This type tends to be wetter than the Red River: Floodplain Wet Prairie.

Red River: Floodplain Seasonally Flooded Hardwood Forest (5114)

Red River Large River Floodplain Seasonally Flooded Deciduous Forest and Woodland
Identifier: CES203.065.14 **MoRAP Code:** 5114
Description: This mapped type occupies wetter sites that experience frequent flooding and tend to be dominated by more flood-tolerant species such as *Quercus lyrata* (overcup oak), *Taxodium distichum* (baldcypress), and *Quercus phellos* (willow oak).

Red River: Floodplain Wet Prairie (5117)

Red River Large River Floodplain Wet Prairie
Identifier: CES203.065.17 **MoRAP Code:** 5117
Description: This mapped type makes up a significant portion of the area mapped at this system. It represents areas of herbaceous cover, not mapped as marsh landcover, in bottomland soils of the region. It may often represent managed pastures. This type tends to be drier than the Red River: Floodplain Herbaceous Wetland.

Rio Grande Delta Thorn Woodland and Shrubland

Identifier: Previously Undescribed System

Geology: Quaternary alluvium.
Landform: Sites within the historic floodplain of the Rio Grande delta, typically on slight rises such as old natural levees or resaca banks.
Soils: Often on Clayey or Loamy Bottomland Ecological Sites, but occasionally on Clay Loam or Gray Sandy Loam types.

Description: This diverse, usually broad-leaved evergreen, woodland is found on resaca banks and old natural levees on the Rio Grande delta. Sites are well-watered, somewhat elevated relative to the surrounding landscape, and tend to occupy loamy or clayey bottomland soils. Occasionally occurrences can be found on clay loams (such as Raymondville or Racombes soils) or gray sandy loams (such as Hidalgo sandy clay loam). The sometimes patchy canopy of these woodlands often contains species such as *Ebenopsis ebano* (Texas ebony), *Ehretia anacua* (anacua), *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), and *Celtis ehrenbergiana* (granjeno), and may reach heights of 15 m. Species such as *Phaulothamnus spinescens* (snake-eyes), *Amyris madrensis* (Sierra Madre torchwood), *Amyris texana* (Texas torchwood), *Diospyros texana* (Texas persimmon), *Leucaena pulverulenta* (tepeguaje), *Guaiacum angustifolium* (guayacan), *Malpighia glabra* (Barbados cherry), *Adelia vaseyi* (Vasey's adelia), *Bernardia myricifolia* (oreja de raton),

Sideroxylon celastrinum (la coma), *Condalia hookeri* (brasil), *Forestiera angustifolia* (desert olive), *Havardia pallens* (tenaza), *Iresine palmeri* (Palmer's bloodleaf), *Trixis inula* (tropical trixis), *Xylosma flexuosum* (brush-holly), and *Randia rhagocarpa* (crucillo) may occur as shrubs or in the sub-canopy, and some individuals of a few of these species may reach heights of 4 to 5 meters. This shrub or understory layer can be extremely dense, almost impenetrable. Woody cover, including the patchier overstory canopy and the almost continuous shrub/understory layer, often reaches greater than 90%. This system is sometimes referred to as a tall shrubland, since shrubs are often the dominant lifeform, but frequently reach heights resembling the stature of woodland. *Prosopis glandulosa* (honey mesquite) may occasionally be absent or uncommon in the canopy, and is generally not dominant except in disturbed situations. The herbaceous layer is generally represented by a only a few species and is relatively sparse, with species such as *Rivina humilis* (pigeonberry), *Plumbago scandens* (climbing plumbago), *Celosia nitida* (West Indian cock's comb), *Chromolaena odorata* (crucita), *Leersia monandra* (bunch cutgrass), *Digitaria californica* (Arizona cottontop), *Setaria* spp. (bristlegrasses), *Salvia coccinea* (tropical sage), *Petiveria alliacea* (hierba de las gallinitas), *Malvastrum americanum* (Rio Grande false-mallow), *Urtica chamaedryoides* (slim stinging nettle), *Verbesina microptera* (southern frostweed), *Calyptocarpus vialis* (straggler daisy), and *Justicia pilosella* (hairy tubetongue) sometimes present. Vines such as *Serjania brachycarpa* (littlefruit slipplejack), *Urvillea ulmacea* (apaac), *Cocculus diversifolius* (orientvine), *Mikania scandens* (climbing hemp-weed), *Cardiospermum* spp. (balloon-vines), *Chiococca alba* (David's milkberry), *Cissus trifoliata* (ivy treebine), and *Passiflora* spp. (passionflowers) may also be commonly encountered. The rather rare epiphyte *Tillandsia baileyi* (Bailey's ballmoss) may be found in these woodlands, along with the more common *Tillandsia recurvata* (ballmoss) and *Tillandsia usneoides* (Spanish moss). Younger occurrences, especially those occupying drier sites, tend to present as shrublands, often dominated by similar, though shorter, canopy species. These occurrences also tend to be less diverse, lack the layered structure, and usually support fewer epiphytes. This system differs from the related Tamaulipan Floodplain system in that it has higher diversity, a significant evergreen component to the canopy, a higher subtropical component to the species assemblage, is restricted in range to the Rio Grande delta and vicinity, and often occurs as slight rises in the otherwise relatively level landscape.

VEGETATION TYPES:

Rio Grande Delta: Evergreen Thorn Woodland (7802)

Rio Grande Delta Evergreen Thorn Woodland and Shrubland
Identifier: **MoRAP Code:** 7802
Description: Much of this system (>90%) is mapped as this type with broadleaf evergreen species such as *Ebenopsis ebano* (Texas ebony) and *Ehretia anacua* (anacua) making up a significant portion of the overstory canopy and a dense shrub layer of numerous species present.

Rio Grande Delta: Deciduous Thorn Woodland and Shrubland (7804)

Rio Grande Delta Deciduous Thorn Woodland and Shrubland
Identifier: **MoRAP Code:** 7804
Description: Woodlands with increased dominance of deciduous species such as *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), and *Celtis ehrenbergiana* (granjeno).

Rio Grande Delta: Dense Shrubland (7805)

Rio Grande Delta Dense Shrubland

Identifier: **MoRAP Code:** 7805

Description: Dense shrublands often representing younger occurrences and occurrences occupying slightly less well-watered sites. *Phaulothamnus spinescens* (snake-eyes), *Guaiacum angustifolia* (guayacan), *Celtis ehrenbergiana* (granjeno), and *Diospyros texana* (Texas persimmon) are often conspicuous components.

Southeastern Great Plains Floodplain Forest

Identifier: CES205.710

Geology: This system generally occupies Quaternary alluvium.

Landform: This floodplain forest occupies relatively broad flats at low topographic positions, along large streams where alluvial deposition dominates. Rivers such as the Sulphur, (and tributaries such as White Oak and Cuthand Creeks), Sabine (and Lake Fork), Trinity (and its major tributaries), Navasota, and portions of the Lower and Middle Brazos (and its major tributaries), Colorado, Guadalupe, Lavaca, Navidad, and San Antonio Rivers may support this system.

Soils: Bottomland Ecological Sites (including Loamy, Sandy, and Clayey) characterize this system.

Description: Dominant communities within this system range from floodplain forests to wet meadows to gravel/sand flats; however, they are linked by underlying soils and the flooding regime. Canopy dominants may include *Carya illinoinensis* (pecan), *Fraxinus americana* (white ash), *Quercus nigra* (water oak), *Ulmus crassifolia* (cedar elm), *Celtis laevigata* (sugar hackberry), *Ulmus americana* (American elm), *Quercus fusiformis* or *Q. virginiana* (plateau or coastal live oak), *Platanus occidentalis* (American sycamore), *Acer negundo* (boxelder), *Gleditsia triacanthos* (common honeylocust), *Quercus macrocarpa* (bur oak), *Morus rubra* (red mulberry), *Fraxinus pennsylvanica* (green ash), and *Sapindus saponaria* var. *drummondii* (western soapberry). Especially along river margins, species such as *Platanus occidentalis* (American sycamore), *Populus deltoides* (eastern cottonwood), and *Salix nigra* (black willow) may dominate. In this eastern part of the range of the system, *Liquidambar styraciflua* (sweetgum), *Quercus phellos* (willow oak), and *Betula nigra* (river birch) may also be commonly encountered. Seasonally flooded sites, especially within the Trinity River basin, may have *Quercus lyrata* (overcup oak) as an overstory component. Overgrazing and/or overbrowsing may influence recruitment of overstory species and composition of the understory and herbaceous layers. Shrub species may include *Callicarpa americana* (American beautyberry), *Cephalanthus occidentalis* (common buttonbush), *Ilex decidua* (possumhaw), *Ilex vomitoria* (yaupon), *Sideroxylon lanuginosum* (gum bumelia), *Diospyros virginiana* (common persimmon), *Vaccinium arboreum* (farkleberry), *Juniperus virginiana* (eastern redcedar), *Cornus drummondii* (roughleaf dogwood), and *Viburnum rufidulum* (rusty blackhaw), which may occur as dense patches following disturbance, but are otherwise generally fairly sparse. In the southern expressions of the system, other shrubs such as *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Diospyros texana* (Texas persimmon), and *Condalia hookeri* (brasil) may be commonly encountered. Vines such as *Berchemia scandens* (Alabama supplejack), *Campsis radicans* (common trumpetcreeper), *Vitis*

spp. (grape), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (poison ivy), *Smilax bona-nox* (saw greenbrier), and *Ampelopsis arborea* (peppervine) may be conspicuous. Herbaceous cover includes *Elymus virginicus* (Virginia wildrye), *Verbesina virginica* (frostweed), *Chasmanthium latifolium* (creek oats), *Chasmanthium sessiliflorum* (narrowleaf woodoats), *Carex cherokeensis* (Cherokee sedge), *Tripsacum dactyloides* (eastern gamagrass), *Symphyotrichum drummondii* var. *texanum* (Drummond's aster), *Calyptocarpus vialis* (straggler daisy), *Geum canadense* (white avens), *Sanicula canadensis* (Canada snakeroot), *Ambrosia trifida* (giant ragweed), *Panicum virgatum* (switchgrass), *Galium* spp. (bedstraw), *Teucrium canadense* (American germander), and *Carex* spp. (caric sedges). Wetter sites may contain species such as *Zizaniopsis miliacea* (marshmillet), *Rhynchospora* spp. (beaksedges), *Eleocharis* spp. (spikerushes), *Nymphaea odorata* (American waterlily), and *Peltandra virginica* (Virginia peltandra). Non-native grasses that may dominate these sites include *Cynodon dactylon* (bermudagrass), *Bothriochola ischaemum* var. *songarica* (King Ranch bluestem), and *Sorghum halepense* (Johnsongrass). Herbaceous cover may be quite high, especially in situations where shrub cover is low. The non-native trees *Triadica sebifera* (Chinese tallow) and *Melia azedarach* (chinaberry) may be present.

VEGETATION TYPES:

Central Texas: Floodplain Evergreen Forest (1801)

Southeastern Great Plains Floodplain Evergreen Forest and Woodland
Identifier: CES205.710.1 **MoRAP Code:** 1801
Description: As described for the system, but the canopy is dominated by *Juniper virginiana* (eastern redcedar). In some cases, this mapped type may have *Pinus taeda* (loblolly pine) as the canopy dominant.

Central Texas: Floodplain Live Oak Forest (1802)

Southeastern Great Plains Floodplain Live Oak Forest and Woodland
Identifier: CES205.710.2 **MoRAP Code:** 1802
Description: As described for the system, but dominated by *Quercus fusiformis* (plateau live oak) or *Quercus virginiana* (coastal live oak). Deciduous species can be, and frequently are, common in the canopy, but *Quercus fusiformis* (plateau live oak) or *Quercus virginiana* (coastal live oak) clearly dominates. *Juniperus virginiana* (eastern redcedar) may also be present.

Central Texas: Floodplain Hardwood / Evergreen Forest (1803)

Southeastern Great Plains Floodplain Mixed Deciduous – Evergreen Forest and Woodland
Identifier: CES205.710.3 **MoRAP Code:** 1903
Description: As described for the system with a mix of evergreen and deciduous species in the canopy, with *Quercus fusiformis* (plateau live oak) representing the most common evergreen component.

Central Texas: Floodplain Hardwood Forest (1804)

Southeastern Great Plains Floodplain Deciduous Forest and Woodland
Identifier: CES205.710.4 **MoRAP Code:** 4
Description: As described for the system, but deciduous species dominating the canopy.

Central Texas: Floodplain Evergreen Shrubland (1805)

Southeastern Great Plains Floodplain Evergreen Shrubland
Identifier: CES205.710.5 **MoRAP Code:** 1805
Description: Shrublands of the floodplains of the region that are dominated by *Juniperus* spp. (juniper) occurring as shrubs, or other evergreen shrubs, such as *Ilex vomitoria* (yaupon) or the non-native *Rosa bracteata* (Macartney rose). This type may also represent young *Pinus taeda* (loblolly pine) stands

Central Texas: Floodplain Deciduous Shrubland (1806)

Southeastern Great Plains Floodplain Deciduous Shrubland
Identifier: CES205.710.6 **MoRAP Code:** 1806
Description: Shrublands of the floodplains of the region that are dominated by deciduous shrubs such as *Ilex decidua* (possumhaw), *Prosopis glandulosa* (honey mesquite), *Salix nigra* (black willow), *Cornus drummondii* (roughleaf dogwood), and/or *Cephalanthus occidentalis* (common buttonbush). This mapped type may also include areas with sparse woodlands composed of typical deciduous overstory species as described above, or sites in early succession dominated by species such as *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Celtis laevigata* (sugar hackberry), or *Triadica sebifera* (Chinese tallow).

Central Texas: Floodplain Herbaceous Vegetation (1807)

Southeastern Great Plains Floodplain Herbaceous Vegetation
Identifier: CES205.710.7 **MoRAP Code:** 1807
Description: Floodplains of the region that lack a significant overstory or shrub canopy, but retain cover in the herbaceous layer. Non-native grass species such as *Cynodon dactylon* (bermudagrass), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), and *Sorghum halepense* (Johnsongrass) may frequently dominate this vegetation type. *Tripsacum dactyloides* (eastern gamagrass) – *Panicum virgatum* (switchgrass) dominated prairies on lowlands, like those that occur at Knight Prairie and Mill Creek Bottom, may also be mapped as this vegetation type.

Central Texas: Floodplain Herbaceous Wetland (1817)

Southeastern Great Plains Floodplain Herbaceous Wetland
Identifier: CES205.710.17 **MoRAP Code:** 1817
Description: These wetlands are dominated by numerous sedge species, including *Carex* spp. (sedges), *Eleocharis* spp. (spikerushes), *Cyperus* spp. (flatsedges), and *Schoenoplectus pungens* (common threesquare). Various grasses and *Juncus* spp. (rushes) are also common. Forbs that may be encountered include species such as *Hydrocotyle verticillata* (whorled water-pennywort), *Polygonum* spp. (smartweeds), *Pluchea odorata* (purple marsh-camphor), and *Ambrosia trifida* (giant ragweed).

Central Texas: Floodplain Seasonally Flooded Hardwood Forest (1814)

Southeastern Great Plains Floodplain Seasonally Flooded Hardwood Forest
Identifier: CES205.710.14 **MoRAP Code:** 1814
Description: In this eastern portion of the range of the system, the occurrence of bottomlands that are seasonally flooded becomes more common. These sites may be

dominated by species that may be more commonly encountered to the east, such as *Quercus lyrata* (overcup oak) and *Quercus phellos* (willow oak). *Salix nigra* (black willow) may also be commonly encountered within the mapped type. Herbaceous cover is very limited due to the frequency of flooding. Shrubs that can withstand frequent inundation, such as *Cephalanthus occidentalis* (common buttonbush), *Planera aquatica* (water elm), and *Forestiera acuminata* (swamp privet), may be present to dominant.

Central Texas: Floodplain Baldcypress Swamp (1824)

Southeastern Great Plains Baldcypress Swamp
Identifier: CES205.710.24 **MoRAP Code:** 1824
Description: In the eastern portion of the range of the system, baldcypress swamps are more commonly encountered, particularly in the eastern part of the upper Trinity River basin. These sites are dominated by *Taxodium distichum* (baldcypress). Some mapped occurrences may be dominated by *Planera aquatica* (water elm).

Southeastern Great Plains Riparian Forest
Identifier: CES205.709

Geology: As defined, this system occupies buffer zones of headwater streams, and soils develop in place over a variety of geologic surfaces

Landform: Valleys and drainages along headwater streams of the Sulphur, Sabine, Navasota, Brazos, upper Trinity River, and middle portions of the Guadalupe and San Antonio River Basins. Typically in areas with erosional processes dominating over alluvial deposition. In the Trinity River basin, occurrences were mapped upstream of approximately the Leon/Madison County line, near the confluence with Cobb Creek.

Soils: By definition, this system is mapped along drainages upstream of the Bottomland Ecoclasses, so they will be mapped on soils of the surrounding uplands.

Description: Trees that may be present in stands of this system include *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), *Platanus occidentalis* (American sycamore), *Populus deltoides* (eastern cottonwood), *Quercus fusiformis* (plateau live oak), *Quercus nigra* (water oak), *Quercus phellos* (willow oak), *Sapindus saponaria* var. *drummondii* (western soapberry), *Salix nigra* (black willow), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Gleditsia triacanthos* (common honeylocust), *Prosopis glandulosa* (honey mesquite), and *Carya illinoinensis* (pecan). To the east, *Quercus falcata* (southern red oak) and *Liquidambar styraciflua* (sweetgum) may become important components of the overstory. To the east, evergreen dominated occurrences may contain *Pinus taeda* (loblolly pine) or *Pinus echinata* (shortleaf pine), as well as *Juniperus virginiana* (eastern redcedar). The shrub layer development is variable, sometimes with species such as *Amorpha fruticosa* (indigobush), *Forestiera acuminata* (swamp privet), *Ilex decidua* (possumhaw), *Ilex vomitoria* (yaupon), *Sideroxylon lanuginosum* (gum bumelia), *Juniperus virginiana* (eastern redcedar), *Diospyros virginiana* (common persimmon), *Cornus drummondii* (roughleaf dogwood), *Condalia hookeri* (brasil), *Acacia farnesiana* (huisache), and/or *Viburnum rufidulum* (rusty blackhaw). A few sites may be shrub dominated without an overstory canopy, containing species such as *Forestiera acuminata* (swamp privet), *Cephalanthus occidentalis* (common buttonbush), *Acacia farnesiana* (huisache), or *Sesbania drummondii*

(rattlebox sesbania). Herbaceous cover is also variable, depending on overstory and shrub canopies and recent flooding history. Herbaceous species may include *Elymus virginicus* (Virginia wildrye), *Verbesina virginica* (frostweed), *Chasmanthium latifolium* (creek oats), *Chasmanthium sessiliflorum* (narrowleaf woodoats), *Tripsacum dactyloides* (eastern gamagrass), *Symphyotrichum drummondii* var. *texanum* (Drummond's aster), *Amphiachyris dracunculoides* (common broomweed), *Ambrosia psilostachya* (western ragweed), *Geum canadense* (white avens), *Sanicula canadensis* (Canada snakeroot), *Panicum virgatum* (switchgrass), *Galium* spp. (bedstraw), and *Carex* spp. (caric sedges). Upland species such as *Schizachyrium scoparium* (little bluestem), *Nassella leucotricha* (Texas wintergrass), and *Sorghastrum nutans* (Indiangrass) may be common. Woody vines such as *Smilax bona-nox* (saw greenbrier), *Toxicodendron radicans* (poison ivy), *Ampelopsis arborea* (peppervine), and *Vitis* spp. (grapes) may be common. The environment and characteristics of the vegetation of this system become drier from east to west, with moister representatives (such as communities containing *Quercus nigra* (water oak)) occurring in the eastern parts of the range. Non-native grass species that may be common to dominant on these sites include *Arundo donax* (giant reed) and *Cynodon dactylon* (bermudagrass) and *Sorghum halepense* (Johnsongrass). The non-native species, such as *Ligustrum* spp. (privets) and *Triadica sebifera* (Chinese tallow), may be commonly encountered.

VEGETATION TYPES:

Central Texas: Riparian Evergreen Forest (1901)

Southeastern Great Plains Riparian Evergreen Forest and Woodland
Identifier: CES205.709.1 **MoRAP Code:** 1901
Description: As described for the system, with *Juniperus virginiana* (eastern redcedar) dominating the canopy. On the eastern edge of the range of this system, some occurrences may be dominated by *Pinus taeda* (loblolly pine), or less commonly, *Pinus echinata* (shortleaf pine).

Central Texas: Riparian Live Oak Forest (1902)

Southeastern Great Plains Riparian Live Oak Forest and Woodland
Identifier: CES205.709.2 **MoRAP Code:** 1902
Description: As described for the system, with *Quercus fusiformis* (plateau live oak) or *Quercus virginiana* (coastal live oak) dominating the canopy. Deciduous species can be, and frequently are, common in the canopy, but *Q. fusiformis* (plateau live oak) or *Quercus virginiana* (coastal live oak) clearly dominates. *Juniperus virginiana* (eastern redcedar) may also be present.

Central Texas: Riparian Hardwood / Evergreen Forest (1903)

Southeastern Great Plains Riparian Mixed Deciduous – Evergreen Forest and Woodland
Identifier: CES205.709.3 **MoRAP Code:** 1903
Description: As described for the system, with a mix of evergreen species, including *Juniperus virginiana* (eastern redcedar), *Pinus* spp. (pines) (to the east), *Quercus fusiformis* (plateau live oak) and/or *Quercus virginiana* (coastal live oak) and deciduous species in the canopy.

Central Texas: Riparian Hardwood Forest (1904)

Southeastern Great Plains Riparian Hardwood Forest and Woodland
Identifier: CES205.709.4 **MoRAP Code:** 1904
Description: As described for the system, with deciduous species dominating the canopy.

Central Texas: Riparian Evergreen Shrubland (1905)

Southeastern Great Plains Riparian Evergreen Shrubland
Identifier: CES205.709.5 **MoRAP Code:** 1905
Description: Shrublands in riparian sites that are dominated by *Juniperus virginiana* (eastern redcedar), young *Pinus* spp. (pines) or, sometimes broadleaf evergreen shrubs such as *Ilex vomitoria* (yaupon).

Central Texas: Riparian Deciduous Shrubland (1906)

Southeastern Great Plains Riparian Deciduous Shrubland
Identifier: CES205.709.6 **MoRAP Code:** 1906
Description: Shrublands in riparian sites that may be dominated by deciduous shrubs such as *Ilex decidua* (possumhaw), *Prosopis glandulosa* (honey mesquite), *Salix nigra* (black willow), *Cornus drummondii* (roughleaf dogwood), *Forestiera acuminata* (swamp privet), and/or *Cephalanthus occidentalis* (common buttonbush). This mapped type may also represent relatively sparse woodlands dominated by overstory species typical of the system.

Central Texas: Riparian Herbaceous Vegetation (1907)

Southeastern Great Plains Riparian Herbaceous Vegetation
Identifier: CES205.709.7 **MoRAP Code:** 1907
Description: Riparian sites lacking overstory or shrub canopy but retaining herbaceous cover. Some sites may be dominated by species such as *Schizachyrium scoparium* (little bluestem) or *Sorghastrum nutans* (Indiangrass), that are more commonly encountered in surrounding uplands. Other sites may be dominated by the non-natives like *Arundo donax* (giant reed), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), or *Cynodon dactylon* (bermudagrass).

Central Texas: Riparian Herbaceous Wetland (1917)

Southeastern Great Plains Riparian Herbaceous Wetland
Identifier: CES205.709.17 **MoRAP Code:** 1917
Description: Small areas dominated by wetland species such as *Cyperus* spp. (flatsedges), *Eleocharis* spp. (spikerushes), *Panicum virgatum* (switchgrass), and *Polygonum* spp. (smartweeds) may occur on these more upland drainages.

Tamaulipan Closed Depression Wetland

Identifier: CES301.197

Geology: This system occurs over various geologic formations, from eolian sands, to the Lissie Formation, to the Goliad Formation. Occurrences are local and appear to be unrelated to underlying strata.

Landform: Local, internally draining basins or depressions.

Soils: Though this sytem may occur in a matrix of sandy substrate, the depressions that characterize it are typically lined by clays or clay loams. Lakebed Ecological Sites typify the occurrences.

Description: This system occupies small, internally drained basins occurring over various substrates, but concentrated over the Lissie and Goliad Formations and the South Texas Sandsheet south of the Nueces River. They may be locally referred to as potholes, lagunas, lagunitas, ponds, or copitas. These basins are typically lined by clay or clay loam soils which tend to hinder drainage, resulting in moist conditions over extended periods. Characteristic woody species surrounding these basins include *Acacia farnesiana* (huisache), *Parkinsonia aculeata* (retama), and *Prosopis glandulosa* (honey mesquite) which make up a relatively sparse woodland canopy at a height of about 6 m. *Celtis laevigata* (sugar hackberry), *Celtis ehrenbergiana* (granjeno), and *Ulmus crassifolia* (cedar elm) may sometimes be present. Shrubs of these species, and other species such as *Condalia hookeri* (brasil), *Lycium carolinianum* (Carolina wolfberry), *Heimia salicifolia* (hachinal), and *Sideroxylon celastrina* (la coma) may be present but typically do not occur as a dense shrub layer. *Sesbania drummondii* (rattlebox sesbania) is often encountered particularly in areas with reduced woodland canopy where water may stand for extended periods. The herbaceous layer winthin the woodland may commonly contain species such as *Urochloa maxima* (guineagrass), *Chloracantha spinosa* (spiny aster), *Clematis drummondii* (old man's beard), and *Teucrium cubense* (Cuban germander). Toward the center of the basin, woody cover is reduced or often absent and the herbaceous layer is often dominated by *Cynodon dactylon* (bermudagrass), but may also be characterized by a number of sedge species of the genera *Eleocharis* (including species such as *Eleocharis quadrangulata* (squarestem spikesedge) and *Eleocharis palustris* (bigstem spikesedge)) and *Cyperus* (including species such as *Cyperus articulatus* (jointed umbrellasedge), *Cyperus acuminatus* (taperleaf flatsedge), and *Cyperus squarrosus* (bearded umbrellasedge)), as well as *Schoenoplecuts saximontanus* (annual bulrush). Numerous other species may be present, including *Paspalum distichum* (knotgrass), *Setaria parviflora* (knotroot bristlegrass), *Eragrostis spicata* (spike lovegrass), *Calyptocarpus vialis* (straggler daisy), *Eryngium nasturtiifolium* (hierba del sapo), *Eclipta prostrata* (yerba de tajo), *Phyla nodiflora* (common frog-fruit), *Soliva mutisii* (Mutis' burrweed), *Rorippa teres* (tansyleaf yellowcress), *Lindernia dubia* (moistbank pimpernel), *Rotala ramosior* (tooth-cup), *Bacopa rotundifolia* (disc waterhyssop), *Heteranthera limosa* (blue mudplantain), *Echinodorus berteroi* (common burhead), *Echinodorus tenellus* (mudbabies), *Sagittaria longiloba* (longlobe arrowhead), *Nymphaea elegans* (tropical royalblue waterlily), *Marsilea macropoda* (bigfoot water-clover), *Lemna* sp. (duckweed) and *Wolffia* sp. (watermeal).

VEGETATION TYPES:

South Texas: Pond and Laguna Woodland (10004)

Identifier: CES301.197.1 **MoRAP Code:** 10004
Description: Woodlands to a height of 6 m, or slightly higher, usually dominated by *Acacia farnesiana* (huisache) and *Parkinsonia aculeata* (retama) surrounding internally draining basins.

South Texas: Pond and Laguna Shrubland (10006)

Identifier: CES301.197.2 **MoRAP Code:** 10006
Description: Shrublands surrounding internally draining basins which are dominated by low stature *Acacia farnesiana* (husiache), *Parkinsonia aculeata* (retama), and species such as *Lycium carolinianum* (Carolina wolfberry), *Celtis ehrenbergiana* (granjeno), and *Sesbania drummondii* (rattlebox sesbania).

South Texas: Pondshore Herbaceous Vegetation (10007)

Identifier: CES301.197.3 **MoRAP Code:** 10007
Description: Area directly surrounding the basin transitioning from species such as *Cynodon dactylon* (bermudagrass) and *Calyptocarpus vialis* (straggler daisy) at the drier edges of the basin to floating species such as *Lemna* sp. (duckweed) and *Nymphaea elegans* (tropical royalblue waterlily) in basins that hold water for extended periods.

Tamaulipan Floodplain
Identifier: CES301.990

Geology: Quaternary alluvium.
Landform: Floodplains of rivers and large creeks where sediment is deposited. Topography is relatively level with some relief associated with levees and depressions developed from meanders of the waterway, or historical meanders of the Rio Grande (Resaca).
Soils: Alluvial soils of the Bottomland Ecological Sites, including loamy, clayey, and sandy. The Lowland Ecological Site type also supports this system.

Description: This ecological system occurs along rivers and major drainages in south Texas from the central portion of the Nueces River south to northeastern Mexico and west to the vicinity of Del Rio, Texas. Generally, the system is expressed as a deciduous woodland or forest with tree height reaching to 15 meters, and canopy cover variable but sometimes reaching near 100 percent. The canopy may have a conspicuous (sometimes dominant to co-dominant) evergreen component of species such as *Ebenopsis ebano* (Texas ebony) and *Ehretia anacua* (anacua). Dominant species of the overstory canopy often includes one or more of the following species: *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), *Fraxinus berlandieriana* (Mexican ash), *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Diospyros texana* (Texas persimmon), *Leucaena pulverulenta* (tepeguaje), *Celtis ehrenbergiana* (granjeno), *Sapindus saponaria* var. *drummondii* (western soapberry), *Ebenopsis ebano* (Texas ebony), *Ehretia anacua* (anacua), and *Parkinsonia aculeata* (retama). In northern portions of the range of this system, particularly within the Nueces River drainage, *Carya illinoinensis* (pecan) and *Quercus fusiformis*

(plateau live oak) may be conspicuous components of the overstory. Forests and woodlands may have significant shrub cover including saplings of the overstory species in addition to species such as *Zanthoxylum fagara* (colima), *Condalia hookeri* (brasil), *Forestiera angustifolia* (desert olive), *Sideroxylon* spp. (bumelias), *Aloysia gratissima* (whitebrush), *Acacia greggii* var. *wrightii* (Wright's acacia), *Malpighia glabra* (Barbados cherry), *Guaiacum angustifolium* (guayacan), *Ziziphus obtusifolia* (lotebush) and *Amyris texana* (Texas torchwood). Other shrub species, such as *Buddleja sessiliflora* (Rio Grande butterflybush), *Phaulothamnus spinescens* (snake-eyes), *Lippia alba* (white lipia), and *Amyris madrensis* (Sierra Madre torchwood) may be encountered in southern expressions of the system. *Salix nigra* (black willow) may dominate sites, especially at river's edge and wet sites. Riverbanks and other sites with a reduced overstory canopy (either from disturbance or prolonged inundation) may also be shrub dominated, often with one or few species such as *Baccharis neglecta* (Rooseveltweed), *Baccharis salicifolia* (seepwillow), *Arundo donax* (giant reed), *Sesbania drummondii* (rattlebox sesbania), or *Cephalanthus occidentalis* (common buttonbush), and *Salix exigua* (Texas sandbar willow), *Mimosa asperata* (black mimosa), or *Cephalanthus salicifolius* (willowleaf buttonbush) in the lower Rio Grande Valley. The herbaceous layer is typically not well developed, but may include species such as *Trichloris pluriflora* (multiflower false Rhodes grass), *Setaria scheelei* (southwestern bristlegrass), *Panicum virgatum* (switchgrass), *Paspalum langei* (rustyseed paspalum), *Paspalum denticulatum* (longtom), *Carex crus-corvi* (crowfoot sedge), *Cyperus articulatus* (jointed umbrellasedge), *Rivina humilis* (pigeonberry), *Calyptocarpus vialis* (straggler daisy), *Chromolaena odorata* (cruciata), *Teucrium cubense* (Cuban germander), *Urtica chamaedryoides* (slim stinging nettle), *Parietaria pensylvanica* (cucumberweed), *Verbesina microptera* (southern frostweed), *Chloracantha spinosa* (spiny aster), *Parthenium confertum* (false ragweed), and *Malvaviscus arboreus* var. *drummondii* (Drummond Turk's cap). Vines such as *Serjania brachycarpa* (littlefruit sipple-jack), *Cocculus diversifolius* (orientvine), *Clematis drummondii* (old man's beard), and *Cissus trifoliata* (ivy treebine) are frequently encountered, and *Tillandsia usneoides* (Spanish moss) often drapes the branches of overstory species. Non-native grasses such as *Cynodon dactylon* (bermudagrass), *Urochloa maxima* (guineagrass), *Pennisetum ciliare* (buffelgrass), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), and *Bromus catharticus* (rescuegrass) are often present to dominant, and sometimes to the exclusion of most other herbaceous species.

VEGETATION TYPES:

South Texas: Floodplain Evergreen Forest and Woodland (7402)

Tamaulipan Floodplain Evergreen Forest and Woodland
Identifier: CES301.990.2 **MoRAP Code:** 7402
Description: Forests or woodlands with the canopy dominated by broadleaf evergreen species such as *Ebenopsis ebano* (Texas ebony), *Ehretia anacua* (anacua), or, in the north *Quercus fusiformis* (plateau live oak). Deciduous species may be present, but broadleaf evergreen species clearly dominate.

South Texas: Floodplain Mixed Deciduous / Evergreen Forest and Woodland (7403)

Tamaulipan Floodplain Mixed Deciduous-Evergreen Forest and Woodland
Identifier: CES301.990.3 **MoRAP Code:** 7403

Description: Forests or woodlands where deciduous canopy species such as *Celtis laevigata* (sugar hackberry) and *Ulmus crassifolia* (cedar elm) share dominance with broadleaf evergreen species such as *Ebenopsis ebano* (Texas ebony) and *Ehretia anacua* (anacua).

South Texas: Floodplain Hardwood Forest and Woodland (7404)

Tamaulipan Floodplain Deciduous Forest and Woodland
Identifier: CES301.990.4 **MoRAP Code:** 7404
Description: Forests or woodlands with the canopy dominated by deciduous species such as *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), *Celtis ehrenbergiana* (granjeno), *Prosopis glandulosa* (honey mesquite), *Leucaena pulverulenta* (tepeguaje), and *Diospyros texana* (Texas persimmon).

South Texas: Floodplain Evergreen Shrubland (7405)

Tamaulipan Floodplain Evergreen Shrubland
Identifier: CES301.990.5 **MoRAP Code:** 7405
Description: Dense shrublands containing species such as *Acacia farnesiana* (huisache), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), *Arundo donax* (giant reed), *Guaiacum angustifolium* (guayacan), and *Zanthoxylum fagara* (colima).

South Texas: Floodplain Deciduous Shrubland (7406)

Tamaulipan Floodplain Deciduous Shrubland
Identifier: CES301.990.6 **MoRAP Code:** 7406
Description: Shrublands or somewhat sparse woodlands dominated by species such as *Prosopis glandulosa* (honey mesquite), *Celtis ehrenbergiana* (granjeno), *Celtis laevigata* (sugar hackberry), *Diospyros texana* (Texas persimmon), *Parkinsonia aculeata* (retama), *Aloysia gratissima* (whitebrush), *Chloracantha spinosa* (spiny aster), and *Condalia hookeri* (brasil).

South Texas: Floodplain Grassland (7407)

Tamaulipan Floodplain Grassland
Identifier: CES301.990.7 **MoRAP Code:** 7407
Description: Sites often dominated by non-native graminoids such as *Cynodon dactylon* (bermudagrass), *Urochloa maximum* (guineagrass), *Dichanthium annulatum* (Kleberg bluestem), *Pennisetum ciliare* (buffelgrass), or *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem). Other species that may be present include *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Panicum hallii* (Hall's panicum), *Spartina spartinae* (Gulf cordgrass), *Sporobolus airoides* (alkali sacaton), *Bouteloua dactyloides* (buffalograss), and *Trichloris pluriflora* (multiflower false Rhodes grass).

South Texas: Floodplain Herbaceous Wetland (7417)

Tamaulipan Floodplain Herbaceous Wetland
Identifier: CES301.990.17 **MoRAP Code:** 7417
Description: Wetlands dominated by herbaceous species such as *Schoenoplectus pungens* (common threesquare), *Cyperus articulatus* (jointed umbrellasedge), *Typha domingensis* (southern cattail), other sedges and forbs such as *Echinodorus berteroi* (common burhead).

Tamaulipan Palm Grove Riparian Forest
Identifier: CES301.991

Geology: Quaternary alluvium.
Landform: Currently on levees and resaca margins and adjacent lower sites near the current Rio Grande channel. Historically more widespread within the Rio Grande delta.
Soils: Loamy or Clayey Bottomland Ecological Sites.

Description: This system is currently limited to relatively small groves (typically less than 20 hectares) of *Sabal mexicana* (Mexican sabal palm, sometimes referred to as *Sabal texana*) located on loamy or clayey bottomland soils, such as those of the Rio Grande, Zalla, and Matamoros series, on the Rio Grande Delta and near the Rio Grande itself in Cameron County, Texas and similar sites in adjacent Mexico. These often occupy slight elevations along the margins of resacas or old river terraces, but may also occur on level sites. The system may have once occurred along the Rio Grande more than 120 km from its mouth, but is now limited to a few sites near the Gulf, with a few small stands identified in extreme southern Hidalgo County, Texas. These forests and woodlands often have a canopy dominated by *Sabal mexicana* (Mexican sabal palm), or may share dominance with other floodplain species such as *Ebenopsis ebano* (Texas ebony), *Celtis laevigata* (sugar hackberry), *Leucaena pulverulenta* (tepeguaje), *Ulmus crassifolia* (cedar elm), *Ehretia anacua* (anacua), and *Fraxinus berlandieriana* (Mexican ash). *Prosopis glandulosa* (honey mesquite), *Sapindus saponaria* var. *drummondii* (western soapberry), and *Diospyros texana* (Texas persimmon) are often present in the subcanopy. The canopy of these forests may reach a height of 15 m, and the subcanopy, to 10 m, may be composed of some of the species mentioned above. The shrub layer can be patchy with some areas extremely dense and containing species such as *Zanthoxylum fagara* (colima), *Malpighia glabra* (Barbados cherry), *Celtis ehrenbergiana* (granjeno), *Erythrina herbacea* (coralbean), *Ziziphus obtusifolia* (lotebush), *Randia rhagocarpa* (crucillo), *Parkinsonia aculeate* (retama), *Havardia pallens* (tenaza), *Chiococca alba* (David's milkberry), *Iresine palmeri* (Palmer's bloodleaf), and members of the canopy and subcanopy, and other areas relatively open. In some situations the ground may be covered with a layer of dead palm fronds, restricting the development of an herbaceous layer. In other areas, species including, but not limited to, *Leersia monandra* (bunch cutgrass), *Salvia coccinea* (tropical sage), *Petiveria alliacea* (hierba de las gallinitas), *Rivina humilis* (pigeonberry), *Plumbago scandens* (climbing plumbago), *Tamaulipa azurea* (blue boneset), *Cocculus diversifolius* (orientvine), and *Malvaviscus arboreus* (Turk's cap) may be present in the herbaceous layer. Fire may have been an important process in these forests as the sites may become extremely dry and a significant, if patchy, layer of palm thatch may be present. These forests appear to differ from other forests dominated by *Sabal mexicana* (Mexican sabal palm) further to the south. Ojeda and González Medrano (1977) describe a site of limited distribution in the northern part of the Sierra de San José de las Rusias in the Municipio of Soto La Marina in Tamaulipas, Mexico. It occurs at higher altitudes and on Oligocene geologic formations. Their brief description suggests that this is likely different in composition and process from the presently described system. Lopez and Dirzo (2007) describe a site further south in Vera Cruz, that also seems to differ relative to composition.

VEGETATION TYPE:

South Texas: Palm Grove (7502)

Tamaulipan Palm Grove Riparian Forest
Identifier: CES301.991 **MoRAP Code:** 7502
Description: As described for system.

Tamaulipan Ramadero
Identifier: CES301.992

Geology: Widespread system on various geologic strata.
Landform: Upland drainages in various landscapes. Drainages are extremely flashy from runoff from surrounding landscape. These sites are infrequently flooded during local rainfall events, but because they accumulate runoff, they tend to be slightly more mesic in this otherwise xeric landscape.
Soils: Various upland soils (not Bottomland ecological site types), sometimes mapped specifically as Ramadero Ecological Site.

Description: These woodlands are found along drainages (locally known as ramaderos) that are extremely flashy and are infrequently and briefly flooded during local rain events. The soils are typically clay loams or sandy clay loams, and moisture accumulation due to their topographic position promotes the development of a closed canopy (relative to the surrounding landscape) from 5 to 10 m in height. The overstory canopy is typically dominated by species such as *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Celtis ehrenbergiana* (granjeno), and/or *Parkinsonia aculeate* (retama). *Celtis laevigata* (sugar hackberry) and/or *Ebenopsis ebano* (Texas ebony) may also be present in the canopy. Some sites have a relatively open subcanopy, but more commonly the shrub layer is thick, sometimes impenetrable, and varies in height from 1 to 5 m. Species commonly encountered in the shrub layer include *Aloysia gratissima* (whitebrush), *Phaulothamnus spinescens* (snake-eyes), *Celtis ehrenbergiana* (granjeno), *Condalia hookeri* (brasil), *Forestiera angustifolia* (desert olive), *Diospyros texana* (Texas persimmon), *Ziziphus obtusifolia* (lotebush), *Koeberlinia spinosa* (allthorn), *Malpighia glabra* (Barbados cherry), *Zanthoxylum fagara* (colima), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), *Guaiacum angustifolium* (guayacan), *Colubrina texensis* (Texas hogplum), and *Amyris texana* (Texas torchwood). Ground cover can be sparse, or in more open stands, may have a fairly continuous grassy cover. Species encountered in the herbaceous layer include *Clematis drummondii* (old man's beard), *Parietaria pensylvanica* (cucumberweed), *Salvia coccinea* (tropical sage), *Calyptocarpus vialis* (straggler daisy), *Rivina humilis* (pigeonberry), *Malvastrum americanum* (Rio Grande false-mallow), *Ruellia* sp. (wild petunia), and *Verbesina microptera* (southern frostweed). Grasses include *Trichloris pluriflora* (multiflower false Rhodes grass), *Bothriochloa barbinodis* (cane bluestem), *Bouteloua curtipendula* (sideoats grama), *Setaria scheelei* (southwestern bristlegrass), *Setaria macrostachya* (bigstem bristlegrass), *Setaria leucopila* (plains bristlegrass), *Chloris cucullata* (hooded windmillgrass), *Digitaria californica* (Arizona cottontop), *Pappophorum bicolor* (pink pappusgrass), *Bouteloua trifida* (red grama), *Bouteloua dactyloides* (buffalograss), and *Hilaria belangeri* (curlymesquite). The introduced grasses *Pennisetum ciliare* (buffelgrass), *Urochloa maximum* (guineagrass), and *Cynodon*

dactylon (bermudagrass) often dominate these sites, sometimes to the near exclusion of other herbaceous cover. This system may merge downstream with the Tamaulipan Floodplain system.

VEGETATION TYPES:

South Texas: Ramadero Evergreen Woodland (7602)

Tamaulipan Ramadero Evergreen Woodland
Identifier: CES301.992.2 **MoRAP Code:** 7602
Description: Less than three percent of this system as it is mapped is occupied by this type which has a significant broadleaf evergreen component, often *Ebenopsis ebano* (Texas ebony) but sometimes *Quercus fusiformis* (plateau live oak) in the northern part of the South Texas Plains.

South Texas: Ramadero Woodland (7604)

Tamaulipan Ramadero Woodland
Identifier: CES301.992.4 **MoRAP Code:** 7604
Description: Woodlands 5 to 10 m in height, with a canopy typically dominated or co-dominated by *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Celtis ehrenbergiana* (granjeno), *Parkinsonia aculeata* (retama), and/or *Celtis laevigata* (sugar hackberry). The shrub layer is often well-developed.

South Texas: Ramadero Dense Shrubland (7605)

Tamaulipan Ramadero Dense Shrubland
Identifier: CES301.992.5 **MoRAP Code:** 7605
Description: Dense shrublands occupying drainages, with canopy cover reaching near 100% from 0.5 to 3 m in height. These shrublands may be dominated by numerous species. *Aloysia gratissima* (whitebrush) may sometimes form dense stands in these sites.

South Texas: Ramadero Shrubland (7606)

Tamaulipan Ramadero Shrubland
Identifier: CES301.992.6 **MoRAP Code:** 7606
Description: Typical shrublands along drainages making up the majority of the system. These sites are dominated by a suite of shrub species including *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Celtis ehrenbergiana* (granjeno), *Diospyros texana* (Texas persimmon), and *Ziziphus obtusifolia* (lotebush).

Western Gulf Coastal Plain Large River Floodplain Forest
Identifier: CES203.488

Geology: Typically occupying Quaternary Alluvium along major rivers including the Trinity (downstream of Cobb Creek), Neches, Angelina, Sabine, Sulphur, and San Jacinto, and a few of their major tributaries.

Landform: Broad floodplains with significant development of bottomland soils. These areas include an array of local geomorphic features such as natural levees, point bars, meander scrolls, oxbows, terraces, and sloughs.

Soils: This system occupies soils of various textures derived from alluvial processes of the associated rivers. The hydrology of these soils is variable, including temporary, seasonal, semi-permanent flooding regimes.

Description: This system is typically represented by forests that vary relative to the flooding regime, which is often controlled by local topographic variation and proximity to the river. Swamps are typically represented by forests of *Taxodium distichum* (baldcypress), with other species such as *Nyssa aquatica* (water tupelo), *Gleditsia aquatica* (water honeylocust), and *Carya aquatica* (water hickory) also present. Some semi-permanently flooded sites may also be dominated by *Planera aquatica* (water elm). Floating aquatics, such as *Lemna minor* (common duckweed), *Potamogeton* spp. (pondweeds), *Ceratophyllum demersum* (coontail), and *Nymphaea odorata* (American waterlily) may also be present at those sites. *Quercus lyrata* (overcup oak) is characteristic of seasonally flooded bottomlands, but numerous other species are also important components of the canopy, including *Taxodium distichum* (baldcypress), *Quercus phellos* (willow oak), *Fraxinus pennsylvanica* (green ash), *Liquidambar styraciflua* (sweetgum), *Nyssa biflora* (swamp tupelo), *Fraxinus caroliniana* (Carolina ash), and *Quercus similis* (bottomland post oak). Commonly encountered, and sometimes dominant, species of temporarily flooded sites include *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), and *Fraxinus pennsylvanica* (green ash). Numerous other species, such as *Quercus laurifolia* (laurel oak), *Quercus michauxii* (swamp chestnut oak), *Quercus pagoda* (cherrybark oak), *Celtis laevigata* (sugar hackberry), *Acer rubrum* (red maple), *Ulmus crassifolia* (cedar elm), *Ulmus americana* (American elm), and *Carya illinoinensis* (pecan) may also be important components of the canopy. *Platanus occidentalis* (American sycamore), *Populus deltoides* (eastern cottonwood), *Betula nigra* (river birch), and *Salix nigra* (black willow) are more conspicuous as early successional species along the riverfront. Understory and shrub cover is variable, but is typically relatively low, particularly in more frequently flooded sites and sites with significant overstory canopy. The understory may have small individuals of the overstory, as well as species such as *Alnus serrulata* (smooth alder), *Arundinaria gigantea* (giant cane), *Carpinus caroliniana* (American hornbeam), *Ilex decidua* (possumhaw), *Ilex opaca* (American holly), *Callicarpa americana* (American beautyberry), *Crataegus viridis* (green hawthorn), *Crataegus marshallii* (parsley hawthorn), *Crataegus opaca* (riverflat hawthorn), *Styrax americanus* (American snowbell), *Ditrysinia fruticosa* (sebastian-bush), *Sambucus nigra* ssp. *canadensis* (common elderberry), *Cephalanthus occidentalis* (common buttonbush), *Forestiera acuminata* (swamp privet), *Planera aquatica* (water elm), and/or *Sabal minor* (dwarf palmetto). Where the overstory canopy is open, *Planera aquatica* (water elm), *Cephalanthus occidentalis* (common buttonbush), or *Forestiera acuminata* (swamp

privet) may form dense stands. Woody vines that may be encountered include *Berchemia scandens* (Alabama supplejack), *Smilax bona-nox* (saw greenbrier), *Vitis rotundifolia* (muscadine grape), *Toxicodendron radicans* (poison ivy), and *Campsis radicans* (trumpet creeper). Herbaceous species may include *Boehmeria cylindrica* (false nettle), *Saururus cernuus* (lizard's tail), *Saccharum baldwinii* (narrow plumegrass), *Elymus virginicus* (Virginia wildrye), *Onoclea sensibilis* (sensitive fern), *Carex cherokeensis* (Cherokee sedge), *Carex intumescens* (bladder sedge), *Carex joorii* (cypress swamp sedge), *Carex debilis* (spindlefruit sedge), other *Carex* (sedge) species, *Chasmanthium latifolium* (creek oats), *Chasmanthium sessiliflorum* (narrowleaf woodoats), *Justicia ovata* (looseflower waterwillow), *Bidens aristosa* (bearded beggarticks), *Panicum hemitomon* (maidencane), *Leersia virginica* (Virginia cutgrass), and numerous others. *Pinus taeda* (loblolly pine) may be found, particularly on some better drained sites, and where it has been planted. *Triadica sebifera* (Chinese tallow) sometimes invades this system.

VEGETATION TYPES:

Pineywoods: Bottomland Temporarily Flooded Live Oak Forest (4902)

West Gulf Coastal Plain Large River Floodplain Temporarily Flooded Live Oak Forest
Identifier: CES203.488.2 **MoRAP Code:** 4902
Description: This very minor component of the system is dominated by broadleaf evergreen species. However, some cold deciduous species that retain their leaves for extended periods, such as *Quercus nigra* (water oak) and *Quercus laurifolia* (laurel oak), may actually dominate these sites.

Pineywoods: Bottomland Temporarily Flooded Mixed Pine / Hardwood Forest (4903)

West Gulf Coastal Plain Large River Floodplain Temporarily Flooded Mixed Evergreen – Deciduous Forest
Identifier: CES203.448.3 **MoRAP Code:** 4903
Description: *Pinus taeda* (loblolly pine) forms a significant portion of the canopy in this type. Areas that are clearly dominated by pine, typically *Pinus taeda* (loblolly pine), are mapped as Pine Plantation.

Pineywoods: Bottomland Temporarily Flooded Hardwood Forest (4904)

Western Gulf Coastal Plain Large River Floodplain Temporarily Flooded Deciduous Forest
Identifier: CES203.448.4 **MoRAP Code:** 4904
Description: This mapped type makes up a significant percentage of the system as it is mapped. The common canopy species are *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), and *Fraxinus pennsylvanica* (green ash), although numerous other species may be important to dominant components. *Triadica sebifera* (Chinese tallow) may be a canopy dominant within this mapped type.

Pineywoods: Bottomland Evergreen Successional Shrubland (4905)

Western Gulf Coastal Plain Large River Floodplain Evergreen Successional Shrubland
Identifier: CES203.448.5 **MoRAP Code:** 4905
Description: This minor component of the system represents transitional sites that may be dominated by *Juniperus virginiana* (eastern redcedar), or may be young planted *Pinus taeda* (loblolly pine).

Pineywoods: Bottomland Deciduous Successional Shrubland (4906)

Western Gulf Coastal Plain Large River Floodplain Deciduous Successional Shrubland
Identifier: CES203.448.6 **MoRAP Code:** 4906
Description: This mapped type may be composed of young trees, especially early successional species such as *Salix nigra* (black willow), *Fraxinus pennsylvanica* (green ash), *Platanus occidentalis* (American sycamore), *Acer negundo* (boxelder), or others. Shrublands may be dominated by species such as *Cephalanthus occidentalis* (common buttonbush), *Forestiera acuminata* (swamp privet), or *Ilex decidua* (possumhaw).

Pinewoods: Bottomland Herbaceous Wetland (4907)

West Gulf Coastal Plain Large River Floodplain Herbaceous Wetland
Identifier: CES203.448.7 **MoRAP Code:** 4907
Description: This mapped type corresponds to marsh landcover that occurs on bottomland soils. Occurrences may consist of graminoids such as *Eleocharis* spp. (spikerushes), *Typha* spp. (cattails), *Rhynchospora* spp. (beaksedges), *Juncus* spp. (rushes), *Scirpus cyperinus* (woolgrass bulrush), *Panicum hemitomon* (maidencane), *Zizaniopsis miliacea* (marshmillet), *Saccharum baldwinii* (narrow plumegrass), and/or *Carex* spp. (caric sedges). *Nymphaea odorata* (American waterlily), *Ludwigia* spp. (primroses), *Polygonum* spp. (smartweeds), *Heteranthera* spp. (mudplantains), *Echinodorus cordifolius* (heartleaf burhead), *Sagittaria* spp. (arrowheads), and other herbaceous wetland plants may also be common. These occurrences tend to be somewhat wetter than Pineywoods: Bottomland Wet Prairie.

Pineywoods: Bottomland Seasonally Flooded Hardwood Forest (4914)

West Gulf Coastal Plain Large River Floodplain Seasonally Flooded Deciduous Forest
Identifier: CES203.448.14 **MoRAP Code:** 4914
Description: This mapped type tends to be occupied by species that are better adapted to flooded soil conditions such as *Quercus lyrata* (overcup oak), *Carya aquatica* (water hickory), *Quercus phellos* (willow oak), *Acer rubrum* (red maple), *Quercus laurifolia* (laurel oak), *Salix nigra* (black willow), and *Taxodium distichum* (baldcypress). However, less flood tolerant species or species with broad tolerances may also be present.

Pineywoods: Bottomland Wet Prairie (4917)

West Gulf Coastal Plain Large River Floodplain Wet Prairie
Identifier: CES203.448.17 **MoRAP Code:** 4917
Description: This herbaceous dominated mapped type is somewhat less wet than Pineywoods: Bottomland Herbaceous Wetland. Sites may be dominated by non-native species such as *Paspalum notatum* (Bahia grass), *Sorghum halepense* (Johnsongrass), and *Cynodon dactylon* (bermudagrass). Native species that may dominate these sites include

Schizachyrium scoparium (little bluestem), *Andropogon glomeratus* (bushy bluestem), *Carex* spp. (caric sedges), *Paspalum floridanum* (Florida paspalum), *Tripsacum dactyloides* (eastern gamagrass), and *Panicum virgatum* (switchgrass).

Pineywoods: Bottomland Baldcypress Swamp (4924)

West Gulf Coastal Plain Large River Floodplain Baldcypress Swamp
Identifier: CES203.448.24 **MoRAP Code:** 4924
Description: This mapped type occupies the semi-permanently flooded sites within the system and is typically dominated by *Taxodium distichum* (baldcypress), with lesser amounts of *Nyssa aquatica* (water tupelo), *Nyssa biflora* (swamp tupelo), *Carya aquatica* (water hickory), *Quercus lyrata* (overcup oak), *Fraxinus caroliniana* (Carolina ash), *Fraxinus pennsylvanica* (green ash), *Quercus phellos* (willow oak), and *Planera aquatica* (water elm).

West Gulf Coastal Plain Near-Coast Large River Swamp
Identifier: CES203.459

Geology: Quaternary alluvium deposited within the Beaumont/Deweyville surfaces.
Landform: Large river floodplains of the Sabine, Neches, and Trinity Rivers near the coast, often with some tidal influence.
Soils: Bottomland soils of the near-coast region.

Description: These swamps, usually dominated by *Taxodium distichum* (baldcypress) and/or *Nyssa aquatica* (water tupelo), occur along the Sabine, Neches, and Trinity Rivers as they enter the bays and estuaries and have some tidal influence. These are generally distributed downstream of Interstate Highway 10 (a coincidental landmark for the distribution of this system). On the Neches River, this is nearly coincident with the area downstream of the confluence with Pine Island Bayou. These swamps are typically interspersed with marshes of the coastal region. Other species are usually more minor components of the canopy, including *Fraxinus pennsylvanica* (green ash), *Acer negundo* (boxelder), and *Triadica sebifera* (Chinese tallow).

VEGETATION TYPE:

Gulf Coast: Near-Coast Baldcypress Swamp (5004)

West Gulf Coastal Plain Near-Coast Large River Swamp
Identifier: CES203.459 **MoRAP Code:** 5004
Description: As described for system.

West Gulf Coastal Plain Nonriverine Wet Hardwood Flatwoods
Identifier: CES203.548

Geology: Like the West Gulf Coastal Plain Pine – Hardwood Flatwoods, this system is associated with high Pleistocene terraces, of the Lissie and upper Beaumont Formations, as well as the Quaternary Fluviatile Terrace Deposits to the north.

Landform: This system represents the lowest topographic position within the level to very gently undulating terraces occupied by flatwoods. Hydrology is controlled by local rainfall, not overbank flooding of nearby streams.

Soils: Soils are fine-textured, with an impermeable subsurface horizon, which leads to a perched water table. Because of the lower topographic position of these flatwoods, saturated soil conditions tend to occur over extended periods of the year.

Description: This system represents the wetter end of the wooded toposequence of the flatwoods and occurs within low positions of swales and other wet circumstances. The canopy is often dominated by *Quercus phellos* (willow oak), *Quercus laurifolia* (laurel oak), *Quercus lyrata* (overcup oak), *Quercus nigra* (water oak), *Quercus michauxii* (swamp chestnut oak), *Ulmus alata* (winged elm), and *Liquidambar styraciflua* (sweetgum). *Pinus taeda* (loblolly pine) may be present in the canopy. *Triadica sebifera* (Chinese tallow) is a commonly encountered non-native species invading this system. The understory and herbaceous layers of this system are not well-developed, as the canopy tends to be closed.

VEGETATION TYPE:

Pineywoods: Wet Hardwood Flatwoods (3704)
Identifier: CES203.548 **MoRAP Code:** 3704
Description: As described for system.

West Gulf Coastal Plain Pine – Hardwood Flatwoods
Identifier: CES203.278

Geology: High Pleistocene terraces, mapped in the northern portion of East Texas as Quaternary Fluviatile Terrace (or Tile) Deposits.

Landform: Very gently undulating to flat surfaces, with local topographic relief provided by ridges and swales.

Soils: Soils tend to be fine-textured. They typically have a somewhat impermeable subsurface horizon, which leads to a perched water table. Saturation results from local rainfall run-on, and alternates with seasonal drying, leading to a xerohydric hydroperiod.

Description: This system primarily occurs within the Flatwoods EPA Level IV ecoregion, but is also found associated with the Pleistocene Fluvial Terraces ecoregion in the northern portion of East Texas. This woodland or forest system is often dominated by more mesic species on interior ridges, including *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), *Pinus elliottii* (slash

pine), *Quercus stellata* (post oak), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), and *Carya texana* (black hickory). Within the range of *Pinus palustris* (longleaf pine), occurrences that represent West Gulf Coastal Plain Wet Longleaf Pine Savanna and Flatwoods may be mapped as this system. On the somewhat wetter sites of the swales, species such as *Quercus nigra* (water oak), *Quercus phellos* (willow oak), *Quercus laurifolia* (laurel oak), *Nyssa sylvatica* (blackgum), *Liquidambar styraciflua* (sweetgum), and *Fraxinus pennsylvanica* (green ash) may be dominant. Sites that are even wetter would likely be mapped as West Gulf Coastal Plain Nonriverine Wet Hardwood Flatwoods. *Triadica sebifera* (Chinese tallow) may invade this system. Mid-story species that may be encountered include *Acer rubrum* (red maple), *Ilex opaca* (American holly), *Ulmus alata* (winged elm), and small members of the overstory. *Morella cerifera* (wax-myrtle), *Ilex decidua* (possumhaw), and *Ilex vomitoria* (yaupon) are commonly encountered shrubs. Herbaceous cover is generally sparse, with species such as *Chasmanthium* spp. (woodoats), *Andropogon glomeratus* (bushy bluestem), and *Gelsemium sempervirens* (Carolina jessamine). Sites dominated by *Pinus taeda* (loblolly pine) or *Pinus elliottii* (slash pine) may often represent plantations or managed forests.

VEGETATION TYPES:

Pineywoods: Longleaf or Loblolly Pine Flatwoods or Plantation (4001)

West Gulf Coastal Pine Flatwoods Forest and Woodland
Identifier: CES203.278.1 **MoRAP Code:** 4001
Description: This mapped type on flatwoods sites are dominated by *Pinus taeda* (loblolly pine), *Pinus elliottii* (slash pine), and to a lesser extent, *Pinus echinata* (shortleaf pine). Within the range of *Pinus palustris* (longleaf pine), this type may represent occurrence of West Gulf Coastal Plain Wet Longleaf Pine Savanna and Flatwoods.

Pineywoods: Longleaf or Loblolly Pine / Hardwood Flatwoods or Plantation (4003)

West Gulf Coastal Plain Pine – Hardwood Flatwoods Forest and Woodland
Identifier: CES203.278.3 **MoRAP Code:** 4003
Description: This mapped type has a mix of *Pinus* spp. (pines) and hardwoods in the canopy. This is a fairly minor component of the system.

Pineywoods: Hardwood Flatwoods (4004)

West Gulf Coastal Plain Hardwood Flatwoods Forest and Woodland
Identifier: CES203.278.4 **MoRAP Code:** 4004
Description: This mapped type lacks significant evergreen canopy.

West Gulf Coastal Plain Seepage Swamp and Baygall
Identifier: CES203.372

Geology: May occur on a range of geological formations, including intermediate to high Pleistocene terraces, Eocene sands, the Catahoula Formation, and the Wilcox Formation.

Landform: Occupies low landscape positions typically along low gradient creeks, headwaters of drainages, or local depressions, often where underground water flow exits to the surface as a seep.

Soils: Typically sandy to loamy soils, often with an impermeable subsurface layer that restricts water percolation. These sites are typically semi-permanently saturated. These are typically soils of medium to strong acidity, with low available nutrients, and significant organic accumulation.

Description: This system typically occurs as densely wooded sites, characterized by overstory species such as *Magnolia virginiana* (sweetbay), *Nyssa biflora* (swamp tupelo), and *Acer rubrum* (red maple). Other species in the overstory may include *Fraxinus pennsylvanica* (green ash), *Quercus nigra* (water oak), *Liquidambar styraciflua* (sweetgum), and *Quercus laurifolia* (laurel oak). A well-developed woody understory is often present and includes species such as *Morella caroliniensis* (evergreen bayberry), *Itea virginica* (Virginia sweetspire), *Persea palustris* (swamp redbay), *Rhododendron prinophyllum* (early azalea), *Rhododendron canescens* (mountain azalea), *Ilex decidua* (possumhaw), *Vaccinium fuscatum* (Arkansas blueberry), *Ilex opaca* (American holly), *Toxicodendron vernix* (poison sumac), *Viburnum nudum* (possumhaw viburnum), *Morella cerifera* (wax-myrtle), *Alnus serrulata* (smooth alder), *Smilax laurifolia* (bamboo-vine), and *Vitis rotundifolia* (muscadine grape). Southern expressions of the type may also have *Ilex coriacea* (bay-gall bush) or *Cyrilla racemiflora* (leatherwood). The herbaceous layer is often dominated by ferns such as *Woodwardia areolata* (chain fern), *Osmunda regalis* (royal fern), *Osmunda cinnamomea* (cinnamon fern), and *Athyrium filix-femina* (common ladyfern). *Carex* spp. (caric sedges), *Rhynchospora* spp. (beaksedges), and *Eleocharis* spp. (spikerushes) are also frequently encountered. *Sphagnum* sp. (sphagnum) occurs in patches throughout, and other bryophytes are common. The rare species *Bartonia texana* (Texas screwstem) may be encountered in this system, along with other interesting forbs such as *Burmannia biflora* (northern bluethread) and *Apteria aphylla* (nodding-nixie).

VEGETATION TYPE:

Pineywoods: Seepage Swamp and Baygall (3604)

West Gulf Coastal Plain Seepage Swamp and Baygall
Identifier: CES203.372 **MoRAP Code:** 3604
Description: This type is poorly mapped. Local edaphic and geomorphic conditions make applying regional models to existing spatial data difficult.

West Gulf Coastal Plain Small Stream and River Forest
Identifier: CES203.487

Geology: This system largely occurs on Quaternary Alluvium, but may also be found on other mapped geologic surfaces on drainages lacking significant alluvial development.

Landform: This system occupies small rivers, streams, creeks, and upland drainages. These sites tend to be higher in the watershed where less depositional activity occurs. The local geomorphological variation tends to be less than in the West Gulf Coastal Plain Large River Floodplain Forest.

Soils: This system occupies bottomland soils on small streams. Fewer sites are seasonally or semi-permanently flooded.

Description: This system, occupying the bottomlands of small rivers, streams, and creeks, is primarily dominated by hardwood species such as *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), *Celtis laevigata* (sugar hackberry), *Fraxinus pennsylvanica* (green ash), *Betula nigra* (river birch), *Quercus phellos* (willow oak), *Quercus laurifolia* (laurel oak), *Ulmus americana* (American elm), *Ulmus crassifolia* (cedar elm), *Ulmus alata* (winged elm), *Quercus pagoda* (cherrybark oak), *Quercus falcata* (southern red oak), *Platanus occidentalis* (American sycamore) and *Acer rubrum* (red maple). *Pinus taeda* (loblolly pine), *Pinus elliottii* (slash pine), and/or *Juniperus virginiana* (eastern redcedar) may be present in the canopy, or occur as a sub-canopy stratum. Wetter sites tend to be dominated by more flood-tolerant species such as *Taxodium distichum* (baldcypress), *Nyssa aquatica* (water tupelo), *Gleditsia aquatica* (water honeylocust), *Carya aquatica* (water hickory), *Quercus lyrata* (overcup oak), *Quercus similis* (bottomland post oak), *Planera aquatica* (water elm), and *Quercus phellos* (willow oak). Shrubs may form dense patches with species such as *Cephalanthus occidentalis* (common buttonbush) or *Planera aquatica* (water elm). The understory of forests may be made of species common to the canopy. Other understory and shrub species that may be common include *Carpinus caroliniana* (American hornbeam), *Ostrya virginiana* (American hop-hornbeam), *Morus rubra* (red mulberry), *Ilex decidua* (possumhaw), *Sabal minor* (dwarf palmetto), *Ilex opaca* (American holly), *Ilex vomitoria* (yaupon), *Morella cerifera* (wax-myrtle), *Callicarpa americana* (American beautyberry), *Itea virginica* (Virginia sweetspire), *Arundinaria gigantea* (giant cane), *Alnus serrulata* (smooth alder), and/or *Maclura pomifera* (bois d'arc). Early successional woodlands may be mapped as shrublands, due to reduced woody cover. These sites may be dominated by early successional species such as *Salix nigra* (black willow), *Gleditsia triacanthos* (common honeylocust), *Platanus occidentalis* (American sycamore), or *Ulmus alata* (winged elm). Non-native woody species that may be present include *Triadica sebifera* (Chinese tallow), *Lonicera japonica* (Japanese honeysuckle), and *Ligustrum* spp. (privets). Woody vines may be conspicuous and include *Berchemia scandens* (Alabama supplejack), *Toxicodendron radicans* (poison ivy), *Brunnichia ovata* (eardrop vine), *Smilax bona-nox* (saw greenbrier), and *Ampelopsis arborea* (peppervine). The herbaceous layer may be well developed in some cases. Non-natives such as *Cynodon dactylon* (bermudagrass), *Lolium perenne* (Italian ryegrass), *Paspalum notatum* (Bahia grass), and *Sorghum halepense* (Johnsongrass) may be dominant. Native herbaceous species of this system include *Chasmanthium laxum* (slender woodoats), *Chasmanthium latifolium* (creek oats), *Dichanthelium* spp. (rosette grasses), *Carex cherokeensis* (Cherokee sedge), *Boehmeria*

cylindrica (false nettle), *Polygonum* spp. (smartweeds), *Ambrosia trifida* (giant ragweed), *Xanthium strumarium* (cocklebur), *Paspalum floridanum* (Florida paspalum), *Leersia* spp. (cutgrasses), *Tripsacum dactyloides* (eastern gamagrass), *Panicum virgatum* (switchgrass), *Elymus virginicus* (Virginia wildrye), and *Geum canadense* (white avens).

VEGETATION TYPES:

Pineywoods: Small Stream and Riparian Live Oak Temporarily Flooded Forest (4802)

West Gulf Coastal Plain Small Stream and River Live Oak Temporarily Flooded Forest
Identifier: CES203.487.2 **MoRAP Code:** 4802
Description: This very minor component of the system is dominated by *Quercus virginiana* (coastal live oak). Other deciduous species that retain their leaves for extended periods (and therefore appear as broadleaf evergreen landcover), including *Quercus nigra* (water oak) and *Quercus laurifolia* (laurel oak), may dominate some sites.

Pineywoods: Small Stream and Riparian Temporarily Flooded Mixed Forest (4803)

West Gulf Coastal Plain Small Stream and River Temporarily Flooded Evergreen – Deciduous Mixed Forest
Identifier: CES203.487.3 **MoRAP Code:** 4803
Description: This mapped type may have significant cover contributed by *Pinus taeda* (loblolly pine), *Pinus elliottii* (slash pine), and/or *Juniperus virginiana* (eastern redcedar). Deciduous species described above share the canopy with these evergreen species.

Pineywoods: Small Stream and Riparian Temporarily Flooded Hardwood Forest (4804)

West Gulf Coastal Plain Small Stream and River Temporarily Flooded Deciduous Forest
Identifier: CES203.487.4 **MoRAP Code:** 4804
Description: This is the prevalent mapped type for this system, with typical dominant species including *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), and *Fraxinus pennsylvanica* (green ash). Many other hardwood species as mentioned above may be found at these sites.

Pineywoods: Small Stream and Riparian Evergreen Successional Shrubland (4805)

West Gulf Coastal Plain Small Stream and River Evergreen Successional Shrubland
Identifier: CES203.487.5 **MoRAP Code:** 4805
Description: This minor component of the system likely corresponds to areas dominated by *Juniperus virginiana* (eastern redcedar), or by young *Pinus taeda* (loblolly pine) or *Pinus elliottii* (slash pine).

Pineywoods: Small Stream and Riparian Deciduous Successional Shrubland (4806)

West Gulf Coastal Plain Small Stream and River Deciduous Successional Shrubland
Identifier: CES203.487.6 **MoRAP Code:** 4806
Description: This minor component of the system often represents young woodlands with reduced woody cover due to disturbance. Species dominating these sites may include *Celtis laevigata* (sugar hackberry), *Betula nigra* (river birch), *Salix nigra* (black willow),

Fraxinus pennsylvanica (green ash), *Acer negundo* (boxelder), *Platanus occidentalis* (American sycamore), or *Liquidambar styraciflua* (sweetgum). Shrub species may also be conspicuous to dominant, including *Cephalanthus occidentalis* (common buttonbush), *Ilex decidua* (possumhaw), *Ilex vomitoria* (yaupon), or *Alnus serrulata* (smooth alder).

Pineywoods: Small Stream and Riparian Herbaceous Wetland (4807)

West Gulf Coastal Plain Small Stream and River Herbaceous Wetland
Identifier: CES203.487.7 **MoRAP Code:** 4807
Description: This mapped type corresponds to sites that contain marsh landcover along small streams. These sites tend to be wetter than Pineywoods: Small Stream and Riparian Wet Prairie. These sites may be dominated by *Typha* spp. (cattails), *Juncus* spp. (rushes), *Carex* spp. (caric sedges), *Sagittaria* spp. (arrowheads), *Justicia* spp. (water-willows), *Panicum hemitomon* (maidencane), *Ludwigia* spp. (water-primroses), and *Polygonum* spp. (smartweeds).

Pineywoods: Small Stream and Riparian Seasonally Flooded Hardwood Forest (4814)

West Gulf Coastal Plain Small Stream and River Seasonally Flooded Deciduous Forest
Identifier: CES203.487.14 **MoRAP Code:** 4814
Description: This mapped type occupies wetter sites within the system and tends to have significant cover of species more tolerant of frequent flooding, such as *Quercus lyrata* (overcup oak), *Taxodium distichum* (baldcypress), *Quercus phellos* (willow oak), *Nyssa aquatica* (water tupelo), and *Salix nigra* (black willow). *Quercus nigra* (water oak), *Liquidambar styraciflua* (sweetgum), *Ulmus americana* (American elm), and *Fraxinus pennsylvanica* (green ash) are often dominant.

Pineywoods: Small Stream and Riparian Wet Prairie (4817)

West Gulf Coastal Plain Small Stream and River Wet Prairie
Identifier: CES203.487.17 **MoRAP Code:** 4817
Description: This mapped type occupies sites less wet than those occupied by Pineywoods: Small Stream and Riparian Herbaceous Wetland. They may be dominated by non-native species such as *Cynodon dactylon* (bermudagrass), *Lolium perenne* (Italian ryegrass), *Paspalum notatum* (Bahia grass), and *Sorghum halepense* (Johnsongrass). Native species that may occupy these sites include *Schizachyrium scoparium* (little bluestem), *Panicum virgatum* (switchgrass), *Tripsacum dactyloides* (eastern gamagrass), *Elymus virginicus* (Virginia wildrye), *Chasmanthium* spp. (woodoats), *Dichanthelium* spp. (rosette grasses), *Paspalum floridanum* (Florida paspalum), *Sorghastrum nutans* (Indiangrass), and *Carex* spp. (caric sedges). Forbs such as *Ambrosia psilostachya* (western ragweed), *Ambrosia trifida* (giant ragweed), *Xanthium strumarium* (cocklebur), and *Geum canadense* (white avens) are frequently encountered.

Pineywoods: Small Stream and Riparian Baldcypress Swamp (4824)

West Gulf Coastal Plain Small Stream and River Baldcypress Swamp
Identifier: CES203.487.24 **MoRAP Code: 4824**
Description: Swamps are a relatively minor component along these small rivers, streams, and creeks. They are typically dominated by *Taxodium distichum* (baldcypress), but may be dominated or co-dominated by other species including *Planera aquatica* (water elm),

Nyssa aquatica (water tupelo), *Gleditsia aquatica* (water honeylocust), *Quercus lyrata* (overcup oak), *Salix nigra* (black willow), or *Quercus laurifolia* (laurel oak). *Liquidambar styraciflua* (sweetgum) may also be a conspicuous component.

West Gulf Coastal Plain Wet Longleaf Pine Savanna and Flatwoods (not mapped)
Identifier: CES203.191

Geology: This system is associated with Lissie and upper Beaumont Formations (including the Montgomery, Irene, and Bentley terraces).

Landform: Mesic to seasonally saturated low areas and flats, on level to gently rolling uplands. Microtopographic variation is provided by the presence of swales and pimple mounds.

Soils: Sandy loams to silty loams that are strongly acid, nutrient poor, and low in organic constituents. Typically these soils are hydric, with seasonal fluctuations between saturation and droughtiness.

Description: This system may be characterized as having a sparse canopy (under natural fire cycles) dominated by *Pinus palustris* (longleaf pine). Other species in the canopy include *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Nyssa sylvatica* (blackgum), *Quercus laurifolia* (laurel oak), *Quercus falcata* (southern red oak), and *Liquidambar styraciflua* (sweetgum). Shrubs are typically limited in distribution within the system to local topographic highs and include species such as *Morella cerifera* (wax-myrtle), *Ilex vomitoria* (yaupon), *Symplocos tinctoria* (common sweetleaf), *Cyrilla racemiflora* (leatherwood), and others. The herbaceous layer may be highly diverse. Drier sites may be dominated by *Schizachyrium scoparium* (little bluestem), *Schizachyrium tenerum* (slender bluestem), *Eupatorium rotundifolium* (roundleaf eupatorium), and others. Wetter sites may not have species showing a clear dominance. Species such as *Liatris* spp. (gay-feathers), *Xyris* spp. (yellow-eyed grasses), *Rhexia* spp. (meadowbeauties), *Rhynchospora* spp. (beaksedges), *Fuirena* spp. (umbrellasedges), *Marshallia graminifolia* (grassleaf Barbara's buttons), *Aletris aurea* (golden colicroot), and many other species may share dominance in this system. Suppression of fire in this system has lead to increased woody dominance. *Pinus taeda* (loblolly pine), *Pinus elliottii* (slash pine), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum), and *Acer rubrum* (red maple) may now dominate the canopy of these sites, with a thick understory dominated by *Ilex vomitoria* (yaupon) and *Morella cerifera* (wax-myrtle). Due in part to the difficulty in distinguishing *Pinus palustris* (longleaf pine) dominated sites from sites dominated by other pines, occurrences of this system may be mapped within the system West Gulf Coastal Plain Pine – Hardwood Flatwoods.

Western Great Plains Floodplain

Identifier: CES303.678

Geology: This system generally occurs on Quaternary Alluvium.

Landform: Valley floors of large rivers and perennial streams. This system tends to occupy broad valley bottoms with deep alluvial deposits. In Phase 1, this system is found within the Clear Fork of the Middle Brazos watersheds.

Soils: This system occurs on Loamy Bottomland, Clayey Bottomland, and Draw ecoclasses.

Description: This system is characteristic of valley floors of large rivers and perennial streams where significant alluvial deposition occurs. Broad alluvial deposits commonly occur and are generally mapped as bottomland soils. This system can be expressed in numerous cover types including forests, woodlands, shrublands, and herbaceous vegetation (where marshes may develop in the floodplain soils, or mesic prairie dominated by *Andropogon gerardii* (big bluestem) and *Panicum virgatum* (switchgrass) may be conspicuous). *Populus deltoides* (eastern cottonwood), *Sapindus saponaria* var. *drummondii* (western soapberry), *Prosopis glandulosa* (mesquite), *Salix nigra* (black willow), *Ulmus americana* (American elm), and/or *Celtis laevigata* var. *reticulata* (netleaf hackberry) may be important components of forests or woodlands of this system. *Juniperus ashei* (Ashe juniper), *Juniperus pinchotii* (redberry juniper), and/or *Quercus fusiformis* (plateau live oak) may be present to dominant, but such evergreen dominated sites generally occur on the eastern edge of the range of this system. As this is the eastern extent of the overall distribution of the system, some species occur in the system at the western edge of their range, and may not be represented further west within the range of the system. Such species include *Quercus fusiformis* (plateau live oak) and *Ulmus americana* (American elm). Shrublands may also have *Prosopis glandulosa* (mesquite) and *Salix nigra* (black willow) as important components. Some shrublands in this system, especially those on more saline sites, may be dominated by the non-native *Tamarix* spp. (saltcedar). Woodlands may sometimes be dominated by the non-natives *Tamarix* spp. (saltcedars), *Ulmus pumila* (Siberian elm), or *Elaeagnus angustifolia* (Russian olive). Herbaceous vegetation may include marshes occupying floodplain sites, with species such as *Schoenoplectus* spp. (bulrush) and/or *Typha* spp. (cattails). Some sites may be dominated by tallgrass species such as *Andropogon gerardii* (big bluestem) and *Panicum virgatum* (switchgrass). More typically, sites lacking significant woody cover may be dominated by *Pleuraphis mutica* (tobosa), *Nessella leucotricha* (Texas wintergrass), and *Panicum obtusum* (vine mesquite). Non-native graminoids are also commonly encountered and include *Cynodon dactylon* (bermudagrass), *Sorghum halepense* (Johnsongrass), *Bromus arvensis* (Japanese brome), and *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem). Shrublands are commonly dominated by *Prosopis glandulosa* (honey mesquite) and are mapped as Western Great Plains Mesquite Woodland and Shrubland (CES303.668).

VEGETATION TYPES:

High Plains: Floodplain Barrens (2500)

Western Great Plains Floodplain Barrens
Identifier: CES303.678.0 **MoRAP Code:** 2500
Description: Areas within the floodplain that lack significant vegetative cover. These occurrences represent mud, sand, and gravel bars, but may also be disturbed sites.

High Plains: Floodplain Juniper Forest (2501)

Western Great Plains Floodplain Juniper Forest and Woodland
Identifier: CES303.678.1 **MoRAP Code: 2501**
Description: Forest or woodland as described for the system, but with *Juniperus ashei* (Ashe juniper) or *Juniperus pinchotii* (redberry juniper) as the overstory dominant. This is a very minor component of the system.

High Plains: Floodplain Live Oak Forest (2502)

Western Great Plains Floodplain Live Oak Forest and Woodland
Identifier: CES303.678.2 **MoRAP:** 2502
Description: Forest or woodland as described for system, but with *Quercus fusiformis* (plateau live oak) as the overstory dominant. This is a minor component of the system.

High Plains: Floodplain Hardwood / Juniper Forest (2503)

Western Great Plains Floodplain Mixed Deciduous – Evergreen Forest and Woodland
Identifier: CES303.678.4 **MoRAP Code:** 2503
Description: Forest or woodland as described for system. Overstory is dominated by a mix of evergreen species (such as *Juniperus ashei* (Ashe juniper), *Juniperus pinchotii* (redberry juniper), and/or *Quercus fusiformis* (plateau live oak)) and deciduous species.

High Plains: Floodplain Hardwood Forest (2504)

Western Great Plains Floodplain Deciduous Forest and Woodland
Identifier: CES303.678.6 **MoRAP Code:** 2504
Description: Forest or woodland as described for system with a deciduous overstory canopy.

High Plains: Floodplain Juniper Shrubland (2505)

Western Great Plains Floodplain Juniper Shrubland
Identifier: CES303.678.7 **MoRAP Code:** 2505
Description: Shrubland on floodplain dominated by *Juniperus ashei* (Ashe juniper) or *Juniperus pinchotii* (redberry juniper). This is a very minor component of the system, at least in Phase 1.

High Plains: Floodplain Deciduous Shrubland (2506)

Western Great Plains Floodplain Deciduous Shrubland
Identifier: CES303.678.8 **MoRAP Code:** 2506
Description: Shrubland on floodplain, dominated by deciduous shrub species such as *Prosopis glandulosa* (mesquite), *Salix nigra* (black willow), *Sapindus saponaria* var.

drummondii (western soapberry), *Ziziphus obtusifolia* (lotebush) and/or *Celtis laevigata* (sugar hackberry). *Tamarix* spp. (saltcedar) may also be present to dominant in the shrub layer.

High Plains: Floodplain Herbaceous Vegetation (2507)

Western Great Plains Floodplain Herbaceous Vegetation
Identifier: CES303.678.9 **MoRAP Code:** 2507
Description: This herbaceous vegetation may be represented by marshes on floodplains, where *Schoenoplectus* spp. (bulrush), *Eleocharis* spp. (spikerush), and/or *Typha* spp. (cattail) dominate. Patches of tallgrass prairie that may be dominated by species such as *Andropogon gerardii* (big bluestem) or *Panicum virgatum* (switchgrass) may also be mapped as this vegetation type.

Western Great Plains Mesquite Woodland and Shrubland
Identifier: CES303.668

Geology: This system occupies areas of alluvial deposition.
Landform: Along drainages and on floodplains.
Soils: Bottomland soils and soils along drainages.

Description: Because *Prosopis glandulosa* (honey mesquite) is the characteristic dominant of this system, and that species can occupy various sites and is thought to have expanded on the landscape as a result of land-use, it is difficult to distinguish this system from areas where *Prosopis glandulosa* (honey mesquite) has invaded. The system is only mapped on bottomland soils and along drainages, while other shrublands dominated by the species are mapped as Native Invasive: Mesquite Shrubland. *Prosopis glandulosa* (honey mesquite) typically dominate the sites, sometimes occurring in the overstory canopy. Other overstory species may include species of the Western Great Plains Floodplain (CES303.678) or Western Great Plains Riparian (CES303.956) systems, such as *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Sapindus saponaria* var. *drummondii* (western soapberry), *Populus deltoides* (eastern cottonwood), and *Salix nigra* (black willow). *Prosopis glandulosa* (honey mesquite) is dominant in the shrub layer, but other shrub species encountered include small representatives of the overstory, *Ziziphus obtusifolia* (lotebush), *Prunus angustifolia* (Chickasaw plum), and *Baccharis* spp. (baccharis). Herbaceous species present in the understory may include *Panicum virgatum* (switchgrass), *Bothriochloa laguroides* var. *torreyana* (silver bluestem), *Nassella leucotricha* (Texas wintergrass), and *Schizachyrium scoparium* (little bluestem). Non-native species such as *Cynodon dactylon* (bermudagrass), *Bromus catharticus* (rescuegrass), *Sorghum halepense* (Johnsongrass), and *Bromus arvensis* (Japanese brome) are also commonly present and may be dominant.

VEGETATION TYPES:

High Plains: Mesquite Woodland (5404)

Western Great Plains Mesquite Woodland
Identifier: CES303.668.2 **MoRAP Code:** 5404
Description: Occurrences characterized by a significant canopy greater than 4m in height.

High Plains: Mesquite Shrubland (5406)

Western Great Plains Mesquite Shrubland
Identifier: CES303.668.1 **MoRAP Code:** 5406
Description: Shrub dominated occurrences with a scattered overstory component, if any.

Western Great Plains Riparian
Identifier: CES303.956

Geology: As defined, this type occurs along headwater streams and generally occurs over upland soils that have developed in place over a variety of bedrock types, often limestone in Phase 1.

Landform: This system occurs along drainages that may be intermittent and tend to be dominated by erosional processes (as opposed to depositional processes) within the drainage of the Clear Fork of the Middle Brazos River.

Soils: As this system is mapped, it by definition occurs outside of areas mapped as bottomland soils. Soils are therefore mapped with soils of the surrounding uplands.

Description: Forests and woodlands may have species such *Populus deltoides* (eastern cottonwood), *Salix nigra* (black willow), *Celtis laevigata* var. *reticulata* (netleaf hackberry), and *Sapindus saponaria* var. *drummondii* (western soapberry). *Juniperus ashei* (Ashe juniper), *Juniperus pinchotii* (redberry juniper), or *Quercus fusiformis* (plateau live oak) may occur along the eastern edge of the range of this system where it grades into Edwards Plateau Riparian (CES303.652) or Southeastern Great Plains Riparian (CES206.709). Grasslands associated with riparian corridors may also be present and will generally be somewhat more mesic than grasslands of the surrounding landscape. Herbaceous species commonly encountered include *Pleuraphis mutica* (tobosa), *Nassella leucotricha* (Texas wintergrass), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Schizachyrium scoparium* (little bluestem). Marshes within these drainage corridors are mapped as Western Great Plains Open Freshwater Depression Wetland (CES303.675). Shrublands are typically strongly dominated by *Prosopis glandulosa* (honey mesquite) and are mapped as Western Great Plains Mesquite Woodland and Shrubland (CES303.668). The non-natives *Tamarix* spp. (saltcedars), *Elaeagnus angustifolia* (Russian olive), and *Ulmus pumila* (Siberian elm) may also be commonly encountered in this system.

VEGETATION TYPES:

High Plains: Riparian Juniper Forest (2701)

Western Great Plains Riparian Juniper Forest and Woodland
Identifier: CES303.678.1 **MoRAP Code: 2701**
Description: Forest or woodland as described for the system, but with *Juniperus ashei* (Ashe juniper) or, less commonly in Phase 1, *Juniperus pinchotii* (redberry juniper) as the overstory dominant.

High Plains: Riparian Live Oak Forest (2702)

Western Great Plains Riparian Live Oak Forest
Identifier: CES303.956.3 **MoRAP Code:** 2702
Description: Woodland or forest of riparian situations with *Quercus fusiformis* (plateau live oak) dominating the canopy. This is a minor component of the system. Live oak occurs in this system only in the southeastern portion of its range, where *Quercus fusiformis* (plateau live oak) is at the western edge of its range.

High Plains: Riparian Hardwood / Juniper Forest (2703)

Western Great Plains Riparian Mixed Deciduous – Evergreen Forest and Woodland
Identifier: CES303.956.4 **MoRAP Code:** 2703
Description: Forest or woodland as described for the system, with the canopy containing significant amounts of *Juniperus ashei* (Ashe juniper) or *Juniperus pinchotii* (redberry juniper) in addition to the deciduous components. This is a minor component of the system in Phase 1.

High Plains: Riparian Hardwood Forest (2704)

Western Great Plains Riparian Deciduous Forest and Woodland
Identifier: CES303.956.6 **MoRAP Code:** 2704
Description: Forest and woodland as described for the system with a canopy dominated by deciduous species.

High Plains: Riparian Juniper Shrubland (2705)

Western Great Plains Riparian Juniper Shrubland
Identifier: CES303.956.7 **MoRAP Code:** 2705
Description: Shrubland of riparian situations dominated by *Juniperus ashei* (Ashe juniper) or *Juniperus pinchotii* (redberry juniper).

High Plains: Riparian Deciduous Shrubland (2706)

Western Great Plains Riparian Deciduous Shrubland
Identifier: CES303.956.8 **MoRAP Code:** 2706
Description: Shrubland of riparian situations dominated by deciduous shrub species, primarily *Prosopis glandulosa* (mesquite). This is the primary vegetation type mapped as this system.

High Plains: Riparian Herbaceous Vegetation (2707)

Western Great Plains Riparian Herbaceous Vegetation
Identifier: CES303.956.9 **MoRAP Code:** 2707
Description: Grassland or marsh of riparian situations as described for the system.

High Plains: Riparian Emergent Marsh (2717)

Western Great Plains Riparian Emergent Marsh
Identifier: CES303.956.10 **MoRAP Code:** 2717
Description: Marsh of riparian situations. These marshes may also be mapped as Western Great Plains Open Freshwater Depression Wetland (CES303.675).

Herbaceous Wetlands

Edwards Plateau Upland Depression
Identifier: CES303.654

Geology: Massive Cretaceous limestones, such as Edwards Limestone.
Landform: Internally draining depressions of karstic origin on level plateau surfaces.
Soils: Loams and clay loams, often mapped as Lakebed ecoclass.

Description: This system includes shallow wetlands formed over limestone on the Edwards Plateau of Texas. Variable in size and duration of inundation, these wetlands are typically found on level uplands. Dominant vegetation includes both graminoids and forbs tolerant of wet periods but not necessarily wetland-dependent. Dominant species may include *Pleuraphis mutica* (tobosa), *Bouteloua dactyloides* (buffalograss), *Tridens albescens* (white tridens), *Sedum pulchellum* (widowscross), *Sedum nuttallianum* (yellow stonecrop), *Sporobolus vaginiflorus* (poverty dropseed), *Chaetopappa bellidifolia* (hairy leastdaisy), *Ambrosia psilostachya* (western ragweed), *Paronychia* spp. (whitlow-wort), and the alga *Nostoc commune* (blue-green algae). *Panicum obtusum* (vine-mesquite), *Bothriochloa barbinodis* (cane bluestem), *Pascopyrum smithii* (western wheatgrass), *Bouteloua gracilis* (blue grama), *Chenopodium album* (lambsquarters), *Helianthus ciliaris* (blue-weed), and *Solanum elaeagnifolium* (silverleaf nightshade) may also be present. Some larger occurrences of this wetland system are found in Crockett, Reagan, Schleicher, Irion, and Sterling counties in the northwest Edwards Plateau (the Eldorado Plateau). In Phase I, they are found primarily in Runnels, Concho, and Sutton counties. Formation of these occurrences is apparently from solution of the underlying limestone.

VEGETATION TYPE:

Edwards Plateau: Playa (1507)

Edwards Plateau Upland Depression
Identifier: CES303.654.9 **MoRAP Code:** 1507
Description: As described for system.

Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Marsh
Identifier: CES203.472

Geology: This system occupies recent alluvial deposits.
Landform: Along bay margins and outlets of coastal rivers where freshwater inflow is sufficient to drive marsh composition. Sites may be interspersed with areas of open water.
Soils: Saturated, very deep, mineral soils, often with high organic content, at least at the surface. Ecoclasses (from Ecological Site Descriptions) include various Fresh and Intermediate Marsh types.

Descriptions: This herbaceous system occupies coastal sites with mucky soils and salinities less than 4 ppt. Dominants are graminoids, including *Panicum hemitomon* (maidencane), *Paspalum vaginatum* (seashore paspalum), *Zizaniopsis miliacea* (marshmillet), *Typha latifolia* (common cattail), *Spartina patens* (marshhay cordgrass), *Schoenoplectus* spp. (bulrushes), and *Phragmites australis* (common reed). Other wetland species such as *Sagittaria* spp. (arrowheads), *Ludwigia* spp. (water-primroses), and *Vigna luteola* (cow pea) may also be present. Some occurrences may have some woody cover with species such as *Iva frutescens* (bigleaf sumpweed) or *Baccharis halimifolia* (baccharis).

VEGETATION TYPE:

Chenier Plain: Fresh and Intermediate Tidal Marsh (5807)

Gulf Coast Chenier Fresh and Oligohaline Tidal Marsh
Identifier: CES203.541.7 **MoRAP Code:** 5807
Description: As described for system, where woody cover is minor.

Chenier Plain: Fresh and Intermediate Tidal Shrub Wetland (5806)

Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Shrub Wetland
Identifier: CES203.541.6 **MoRAP Code:** 5806
Description: Sites with significant cover of woody species such as *Iva frutescens* (bigleaf sumpweed) and/or *Baccharis halimifolia* (baccharis). *Arundo donax* (giant reed) dominated sites may also be mapped as this type.

Gulf Coast Chenier Plain Salt and Brackish Tidal Marsh
Identifier: CES203.468

Geology: Recent alluvial deposits.
Landform: Coastlines, bay margins, bay inlets, along dredged canals, creeks, and river inlets where tidal influence is adequate to maintain high salinities.
Soils: Fine textured soils, sometimes with high organic content at the surface. Ecoclasses (from Ecological Site Descriptions) include Brackish and Saltmarsh types.

Description: This typically herbaceous dominated system has a composition that varies depending on the salinity of the environment and the depth of frequent tidal flooding. Marshes that are frequently flooded by tides (low marshes) tend to be strongly dominated by *Spartina alterniflora* (smooth cordgrass). Occasionally these sites may have significant cover of *Avicennia germinans* (black mangrove), though freezes tend to reduce the cover of mangrove. Some patches of *Juncus roemerianus* (blackrush) may be interspersed. Higher marshes of saline to brackish sites tend to be somewhat more diverse, with *Spartina patens* (marshhay cordgrass) a common dominant. *Spartina alterniflora* (smooth cordgrass) may be present, but is typically not strongly dominant. Other species that may be present, or sometimes dominant include *Spartina spartinae* (Gulf cordgrass), *Distichlis spicata* (saltgrass), *Batis maritima* (saltwort), *Salicornia* spp. (glasswort), *Schoenoplectus robustus* (sturdy bulrush), *Schoenoplectus americanus* (three-square bulrush), *Paspalum vaginatum* (seashore paspalum), *Sporobolus virginicus* (seashore dropseed), and

Borrichia frutescens (sea ox-eye daisy). *Iva frutescens* (bigleaf sumpweed) and *Baccharis halimifolia* (baccharis) are commonly encountered woody species.

VEGETATION TYPES:

Chenier Plain: Salt and Brackish Low Tidal Marsh (5707)

Gulf Coast Chenier Plain Salt and Brackish Regularly Flooded Tidal Marsh
Identifier: CES203.468.7 **MoRAP Code:** 5707
Description: Low, regularly flooded tidal marsh, often dominated by *Spartina alterniflora* (smooth cordgrass).

Chenier Plain: Salt and Brackish Low Shrub Tidal Wetland (5706)

Gulf Coast Chenier Plain Salt and Brackish Regularly Flooded Tidal Shrub Wetland
Identifier: CES203.468.6 **MoRAP Code:** 5706
Description: Low, regularly flooded tidal marsh with significant cover of woody species such as *Avicennia germinans* (black mangrove), *Iva frutescens* (bigleaf sumpweed), or *Baccharis halimifolia* (baccharis).

Chenier Plain: Salt and Brackish High Tidal Marsh (5717)

Gulf Coast Chenier Plain Salt and Brackish Irregularly Flooded Tidal Marsh
Identifier: CES203.468.17 **MoRAP Code:** 5717
Description: Sites with irregular tidal inundation, often dominated by species other than *Spartina alterniflora* (smooth cordgrass), though it may be present.

Chenier Plain: Salt and Brackish High Tidal Shrub Wetland (5716)

Gulf Coast Chenier Plain Salt and Brackish Irregularly Flooded Tidal Shrub Wetland
Identifier: CES203.468.16 **MoRAP Code:** 5716
Description: Shrub dominated sites with irregular tidal inundation. Species such as *Iva frutescens* (bigleaf sumpweed) or *Baccharis halimifolia* (baccharis) are often common. Some sites dominated by *Arundo donax* (giant reed) may also be mapped as this type.

North American Arid West Emergent Marsh
Identifier: CES300.729

Geology: Various substrates, but often Quaternary alluvium.
Landform: Depressions, margins of freshwater lakes, and margins of streams and rivers.
Soils: Various edaphic situations, with accumulation of organic material depending on the length of time the marsh has been established.

Description: Vegetation occupying depressions, margins of lakes, or margins of streams that are frequently or continuously inundated by freshwater. This system includes marshes occupying stock tanks and other man-made depressions, and other moist to wet sites other than marshes. The vegetation is dominated by herbaceous species including *Schoenoplectus pungens* var. *longispicatus* (American bulrush), *Schoenoplectus acutus* (hardstem bulrush), *Cladium mariscus* ssp. *jamaicense* (saw-grass), *Eleocharis montevidensis* (sand spikerush), *Polypogon monspeliensis*

(rabbitfoot grass), *Echinochloa crus-galli* (barnyardgrass), *Cynodon dactylon* (Bermudagrass), *Phragmites australis* (common reed), *Phalaris caroliniana* (Carolina canarygrass), *Typha domingensis* (southern cattail), *Juncus* spp. (rushes), *Potamogeton* spp. (pondweeds), *Polygonum* spp. (smartweeds), *Ceratophyllum demersum* (coontail), and *Chara* spp. (stoneworts).

VEGETATION TYPE:

Trans-Pecos: Marsh (8908)

North American Arid West Emergent Marsh
Identifier: CES300.729 **MoRAP Code:** 8908
Description: As described for system.

North American Warm Desert Cienega

Identifier: CES302.747

Geology: While the cienegas themselves often occur within Quaternary alluvium, the springs that feed the marshes and moist-soil habitats emanate from contacts often of Cretaceous limestone with less permeable formations.
Landform: Spring runs and draws fed by freshwater springs.
Soils: Often associated with Draw (Desert Grassland) Ecological Sites.

Description: This predominately herbaceous system occurs on drainages fed by freshwater springs. Evaporative processes may create saline conditions leading to the presence and/or dominance of species such as *Sporobolus airoides* (alkali sacaton), *Distichlis spicata* (saltgrass), *Sesuvium verrucosum* (winged sea purslane), and *Trianthema portulacastrum* (desert horse purslane), and *Limonium limbatum* (bordered sea-lavender). Other moist-soil species include *Schoenoplectus pungens* var. *longispicatus* (American bulrush), *Juncus* spp. (rushes), and *Eleocharis* spp. (spikerushes). Composition of the occurrence is dependent on the depth and availability of water associated with the originating spring. At some sites, rare species such as *Helianthus paradoxus* (Pecos sunflower), *Nesaea longipes* (longstalk heimia), and *Agalinis calycina* (Leoncita false foxglove) may be found. The non-native grass *Cynodon dactylon* (Bermudagrass) is often encountered.

VEGETATION TYPES:

Trans-Pecos: Desert Cienega Shrubland (11506)

North American Warm Desert Cienega Shrubland
Identifier: CES302.747.1 **MoRAP Code:** 11506
Description: Though this system is typically herbaceous, some occurrences may become dominated by species such as *Atriplex canescens* (four-wing saltbush) or *Prosopis glandulosa* (honey mesquite).

Trans-Pecos: Desert Cienega Marsh (11517)

North American Warm Desert Cienega Marsh
Identifier: CES302.747.2 **MoRAP Code:** 11517
Description: Occurrences dominated by herbaceous species as described for the system.

North American Warm Desert Playa
Identifier: CES302.751

Geology: Quaternary alluvial, playa, and caliche deposits.
Landform: Internally draining, somewhat circular basins.
Soils: Verhalen clay.

Description: This system forms in alternately wet and dry, internally draining, often clay-lined basins, sometimes over caliche. They tend to be sparsely vegetated, sometimes with open water, or herbaceous vegetation. High evaporation rates leads to high salinity and halophytic species may be common. Species that may be present include *Distichlis spicata* (saltgrass), *Allenrolfea occidentalis* (pickle-weed), *Tiquilia canescens* (oreja de pero), *Suaeda* ssp. (seablite), *Salsola* ssp. (Russian thistle), and *Atriplex canescens* (four-wing saltbush).

VEGETATION TYPES:

Trans-Pecos: Desert Playa Lake and Barrens (11900)
North American Warm Desert Playa
Identifier: CES302.751.1 **MoRAP Code:** 11900
Description: Sites as described for the system that are sparsely vegetated or are open water when precipitation events occur.

Trans-Pecos: Desert Playa Grassland (11907)
North American Warm Desert Playa Grassland
Identifier: CES302.751.2 **MoRAP Code:** 11907
Description: Sites as described for system with vegetative cover as described for system.

Southeastern Coastal Plain Interdunal Wetland
Identifier: CES203.258

Geology: Coastal eolian sands, extending inland on the South Texas Sand Sheet. Also on Pleistocene barrier island and beach deposits of the Beaumont formation, such as on the Ingleside Barrier.
Landform: Occupying topographic lows of interdunal swales and potholes.
Soils: Deep sands and coastal sands.

Description: These wetlands occur on topographic lows in nearly level to steeply rolling landscapes on sands and deep sands along the coast and inland on the South Texas Sand Sheet. They are alternately wet and dry (due to seasonal rainfall events) and generally lack tidal influence, but may contain halophytic species due to the influence of salt spray and repeated inundation and evaporation. They are graminoid dominated sites, with species such as *Spartina patens* (marshhay cordgrass), *Andropogon glomeratus* (bushy bluestem), *Panicum virgatum* (switchgrass), *Paspalum monostachyum* (gulfdune paspalum), *Distichlis spicata* (saltgrass), *Fimbristylis*

castanea (chestnut fimbry), *Rhynchospora colorata* (whitetop sedge), *Eleocharis* spp. (spikerushes), *Rhynchospora* spp. (beaksedges), *Typha* spp. (cattails), and *Schoenoplectus pungens* (common threesquare). Forbs such as *Hydrocotyle bonariensis* (largeleaf pennywort), *Centella erecta* (spadeleaf), *Phyla nodiflora* (common frog-fruit), *Samolus ebracteatus* (coast brookweed), *Bacopa monnieri* (coastal water-hyssop), and *Pluchea foetida* (marsh fleabane) may be conspicuous. Woody species such as *Batis maritima* (saltwort), *Sesbania* spp. (rattleboxes), *Prosopis glandulosa* (honey mesquite), and *Baccharis* spp. (baccharis) may be present but do not typically constitute significant cover.

VEGETATION TYPE:

Coastal and Sandsheet: Deep Sand Grasslands Swale Marsh (6507)

Southeastern Coastal Plain Interdunal Wetland
Identifier: CES203.258 **MoRAP Code:** 6507
Description: As described for system.

Texas Coast Fresh and Oligohaline Tidal Marsh

Identifier: CES203.472

Geology: Young quaternary alluvium.
Landform: Mouths of rivers and bayous emptying into bays of the Galveston Bay system.
Soils: Soils of the Tidal Flats and Salt Marsh Ecological Sites where they occur in areas of sufficient freshwater inflow.

Description: Tidal marshes where salinity is maintained sufficiently low through freshwater inflows to produce fresh to oligohaline water chemistry. These marshes typically occur as small patches along bay margin and river or bayou mouths.

VEGETATION TYPE:

Coastal: Fresh and Intermediate Tidal Marsh (5907)

Texas Coast Fresh and Oligohaline Tidal Marsh
Identifier: CES203.472 **MoRAP Code:** 5907
Description: As described for the system.

Texas Coast Salt and Brackish Tidal Marsh

Identifier: CES203.473

Geology: Recent alluvial and eolian deposits along the coast.
Landform: Nearly level very gentle slopes, and flats influenced by tides.
Soils: Coastal sands and various Salt Marsh Ecological Sites.

Description: These marshes occupy relatively low-lying, coastal situations on level landforms influenced by tidal fluctuations. Some sites are only influenced by storm tides, or tides resulting

from extreme wind events. The composition of these marshes is primarily influenced by the frequency and duration of tidal inundation. Salinity on some marshes, particularly in the south, is maintained by salt spray from prevailing southeasterly winds. Low marshes are regularly flooded and representative examples are dominated by *Spartina alterniflora* (smooth cordgrass), *Juncus roemerianus* (blackrush), or *Avicennia germinans* (black mangrove). Significant areas of *Avicennia germinans* (black mangrove) become more frequent towards the south, while extensive areas of *Spartina alterniflora* (smooth cordgrass) become rare south of Corpus Christi Bay. Areas of decreased frequency and/or duration of tidal inundation are often referred to as high, or irregularly flooded, marsh. These marshes may be dominated by species such as *Spartina patens* (marshhay cordgrass), *Distichlis spicata* (saltgrass), *Schoenoplectus robustus* (sturdy bulrush), *Schoenoplectus americanus* (three-square bulrush), *Sporobolus virginicus* (seashore dropseed), *Monanthochloe littoralis* (shoregrass), and *Spartina spartinae* (Gulf cordgrass). Shrubs, subshrubs, and forbs, such as *Batis maritima* (saltwort), *Borrichia frutescens* (sea ox-eye daisy), *Sesuvium portulacastrum* (shoreline seapurslane), *Salicornia* spp. (glassworts), *Suaeda linearis* (annual seepweed), *Limonium* spp. (sea-lavenders), and *Lycium carolinianum* (Carolina wolfberry) are commonly encountered in these marshes. Some irregularly flooded sites may become shrub-dominated with species such as *Iva frutescens* (shrubby sumpweed) or *Baccharis halimifolia* (eastern baccharis). In the south, extensive areas are dominated by *Borrichia frutescens* (sea ox-eye daisy) and these often occur at very slightly lower elevations and higher salinities than nearby *Spartina spartinae* (Gulf cordgrass) salty prairie. These *Borrichia* flats may be very infrequently flooded, perhaps only under extreme storm tide conditions. Other species that may be encountered in these situations include *Maytenus phyllanthoides* (gutta-percha), *Prosopis reptans* (tornillo), *Monanthochloe littoralis* (shoregrass), *Distichlis spicata* (saltgrass), and *Batis maritima* (saltwort). The aspect dominant on these sites is clearly *Borrichia frutescens* (sea ox-eye daisy).

VEGETATION TYPES:

Coastal: Tidal Flat (5600)

Texas Coast Salt and Brackish Tidal Flats
Identifier: CES203.473.1 **MoRAP Code:** 5600
Description: Unvegetated or very sparsely vegetated flats affected by tidal fluctuations.

Coastal: Sea Ox-eye Daisy Flats (5605)

Texas Coast Salt and Brackish Borrichia Flats
Identifier: CES203.473.5 **MoRAP Code:** 5605
Description: *Borrichia frutescens* (sea ox-eye daisy) is the clear aspect dominant of these irregularly flooded sites. These flats become very extensive from Corpus Christi Bay, southward.

Coastal: Mangrove Shrubland (5606)

Texas Coast Mangrove Shrubland
Identifier: CES203.473.6 **MoRAP Code:** 5606
Description: Shrublands dominated by *Avicennia germinans* (black mangrove). These tidal shrublands become increasingly well-developed towards the south. Fairly well-developed mangrove shrublands can be found in Redfish Bay near Aransas Pass.

Coastal: Salt and Brackish Low Tidal Marsh (5607)

Texas Coast Salt and Brackish Regularly Flooded Marsh
Identifier: CES203.473.7 **MoRAP Code:** 5607
Description: Marshes frequently inundated by tides and often dominated by *Spartina alterniflora* (smooth cordgrass).

Coastal: Salt and Brackish High Tidal Shrub Wetland (5616)

Texas Coast Salt and Brackish Irregularly Flooded Tidal Shrub Wetland
Identifier: CES203.473.16 **MoRAP Code:** 5616
Description: These sites may be dominated by species such as *Iva frutescens* (shrubby sumpweed) or *Baccharis halimifolia* (eastern baccharis).

Coastal: Salt and Brackish High Tidal Marsh (5617)

Texas Coast Salt and Brackish Irregularly Flooded Marsh
Identifier: CES203.473.17 **MoRAP Code:** 5617
Description: Irregularly flooded marsh dominated by graminoids such as *Spartina patens* (marshhay cordgrass), *Distichlis spicata* (saltgrass), and *Schoenoplectus* spp. (bulrushes).

Texas-Louisiana Coastal Prairie Pondshore

Identifier: CES203.541

Geology: This system occurs on the coastal Pleistocene terraces, including the Beaumont and Lissie Formations.
Landform: Local topographic lows such as ponds and swales within the generally level landscape.
Soils: Soils tend to be fine-textured, or are characterized by a relatively impermeable subsurface horizon.

Description: This system occurs as ponds or swales within the coastal prairie matrix. Soils are poorly-drained, and surface water from rainfall and local runoff is retained for much of the year (except for periods of high evapotranspiration). Occurrences are wetter than the *Tripsacum dactyloides* (eastern gamagrass) or *Panicum virgatum* (switchgrass) dominated prairie sites of the Texas-Louisiana Coastal Prairie. These wetlands are primarily herbaceous, sometimes with sparse woody cover, and are composed of various species, such as *Eleocharis quadrangulata* (squarestem spikesedge), *Fuirena squarrosa* (hairy umbrellasedge), *Cyperus haspan* (sheathed umbrellasedge), *Cyperus virens* (green flatsedge), *Rhynchospora* spp. (beaksedges), *Leersia hexandra* (clubhead cutgrass), *Steinchisma hians* (gaping panicum), *Panicum virgatum* (switchgrass), *Andropogon glomeratus* (bushy bluestem), *Xyris jupicai* (Richard's yellow-eyed grass), *Centella erecta* (erect centella), *Sagittaria papillosa* (nipplebract arrowhead), *Sagittaria longiloba* (longlobe arrowhead), *Ludwigia glandulosa* (Torrey water-primrose), *Ludwigia linearis* (narrowleaf water-primrose), *Bacopa* spp. (waterhyssops), *Hydrocotyle* spp. (pennyworts), *Symphyotrichum subulatum* (hierba del marrano), and *Sesbania* spp. (rattleboxes). Large areas of some of the occurrences may be relatively homogeneous, dominated by one or a few species. Areas of open water within the ponds may contain floating and submerged aquatic species, including *Stuckenia pectinata* (sago pondweed), *Ceratophyllum demersum* (coontail), *Brasenia schreberi*

(Schreber watershield), *Nymphoides aquatica* (largeleaf floating heart), and *Nelumbo lutea* (yellow lotus).

VEGETATION TYPE:

Gulf Coast: Coastal Prairie Pondshore (5307)

Texas-Louisiana Coastal Prairie Pondshore
Identifier: CES203.541 **MoRAP Code:** 5307
Description: As described for system.

West Gulf Coastal Plain Flatwoods Pond

Identifier: CES203.547

Geology: Pleistocene terraces, including the upper Beaumont Formation, but also mapped on the high Pleistocene terraces in the northern part of Texas. These are mapped as Quaternary Fluviatile Terrace (Tile) Deposits along the Red, Sulphur, and Sabine Rivers.
Landform: Occupy local topographic lows within the flatwoods.
Soils: Relatively fine-textured soils with an impermeable subsoil horizon, giving rise to a perched water table and saturated conditions during extended periods of the year.

Description: The system as currently described, focuses on those herbaceous dominated wetlands that are embedded within the West Gulf Coastal Plain Longleaf Pine Wet Savanna and Flatwoods. As we mapped this system, it occupies sites with a much broader distribution, including wet, herbaceous dominated sites within the West Gulf Coastal Plain Wet Hardwood Flatwoods or West Gulf Coastal Plain Pine – Hardwood Flatwoods. This mapped system is likely dominated by species such as *Panicum hemitomon* (maidencane), *Carex* spp. (caric sedges), *Rhynchospora* (beaksedges), *Eleocharis* spp. (spikerushes), *Andropogon glomeratus* (bushy bluestem), and *Ludwigia* spp. (water-primroses). On drier sites *Schizachyrium scoparium* (little bluestem) may be present. Some sites may be dominated by the non-native *Cynodon dactylon* (bermudagrass). A few woody species may occur, including *Nyssa biflora* (swamp tupelo), *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), *Planera aquatica* (water elm), and *Cephalanthus occidentalis* (common buttonbush). Flatwood ponds, as described by Bridges and Orzell, represent a more restricted subset of herbaceous-dominated sites with saturated soils resulting from perched water table due to an impermeable subsurface.

VEGETATION TYPES:

Pineywoods: Herbaceous Flatwoods Pond (3507)

West Gulf Coastal Plain Herbaceous Flatwoods Pond
Identifier: CES203.547 **MoRAP Code:** 3507
Description: As described for system.

West Gulf Coastal Plain Herbaceous Seep and Bog
Identifier: CES203.194

Geology: Often associated with Eocene sand formations such as Queen City, Sparta, and particularly Carrizo Sands.

Landform: Generally found on slopes, as well as on valley floors and toe slopes where seepage from upslope occurs through the deep sands on site.

Soils: Deep Sand, Very Deep Sand, or Wet Sandy Draw Ecological Sites are typical of this system and surrounding areas.

Description: This small patch system typically presents as an herbaceous wetland, though sometimes significant shrub cover by *Morella cerifera* (wax-myrtle) and/or other species may be conspicuous. The herbaceous layer is dominated by a dense, species-rich, graminoid-forb layer less than 1 m tall with continuous to nearly continuous cover, typically 80-90%. Seepage results from the percolation of water through a porous sand layer until it encounters a more impermeable layer and flows to the surface. Grass species present may include species such as *Andropogon glomeratus* (bushy bluestem), *Dichanthelium scoparium* (velvet panicum), *Panicum anceps* (beaked panicum), *Panicum brachyanthum* (pimple panicgrass), *Panicum virgatum* (switchgrass), *Paspalum laeve* (smooth paspalum), *Saccharum giganteum* (sugarcane plumegrass), and *Steinchisma hians* (gaping panicum) [=*Panicum hians*]. Sedges and rushes are well-represented and may include *Cyperus strigosus* (false nutgrass), *Eleocharis acicularis* (needle spikesedge), *Fuirena squarrosa* (hairy umbrellasedge), *Juncus dichotomus* (forked rush), *Juncus diffusissimus* (slimpod rush), *Juncus effusus* (common rush), and *Rhynchospora* spp. (beakrushes, including *R. gracilenta, R. oligantha,* and/or *R. rariflora*). A diverse forb assemblage is typically present, and may include *Eryngium integrifolium* (simpleleaf eryngo), *Eupatorium perfoliatum* (common boneset), *Habenaria repens* (waterspider false reinorchid), *Hypericum mutilum* (dwarf St. John's-wort), *Ludwigia alternifolia* (bushy seedbox), *Lycopodiella* spp. (clubmoss), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Pogonia ophioglossoides* (rose pogonia), *Polygala cruciata* (drumheads), *Rhexia mariana* (Maryland meadowbeauty), *Sarracenia alata* (pitcher-plant), *Symphyotrichum dumosum* var. *dumosum* (bushy aster), *Woodwardia* spp. (chainfern), and/or *Xyris* spp. (yellow-eyed grass, *X. ambigua, X. baldwiniana, X. difformis, X. jupicai, X. laxifolia,* and/or *X. torta*). Seeps may feed downslope depressional wetlands which may be overtaken by shrub species such as *Morella cerifera* (wax-myrtle), or may be dominated by *Eleocharis* spp. (spikerush), *Juncus* spp. (rush), *Panicum hemitomon* (maidencane), and/or *Rhynchospora* spp. (beakrush). The bogs of portions of the East-Central Texas Plains Post Oak Savanna, commonly referred to as "muck bogs," differ from similar bogs within the West Gulf Coastal Plain by a decrease in species richness towards the west. These bogs can become dominated by woody species such as *Morella cerifera* (wax-myrtle), *Ilex vomitoria* (yaupon), and *Smilax laurifolia* (bamboo-vine). East of the Post Oak Savanna, other woody species such as *Toxicodendron vernix* (poison sumac), *Magnolia virginiana* (sweetbay), *Persea borbonia* (redbay), and *Pinus palustris* (longleaf pine) may form a sparse emergent canopy. Sites east of the Post Oak Savanna may contain broadleaved evergreen woody species such as *Magnolia virginiana* (sweetbay), *Cyrilla racemiflora* (leatherwood), *Morella caroliniensis* (evergreen bayberry), *Persea palustris* (swamp redbay), and *Ilex coriacea* (bay-gall bush). Herbaceous species more

characteristic of eastern occurrences include *Gelsemium sempervirens* (Carolina jessamine), *Hypericum galioides* (bedstraw St. John's -wort), *Lachnocaulon anceps* (whitehead bogbutton), *Ludwigia hirtella* (spindleroot), *Marshallia graminifolia* (grassleaf Barbara's buttons), *Rhexia petiolata* (ciliate meadowbeauty), *Rhynchospora inexpansa* (nodding beaksedge), *Rhychospora plumosa* (plumed beaksedge), *Rudbeckia scabrifolia* (bog coneflower), and *Xyris drummondii* (Drummond's yellow-eyed grass).

VEGETATION TYPE:

Pineywoods: Herbaceous Seepage Bog (2307)

West Gulf Coastal Plain Herbaceous Seepage Bog
Identifier: CES203.194.7 **MoRAP Code:** 2307
Description: As described above. Some mapped sites are based directly on field collected locations.

Western Great Plains Closed Depression Wetland

Identifier: CES303.666

Geology: This system typically occurs on various formations of the tablelands of the High Plains.
Landform: Internally draining depressions, typically on the tablelands of the High Plains, including the Llano Estacado, and outliers of those level plateaus.
Soils: These basins are typically lined by vertisols and may be mapped as Playa, Lakebed, or in some cases Clay Flat ecoclasses.

Description: As mapped, this system represents the playas of the southern Great Plains. They are shallow, small (averaging about 6 ha), generally circular, recharge basins receiving moisture from rainfall within internally draining watersheds and lacking significant overland drainage from the basins. They are usually characterized as occupying Vertisols with a clay layer of reduced permeability, and are variably wet and dry depending on local weather conditions. Moisture accumulation occurs through overland flow of rainfall falling on the surrounding, internally draining watershed, and drying results from evaporation, transpiration, and infiltration, with playas representing a significant recharge feature of the Ogallala Aquifer. This system is typically dominated by herbaceous vegetation including species such as *Pascopyrum smithii* (western wheatgrass), *Bouteloua dactyloides* (buffalograss), *Eleocharis macrostachya* (pale spikerush), *Panicum obtusum* (vine mesquite), *Helianthus ciliaris* (blue-weed), *Phyla nodiflora* (common frog-fruit), *Oenothera canescens* (beakpod eveningprimrose), *Chenopodium leptophyllum* (narrowleaved goosefoot), *Ambrosia grayi* (woollyleaf burr ragweed), *Polygonum pensylvanicum* (Pennsylvania smartweed), and *Symphyotrichum subulatum* (hierba del marrano). Species such as *Bouteloua dactyloides* and *Pascopyrum smithii* may occupy drier portions of a playa, or may occupy entire playas when those playas have lacked inundation for extended periods. Wetter portions of the playa may be occupied by marshes if the inundation has been maintained over extended periods. Species richness can vary considerably among individual examples of this system and is especially influenced by hydroperiod and adjacent land use, which is often agriculture. Dynamic processes that affect these depressions are hydrological changes, grazing, and conversion to agricultural use. This system differs from Western Great Plains Open Freshwater

Depression Wetland (CES303.675) in that the hydrology of these open wetlands are influenced by associated drainages.

VEGETATION TYPES:

High Plains: Playa Lake (6900)

Western Great Plains Closed Depression Lake
Identifier: CES303.666.0 **MoRAP Code:** 6900
Description: Areas in the vicinity of playa lakes that either lack significant vegetative cover or are covered by water.

High Plains: Playa Grassland (6907)

Western Great Plains Closed Depression Grassland
Identifier: CES303.660.1 **MoRAP Code:** 6907
Description: Areas of the playa lake dominated by grassland species, typically occupying drier portions of the playa or playas that have not been inundated for extended periods.

High Plains: Playa Marsh (6908)

Western Great Plains Closed Depression Wetland
Identifier: CES303.660.2 **MoRAP Code:** 6908
Description: Areas of the playas that have been inundated for sufficient time to be dominated by marsh species such as *Sagittaria* spp. (arrowheads), *Typha* spp. (cattails), *Schoenoplectus* spp. (bulrushes), *Eleocharis* spp. (spikerushes), and *Polygonum* spp. (smartweeds).

Western Great Plains Open Freshwater Depression Wetland
Identifier: CES303.675

Geology: On various substrates, but often on alluvium.
Landform: Depressions along drainages and lakes. These may also occupy other landforms, but typically do not occur within closed basins as in the Western Great Plains Closed Depression Wetland.
Soils: Various soils, often tight soils that restrict drainage, but also other soil types where water accumulates due to position along a drainage.

Description: This ecological system is composed of lowland depressions; it also occurs along lake borders that have more open basins and a permanent water source through most of the year, except during exceptional drought years. These areas are distinct from Western Great Plains Mesquite Woodland and Shrubland (CES303.668) by having a large watershed and/or significant connection to the groundwater table. A variety of species are part of this system, including emergent species of *Typha* (cattails), *Carex* (carices), *Eleocharis* (spikerushes), *Juncus* (rushes), and *Schoenoplectus* (bulrushes), as well as floating genera such as *Potamogeton* (pondweed), *Sagittaria* (arrowhead), or *Ceratophyllum* (hornwort). The system includes submergent and emergent marshes and associated wet meadows and wet prairies. These types can also drift into stream margins that are more permanently wet and linked directly to the basin via groundwater flow from/into the pond or

lake. Some of the specific communities will also be found in the floodplain system and are here considered a separate system. These types should also not be considered a separate system if they are occurring in lowland areas of the prairie matrix only because of an exceptional wet year. As mapped, this system may also occupy anthropogenic ponds and lakes.

VEGETATION TYPES:

High Plains: Depressional Marsh (3808)

Western Great Plains Open Freshwater Depression Wetland
Identifier: CES303.675 **MoRAP Code:** 3808
Description: As described for system.

High Plains: Depressional Wet Prairie (3807)

High Plains: Depressional Wet Shrubland (3806)

Western Great Plains Saline Depression Wetland
Identifier: CES303.669

Geology: Sometimes associated with the Tahoka Formation or the Ogallala Formation, but may occur over other substrates including Quaternary alluvium.
Landform: Somewhat circular basins, or sometimes forming linear bands adjacent to drainages.
Soils: High Lime, Salty Bottomland, and Wet Saline Ecological Sites.

Description: Saline lakes and salty bottomlands often with salt encrusted surfaces and sometimes sparsely vegetated. Some of these lakes were thought to form from wind deflation and/or dissolution of subsurface strata and some have associated springs, with evaporation causing concentration of salts at the surface. Dominant species of the sites are often halophytic, or at least salt tolerant, including *Sporobolus airoides* (alkali sacaton), *Distichlis spicata* (saltgrass), *Hordeum jubatum* (foxtail barley), *Sporobolus pyramidatus* (whorled dropseed), *Schoenoplectus* spp. (bulrushes), *Suaeda suffrutescens* (desert seepweed), *Allenrolfea occidentalis* (pickle-weed), *Salsola tragus* (prickly Russian thistle), and *Bassia scoparia* (kochia). Woody species including *Atriplex canescens* (four-wing saltbush) and *Prosopis glandulosa* (honey mesquite) may also be present and sometimes develop significant cover. During periods of high rainfall and as one moves further from the salt encrusted surfaces into surrounding habitats, species composition becomes less dominated by halophytes with species such as *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Sporobolus cryptandrus* (sand dropseed), *Aristida purpurea* (purple threeawn), and *Ziziphus obtusifolia* (lotebush). *Tamarix* spp. (saltcedar) may be present to dominant.

VEGETATION TYPES:

High Plains: Salt Lake (3900)

Western Great Plains Saline Lake
Identifier: CES303.669.1 **MoRAP Code:** 3900
Description: Margins and center of salt lakes, either sparsely vegetated or open water.

High Plains: Salt Lake Shrubland (3906)

Western Great Plains Saline Depression Shrubland
Identifier: CES303.669.2 **MoRAP Code:** 3906
Description: Shrublands surrounding salt lakes, often dominated by *Atriplex canescens* (four-wing saltbush) or *Tamarix* spp. (saltcedar). *Prosopis glandulosa* (honey mesquite) is also commonly encountered.

High Plains: Alkali Sacaton Grassland (3907)

Western Great Plains Saline Depression Alkali Sacaton Grassland
Identifier: CES303.669.3 **MoRAP Code:** 3907
Description: Grasslands surrounding salt lakes typically dominated by *Sporobolus airoides* (alkali sacaton), but with other species as mentioned in system description.

High Plains: Salt Marsh (3908)

Western Great Plains Saline Depression Marsh
Identifier: CES303.669.4 **MoRAP Code:** 3908
Description: The wettest vegetated portion of the salt lake where marsh has developed with species such as *Schoenoplectus* spp. (bulrushes) abundant.

Agricultural and other Human-related Mapped Types

CRP / Other Improved Grassland (9327)

MoRAP Code: 9327
Description: Grasslands of highly managed areas, sometimes dominated by non-native grasses such as *Cynodon dactylon* (bermudagrass), *Sorghum halepense* (Johnsongrass), and *Panicum coloratum* (kleingrass).

Grass Farm (9317)

MoRAP Code: 9317
Description: Most areas mapped as this type in Phase 1 are dominated by *Cynodon dactylon* (Bermudagrass) and consist of golf course fairways and greens that are fertilized and irrigated. This type also includes areas of moist soil and fast-growing, highly productive grassland.

Orchard (9304)

MoRAP Code: 9304
Description: Plantings of fruit or nut trees.

Pine Plantation 1 to 3 meters tall (9305)

MoRAP Code: 9305
Description: Young, planted *Pinus taeda* (loblolly pine) stands are most common within this type, which is mapped over moist soils where natural pine stands are not expected to occur. Other species such as *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), *Ulmus alata* (winged elm), *Ilex vomitoria* (yaupon), and *Rubus trivialis* (southern dewberry) may also be components. Some sites mapped as this type contain sparse or short *Quercus virginiana* (coastal live oak), *Juniperus virginiana* (eastern redcedar), or *Ilex vomitoria* (yaupon).

Pine Plantation >3 meters tall (9301)

MoRAP Code: 9301
Description: Dense stands of *Pinus taeda* (loblolly pine) or mixed *Pinus taeda* (loblolly pine) and *Pinus echinata* (shortleaf pine) characterize this type that is mapped over moist soils where natural pine stands are not expected to occur. Plantations of *Pinus elliottii* (slash pine) may also be present. Important components may include *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), *Nyssa sylvatica* (blackgum), *Quercus falcata* (southern red oak), *Quercus stellata* (post oak), and *Quercus alba* (white oak). Some sites mapped as this type contain *Quercus fusiformis* (plateau live oak), *Quercus virginiana* (coastal live oak), *Juniperus virginiana* (eastern redcedar), or *Ilex vomitoria* (yaupon).

Row Crops (9307)

MoRAP Code: 9307
Description: This type includes all cropland where fields are fallow for some portion of the year. Some fields may rotate into and out of cultivation frequently, and year-round cover crops are generally mapped as grassland.

Urban Low Intensity (9411)

MoRAP Code: 9411
Description: This type includes areas that are built-up but not entirely covered by impervious cover, including most of the area within cities and towns.

Urban High Intensity (9410)

MoRAP Code: 9410
Description: This type consists of built-up areas and wide transportation corridors that are dominated by impervious cover.

Mainly Natural Azonal Mapped Types

Azonal types are those types that are widespread and not particularly characteristic of any region or naturally occurring vegetation type. This may be due to disturbance, where wide ranging species adapted to disturbed conditions predominate. In other areas, land management may have resulted in invasion of widespread species such as juniper or mesquite. Azonal types may also be used to refer to general physiognomic types that are not ascribable to particular naturally occurring systems.

Barren

MoRAP Code: 9000

Description: This type includes areas where little or no vegetative cover existed at the time of image data collection. Large areas cleared for development are included, as well as rural roads and buildings and associated clearing in primarily rural areas. Stream beds with exposed gravel or bedrock, rock outcrops, quarries, and mines may be mapped as this type. Fallow fields or areas within cropland blocks that remain barren throughout one growing season or heavily grazed pastures where bare soils are dominant may also be mapped as barren.

Invasive: Evergreen Shrubland (9505)

MoRAP Code: 9505

Description: A variety of mainly disturbance shrublands with species such as *Acacia farnesiana* (huisache), *Baccharis* spp. (baccharis), *Rosa bracteata* (Macartney rose), *Triadica sebifera* (Chinese tallow)(north), *Ilex vomitoria* (yaupon), *Prosopis glandulosa* (honey mesquite), *Ziziphus obtusifolia* (lotebush), *Zanthoxylum fagara* (colima)(south), *Celtis ehrenbergiana* (granjeno)(south), and *Condalia hookeri* (brasil)(south) characterize this type. Sparse tree cover with species such as *Quercus fusiformis* (plateau live oak), *Quercus virginiana* (coastal live oak), *Quercus nigra* (water oak)(north), *Celtis laevigata* (sugar hackberry), and *Ulmus crassifolia* (cedar elm) may also occur.

Marsh (9007)

MoRAP Code: 9007

Description: Areas mapped as marsh are small, and consist of wet or alternately wet and dry soils with herbaceous vegetation. These are often near tanks or ponds, and may contain *Typha* spp. (cattails), *Eleocharis* spp. (spikerushes), *Schoenoplectus* spp. (bulrushes), other sedges,*Polygonum* spp. (smartweeds) and grasses such as *Sorghum halepense* (Johnsongrass) or *Cynodon dactylon* (bermudagrass) as important species. Some shrubs such as *Cephalanthus occidentalis* (common buttonbush) and *Salix nigra* (black willow) may be important in this mapped type.

Mud Flat (9002)

MoRAP Code: 9002

This mapped type is essentially unvegetated at the time of data collection, but annual variation in storm events and precipitation influence the ability of these low areas to support vegetation.

Native Invasive: Baccharis Shrubland (9116)

MoRAP Code: 9116
Description: This type is mapped on salty or sandy soils and *Baccharis* spp. (baccharis), *Prosopis glandulosa* (honey mesquite), *Tamarix* spp. (salt cedars), and *Iva frutescens* (shrubby sumpweed) are the most common dominants. Other shrubs may include *Triadica sebifera* (Chinese tallow), *Borrichia frutescens* (sea ox-eye daisy), *Rosa bracteata* (Macartney rose), *Forestiera acuminata* (swamp privet), and *Zanthoxylum fagara* (colima), and grasses may include *Spartina spartinae* (Gulf cordgrass), *Distichlis spicata* (saltgrass), *Cynodon dactylon* (bermudagrass), and *Sporobolus indicus* (rat-tail smutgrass).

Native Invasive: Catclaw Shrubland (9166)

MoRAP Code: 9166
Description: Invasive shrublands often dominated by *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), *Acacia constricta* (whitethorn acacia), and/or *Parthenium incanum* (mariola).

Native Invasive: Common Reed (9107)

MoRAP Code: 9107
Description: Areas mapped within this type are often dominated by nearly pure stands of *Phragmites australis* (common reed) on formerly disturbed soils.

Native Invasive: Deciduous – Juniper Woodland (9103)

MoRAP Code: 9103
Description: Woodlands, typically of disturbed sites, sharing dominance between *Juniperus* spp. (junipers) and deciduous species such as *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Sapindus saponaria* var. *drummondii* (western soapberry), *Prosopis glandulosa* (honey mesquite), and the non-native *Ulmus pumila* (Siberian elm).

Native Invasive: Deciduous Shrubland (9126)

MoRAP Code: 9126
Description: A variety of shrubs and generally small or sparse deciduous trees may be important in this successional type that was mapped on non-prairie soils. Important species may include *Celtis laevigata* (sugar hackberry), *Quercus nigra* (water oak), *Prosopis glandulosa* (honey mesquite), *Triadica sebifera* (Chinese tallow, south), *Ilex vomitoria* (yaupon), *Baccharis* sp. (baccharis), *Rubus trivialis* (southern dewberry), *Liquidambar styraciflua* (sweetgum), *Quercus falcata* (southern red oak), *Ulmus alata* (winged elm), or *Ulmus crassifolia* (cedar elm). Small pine trees may be present in young, managed plantations.

Native Invasive: Deciduous Woodland (9104)

MoRAP Code: 9104
Description: This broadly-defined type may have *Celtis laevigata* (sugar hackberry), *Quercus nigra* (water oak), *Ulmus crassifolia* (cedar elm), *Liquidambar styraciflua* (sweetgum), *Ulmus alata* (winged elm), *Ilex vomitoria* (yaupon), *Acacia farnesiana* (huisache), *Fraxinus* spp. (ashes), or *Prosopis glandulosa* (honey mesquite) among the dominants. To the south and west, species such as *Celtis ehrenbergiana* (granjeno), *Zanthoxylum fagara* (colima), and *Diospyros texana* (Texas persimmon) are more common. *Quercus stellata* (post oak), *Quercus virginiana* (coastal live oak), and *Quercus fusiformis* (plateau live oak) may be important. *Juniperus*

virginiana (eastern redcedar) and *Pinus taeda* (loblolly pine) may also be present.

Native Invasive: Huisache Woodland or Shrubland (9124)

MoRAP Code: 9124

Description: This broadly-defined type often has invasive shrubs or small tress such as *Acacia farnesiana* (huisache), *Prosopis glandulosa* (honey mesquite), *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), *Sideroxylon lanuginosum* (gum bumelia), *Quercus nigra* (water oak), or *Triadica sebifera* (Chinese tallow) among the dominants. *Quercus fusiformis* (plateau live oak) or *Quercus virginiana* (coastal live oak) may be present in the tree layer and other common species include *Celtis ehrenbergiana* (granjeno), *Forestiera angustifolia* (elbow bush), *Acacia berlandieri* (guajillo), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), *Diospyros texana* (Texas persimmon), and *Rosa bracteata* (Macartney rose).

Native Invasive: Juniper Shrubland (9105)

MoRAP Code: 9105

Description: Various species of *Juniperus* (juniper) dominate these shrublands. *Juniperus virginiana* (eastern redcedar) is the primary dominant of these shrublands or low woodlands in the Blackland Prairie, Post Oak Savanna, and far northern Crosstimbers ecoregions. To the west, on the Rolling Plains, *Juniperus pinchotii* (redberry juniper) may be the dominant. In other areas, *Juniperus ashei* (Ashe juniper) may dominate these shrublands. Other sites mapped as this type may be dominated by *Ilex vomitoria* (yaupon). A variety of deciduous species may also be present, including *Ulmus crassifolia* (cedar elm), *Ulmus alata* (winged elm), *Celtis laevigata* (sugar hackberry), *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), and *Prosopis glandulosa* (honey mesquite). To the east, sites dominated by young *Pinus taeda* (loblolly pine) may be mapped as this type.

Native Invasive: Mesquite - Creosotebush Shrubland (9186)

MoRAP Code: 9186

Description: Invasive shrublands dominated by *Prosopis glandulosa* (honey mesquite) and/or *Larrea tridentata* (creosotebush). Other species such as *Flourensia cernua* (tarbush), *Parthenium incanum* (mariola), *Acacia constricta* (whitethorn acacia), and *Atriplex canescens* (four-wing saltbush) are commonly encountered.

Native Invasive: Juniper Woodland (9101)

MoRAP Code: 9101

Description: This type may be dominated either by *Juniperus ashei* (Ashe juniper) in the northwest, over Edwards Plateau limestones, or by *Juniperus virginiana* (eastern redcedar) in the northeast and east, or *Juniperus pinchotii* (redberry juniper) to the northwest. *Quercus fusiformis* (plateau live oak) is a common component, and species such as *Celtis laevigata* (sugar hackberry) and *Ulmus crassifolia* (cedar elm) occur throughout. *Quercus stellata* (post oak) and *Ilex vomitoria* (yaupon) are commonly associated with *Juniperus virginiana* (eastern redcedar).

Native Invasive: Mesquite Shrubland (9106)

MoRAP Code: 9106
Description: *Prosopis glandulosa* (honey mesquite) is often the dominant species of this broadly-defined type, but species such as *Acacia farnesiana* (huisache), *Celtis laevigata* (sugar hackberry), *Juniperus ashei* (Ashe juniper), *Ulmus crassifolia* (cedar elm), *Ziziphus obtusifolia* (lotebush), *Mahonia trifoliolata* (agarito), *Ulmus alata* (winged elm), *Rhus* spp. (sumacs), *Condalia hookeri* (brasil), *Diospyros virginiana* (common persimmon), *Diospyros texana* (Texas persimmon), *Celtis ehrenbergiana* (granjeno), and *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear) may also be important. Trees such as *Quercus fusiformis* (plateau live oak), *Quercus virginiana* (coastal live oak), or *Quercus stellata* (post oak) may form a sparse canopy.

Native Invasive: Mesquite Woodland (9114)

MoRAP Code: 9114
Description: Areas where *Prosopis glandulosa* (honey mesquite) has invaded and grown to tree stature to dominate the canopy.

Native Invasive: Pricklypear (9128)

MoRAP Code: 9128
Description: This type is only mapped on disturbed soils and may contain species such as *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Celtis ehrenbergiana* (granjeno), and *Zanthoxylum fagara* (colima) as well as *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear) among the dominants.

Native Invasive: Sand Sagebrush Shrubland (9206)

MoRAP Code: 9206
Description: Shrublands dominated by *Artemisia filifolia* (sand sagebrush), usually in overgrazed and/or fire suppressed prairie soils. This species occupying deep sands would likely be mapped as **Western Great Plains Sandhill Steppe (CES303.671)**.

Native Invasive: Yucca – Succulent Shrubland (9118)

MoRAP Code: 9118
Description: Canopy dominated by shrub or succulent species such as *Yucca glauca* (narrowleaf yucca), *Cylindropuntia imbricata* (tree cholla), or *Opuntia* spp. (pricklypear).

Non-native Invasive: Chinese Tallow Forest, Woodland, and Shrubland (9214)

MoRAP Code: 9214
Description: More or less dense stands of *Triadica sebifera* (Chinese tallow) characterize this type, which is generally mapped over prairie soils, but a diversity of mainly invasive deciduous shrublands and sparse woodlands are circumscribed. Other component species may include *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Baccharis* spp. (baccharis), *Rosa bracteata* (Macartney rose), *Ulmus crassifolia* (cedar elm), *Quercus nigra* (water oak), *Ligustrum sinense* (Chinese privet), and *Ilex vomitoria* (yaupon). Sparse tree cover with *Celtis laevigata* (sugar hackberry), *Quercus nigra* (water oak), *Quercus phellos* (willow oak), *Quercus fusiformis* (plateau live oak), *Quercus virginiana* (coastal live oak), *Pinus taeda* (loblolly pine), and *Liquidambar styraciflua* (sweetgum) may be present.

Non-native Invasive: Elm – Olive Woodland (9224)

MoRAP Code: 9224
Description: This woodland typically occupies sites that do not naturally support woodland, but they may occur in floodplains or riparian sites as well. This type is often found on fence rows, home sites, and shelterbelt plantings typically of the High Plains and Rolling Plains. It is often dominated by *Ulmus pumila* (Siberian elm) and *Elaeagnus angustifolia* (Russian olive), though *Prosopis glandulosa* (honey mesquite) and *Celtis* spp. (hackberries) may also be present.

Non-native Invasive: Rose Shrubland (9205)

MoRAP Code: 9205
Description: *Rosa bracteata* (Macartney rose) is the most common dominant of this type, but a variety of mainly invasive shrub types may occur, including species such as *Acacia farnesiana* (huisache), *Baccharis* spp. (baccharis), *Triadica sebifera* (Chinese tallow), *Celtis laevigata* (sugar hackberry), *Ulmus crassifolia* (cedar elm), and *Ilex vomitoria* (yaupon). Sparse tree cover with species such as *Quercus fusiformis* (plateau live oak), *Quercus virginiana* (coastal live oak), *Quercus nigra* (water oak), *Celtis laevigata* (sugar hackberry), and *Fraxinus pennsylvanica* (green ash) may also occur.

Non-native Invasive: Salt Cedar Shrubland (9204)

MoRAP Code: 9204
Description: Mainly invasive shrublands are characteristic of this type and *Tamarix* spp. (salt cedars) is the most common dominant. Species such as *Iva frutescens* (shrubby sumpweed), *Baccharis* spp. (baccharis), *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Celtis laevigata* (sugar hackberry), and *Borrichia frutescens* (sea ox-eye daisy) may also be present.

Open Water (9600)

MoRAP Code: 9600
Description: In addition to large lakes, rivers, and marine water, ephemeral ponds may be mapped as open water. Some mapped areas may support vegetation with pioneering species such as *Salix nigra* (black willow), *Populus deltoides* (eastern cottonwood), *Triadica sebifera* (Chinese tallow), *Suaeda* spp. (seepweeds), *Borrichia frutescens* (sea ox-eye daisy), *Batis maritima* (saltwort), *Juncus* spp. (rushes), sedges, *Typha* spp. (cattails), and *Eleocharis* spp. (spikerushes).

Pineywoods: Disturbance or Tame Grassland (9197)

MoRAP Code: 9197
Description: This grass dominated vegetation type occurs within a landscape that would naturally be dominated by forest or woodland. Natural occurrences would be short-lived following natural disturbances, such as fire. The predominant cover often consists of non-native grass species such as *Cynodon dactylon* (bermudagrass), *Paspalum notatum* (Bahia grass), *Lolium perenne* (Italian ryegrass), *Schedonorus phoenix* (tall fescue), and/or *Bromus catharticus* (rescuegrass). However, native grasses such as *Schizachyrium scoparium* (little bluestem) and *Andropogon virginicus* (broomsedge bluestem) may also have significant cover. Various forbs and some woody species may also be present. These sites will develop significant woody cover in the absence of active management.

South Texas: Disturbance Grassland (9187)

MoRAP Code: 9187

Description: A variety of mainly heavily grazed grasslands, including managed exotic pastures, are circumscribed within this type. Common dominant species include *Cynodon dactylon* (bermudagrass), *Dichanthium annulatum* (Kleberg bluestem), *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Pennisetum ciliare* (buffelgrass), *Panicum coloratum* (kleingrass), *Aristida* spp. (threeawns), and *Urochloa maximum* (guineagrass). Shrubs and small trees such as *Prosopis glandulosa* (honey mesquite), *Acacia farnesiana* (huisache), *Ziziphus obtusifolia* (lotebush), and *Celtis ehrenbergiana* (granjeno) are common components.

Swamp (or Non-riverine Swamp) (9004)

MoRAP Code: 9004

Description: Typically forested, wet or alternately wet and dry soils at the upper ends of reservoirs, or on stock tanks or ponds. A variety of species, including *Taxodium distichum* (baldcypress), *Ulmus americana* (American elm), *Ulmus crassifolia* (cedar elm), *Salix nigra* (black willow), *Quercus macrocarpa* (bur oak), and *Quercus nigra* (water oak), *Liquidambar styraciflua* (sweetgum), or *Cephalanthus occidentalis* (common buttonbush) may be present.