

Descriptions of Systems, Mapping Subsystems, and Vegetation Types for Phase VI

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20 September 2013

The following descriptions cover the systems that have been identified for the legend for Phase VI 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

Edwards Plateau Limestone Savanna and Woodland

Identifier: CES303.660

Geology: Primarily found on Cretaceous limestones of the Edwards Plateau (including the Callahan Divide) and Limestone (also referred to as Lampasas) Cutplain. This system may also be associated with Pennsylvanian limestones of the Palo Pinto Formation and Winchell, Ranger, Home Creek Limestone in the vicinity of Palo Pinto County (Carbonate Cross Timbers), 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) and north (mixedgrass prairie). Species such as *Quercus fusiformis* (plateau live oak), *Juniperus ashei* (Ashe juniper), and/or *Juniperus pinchotii* (redberry juniper) often dominate the canopy of this system. Other canopy species may include *Quercus buckleyi* (Texas oak), *Ulmus crassifolia* (cedar elm), *Fraxinus texensis* (Texas ash), *Quercus sinuata* var. *breviloba* (white shin oak), *Celtis laevigata* var. *reticulata* (netleaf hackberry), and *Quercus vaseyana* (Vasey shin oak). The shrub layer may be fairly well-developed, containing overstory species, as well as species such as *Prosopis glandulosa* (honey mesquite), *Diospyros texana* (Texas persimmon), *Mahonia trifoliolata* (agarito), *Sideroxylon lanuginosum* (gum bumelia), *Opuntia engelmannii* (Engelmann 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. Understory species can contain various grass species, including *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Bothriochloa barbinodis* (cane bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Nassella leucotricha* (Texas wintergrass), *Hilaria belangeri* (curlmesquite), *Bouteloua dactyloides* (buffalograss), *Bouteloua hirsuta* (hairy grama), *Bouteloua rigidisetata* (Texas grama), *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* (curlmesquite) 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 may be 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 typically dominant in the canopy and is often a conspicuous component of the shrub layer as well. *Juniperus virginiana* (eastern redcedar) may be present in the canopy to the east, while *Juniperus pinchotii* (redberry juniper) may be present to the west. Occurrences containing thick stands of juniper are sometimes referred to as “cedar breaks.” *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), *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) and/or *Juniperus pinchotii* (redberry 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 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. 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* (Engelmann pricklypear), and *Cylindropuntia leptocaulis* (tasajillo), as well as small individuals of the overstory species. The herbaceous layer may be sparse if canopy 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 often 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), *Juniperus pinchotii* (redberry juniper) and/or *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 stellata* (post 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), *Prosopis glandulosa* (honey mesquite), and *Opuntia engelmannii* (Engelmann pricklypear), 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 *Ulmus crassifolia* (cedar elm), *Celtis* sp. (hackberry), and *Quercus buckleyi* (Texas oak) 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), *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), *Juniperus pinchotii* (redberry juniper) 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: 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 western transitions to shortgrass prairie and northern transitions to mixedgrass prairie), may closely resemble and be difficult to distinguish from these prairie types. *Schizachyrium scoparium* (little bluestem), *Aristida*

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 *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Bouteloua hirsuta* var. *pectinata* (tall grama), *B. trifida* (red grama), *B. rigidiseta* (Texas grama), *Bouteloua hirsuta* (hairy grama), *Erioneuron pilosum* (fluffgrass), *Hilaria belangeri* (curly mesquite), and many others may be present or dominate these sites. 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), and/or *Ziziphus obtusifolia* (lotebush).

Edwards Plateau Dry-Mesic Slope Forest and Woodland

Identifier: CES303.656

Geology: Found on limestone (primarily Cretaceous 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. Other substrates where the system may be found include cuestas of cretaceous chalk in the Blackland Prairie and calcareous slopes of the Crosstimbers.

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 are often 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 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), *Quercus buckleyi* (Texas oak), and/or *Celtis laevigata* var. *reticulata* (netleaf hackberry). *Quercus fusiformis* (plateau live oak), *Juniperus pinchotii* (redberry juniper), and/or *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 *Cercis canadensis* var. *texensis* (Texas redbud), *Forestiera pubescens* (elbowbush), *Ungnadia speciosa* (Mexican buckeye), *Ceanothus herbaceus* (Jersey tea), *Frangula caroliniana* (Carolina buckthorn), *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. Other herbaceous species such as *Schizachyrium scoparium* (little bluestem), *Bouteloua* spp. (gramas), *Tinantia anomala* (widowsteers), *Nemophila phacelioides* (baby blue-eyes), *Salvia roemeriana* (cedar sage), *Lespedeza texana* (Texas lespedeza), and various ferns may also be present, if 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) or *Juniperus pinchotii* (redberry juniper), but often with *Quercus fusiformis* (plateau live oak) and a deciduous component present (often *Quercus buckleyi* (Texas oak) or *Quercus sinuata* var. *breviloba* (white shin oak)). 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) or *Juniperus pinchotii* (redberry juniper) may also form a somewhat dense layer to within a meter of the forest floor. *Diospyros texana* (Texas persimmon), *Mahonia trifoliolata* (agarito), *Mimosa borealis* (fragrant mimosa), *Quercus sinuata* var. *breviloba* (white shin oak), *Viburnum rufidulum* (rusty blackhaw), 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) or *Juniperus pinchotii* (redberry juniper) are 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), *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 *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 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 laevigata* var. *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 *Forestiera pubescens* (elbowbush), *Ungnadia speciosa* (Mexican buckeye), *Diospyros texana* (Texas persimmon), *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 **MoRAP Code:** 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 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 or on Pennsylvanian limestone of the Carbonate Cross Timbers. 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 *Cercis canadensis* var. *texensis* (Texas redbud), *Cornus drummondii* (roughleaf 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, herbaceous species such as *Schizachyrium scoparium* (little bluestem), *Carex planostachys* (cedar sedge), *Bouteloua* spp. (gramas), *Tinantia anomala* (widowstears), *Nemophila phacelioides* (baby blue-eyes), *Salvia roemeriana* (cedar sage), *Lespedeza texana* (Texas lespedeza), and various ferns may be present, if patchy.

Crosstimbers Oak Forest and Woodland

Identifier: CES205.682

Geology: In Phase 6, the system occurs on various sedimentary types of Pennsylvanian formations. Some occur on more rugged, rocky and gravelly sites.

Landform: Gently rolling, moderately dissected uplands, and irregular plains becoming more rugged in the western portions of the distribution of this system, as represented in Phase 6.

Soils: Sands, sandy loams, clay loams, claypans, and rocky hill soils support occurrences of this system. Ecological Sites typical of the expressions of the system include Sandy Loam, Tight Sandy Loam, Claypan Prairie, Clay Loam, Sandy, and Rocky Hill.

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. Other species in the canopy may include *Ulmus crassifolia* (cedar elm), *Quercus fusiformis* (plateau live oak), *Celtis laevigata* (sugar hackberry), *Juniperus ashei* (Ashe juniper), 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), *Nassella leucotricha* (Texas wintergrass), *Paspalum setaceum* (fringeleaf paspalum), *Sporobolus compositus* (tall dropseed), *Bouteloua curtipendula* (sideoats grama), *Bouteloua hirsuta* (hairy grama), *Bouteloua rigidisetata* (Texas grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Aristida* spp. (threeawn). Non-native species such as *Bromus catharticus* (rescuegrass), *Bromus arvensis* (Japanese brome), *Bromus tectorum* (cheatgrass), *Cynodon dactylon* (bermudagrass) and *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) sometimes 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), *Prosopis glandulosa* (honey mesquite), *Rhus trilobata* (skunkbush sumac), *Crataegus* spp. (hawthorn), *Zanthoxylum hirsutum* (tickle-tongue), *Rhus glabra* (smooth sumac), and *Sideroxylon lanuginosum* (gum bumelia). Sites dominated by *Prosopis glandulosa* (mesquite), sometimes with *Ziziphus obtusifolia* (lotebush) as a common shrub component, may be frequently encountered. 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.

Occurrences in Phase 6 occur in the Western Crosstimbers, which 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 (east of Phase 6) 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 in the southern portions of the Western Crosstimbers, often occurring on calcareous substrates. The 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 are co-dominated by juniper species (*Juniperus virginiana* (eastern redcedar) and/or *Juniperus ashei* (Ashe juniper)) and are thought to result from anthropogenic disturbances or disruption in the fire regime. *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) are typically co-dominants in the canopy. The dense canopy cover by cedars often results in limited light penetration and a consequent reduction in herbaceous cover. Some areas over limestone substrate that are mapped as this type may be dominated by *Quercus fusiformis* (plateau live oak), and *Juniperus ashei* (Ashe juniper), and *Prosopis glandulosa* (honey mesquite). *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 *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak), with other canopy species such as *Celtis laevigata* var. *reticulata* (netleaf hackberry), *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 and occur in the canopy as well as the shrub layer. Other shrub species that may be encountered include *Sideroxylon lanuginosum* (gum bumelia), *Rhus trilobata* (skunkbush sumac), and *Zanthoxylum hirsutum* (tickle-tongue). Grass species, including *Schizachyrium scoparium* (little bluestem), *Nassella leucotricha* (Texas wintergrass), *Bouteloua curtipendula* (sideoats grama), and *Bothriochloa laguroides* ssp. *torreyana* (silver 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 dependent on appropriate land management (such as prescribed fire and/or brush control) that ensures reduced woody cover. Woody canopy typically 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 to dominant include *Nassella leucotricha* (Texas wintergrass), *Schizachyrium scoparium* (little bluestem), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), *Paspalum setaceum* (fringeleaf paspalum), *Sporobolus compositus* (tall dropseed), *Bouteloua curtipendula* (sideoats grama), *Bouteloua hirsuta* (hairy grama), *Bouteloua rigidisetata* (Texas grama), 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 sometimes significant components. It may be difficult to distinguish occurrences of this vegetation type from occurrences of **Central Mixedgrass Prairie (CES303.659)**. *Prosopis glandulosa* (honey mesquite) is a common shrub in this type, and some areas have fairly dense mesquite cover.

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 virginiana* (eastern redcedar), or *J. ashei* (Ashe juniper), depending on the site). On some mesic slopes on limestones or chinks, *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 in 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 marilandica* (blackjack oak), and *Quercus muehlenbergii* (chinkapin oak). *Ulmus crassifolia* (cedar elm), *Sideroxylon lanuginosum* (gum bumelia), and/or *Celtis laevigata* var. *reticulata* (netleaf hackberry) may also be

common in the canopy. These slopes are frequently associated with the Sandstone Hill, Boulderly Hill, or Rocky Hill ecoclasses. Evergreen species such as *Quercus fusiformis* (plateau live oak) and *Juniperus* sp. (juniper) may be present, but relatively minor components. On some calcareous slopes in the northern part of the Crosstimbers, *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:** 524

Description: This vegetation type represents system occurrences that occupy particularly sandy sites (typically Deep Sand and Sand Hill ecoclasses), often associated with 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. *Carya texana* (black hickory), *Ulmus crassifolia* (cedar elm), and *Celtis laevigata* (sugar hackberry) may be well-represented in the overstory.

Riparian and Wetland Systems

Edwards Plateau Floodplain Terrace

Identifier: CES303.651

Geology: This system usually occupies Quaternary alluvial deposits often within drainages largely underlain by limestones or other calcareous substrates.

Landform: Valley floors of large rivers and perennial streams. This system tends to occupy broad valley bottoms with deep alluvial deposits.

Soils: Bottomland soils of various types (Loamy, Clayey, and Sandy) of drainages of the Leon, Concho, Colorado, and San Saba Rivers.

Description: These are forests and woodlands with a canopy dominated or co-dominated by *Carya illinoensis* (pecan), *Ulmus crassifolia* (cedar elm), *Ulmus americana* (American elm), *Celtis laevigata* (sugar hackberry), *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Sapindus saponaria* var. *drummondii* (western soapberry), and/or *Quercus fusiformis* (plateau live oak). *Carya illinoensis* (pecan) may be more likely to occur in deeper and better-developed alluvial soils. Apparent dominance of *Carya illinoensis* (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), *Juniperus pinchotii* (redberry juniper), *Prosopis glandulosa* (mesquite), *Sideroxylon lanuginosum* (gum bumelia), and *Platanus occidentalis* (American sycamore). *Quercus stellata* (post oak) may be dominant on sandy soils within the floodplain. Woody species in the subcanopy may include *Prosopis glandulosa* (honey mesquite), *Ziziphus obtusifolia* (lotebush), *Ptelea trifoliata* (wafer-ash), *Sideroxylon lanuginosum* (gum bumelia), *Cornus drummondii* (roughleaf dogwood), *Morus rubra* (red mulberry), *Diospyros texana* (Texas persimmon), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis* spp. (grape), *Toxicodendron radicans* (poison ivy), *Smilax bona-nox* (greenbrier), *Baccharis neglecta* (roosevelt-weed), *Juniperus ashei* (Ashe juniper), *Juniperus pinchotii* (redberry juniper), and *Ilex decidua* (possumhaw). The herbaceous layer may be continuous, though relatively sparse, or patchy with species such as *Elymus virginicus* (Virginia wildrye), *Elymus canadensis* (Canada wildrye), *Chasmanthium latifolium* (creekoats), *Nassella leucotricha* (Texas wintergrass), *Panicum virgatum* (switchgrass), *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* (honey mesquite), *Sapindus saponaria* var. *drummondii* (western soapberry), *Juglans microcarpa* (little walnut), *Ziziphus obtusifolia* (lotebush), *Mahonia trifoliolata* (agarito), *Sideroxylon lanuginosum* (gum bumelia), and *Cephalanthus occidentalis* (common buttonbush). Grassland sites are frequently dominated by the non-native species *Cynodon dactylon* (bermudagrass), *Bromus catharticus* (rescuegrass), 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),

Pleuraphis mutica (tobosa), *Andropogon glomeratus* (bushy bluestem), *Elymus virginicus* (Virginia wildrye), *Nassella leucotricha* (Texas wintergrass), *Hordeum pusillum* (little barley), *Tripsacum dactyloides* (eastern gamagrass), *Tridens albescens* (white tridens), *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), *Brickellia* spp. (brickellbush), and *Panicum virgatum* (switchgrass) are frequently encountered.

VEGETATION TYPES:

Edwards Plateau: Floodplain Barrens (1000)

Edwards Plateau Floodplain Sparsely Vegetated

Identifier: CES303.651.0 **MoRAP Code:** 1000

Description: Areas along and within floodplains lacking significant vegetative cover. These may be sand, mud, or gravel flats, but may also be mapped in areas of disturbance where vegetation cover is lacking.

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 are frequently common in the canopy, but *Q. fusiformis* 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. *Juniperus ashei* (Ashe juniper) and/or *Juniperus pinchotii* (redberry juniper) may constitute the evergreen component and *Quercus fusiformis* (plateau live oak) may also contribute to that component.

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) and/or *Juniperus pinchotii* (redberry 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), *Sapindus saponaria* var. *drummondii* (western soapberry), *Ziziphus obtusifolia* (lotebush), *Sideroxylon lanuginosum* (gum bumelia), *Juglans microcarpa* (little walnut), *Mahonia trifoliolata* (agarito), *Salix nigra* (black willow), and *Cephalanthus occidentalis* (common buttonbush). *Prosopis glandulosa* (honey mesquite) dominated shrubland is the most common representation of this type. *Ulmus crassifolia* (cedar elm), *Quercus fusiformis* (plateau live oak), *Sapindus saponaria* var. *drummondii* (western soapberry), and/or *Celtis laevigata* var. *reticulata* (netleaf 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), *Bromus catharticus* (rescuegrass) 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), *Pleuraphis mutica* (tobosa), *Nassella leucotricha* (Texas wintergrass), *Hordeum pusillum* (little barley), *Tripsacum dactyloides* (eastern gamagrass), *Chasmanthium latifolium* (creekoats), *Chloracantha spinosa* (spiny aster), *Carex* spp. (carices), and *Eleocharis* spp. (spikerushes). Scattered *Prosopis glandulosa* (mesquite), *Quercus fusiformis* (plateau live oak), 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 along floodplain margins and pools where species such as *Carex* spp. (carices), *Eleocharis* spp. (spikerushes), *Typha* spp. (cattails), *Schoenoplectus* spp. (bulrushes), and *Justicia americana* (American water-willow) may be commonly encountered.

Edwards Plateau Riparian

Identifier: CES303.652

Geology: This system along headwater streams and soils are generally similar to adjacent uplands, and have often developed over limestone or other calcareous substrates. The limestones are typically of Cretaceous or Pennsylvanian age.

Landform: As mapped here, riparian systems occur along intermittent streams. 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 and therefore occurs on soil types of the surrounding uplands in the drainages of the Leon, Concho, Colorado, and San Saba Rivers.

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), *Ulmus crassifolia* (cedar elm), *Sapindus saponaria* var. *drummondii* (western soapberry), *Platanus occidentalis* (American sycamore), *Fraxinus pennsylvanica* (green ash), *Fraxinus texensis* (Texas ash), *Celtis laevigata* (sugar hackberry) (including var. *reticulata*), *Acer negundo* (boxelder), *Prosopis glandulosa* (mesquite), *Juniperus ashei* (Ashe juniper), *Juniperus pinchotii* (redberry juniper), and/or *Salix nigra* (black willow). 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 *Prosopis glandulosa* (honey mesquite), *Ziziphus obtusifolia* (lotebush), *Juglans microcarpa* (little walnut), *Chilopsis linearis* (desert willow) in the western part of the Edwards Plateau, *Baccharis* spp. (false-willow), *Salix nigra* (black willow), *Juniperus ashei* (Ashe juniper), *Juniperus pinchotii* (redberry juniper), *Sapindus saponaria* var. *drummondii* (western soapberry), *Cornus drummondii* (roughleaf dogwood), *Sideroxylon lanuginosum* (gum bumelia), *Diospyros texana* (Texas persimmon), *Ungnadia speciosa* (Mexican buckeye), *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), *Tripsacum dactyloides* (eastern gamagrass), *Bouteloua curtipendula* (sideoats grama), *Nassella leucotricha* (Texas wintergrass), *Eleocharis* spp. (spikerush), *Brickellia* spp. (brickellbush), *Justicia americana* (American water-willow), *Salvia farinacea* (mealycup sage), *Verbesina encelioides* (cowpen daisy), and/or *Aristida* spp. (threeawns). Frequently, *Cynodon dactylon* (bermudagrass), *Bromus catharticus* (rescuegrass), *Bromus arvensis* (Japanese brome), and/or *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) dominate these grassland sites. *Sorghum halepense* (Johnsongrass) is also a commonly encountered non-native grass. This system includes vegetation along very small streams, reaching upstream to spring heads and runs. Mapped occurrences of this system may closely resemble the vegetation of the surrounding uplands where drainages merge into these uplands.

VEGETATION TYPES:

Edwards Plateau: Riparian Barrens (1400)

Edwards Plateau Riparian Sparsely Vegetated

Identifier: CES303.652.0 **MoRAP Code:** 1400

Description: Areas along upland drainages that lack significant vegetative cover. These may be gravel, mud, or sand bars, bare rock or disturbed sites where vegetative cover is lacking.

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) and/or *Juniperus pinchotii* (redberry juniper). Otherwise, this type fits 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 and Woodland

Identifier: CES303.652.4 **MoRAP Code:** 1403

Description: Forest or woodland on riparian sites co-dominated by evergreen species (*Juniperus ashei* (Ashe juniper), *Juniperus pinchotii* (redberry 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) and/or *Juniperus pinchotii* (redberry 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. *Prosopis glandulosa* (honey mesquite) and *Ziziphus obtusifolia* (lotebush) are commonly the dominants.

Edwards Plateau: Riparian Herbaceous Vegetation (1407)

Identifier: CES303.652.9 **MoRAP Code:** 1407

Description: Riparian sites dominated by herbaceous vegetation as described in the system description.

Edwards Plateau: Riparian Herbaceous Wetland (1417)

Identifier: CES303.652.10 **MoRAP Code:** 1417

Description: Wetlands found along upland drainages, often with species such as *Carex* spp. (carices), *Eleocharis* spp. (spikerushes), *Schoenoplectus* spp. (bulrushes), and *Typha* spp. (cattails).

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, clays, 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. 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 **MoRAP Code:** 1507

Description: As described for system.

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 in drainages of the Little Wichita, Upper Trinity and middle reaches of the Brazos River.

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 illinoensis* (pecan), *Fraxinus pennsylvanica* (green ash), *Ulmus crassifolia* (cedar elm), *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Ulmus americana* (American elm), *Quercus fusiformis* (plateau live oak), *Quercus stellata* (post oak), *Platanus occidentalis* (American sycamore), *Acer negundo* (boxelder), *Quercus macrocarpa* (bur oak), *Morus rubra* (red mulberry), and *Sapindus saponaria* var. *drummondii* (western soapberry). Overgrazing and/or overbrowsing may influence recruitment of overstory species and composition of the understory and herbaceous layers. Shrub species may include *Prosopis glandulosa* (honey mesquite), *Callicarpa americana* (American beautyberry), *Ilex decidua* (possumhaw), *Sideroxylon lanuginosum* (gum bumelia), *Diospyros virginiana* (eastern persimmon), *Juniperus virginiana* (eastern redcedar), *Juniperus ashei* (Ashe juniper), *Cornus drummondii* (roughleaf dogwood), *Salix nigra* (black willow), *Smilax bona-nox* (greenbrier), *Ephedra antisiphilitica* (joint-fir), *Ziziphus obtusifolia* (lotebush), and *Viburnum rufidulum* (rusty blackhaw), which may occur as dense patches following disturbance, but are otherwise generally fairly sparse. Herbaceous cover includes *Elymus virginicus* (Virginia wildrye), *Elymus canadensis* (Canada wildrye), *Verbesina virginica* (frostweed), *Chasmanthium latifolium* (inland sea-oats), *Chasmanthium sessiliflorum* (narrowleaf woodoats), *Tripsacum dactyloides* (eastern gamagrass), *Panicum virgatum* (switchgrass), *Nassella leucotricha* (Texas wintergrass), *Hordeum pusillum* (little barley), *Galium* spp. (bedstraw), and *Carex* spp. (caric sedge). Non-native grasses that may be conspicuous at these sites include *Cynodon dactylon* (bermudagrass), *Bromus arvensis* (Japanese brome), and *Sorghum halepense* (Johnsongrass). Herbaceous cover may be quite high, especially in situations where shrub cover is low. Some drainages may have significant effects of salinity, sometimes from runoff from nearby gyp-rich geologic formations and sometimes from runoff from anthropogenic influences. These drainages may be dominated by species like *Atriplex canescens* (four-wing saltbush), *Tamarix* spp. (saltcedars), *Sporobolus airoides* (alkali sacaton), and *Distichlis spicata* (saltgrass).

VEGETATION TYPES:

Central Texas: Floodplain Evergreen Forest (1801)

Southeastern Great Plains Floodplain Juniper Forest and Woodland

Identifier: CES205.710.1

MoRAP Code: 1801

Description: As described for the system, but the canopy is dominated by *Juniper* spp. (juniper), usually *Juniperus virginiana* (eastern redcedar) but *Juniperus ashei* (Ashe juniper) and *Juniperus pinchotii* (redberry juniper) may also be present. This vegetation type is a very minor component of the system as it is mapped in Phase 6.

Central Texas: Floodplain Hardwood - Evergreen Forest (1803)

Southeastern Great Plains Floodplain Mixed Deciduous – Evergreen Forest and Woodland

Identifier: CES205.710.4

MoRAP Code: 1803

Description: As described for the system with a mix of evergreen and deciduous species in the canopy.

Central Texas: Floodplain Hardwood Forest (1804)

Southeastern Great Plains Floodplain Deciduous Forest and Woodland

Identifier: CES205.710.6 **MoRAP Code:** 1804

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: CES205.710.7 **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. This is a very minor component of the system as it is mapped in Phase 6.

Central Texas: Floodplain Deciduous Shrubland (1806)

Southeastern Great Plains Floodplain Deciduous Shrubland

Identifier: CES205.710.8 **MoRAP Code:** 1806

Description: Shrublands of the floodplains of the region that are dominated by deciduous shrubs such as *Prosopis glandulosa* (mesquite), *Ziziphus obtusifolia* (lotebush), *Salix nigra* (black willow), *Sapindus saponaria* var. *drummondii* (western soapberry), *Sideroxylon lanuginosum* (gum bumelia), *Cornus drummondii* (roughleaf dogwood), and/or *Cephalanthus occidentalis* (common buttonbush). Some areas influenced by salinity may be dominated by *Atriplex canescens* (four-wing saltbush).

Central Texas: Floodplain Herbaceous Vegetation (1807)

Southeastern Great Plains Floodplain Herbaceous Vegetation

Identifier: CES205.710.9 **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 *Bromus arvensis* (Japanese brome), *Bromus tectorum* (cheatgrass), *Bromus catharticus* (rescuegrass), *Cynodon dactylon* (bermudagrass), and *Sorghum halepense* (Johnsongrass) may frequently dominate this vegetation type. Some drainages may have significant effects of salinity, sometimes from runoff from nearby gyp-rich geologic formations and sometimes from runoff from anthropogenic influences. These saline drainages may have substantial cover of *Sporobolus airoides* (alkali sacaton), *Distichlis spicata* (saltgrass), and *Sporobolus pyramidatus* (whorled dropseed).

Central Texas: Floodplain Herbaceous Wetland (1817)

Southeastern Great Plains Floodplain Herbaceous Wetland

Identifier: CES205.710.10 **MoRAP Code:** 1817

Description: Herbaceous wetlands along floodplains with species such as *Carex* spp. (carices), *Eleocharis* spp. (spikerushes), *Paspalidium geminatum* (Egyptian Paspalidium), *Schoenoplectus* spp. (bulrushes), and *Typha* spp. (cattails).

Southeastern Great Plains Riparian Forest

Identifier: CES206.709

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 drainages of the Little Wichita, Upper Trinity and middle reaches of the Brazos River. Typically in areas with erosional processes dominating over alluvial deposition.

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* var. *reticulata* (netleaf hackberry), *Ulmus crassifolia* (cedar elm), *Platanus occidentalis* (American sycamore), *Quercus stellata* (post oak), *Populus deltoides* (eastern cottonwood), *Juglans major* (Arizona walnut), *Quercus fusiformis* (plateau live oak), *Sapindus saponaria* var. *drummondii* (western soapberry), *Salix nigra* (black willow), *Maclura pomifera* (osage orange), *Gleditsia triacanthos* (common honeylocust), and *Carya illinoensis* (pecan). The shrub layer development is variable, sometimes with species such as those of the canopy or *Prosopis glandulosa* (honey mesquite), *Forestiera pubescens* (elbow-bush), *Ilex decidua* (possumhaw), *Sideroxylon lanuginosum* (gum bumelia), *Juniperus virginiana* (eastern redcedar), *Juniperus ashei* (Ashe juniper), *Diospyros virginiana* (eastern persimmon), *Cornus drummondii* (roughleaf dogwood), *Prunus angustifolia* (Chickasaw plum), *Smilax bona-nox* (greenbrier), and/or *Viburnum rufidulum* (rusty blackhaw). Herbaceous cover is also variable, depending on overstory and shrub canopies and recent flooding history. Herbaceous species may include *Elymus virginicus* (Virginia wildrye), *Elymus canadensis* (Canada wildrye), *Nassella leucotricha* (Texas wintergrass), *Verbesina virginica* (frostweed), *Chasmanthium latifolium* (inland sea-oats), *Schizachyrium scoparium* (little bluestem), *Panicum virgatum* (switchgrass), *Galium* spp. (bedstraw), and *Carex* spp. (caric sedge). Non-native grass species that may be common to dominant on these sites include *Cynodon dactylon* (bermudagrass) and *Sorghum halepense* (Johnsongrass). Occurrences of this system often resemble vegetation of the surrounding uplands, especially at the extreme headwaters of these small drainages.

VEGETATION TYPES:

Central Texas: Riparian Juniper Forest (1901)

Southeastern Great Plains Riparian Juniper Forest and Woodland

Identifier: CES206.709.1

MoRAP Code: 1901

Description: As described for the system, with *Juniperus* spp. (juniper) dominating the canopy. *Juniperus virginiana* (eastern redcedar) is the typical dominant, but *Juniperus ashei* (Ashe juniper) may dominate locally. However, this is a minor component of the system.

Central Texas: Riparian Hardwood - Evergreen Forest (1903)

Southeastern Great Plains Riparian Mixed Deciduous – Evergreen Forest and Woodland

Identifier: CES206.709.4

MoRAP Code: 1903

Description: As described for the system, with a mix of evergreen species (including *Juniperus spp.* (junipers) and/or *Quercus fusiformis* (plateau live oak)) and deciduous species in the canopy.

Central Texas: Riparian Hardwood Forest (1904)

Southeastern Great Plains Riparian Hardwood Forest and Woodland

Identifier: CES206.709.6 **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: CES206.709.7 **MoRAP Code:** 1905

Description: Shrublands in riparian sites that are dominated by *Juniperus spp.* (juniper). The juniper is usually *Juniperus virginiana* (eastern redcedar), but may be *Juniperus ashei* (Ashe juniper) or *Juniperus pinchotii* (redberry juniper) in some areas. This is a minor component of the system.

Central Texas: Riparian Deciduous Shrubland (1906)

Southeastern Great Plains Riparian Deciduous Shrubland

Identifier: CES206.709.8 **MoRAP Code:** 1906

Description: Shrublands in riparian sites dominated by deciduous shrubs such as *Prosopis glandulosa* (mesquite), *Ziziphus obtusifolia* (lotebush), *Prunus angustifolia* (Chickasaw plum), *Salix nigra* (black willow), *Cornus drummondii* (roughleaf dogwood), and/or *Cephalanthus occidentalis* (common buttonbush).

Central Texas: Riparian Herbaceous Vegetation (1907)

Southeastern Great Plains Riparian Herbaceous Vegetation

Identifier: CES206.709.9 **MoRAP Code:** 1907

Description: Riparian sites lacking overstory or shrub canopy but retaining herbaceous cover. Composition of occurrences of this type may resemble that of surrounding uplands.

Central Texas: Riparian Herbaceous Wetland (1917)

Southeastern Great Plains Riparian Herbaceous Wetland

Identifier: CES206.709.10 **MoRAP Code:** 1917

Description: Marshes and other herbaceous wetlands occurring along small drainages of the region.

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 6, this system is found within

the upper Brazos River (and its forks), Wichita River, Pease River, and upper Red River 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. *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. In Phase 6, *Juniperus ashei* (Ashe juniper) and/or *Juniperus pinchotii* (redberry juniper) may be present to dominant. Sites lacking significant woody cover may be dominated by species such as *Pleuraphis mutica* (tobosa), *Nassella leucotricha* (Texas wintergrass), *Panicum virgatum* (switchgrass), *Elymus canadensis* (Canada wildrye), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Panicum obtusum* (vine mesquite). Non-native species such as *Cynodon dactylon* (bermudagrass), *Sorghum halepense* (Johnsongrass), *Bromus arvensis* (Japanese brome), *Bromus catharticus* (rescuegrass), and *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) may be conspicuous components to dominant. Some sites may be dominated by tallgrass species such as *Andropogon gerardii* (big bluestem) and *Panicum virgatum* (switchgrass). Especially on saline sites such as along the Salt Fork of the Brazos River, North Croton Creek, Little Croton Creek, and portions of the Red River, *Tamarix* spp. (saltcedar) may form extensive shrublands and herbaceous species such as *Sporobolus airoides* (alkali sacaton) and *Distichlis spicata* (saltgrass) may form grasslands or be conspicuous in the understory. Marshes along the floodplain are typically mapped as **Western Great Plains Open Freshwater Depression Wetland (CES303.675)**. 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 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 Herbaceous Vegetation (2507)

Western Great Plains Floodplain Herbaceous Vegetation

Identifier: CES303.678.9

MoRAP Code: 2507

Description: This herbaceous vegetation may be dominated by species such as *Pleuraphis mutica* (tobosa), *Nassella leucotricha* (Texas wintergrass), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Panicum obtusum* (vine mesquite). Non-native species such as *Cynodon dactylon* (bermudagrass), *Sorghum halepense* (Johnsongrass), *Bromus arvensis* (Japanese brome), and *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem) may be conspicuous components. 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. Sites with high salinity may be dominated by *Sporobolus airoides* (alkali sacaton) and *Distichlis spicata* (saltgrass).

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.

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 upper Brazos River and its forks, Wichita River, Pease River, and upper Red River watersheds.

Soils: As this system is mapped, it by definition occurs outside of areas mapped as bottomland soils. Soils are therefore mapped as units 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), *Sapindus saponaria* var. *drummondii* (western soapberry), *Juniperus ashei* (Ashe juniper), and *Juniperus pinchotii* (redberry juniper). *Prosopis glandulosa* (honey mesquite) may form an important part of the canopy or shrub layer. 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)**.

VEGETATION TYPES:

High Plains: Riparian Barrens (2700)

Western Great Plains Riparian Barrens

Identifier: CES303.678.0

MoRAP Code: 2700

Description: Areas along drainages lacking significant vegetative cover. These sites may be mud, sand, or gravel bars, bare rock, or sites of recent disturbance.

High Plains: Riparian Hardwood Forest (2704)

Western Great Plains 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 Herbaceous Vegetation (2707)

Western Great Plains Herbaceous Vegetation

Identifier: CES303.956.9 **MoRAP Code:** 2707

Description: Typically grasslands as described for the system.

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.

High Plains: Mesquite Shrubland (5406)

Western Great Plains Mesquite Shrubland

Identifier: CES303.668.1 **MoRAP Code:** 5406

Description: As described for the system.

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 *Symphytotrichum 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), *Sagittaria* (arrowhead), and *Schoenoplectus* (bulrushes), as well as floating genera such as *Potamogeton* (pondweed) 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.

Western Great Plains Saline Depression Wetland

Identifier: CES303.669

Geology: This system may occur on various substrates, but some of the better developed representatives are associated with alkaline springs where evaporation has concentrated salinity.

Landform: Typically depression wetlands, sometimes associated with alkaline springs.

Soils: Soils of high salinity, sometimes explicitly identified as salt lake, but may be within the Gyp or High Lime ecoclasses.

Description: This system occurs around lakes and other depressions where soil salinity is high, sometimes as a result of association with alkaline springs or resulting from evaporation of runoff from surrounding landscapes that provide a source of salinity. Areas of these salt lakes may be unvegetated and salt encrusted, giving rise to extensive salt flats. Where vegetation does occur, it is often herbaceous or of low shrubs, though extensive tall shrublands of *Tamarix* spp. (saltcedar) may occur. Salt-tolerant herbaceous species may sometimes form extensive grasslands of species such as *Sporobolus airoides* (alkali sacaton), *Distichlis spicata* (saltgrass), and *Hordeum jubatum* (foxtail barley), though these species and other salt tolerant taxa may be patchy or of low cover. Shrublands may also develop with species such as *Atriplex* spp. (saltbush), *Tamarix* spp. (saltcedar), and *Prosopis glandulosa* (honey mesquite). In situation where inundation is consistent, salt tolerant species of *Schoenoplectus* (bulrushes) may form marshes.

VEGETATION TYPES:

High Plains: Salt Flat (3910)

Western Great Plains Saline Depression Flats

Identifier: CES303.669.0 **MoRAP Code:** 3910

Description: This type represents sparsely vegetated, often salt encrusted areas at the margins of saline lakes.

High Plains: Salt Lake (3900)

Western Great Plains Saline Lake

Identifier: CES303.669.1 **MoRAP Code:** 3900

Description: Open water associated with saline lakes.

High Plains: Salt Lake Shrubland (3906)

Western Great Plains Saline Depression Shrubland

Identifier: CES303.669.2 **MoRAP Code:** 3906

Description: Deciduous shrubland dominated by salt-tolerant shrubs species such as *Atriplex* spp. (saltbush). *Prosopis glandulosa* (honey mesquite) may also be a common component of this shrubland type.

High Plains: Alkali Sacaton Grassland (3907)

Western Great Plains Saline Depression Grassland

Identifier: CES303.669.3 **MoRAP Code:** 3907

Description: Grasslands in the vicinity of saline lakes typically dominated by such species as *Sporobolus airoides* (alkali sacaton) and *Distichlis spicata* (saltgrass). These grasslands may also occupy the margins of drainages where salinity is high.

High Plains: Salt Marsh (3908)

Western Great Plains Saline Depression Wetland

Identifier: CES303.669.4

MoRAP Code: 3908

Description: Herbaceous wetlands dominated by salt-tolerant species including *Schoenoplectus* spp. (bulrushes).

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 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 drainage ways, 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), *Dasyilirion 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, or rocky stretches of desert drainages.

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), *Pleuraphis mutica* (tobosa), and/or *Bouteloua eriopoda* (black grama).

Shrublands

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 mohriana* (Mohr's shin oak), *Quercus fusiformis* (plateau live oak), *Juniperus pinchotii* (redberry juniper), and/or *Juniperus ashei* (Ashe juniper) may be important components of the system. 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), *Mahonia trifoliolata* (agarito), *Ziziphus obtusifolia* (lotebush), *Cercis canadensis* var. *texensis* (Texas redbud), *Forestiera pubescens* (elbowbush), *Forestiera reticulata* (netleaf forestiera), *Ungnadia speciosa* (Mexican buckeye), *Diospyros texana* (Texas persimmon), *Salvia ballotiflora* (mejorana), *Mimosa borealis* (fragrant mimosa), *Condalia hookeri* (brasil), *Mimosa borealis* (fragrant mimosa), *Opuntia engelmannii* var. *lindheimeri* (Lindheimer pricklypear), and *Rhus trilobata* (skunkbush sumac). 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. To the west, species such as *Condalia ericoides* (javelina bush) and *Rhus microphylla* (littleleaf sumac) become more conspicuous. *Prosopis glandulosa* (honey mesquite) may dominate some sites. Herbaceous cover may be patchy and is generally graminoid with species including *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Bouteloua rigidisetata* (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. Arid western occurrences of the system may have significant patches of these grasslands. Disturbances such as fire may be important processes maintaining this system. However, it appears to persist on thin-soiled sites. In the western portions of the Edwards Plateau, more xeric conditions lead to the slow succession of sites to woodlands resulting in long-persisting shrublands. Particularly in the arid portions of the Edwards Plateau, *Juniperus pinchotii* (redberry juniper) becomes the more common dominant coniferous shrub (as opposed to *Juniperus ashei* (Ashe juniper)).

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. To the west, *Juniperus pinchotii* (redberry juniper) becomes increasingly common. If other species are present, *Quercus fusiformis* (plateau live oak), *Quercus vaseyana* (Vasey shin oak), *Quercus mohriana* (Mohr's shin oak), *Mahonia trifoliolata* (agarito), and/or *Rhus virens* (evergreen sumac) may 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), *Ziziphus obtusifolia* (lotebush), *Quercus sinuata* var. *breviloba* (white shin oak), *Acacia roemeriana* (Roemer's acacia), and *Forestiera* spp. (elbowbush) may also be present but never dominant. To the west 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), *Juniperus pinchotii* (redberry juniper), *Quercus fusiformis* (plateau live oak), *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. Some areas currently mapped as **Native Invasive: Juniper Shrubland (9105)** (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 (9105)** 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.

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.

Edwards Plateau: Juniper Semi-arid Shrubland (1235)

Edwards Plateau Limestone Evergreen Semi-arid Shrubland

Identifier: CES303.041.27

MoRAP Code: 1235

Description: Coniferous evergreen shrublands on the more arid portions of the Edwards Plateau to the west that are typically dominated by *Juniperus pinchotii* (redberry juniper). *Prosopis glandulosa* (honey mesquite), *Mahonia trifoliolata* (agarito), *Rhus microphylla* (littleleaf sumac), *Ziziphus obtusifolia* (lotebush), and *Condalia ericoides* (javelina bush) are other common shrub components of the type.

Edwards Plateau: Juniper Semi-arid Slope Shrubland (1215)

Edwards Plateau Limestone Evergreen Semi-arid Slope Shrubland

Identifier: CES303.041.37 **MoRAP Code:** 1215

Description: Typically *Juniperus pinchotii* (redberry juniper) dominated shrublands occupying slopes greater than 20% in the arid western portions of the Edwards Plateau.

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), *Quercus mohriana* (Mohr's shin oak), and/or *Quercus vaseyana* (Vasey shin oak) may be significant dominants in these shrublands, sometimes forming nearly monotypic stands. *Quercus fusiformis* (plateau live oak), *Juniperus ashei* (Ashe juniper), *Juniperus pinchotii* (redberry 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), and *Prosopis glandulosa* (mesquite)) 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. As mapped, some sites may be significantly dominated by *Prosopis glandulosa* (honey mesquite). Shrublands of this mapped type may be surrounded by grassland, or may transition to adjacent woodland.

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 (1206)**, but occurs on slopes greater than twenty percent. As with the occurrences off of slopes, *Quercus sinuata* var. *breviloba* (white shin oak), *Quercus mohriana* (Mohr's shin oak), or *Quercus vaseyana* (Vasey 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: Semi-arid Grassland (1207)

Edwards Plateau Limestone Semi-arid Steppe Grassland

Identifier: CES303.041.7 **MoRAP Code:** 1207

Description: Grasslands of the arid portions of the Edwards Plateau to the west which typically occupy level plateau tops and are dominated by shorter grasses such as *Bouteloua dactyloides* (buffalograss), *Bouteloua rigidiseta* (Texas grama), *Bouteloua trifida* (red grama), *Hilaria belangeri* (curlymesquite), and *Erioneuron pilosum* (hairy

tridens), though taller grasses may also be common. Common forbs may include *Croton pottsii* (Pott's croton),

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), *Sporobolus cryptandrus* (sand dropseed), and *Urochloa ciliatissima* (fringed signalgrass). 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.

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), *Sporobolus cryptandrus* (sand dropseed), *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 antisiphilitica* (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). Some sites may be strongly dominated by *Prosopis glandulosa* (honey mesquite). 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 (2106)** 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 (2107)** 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 (2107)**, 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.

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 present.

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.

Herbaceous Vegetation

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, and typically receive 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), *Bouteloua gracilis* (blue grama), *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem), and *Pascopyrum smithii* (western wheatgrass) may be present. *Prosopis glandulosa* (honey mesquite), *Flourensia cernua* (tarbush), and/or *Koeberlinia spinosa* (allthorn) may be present. In some cases *Prosopis glandulosa* (honey mesquite) may develop into a significant canopy. The system often occupies the Clay Flat Ecological Site.

VEGETATION TYPES:

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).

Western Great Plains Sand Prairie

Identifier: CES303.670

Geology: Restricted to eolian or alluvial deep sand deposits in the northwestern portion of Phase 6.

Landform: Rolling to level sand deposits.

Soils: Deep Sand or Sandhill ecological sites.

Description: The sand prairies constitute a unique system within the western Great Plains, often spatially associated with **Western Great Plains Sandhill Steppe (CES303.671)**. These sand prairies are often considered part of the tallgrass or mixedgrass regions in the western Great Plains, but can contain elements from **Western Great Plains Shortgrass Prairie (CES303.672)**, **Central Mixedgrass Prairie (CES303.659)**, and **Northwestern Great Plains Mixedgrass Prairie (CES303.674)**. While the largest expanse of this system occurs in the Sandhills of north-central Nebraska and southwestern South Dakota, these minor outliers in Phase 6 occupy similar sites (deep sands and sandhills) and share some species. The unifying and controlling feature of this system is that coarse-textured soils predominate and the dominant grasses are well-adapted to this condition. Graminoid species dominate the sand prairies including species such as *Andropogon hallii* (sand bluestem), *Calamovilfa gigantea* (big sandreed), *Sporobolus cryptandrus* (sand dropseed), *Hesperostipa comata* (needle-and-thread), and *Schizachyrium scoparium* (little bluestem). Shrub species such as *Artemisia filifolia* (sand sage), *Prunus angustifolia* (Chickasaw plum), *Rhus trilobata* (skunkbush sumac), and *Quercus havardii* (Havard's shin oak) may be present but constitute relatively little cover. Mapped shrubland patches are mapped as **Western Great Plains Sandhill Steppe (CES303.671)**.

VEGETATION TYPES:

High Plains: Sand Prairie (8007)

Western Great Plains Sand Prairie

Identifier: CES303.670

MoRAP Code: 8007

Description: As described for the system.

Western Great Plains Shortgrass Prairie

Identifier: CES303.672

Geology: On the Quaternary Blackwater Draw Formation, the Ogallala Formation, and Quaternary caliche and pond deposits.

Landform: Level plain.

Soils: Moderately alkaline deep hardland and hardland sites.

Description: Occurrences within Phase 6 represent the southwesternmost expressions of this system. It occupies the level, loamy, ustic (bordering on aridic) soils of the Llano Estacado and other plateau surfaces. These grasslands are typically dominated by shortgrasses such as *Bouteloua dactyloides* (buffalograss), *Bouteloua gracilis* (blue grama), and *Bouteloua hirsuta* (hairy grama). Other species frequently encountered include *Bouteloua curtipendula* (sideoats

grama), *Pascopyrum smithii* (western wheatgrass), *Pleuraphis mutica* (tobosa), *Scleropogon brevifolius* (burro grass), *Aristida purpurea* (purple threeawn), *Sporobolus cryptandrus* (sand dropseed), *Hordeum pusillum* (little barley), and *Bothriochloa laguroides* ssp. *torreyana* (silver bluestem). Forbs and woody species that may be encountered include *Artemisia filifolia* (sand sage), *Gutierrezia sarothrae* (broom snakeweed), *Yucca glauca* (narrowleaf yucca), *Ambrosia psilostachya* (western ragweed), *Ratibida columnifera* (Mexican hat), *Psoralidium tenuiflorum* (slimflower scurfpea), and *Cylindropuntia imbricata* (tree cholla).

VEGETATION TYPE:

High Plains: Shortgrass Prairie (2907)

Western Great Plains Shortgrass Prairie

Identifier: CES303.672

MoRAP Code: 2907

Description: As described for system.

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.

Sparsely Vegetated

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* (southern maidenhair-fern) with patches of *Thelypteris ovata* var. *lindheimeri* (Lindheimer's maidenhair) present. More xeric sites often have significant shrub cover, with species such as *Ungnadia speciosa* (Mexican buckeye), *Diospyros texana* (Texas persimmon), *Garrya* spp. (silktassel), and *Philadelphus* spp. (mock-orange). Cliff faces become increasingly xeric further west, often with increasing cover of succulents such as *Dasyllirion texanum* (Texas sotol) and *Agave lechuguilla* (lechuguilla). Herbaceous species that may be present include *Salvia roemeriana* (cedar sage), *Penstemon baccharifolius* (baccharisleaf penstemon), *Perityle* spp. (rockdaisy), and ferns in the genera *Asplenium*, *Astrolepis*, *Cheilanthes*, and *Pellaea*. Sparse grasses including *Bouteloua hirsuta* (hairy grama), and *Bouteloua rigidiseta* (Texas grama) 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: Occurrences with woody cover.

Southeastern Great Plains Cliff

Identifier: Not Currently Defined

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 of the Brazos River and its tributaries.

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

Description: This system typically occurs on steep bluffs forming along riparian corridors and 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 by 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: Not Currently Defined **MoRAP Code:** 1706

Description: Cliffs or bluffs with significant overstory canopy resembling that of surrounding slope forest.

Agricultural and Other Human-related Mapped Types

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 High Intensity (9410)

MoRAP Code: 9410

Description: This type consists of built-up areas and wide transportation corridors that are dominated by impervious cover.

Urban Low Intensity (9411)

MoRAP Code: 9411

Description: This type includes areas that are built-up but not entirely covered by impervious cover, and includes most of the non-industrial areas within cities and towns.

Mainly Natural Azonal Mapped Types

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. Exposed 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.

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.

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 Woodland (9104)

MoRAP Code: 9104

Description: This broadly-defined type may have *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Sapindus saponaria* var. *drummondii* (western soapberry), *Populus deltoides* (eastern cottonwood), *Prosopis glandulosa* (honey mesquite), *Salix nigra* (black willow), *Maclura pomifera* (osage orange), or the non-native *Ulmus pumila* (Siberian elm) among the dominants.

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: 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 eastern part of Phase 6. To the west, on the Rolling Plains, Caprock, and parts of the Edwards Plateau, *Juniperus pinchotii* (redberry juniper) may be the dominant. In other areas to the south and east, *Juniperus ashei* (Ashe juniper) may dominate these shrublands. A variety of other shrub species may also be present, including *Prosopis glandulosa* (honey mesquite), *Ziziphus obtusifolia* (lotebush), *Quercus fusiformis* (plateau live oak), and *Sideroxylon lanuginosum* (gum bumelia). This type is typically mapped on deeper soils where prairies or woodlands would be expected in the historical landscape.

Native Invasive: Juniper Woodland (9101)

MoRAP Code: 9101

Description: This type may be dominated either by *Juniperus ashei* (Ashe juniper) in the east, often associated with Edwards Plateau limestones, or by *Juniperus virginiana* (eastern redcedar) in the northeast and east, or *Juniperus pinchotii* (redberry juniper) to the west and southwest. *Prosopis glandulosa* (honey mesquite) is a common component, and species such as *Celtis laevigata* var. *reticulata* (netleaf hackberry) and *Ulmus crassifolia* (cedar elm) may also occur. This type is typically mapped on deeper soils where prairies or woodlands would be expected in the historical landscape.

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 *Ziziphus obtusifolia* (lotebush), *Celtis laevigata* var. *reticulata* (netleaf hackberry), *Juniperus* spp. (junipers), and *Opuntia engelmannii* (Engelmann pricklypear) may also be important. Trees such as *Quercus fusiformis* (plateau live oak), *Celtis laevigata* var. *reticulata* (netleaf hackberry), or *Quercus stellata* (post oak) may form a sparse canopy. This type is typically mapped on deeper soils where prairies or woodlands would be expected in the historical landscape. The actual historical extent of **Western Great Plains Mesquite Woodland and Shrubland (CES303.668)** is difficult to determine, but is thought to have been limited to deeper soils on drainages where this system is mapped in Phase 6.

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. This type is typically mapped on deeper soils where prairies or woodlands would be expected in the historical landscape. The actual historical extent of **Western Great Plains Mesquite Woodland and Shrubland (CES303.668)** is difficult to determine, but is thought to have been limited to deeper soils on drainages where this system is mapped in Phase 6.

Non-native Invasive: Saltcedar Shrubland (9204)

MoRAP Code: 9204

Description: Mainly invasive shrublands are characteristic of this type and *Tamarix* spp. (saltcedars) is the most common dominant. Species such as *Baccharis* spp. (baccharis), *Prosopis glandulosa* (honey mesquite), and *Atriplex* spp. (saltbush) may also be present. Occurrences of

this type may occur as narrow bands, especially along waterways with some salinity. These narrow bands were typically not mapped in much of Phase 6.

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).

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), *Juncus* spp. (rushes), sedges, *Typha* spp. (cattails), and *Eleocharis* spp. (spikerushes).