

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Texas' Arizona / New Mexico (Guadalupe) Mountains

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by

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This subset of the International Ecological Classification Standard covers terrestrial ecological systems attributed to the Texas. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to [Judy Teague <judy_teague@natureserve.org>].



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FOREST AND WOODLAND

CES305.795 MADREAN ENCINAL

Madrean Encinal occurs on foothills, canyons, bajadas and plateaus in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, extending north into Trans-Pecos Texas, southern New Mexico and sub-Mogollon Arizona. These woodlands are dominated by Madrean evergreen oaks along a low-slope transition below Madrean Lower Montane Pine-Oak Forest and Woodland (CES305.796) and Madrean Pinyon-Juniper Woodland (CES305.797). Lower elevation stands are typically open woodlands or savannas where they transition into desert grasslands, chaparral or in some cases deserts scrub. Common evergreen oak species include *Quercus arizonica*, *Quercus emoryi*, *Quercus intricata*, *Quercus grisea*, *Quercus oblongifolia*, *Quercus toumeyii*, and in Mexico *Quercus chihuahuensis* and *Quercus albocincta*. Madrean pine, Arizona cypress, pinyon and juniper trees may be present but do not codominate. Chaparral species such as *Arctostaphylos pungens*, *Cercocarpus montanus*, *Purshia* spp., *Garrya wrightii*, *Quercus turbinella*, *Frangula betulifolia* (= *Rhamnus betulifolia*), or *Rhus* spp. may be present but do not dominate. The graminoid layer is usually prominent between trees in grassland or steppe that is dominated by warm-season grasses such as *Aristida* spp., *Bouteloua gracilis*, *Bouteloua curtipendula*, *Bouteloua rothrockii*, *Digitaria californica*, *Eragrostis intermedia*, *Hilaria belangeri*, *Leptochloa dubia*, *Muhlenbergia* spp., *Pleuraphis jamesii*, or *Schizachyrium cirratum*, species typical of Apacherian-Chihuahuan Semi-Desert Grassland and Steppe (CES302.735). This system includes seral stands dominated by shrubby Madrean oaks typically with a strong graminoid layer. In transition areas with drier chaparral systems, stands of chaparral are not dominated by Madrean oaks; however, Madrean Encinal may extend down along drainages.

This system occurs along a low-slope transition from Madrean Pinyon-Juniper Woodland (CES305.797) or Madrean Lower Montane Pine-Oak Forest and Woodland (CES305.796).

CES305.796 MADREAN LOWER MONTANE PINE-OAK FOREST AND WOODLAND

This system occurs on mountains and plateaus in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, Trans-Pecos Texas, southern New Mexico and Arizona, generally south of the Mogollon Rim. These forests and woodlands are composed of Madrean pines (*Pinus arizonica*, *Pinus engelmannii*, *Pinus leiophylla*, or *Pinus strobiformis*) and evergreen oaks (*Quercus arizonica*, *Quercus emoryi*, or *Quercus grisea*) intermingled with patchy shrublands on most mid-elevation slopes (1500-2300 m elevation). Other tree species include *Cupressus arizonica*, *Juniperus deppeana*, *Pinus cembroides*, *Pinus discolor*, *Pinus ponderosa* (with Madrean pines or oaks), and *Pseudotsuga menziesii*. Subcanopy and shrub layers may include typical encinal and chaparral species such as *Agave* spp., *Arbutus arizonica*, *Arctostaphylos pringlei*, *Arctostaphylos pungens*, *Garrya wrightii*, *Nolina* spp., *Quercus hypoleucoides*, *Quercus rugosa*, and *Quercus turbinella*. Some stands have moderate cover of perennial graminoids such as *Muhlenbergia emersleyi*, *Muhlenbergia longiligula*, *Muhlenbergia virescens*, and *Schizachyrium cirratum*. Fires are frequent with perhaps more crown fires than ponderosa pine woodlands, which tend to have more frequent ground fires on gentle slopes.

CES306.813 ROCKY MOUNTAIN ASPEN FOREST AND WOODLAND

This widespread ecological system is more common in the southern and central Rocky Mountains but occurs in the montane and subalpine zones throughout much of the western U.S. and north into Canada. An eastern extension occurs along the Rocky Mountains foothill front and in mountain "islands" in Montana (Big Snowy and Highwood mountains), and the Black Hills of South Dakota. In California, this system is only found on the east side of the Sierra Nevada adjacent to the Great Basin. Large stands are found in the Inyo and White mountains, while small stands occur on the Modoc Plateau. Elevations generally range from 1525 to 3050 m (5000-10,000 feet), but occurrences can be found at lower elevations in some regions. Distribution of this ecological system is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand. Secondly, it is limited by the length of the growing season or low temperatures. These are upland forests and woodlands dominated by *Populus tremuloides* without a significant conifer component (<25% relative tree cover). The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs. In California, *Symphotrichum spathulatum* (= *Aster occidentalis*) is a common forb. Associated shrub species include *Symphoricarpos* spp., *Rubus parviflorus*, *Amelanchier alnifolia*, and *Arctostaphylos uva-ursi*. Occurrences of this system originate and are maintained by stand-replacing disturbances such as avalanches, crown fire, insect outbreak, disease and windthrow, or clearcutting by man or beaver, within the matrix of conifer forests. It differs from Northwestern Great Plains Aspen Forest and Parkland (CES303.681), which is limited to plains environments. The scattered occurrences in Trans-Pecos of Texas are of interest as they represent disjunct outliers of the type occurring under highly limited circumstances.

CES306.814 ROCKY MOUNTAIN BIGTOOTH MAPLE RAVINE WOODLAND

This ecological system occurs in cool ravines, on toeslopes and slump benches associated with riparian areas in the northern and central Wasatch Range and Tavaputs Plateau extending into southern Idaho, as well as in scattered localities in southwestern Utah, central Arizona and New Mexico and the Trans-Pecos of Texas. Substrates are typically rocky colluvial or alluvial soils with favorable soil moisture. These woodlands are dominated by *Acer grandidentatum* but may include mixed stands codominated by *Quercus gambelii* or with scattered conifers. Some stands may include *Acer negundo* or *Populus tremuloides* as minor components. It also occurs on steeper, north-facing slopes at higher elevations, often adjacent to Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818) or Rocky Mountain Aspen Forest and Woodland (CES306.813). In the Trans-Pecos of Texas, this system is a cool ravine woodland type generally occupying lower slope positions. It forms a patchy narrow band on lower slopes that may include *Quercus muehlenbergii*, *Acer grandidentatum*, *Fraxinus* sp., *Prunus serotina*, and *Arbutus xalapensis*.

CES306.835 SOUTHERN ROCKY MOUNTAIN PINYON-JUNIPER WOODLAND

This southern Rocky Mountain ecological system occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of north-central New Mexico, and extends out onto limestone breaks in the southeastern Great Plains. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay. *Pinus edulis* and/or *Juniperus monosperma* dominate the tree canopy. *Juniperus scopulorum* may codominate or replace *Juniperus monosperma* at higher elevations. Stands with *Juniperus osteosperma* are representative the Colorado Plateau and are not included in this system. In southern transitional areas between Madrean Pinyon-Juniper Woodland (CES305.797) and Southern Rocky Mountain Pinyon-Juniper Woodland (CES306.835) in central New Mexico, *Juniperus deppeana* becomes common. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species are more typical of southern Rocky Mountains than the Colorado Plateau and include *Artemisia bigelovii*, *Cercocarpus montanus*, *Quercus gambelii*, *Achnatherum scribneri*, *Bouteloua gracilis*, *Festuca arizonica*, or *Pleuraphis jamesii*.

CES306.648 SOUTHERN ROCKY MOUNTAIN PONDEROSA PINE WOODLAND

This very widespread ecological system is most common throughout the cordillera of the Rocky Mountains, from the Greater Yellowstone region south. It is also found in the Colorado Plateau region, west into scattered locations of the Great Basin. Its easternmost extent in Wyoming is in the Bighorn Mountains. These woodlands occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from less than 1900 m in northern Wyoming to 2800 m in the New Mexico mountains. Occurrences are found on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops are most common. This ecological system generally occurs on soils derived from igneous, metamorphic, and sedimentary material, with characteristic features of good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, rockiness, and periods of drought during the growing season. Northern Rocky Mountain Ponderosa Pine Woodland and Savanna (CES306.030) in the eastern Cascades, Okanogan, and northern Rockies regions receives winter and spring rains, and thus has a greater spring "green-up" than the drier woodlands in the central Rockies. *Pinus ponderosa* (primarily var. *scopulorum* and var. *brachyptera*) is the predominant conifer; *Pseudotsuga menziesii*, *Pinus edulis*, *Pinus contorta*, *Populus tremuloides*, and *Juniperus* spp. may be present in the tree canopy. The understory is usually shrubby, with *Artemisia nova*, *Artemisia tridentata*, *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Cercocarpus montanus*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus gambelii*, *Symphoricarpos* spp., *Prunus virginiana*, *Amelanchier alnifolia* (less so in Montana), and *Rosa* spp. common species. *Pseudoroegneria spicata*, *Pascopyrum smithii*, and species of *Hesperostipa*, *Achnatherum*, *Festuca*, *Muhlenbergia*, and *Bouteloua* are some of the common grasses. Mixed fire regimes and ground fires of variable return intervals maintain these woodlands, depending on climate, degree of soil development, and understory density.

SHRUBLAND

CES302.031 MADREAN ORIENTAL CHAPARRAL

This ecological system occurs in mountains across southeastern New Mexico (Guadalupe Mountains), Trans-Pecos Texas (Chisos and Davis mountains) and Madrean Oriental in northern Mexico. It often dominates along the mid-elevation transition from the Chihuahuan Desert into mountains (1700-2500 m). It occurs on foothills, mountain slopes and canyons in drier habitats below the encinal and pine woodlands, and is often associated with more xeric and coarse-textured substrates such as limestone, basalt or alluvium, especially in transition areas with more mesic woodlands. The moderate to dense shrub canopy includes many shrub oak species, such as *Quercus emoryi*, *Quercus grisea*, *Quercus intricata*, *Quercus invaginata*, *Quercus laceyi*, *Quercus mohriana*, *Quercus pringlei*, *Quercus pungens*, and *Quercus vaseyana*, and several widespread chaparral species, such as *Arctostaphylos pungens*, *Ceanothus greggii*, *Cercocarpus montanus*, *Fallugia paradoxa*, and *Garrya wrightii*; other species characteristic of this system include *Arbutus xalapensis* (= *Arbutus texana*), *Fraxinus greggii*, *Fendlera rigida* (= *Fendlera linearis*), *Garrya ovata*, *Purshia mexicana*, *Rhus virens* var. *choriophylla* (= *Rhus choriophylla*), *Salvia lycioides* (= *Salvia ramosissima*), *Salvia roemeriana*, and *Salvia regla*. In the Trans-Pecos of Texas, disjunct *Quercus gambelii* may occur as a significant component of this shrubland. Most chaparral species are fire-adapted, resprouting vigorously after burning or producing fire-resistant seeds. Stands occurring within montane woodlands are seral and a result of recent fires. Grass cover may be significant. Dominant grasses often include *Bouteloua curtipendula*, *Bouteloua hirsuta*, and *Muhlenbergia emersleyi*. The similar Mogollon chaparral system has floristics mostly derived from the Sierra Madre Occidentale, whereas floristics of this system are derived from the Sierra Madre Oriental. However, this system is not matorral (thornscrub) as it is typically dominated by shrubby evergreen oaks and chaparral species, not thornscrub species. More survey is needed to determine if *Quercus turbinella*, common in the Mogollon Chaparral system, also occurs in the Madrean Oriental Chaparral.

CES306.822 ROCKY MOUNTAIN LOWER MONTANE-FOOTHILL SHRUBLAND

This ecological system is found in the foothills, canyon slopes and lower mountains of the Rocky Mountains and on outcrops and canyon slopes in the western Great Plains. It ranges from southern New Mexico, extending north into Wyoming, and west into the Intermountain West region. These shrublands occur between 1500 and 2900 m elevation and are usually associated with exposed sites, rocky substrates, and dry conditions, which limit tree growth. It is common where *Quercus gambelii* is absent, such as the northern Colorado Front Range and in drier foothills and prairie hills. This system is generally drier than Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818) but may include mesic montane shrublands where *Quercus gambelii* does not occur. *Cercocarpus montanus* dominates pure stands in parts of Wyoming and Colorado. Scattered trees or inclusions of grassland patches or steppe may be present, but the vegetation is typically dominated by a variety of shrubs, including *Amelanchier utahensis*, *Cercocarpus montanus*, *Purshia tridentata*, *Rhus trilobata*, *Ribes cereum*, *Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses are represented as species of *Muhlenbergia*, *Bouteloua*, *Hesperostipa*, and *Pseudoroegneria spicata*. Fires play an important role in this system as the dominant shrubs usually have a severe die-back, although some plants will stump sprout. *Cercocarpus montanus* requires a disturbance such as fire to reproduce, either by seed sprout or root-crown sprouting. Fire suppression may have allowed an invasion of trees into some of these shrublands, but in many cases sites are too xeric for tree growth. In Wyoming, stands where *Cercocarpus montanus* is a component of mixed shrublands are placed in Northern Rocky Mountain Montane-Foothill Deciduous Shrubland (CES306.994).

STEPPE/SAVANNA

CES302.735 APACHERIAN-CHIHUAHUAN SEMI-DESERT GRASSLAND AND STEPPE

This ecological system is a broadly defined desert grassland, mixed shrub-succulent or xeromorphic oak savanna that is typical of the Borderlands of Arizona, New Mexico and northern Mexico (Apacherian region) but extends west to the Sonoran Desert, north into the Mogollon Rim and throughout much of the Chihuahuan Desert. It is found on gently sloping bajadas that support frequent fire throughout the Sky Islands and on mesas and steeper piedmont, foothill and desert mountain slopes up to 1670 m elevation in the Chihuahuan Desert. It is characterized by typically diverse perennial grasses. Common species include grasses *Bouteloua eriopoda*, *Bouteloua hirsuta*, *Bouteloua ramosa*, *Bouteloua rothrockii*, *Bouteloua curtipendula*, *Bouteloua gracilis*, *Eragrostis intermedia*, *Muhlenbergia emersleyi*, *Muhlenbergia porteri*, *Muhlenbergia setifolia*, and *Pleuraphis jamesii*, succulent species of *Agave*, *Dasyllirion*, and *Yucca*, short-shrub species of *Calliandra*, *Mimosa*, and *Parthenium*, and tall-shrub/short-tree species of *Acacia*, *Prosopis*, and various oaks (e.g., *Quercus grisea*, *Quercus emoryi*, *Quercus arizonica*, *Quercus oblongifolia*). *Pleuraphis mutica*-dominated semi-desert grasslands often with *Bouteloua eriopoda* or *Bouteloua gracilis* occurring on lowlands and loamy plains in the Chihuahuan Desert are classified as Chihuahuan Loamy Plains Desert Grassland (CES302.061). Many of the historical desert grassland and savanna areas have been converted through intensive grazing and other land uses, some to Apacherian-Chihuahuan Mesquite Upland Scrub (CES302.733) (*Prosopis* spp.-dominated). Chihuahuan grassland types that are currently included in this system are: (1) Chino grasslands of mountain slopes on acidic igneous, limestone, or deeper gravelly soils at elevations less than 1070 m (3500 feet). These sites are dominated by *Bouteloua ramosa* with *Euphorbia antisiphilitica*, *Hechtia texensis* (= *Hechtia scariosa*), *Fouquieria splendens*, *Jatropha dioica*, and *Agave lechuguilla*. (2) Desert mountain grasslands on mountain slopes between 1070 and 1370 m (3500-4500 feet) elevation on acidic igneous substrates, but also sometimes on limestone. *Bouteloua eriopoda* and *Bouteloua curtipendula* are constituents of this system. (3) Gravelly piedmont slope grasslands between 1370 and 1670 m (4500-5500 feet) elevation on Perdiz conglomerate or Tascotal tuff. These grasslands have *Bouteloua eriopoda*, *Bouteloua gracilis*, and *Dasyllirion* as common components.

CES301.730 MADREAN JUNIPER SAVANNA

This Madrean ecological system occurs in lower foothills and plains of southeastern Arizona, southern New Mexico extending into west Texas and Mexico. These savannas have widely spaced mature juniper trees and moderate to high cover of graminoids (>25% cover). The presence of Madrean *Juniperus* spp. such as *Juniperus coahuilensis*, *Juniperus pinchotii*, and/or *Juniperus deppeana* is diagnostic. *Juniperus monosperma* may be present in some stands; *Juniperus deppeana* has a broader range than this Madrean system and extends north into southern stands of Southern Rocky Mountain Juniper Woodland and Savanna (CES306.834). Stands of *Juniperus pinchotii* may be short and resemble a shrubland. Graminoid species are a mix of those found in Western Great Plains Shortgrass Prairie (CES303.672) and Apacherian-Chihuahuan Semi-Desert Grassland and Steppe (CES302.735), with *Bouteloua gracilis* and *Pleuraphis jamesii* being most common. In addition, these areas include succulents such as species of *Yucca*, *Opuntia*, and *Agave*. Juniper savanna expansion into grasslands has been documented in the last century.

CES306.649 SOUTHERN ROCKY MOUNTAIN PONDEROSA PINE SAVANNA

This ecological system is found predominantly in the Colorado Plateau region, west into scattered locations in the Great Basin, and north along the eastern front of the southern Rocky Mountains into southeastern Wyoming. These savannas occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from less than 1900 m in central and northern Wyoming to 2800 m in the New Mexico mountains to well over 2700 m on the higher plateaus of the Southwest. It is found on rolling plains, plateaus, or dry slopes usually on more southerly aspects. This system is best described as a savanna that has widely spaced (<25% tree canopy cover) (>150 years old) *Pinus ponderosa* (primarily var. *scopulorum* and var. *brachyptera*) as the predominant conifer. It is maintained by a fire regime of frequent, low-intensity surface fires. A healthy occurrence often consists of open and park-like stands dominated by *Pinus ponderosa*. Understory vegetation in the true savanna occurrences is predominantly fire-resistant grasses and forbs that resprout following surface fires; shrubs, understory trees and downed logs are uncommon. Important species include *Festuca arizonica*, *Muhlenbergia virescens*, *Pseudoroegneria spicata*, *Andropogon gerardii*, *Schizachyrium scoparium*, *Festuca idahoensis*, *Piptatherum micranthum*, and *Bouteloua gracilis*. A century of anthropogenic disturbance and fire suppression has resulted in a higher density of *Pinus ponderosa* trees, altering the fire regime and species composition. Presently, many stands contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. Northern Rocky Mountain Ponderosa Pine Woodland and Savanna (CES306.030) in the eastern Cascades, Okanogan, and northern Rockies regions receives winter and spring rains, and thus has a greater spring "green-up" than the drier woodlands in the central Rockies.

HERBACEOUS

CES302.061 CHIHUAHUAN LOAMY PLAINS DESERT GRASSLAND

This ecological system occurs in the northern Chihuahuan Desert and extends into limited areas of the southern Great Plains on alluvial flats, loamy plains, and basins sometimes extending up into lower piedmont slopes. Sites are typically flat or gently sloping so precipitation does not run off and may be somewhat mesic if they receive runoff from adjacent areas, but these are not wetlands. Soils are non-saline, finer textured loams or clay loam. Vegetation is characterized by perennial grasses and is typically dominated by *Pleuraphis mutica* (tobosa) or with *Bouteloua eriopoda* codominant (more historically) or *Bouteloua gracilis*. In degraded stands, *Scleropogon brevifolius*, *Dasyochloa pulchella* (= *Erioneuron pulchellum*), or *Aristida* spp. may codominate. *Pleuraphis jamesii* may become important in northern stands and *Bouteloua gracilis* in the Great Plains and on degraded stands. If present, mesic graminoids such as *Pascopyrum smithii*, *Panicum obtusum*, *Sporobolus airoides*, and *Sporobolus wrightii* typically have low cover and are restricted to drainages and moist depressions (inclusions). Scattered shrubs such as *Ephedra torreyana*, *Flourensia cernua*, *Gutierrezia sarothrae*, *Larrea tridentata*, *Opuntia imbricata*, *Prosopis glandulosa*, and *Yucca* spp. may be present, especially on degraded sites.

This upland grassland is similar to the bottomland/depressional wetland system Chihuahuan-Sonoran Desert Bottomland and Swale Grassland (CES302.746) and grades into Apacherian-Chihuahuan Semi-Desert Grassland and Steppe (CES302.735) in the foothills and piedmont desert grasslands. In similar loamy plains land positions in the Great Plains, *Bouteloua gracilis*, *Buchloe dactyloides*, or *Pleuraphis jamesii* are dominant grasses in Western Great Plains Shortgrass Prairie (CES303.672). This grassland system is found from the northern to central Chihuahuan Desert and extends across the Trans-Pecos and into areas of the southwestern Great Plains. It extends from western Texas across New Mexico and into southeastern Arizona. Stands are described from Jornada del Muerto Basin, Marfa grasslands and Marathon Basin, south to central Chihuahua and Coahuila, Mexico.

Examples of this system are found on alluvial flats, loamy plains, and basins sometimes extending up into lower piedmont slopes. Sites are typically flat or gently sloping so precipitation does not run off and may be somewhat mesic if they receive runoff from adjacent areas, but these are not wetlands. Soils are non-saline, finer textured loams or clay loam.

CES302.736 CHIHUAHUAN SANDY PLAINS SEMI-DESERT GRASSLAND

This ecological system occurs across the Chihuahuan Desert and extends into the southern Great Plains where soils have a high sand content. These dry grasslands or steppe are found on sandy plains and sandstone mesas. The graminoid layer is typically dominated or codominated by *Bouteloua eriopoda* and *Sporobolus flexuosus* with characteristic Chihuahuan species. Other common species are *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua gracilis*, *Hesperostipa neomexicana* (minor), *Muhlenbergia arenicola*, *Pleuraphis jamesii*, *Sporobolus airoides*, *Sporobolus constrictus*, and *Sporobolus cryptandrus*. Typically, there are scattered desert shrubs and stem succulents present, such as *Ephedra torreyana*, *Ephedra trifurca*, *Opuntia imbricata*, *Yucca baccata*, *Yucca elata*, and *Yucca torreyi*, that are characteristic of the Chihuahuan Desert. The widespread shrub *Artemisia filifolia* is also frequently present, especially in the northern extent.

CES306.824 SOUTHERN ROCKY MOUNTAIN MONTANE-SUBALPINE GRASSLAND

This Rocky Mountain ecological system typically occurs between 2200 and 3000 m elevation on flat to rolling plains and parks or on lower sideslopes that are dry, but it may extend up to 3350 m on warm aspects. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acidic, and usually well-drained. An occurrence usually consists of a mosaic of two or three plant associations with one of the following dominant bunch grasses: *Danthonia intermedia*, *Danthonia parryi*, *Festuca idahoensis*, *Festuca arizonica*, *Festuca thurberi*, *Muhlenbergia filiculmis*, or *Pseudoroegneria spicata*. The subdominants include *Muhlenbergia montana*, *Bouteloua gracilis*, and *Poa secunda*. These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests. In limited circumstances (e.g., South Park in Colorado), they form the "matrix" of high-elevation plateaus. Small-patch representations of this system do occur at high elevations of the Trans-Pecos where they present as occurrences of *Festuca arizonica* - *Blepharoneuron tricholepis* Herbaceous Vegetation (CEGL004508). These occurrences often occupy sites adjacent to Madrean Oriental Chaparral (CES302.031).

WOODY WETLAND

CES302.748 NORTH AMERICAN WARM DESERT LOWER MONTANE RIPARIAN WOODLAND AND SHRUBLAND

This ecological system occurs in foothill and mountain canyons and valleys of the warm desert regions of the southwestern U.S. and adjacent Mexico, and consists of mid-to low-elevation (1100-1800 m) riparian corridors along perennial and seasonally intermittent streams. Rivers include upper portions of the Gila, Santa Cruz, Salt, San Pedro, and tributaries of the lower Colorado River (below the Grand Canyon), the lower Rio Grande and Pecos (up to its confluence with Rio Hondo) that occur in the desert portions of their range. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include *Populus angustifolia*, *Populus deltoides ssp. wislizeni*, *Populus fremontii*, *Platanus wrightii*, *Juglans major*, *Fraxinus velutina*, and *Sapindus saponaria*. Shrub dominants include *Salix exigua*, *Prunus spp.*, *Alnus oblongifolia*, and *Baccharis salicifolia*. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction.

CES302.752 NORTH AMERICAN WARM DESERT RIPARIAN MESQUITE BOSQUE

This ecological system consists of low-elevation (<1100 m) riparian corridors along perennial and intermittent streams in valleys of the warm desert regions of the southwestern U.S. and adjacent Mexico. Rivers include the lower Colorado (within and downstream of the Grand Canyon), Gila, Santa Cruz, Salt, lower Rio Grande, Pecos (up to near its confluence with Rio Hondo), and their tributaries that occur in the desert portions of their range. Dominant trees include *Prosopis glandulosa* and *Prosopis velutina*. Shrub dominants include *Baccharis salicifolia*, *Pluchea sericea*, and *Salix exigua*. Woody vegetation is relatively dense, especially when compared to drier washes. Vegetation, especially the mesquites, tap groundwater below the streambed when surface flows stop. Vegetation is dependent upon annual rise in the water table for growth and reproduction.

CES302.753 NORTH AMERICAN WARM DESERT RIPARIAN WOODLAND AND SHRUBLAND

This ecological system consists of low-elevation (<1200 m) riparian corridors along medium to large perennial streams throughout canyons and desert valleys of the southwestern United States and adjacent Mexico. Rivers include the lower Colorado (into the Grand Canyon), Gila, Santa Cruz, Salt, lower Rio Grande (below Elephant Butte Reservoir in New Mexico to the Coastal Plain of Texas), and the lower Pecos (up to near its confluence with Rio Hondo in southeastern New Mexico). The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include *Acer negundo*, *Fraxinus velutina*, *Populus fremontii*, *Salix gooddingii*, *Salix lasiolepis*, *Celtis laevigata var. reticulata*, *Platanus racemosa*, and *Juglans major*. Shrub dominants include *Salix geyeriana*, *Shepherdia argentea*, and *Salix exigua*. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction.

MIXED UPLAND AND WETLAND

CES302.746 CHIHUAHUAN-SONORAN DESERT BOTTOMLAND AND SWALE GRASSLAND

This ecological system occurs in relatively small depressions or swales and along drainages throughout the northern and central Chihuahuan Desert and adjacent Sky Islands and Sonoran Desert, as well as limited areas of the southern Great Plains on broad mesas, plains and valley bottoms that receive runoff from adjacent areas. Occupying low topographic positions, these sites generally have deep, fine-textured soils that are neutral to slightly or moderately saline/alkaline. During summer rainfall events, ponding is common. Vegetation is typically dominated by *Sporobolus airoides*, *Sporobolus wrightii*, *Pleuraphis mutica* (tobosa swales), or other mesic graminoids such as *Pascopyrum smithii* or *Panicum obtusum*. With tobosa swales, sand-adapted species such as *Yucca elata* may grow at the swale's edge in the deep sandy alluvium that is deposited there from upland slopes. *Sporobolus airoides* and *Sporobolus wrightii* are more common in alkaline soils and along drainages. Other grass species may be present, but these mesic species are diagnostic. Scattered shrubs such as *Atriplex canescens*, *Prosopis glandulosa*, *Ericameria nauseosa*, *Fallugia paradoxa*, *Krascheninnikovia lanata*, or *Rhus microphylla* may be present. This bottomland/depressional wetland system can be similar to the upland Chihuahuan Loamy Plains Desert Grassland (CES302.061) but is restricted to moist depressions and intermittently flooded drainage terraces and adjacent flats. Alkali sacaton (*Sporobolus airoides*) is often associated with more alkaline (to gypsic), poorly drained areas and giant sacaton (*Sporobolus wrightii*) with less alkaline better drained areas. *Distichlis spicata*, *Allenrolfea occidentalis*, and *Suaeda* spp. are characteristic of more saline and alkaline sites.

This ecological system occurs in relatively small depressions or swales and along drainages on broad mesas, plains and valley bottoms that receive runoff from adjacent areas. These sites occupy low topographic positions and generally have deep, fine-textured soils that are neutral to slightly or moderately saline/alkaline.

BARREN

CES302.745 NORTH AMERICAN WARM DESERT BEDROCK CLIFF AND OUTCROP

This ecological system is found from subalpine to foothill elevations and includes barren and sparsely vegetated landscapes (generally <10% plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. Species present are diverse and may include *Bursera microphylla*, *Fouquieria splendens*, *Nolina bigelovii*, *Opuntia bigelovii*, and other desert species, especially succulents. Lichens are predominant lifeforms in some areas. May include a variety of desert shrublands less than 2 ha (5 acres) in size from adjacent areas.

CES302.750 NORTH AMERICAN WARM DESERT PAVEMENT

This ecological system occurs throughout much of the warm deserts of North America and is composed of unvegetated to very sparsely vegetated (<2% plant cover) landscapes, typically flat basins where extreme temperature and wind develop ground surfaces of fine to medium gravel coated with "desert varnish." This sparsely vegetated system may surround playas in valley bottoms or near washes and, less commonly, on dissected, eroding alluvial fans. Very low cover of desert scrub species such as *Larrea tridentata* or *Eriogonum fasciculatum* is usually present. However, ephemeral herbaceous species may have high cover in response to seasonal precipitation, including *Chorizanthe rigida*, *Eriogonum inflatum*, and *Geraea canescens*.

CES302.754 NORTH AMERICAN WARM DESERT VOLCANIC ROCKLAND

This ecological system occurs across the warm deserts of North America and is restricted to barren and sparsely vegetated (<10% plant cover) volcanic substrates such as basalt lava (malpais) and tuff. Vegetation is variable and includes a variety of species depending on local environmental conditions, e.g., elevation, age and type of substrate. Typically scattered *Larrea tridentata*, *Atriplex hymenelytra*, or other desert shrubs are present.

CES306.815 ROCKY MOUNTAIN CLIFF, CANYON AND MASSIVE BEDROCK

This ecological system of barren and sparsely vegetated landscapes (generally <10% plant cover) is found from foothill to subalpine elevations on steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous (intrusives), sedimentary, and metamorphic bedrock types. It is located throughout the Rocky Mountains and northeastern Cascade Ranges in North America. Also included are unstable scree and talus slopes that typically occur below cliff faces. In general these are the dry sparsely vegetated places on a landscape. The biota on them reflect what is surrounding them, unless it is an extreme parent material. There may be small patches of dense vegetation, but it typically includes scattered trees and/or shrubs. Characteristic trees includes species from the surrounding landscape, such as *Pseudotsuga menziesii*, *Pinus ponderosa*, *Pinus flexilis*, *Populus tremuloides*, *Abies concolor*, *Abies lasiocarpa*, or *Pinus edulis* and *Juniperus* spp. at lower elevations. There may be scattered shrubs present, such as species of *Holodiscus*, *Ribes*, *Physocarpus*, *Rosa*, *Juniperus*, and *Jamesia americana*, *Mahonia repens*, *Rhus trilobata*, or *Amelanchier alnifolia*. Soil development is limited, as is herbaceous cover. This has a very broad elevation range (<3350 m) for a system; consider dividing into foothills/montane and subalpine. And/or by floristic division. This is in the Okanagan and Rockies as the montane sparse. North Pacific Montane Massive Bedrock, Cliff and Talus (CES204.093) includes everything in the Cascades and west, except the northeastern Cascades, where occurrences are this system (CES306.815). Inter-Mountain Basins Cliff and Canyon (CES304.779) occurs in the dry foothills on the east side of EDC MapZone1.

This system is located throughout the Rocky Mountain, including the isolated island ranges of central Montana, and northeastern Cascade Ranges in North America.