Warm temperate grasslands are found on six continents and formerly covered sizable areas of southern Eurasia and North America as well as Australia, and include such important regions as the South American “pampas” and South African “veldt.” Seasonal drought and drying winds are characteristic climatic features, and periodic long term droughts are to be expected in these landscapes. The mild climate of warm temperate grasslands has always been an attractive feature for agrarian economies even though the incidences of drought make livestock raising erratic and prone to alter these landscapes in several ways.

In North America, warm temperate grasslands are represented by a mostly summer-active Gulf Coastal Grassland in southeast Texas and southwest Louisiana, a more or less biseasonal rainfall Semidesert Grassland centered in northern Mexico and the American Southwest, and a winter precipitation-summer drought California Valley Grassland found in Alta and Baja California and offshore islands. The original grass cover over much of these biotic communities has been considerably reduced, altered and in some cases replaced entirely. Many Gulf Coastal Grassland and Semidesert Grassland sites, for example, have been invaded almost beyond recognition by woody plants and their grasses replaced by leaf succulents, cacti, or shrubs. California Valley Grassland, where this entity remains, is now comprised almost entirely of introduced annuals. Similar displacements have occurred with the native fauna in the above. One herbaceous biotic community, Southeastern Canebrakes, formerly an important landscape feature in the southeastern U. S. is now functionally extinct.
Much of the flat, low-lying coastal plain of Texas and western Louisiana was formerly a tall-grass prairie in which the grasses attained a height of 2 m (80 in) or more by the end of the long May to September growing season. Some of the most prominent species included big bluestem (*Andropogon gerardii*), silver bluestem (*Bothriochloa saccharoides*), Texas wintergrass (*Nassella leucotricha*), switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), and Indiangrass (*Sorghastrum nutans*). A number of shorter-statured grasses were also present as were a great variety of prairie flowers which often dominated locally. Mottes of wax myrtle (*Myrica cerifera*) and live oaks (*Quercus virginiana*) were generally confined to stream margins and sandy ridges.

Sometimes called “Coastal Prairie” (Tharp 1939), Gulf Coastal Grassland formerly extended from 120 km (75 mi) to 150 km (90 mi) inland along the Gulf of Mexico from the vicinity of Matamoros, Mexico, northeastward into southwest Louisiana. Separated from the ocean by extensive coastal strands and coastal marshes, the grassland was bordered on the north and east by Southeastern Deciduous and Evergreen Forest. To the west and southwest, Gulf Coastal Grassland merged with tropic-subtropic Tamaulipan Savanna Grassland, Tamaulipan Thornscrub, or Tamaulipan Semi-deciduous forest. Today, where not under cultivation or urbanized, this biotic community has been so invaded by trees and shrubs that it is often difficult to interpret as a former grassland. Originally estimated to cover 5.3 million ha (13 million acre), in 1900, approximately 2.4 million ha (6 million acre) remained with less than 2 percent in a recognizable state (Tharp 1939, Shelford 1963, Frye et al. 1984, USDI 1994).

Located primarily on loam and sandy soils as well as some claypans, these grasslands reflected conditions inhibiting tree growth. Wind driven fires undoubtedly played a major role in grassland maintenance as mean monthly wind speeds at climatic stations located in Gulf Coastal Grassland exceed those in historic forest communities. Other factors working to maintain a grassland setting in this nearly subtropical biotic community were the hurricanes which periodically visit the region in late summer, and the high incidence of waterlogged soils. Mean annual precipitation is high, if somewhat irregular, with more than 60% of the rain falling during the long April to November growing season (Table 9). Totals range from a mean of 762 mm (30 in) in the south to more than 1,400 mm (55 in) at the prairie’s northeastern limits. Gulf Coastal Grassland is thus one of the wettest grasslands in the United States.

Numerous grasses, including several endemics, complement the bluestems and other tall dominants. Based on a plant list collected on Attwater Prairie Chicken National
Wildlife Refuge and other sources, some of the more prevalent species include bushy bluestem (*Andropogon glomeratus*), splitbeam bluestem (*A. ternarius*), broomsedge bluestem (*A. virginicus*), slimspike and other threeawn (*Aristida longespica, A. purpurascens et al*), various lovegrasses (*Eragrostis spp*), hairy woollygrass (*Eriophorum pilosum*), tanglehead (*Heteropogon contortus*), Gulf or hairawn muhly (*Muhlenbergia capitellaris*), several *Panicum*, guldfume paspalum (*Paspalum monosachyrum*), longspike tridens (*Tridens strictus*), and crinkleaw (*Trachypogon spicatus*) (Frye et al. 1984, USDI 1994) (Figure 54). These grasses are replaced in the wetlands that characterize so much of the region by rough dropseed (*Sporobolus virgineus*), sweet acacia (*Prosopis glandulosa*), and honey mesquite (*Prosopis glandulosa*), as to be considered “thornscrub” (Figure 55). Supposedly grazed by bison in historic times, these grasslands were apparently not suited for pronghorn. Although *Gulf Coast Grassland* has been reported to have been a stronghold for the so-called red wolf (*Canis niger*), recent inbreeding suggests that this animal was only a regional race of coyote. Other mammals, with the exception of a few subspecies such as the subwater race of pygmy mouse (*Peromyscus boylii*), and the Cassin sparrow (*Spizella pusilla*), are similar to those present in certain tall-grass communities within *Plains Grassland*.

Birds too, lack much distinction, and except for the poorly differentiated Attwater subspecies of prairie chicken (*Tympanuchus cupido attwateri*), no taxon is restricted to *Gulf Coast Grassland*. Grassland species in general are well represented, however, and the Cassin sparrow (*Spizella pusilla*), striped cowbird (*Icterus parisorum*), and scissor-tailed flycatcher (*Tyrannus forficatus*) can be considered characteristic breeding birds.

Reptiles and amphibians are better represented, although only a few such as the Gulf Coast toad (*Bufo valliceps*), Texas tortoise (*Gopherus berlandieri*), and northern keeled earless lizard (*Holbrookia propinquia propinquia*) can be considered
Figure 55. Gulf Coastal Grassland in Wharton County, Texas, invaded by brush, in this case, sweet acacia (*Acacia farnesiana*). Elevation 18 m. June 1999, D.E.B.

Table 9. Mean precipitation totals for stations located within or adjacent to Gulf Coastal Grassland.

<table>
<thead>
<tr>
<th>Location - Lat./Long.</th>
<th>Altitude (m)</th>
<th>Precipitation (mm)</th>
<th>Mean Frost Free Days &gt; 0° C</th>
<th>Mean Wind Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corpus Christi, Texas, USA</td>
<td>27.8° N, 97.5° W</td>
<td>12 (41°)</td>
<td>41 39 21 51 77 85 50 89 156 81 39 36 765 (30.2°)</td>
<td>457 60 350 19 kph</td>
</tr>
<tr>
<td>Victoria, Texas, USA</td>
<td>28.9° N, 96.9° W</td>
<td>32 (104°)</td>
<td>47 57 34 66 115 66 84 158 84 57 54 936 (36.4°)</td>
<td>537 58 361 16 kph</td>
</tr>
<tr>
<td>Galveston, Texas, USA</td>
<td>29.3° N, 94.8° W</td>
<td>2 (7°)</td>
<td>75 59 53 67 84 88 96 112 148 66 82 92 1022 (40.2°)</td>
<td>528 52 345 18 kph</td>
</tr>
<tr>
<td>Port Arthur, Texas, USA</td>
<td>29.9° N, 94.0° W</td>
<td>5 (16°)</td>
<td>106 94 74 103 101 138 156 92 110 116 1340 (52.8°)</td>
<td>645 48 357 18 kph</td>
</tr>
<tr>
<td>Lake Charles, Louisiana, USA</td>
<td>30.1° N, 93.2° W</td>
<td>3 (9°)</td>
<td>108 99 77 103 106 137 132 88 96 129 1347 (53.0°)</td>
<td>647 48 356 14 kph</td>
</tr>
</tbody>
</table>

indicator species. Other lizards of **Gulf Coastal Grassland** include the more widely occurring prairie racerunner (*Cnemidophorus sexlineatus viridis*), Texas spotted whiptail (*C. gularis gularis*), southern Prairie skink (*Eumeces septentrionalis obtusirostris*), Western slender grass lizard (*Ophisaurus attenuatus attenuatus*), and Texas horned lizard (*Phrynosoma cornutum*). The snakes too are largely subspecies of species also found in either Plains or Semidesert grasslands—Texas glossy snake (*Arizona elegans arenicola*), Texas scarlet snake (*Cemophora occinea lineri*), Eastern yellow-bellied racer (*Coluber constrictor flaviventris*), Western diamondback rattlesnake (*Crotalus atrox*), Texas rat snake (*Elaphe obsoleta lindheimeri*), Western coachwhip (*Masticophis flagellum testacens*), Prairie kingsnake (*Lampropeltis calligaster calligaster*), Plains blind snake (*Lepto-
typhlops dulcis dulcis), Western smooth green snake (*Opheodrys vernalis*), a bullsnake (*Pituophis melanoleucus sayi*), Massasauga (*Sistrurus catenatus*), the marsh brown snake (*Storeria dekayi limnetes*), Plains black-headed snake (*Tantilla nigriceps fumiceps*), and Western ribbon snake (*Thamnophis proximus orarius*).

Amphibian representatives are also mostly at the subspecies level and include such restricted taxa as the Eastern green toad (*Bufo debilis debilis*) and Hunter’s spadefoot (*Scaphiopus holbrooki hunterii*), as well as several chorus frogs having a greater grassland distribution— the spotted chorus frog (*Pseudacris clarkii*), Strecker’s chorus frog (*P. streckeri*), and upland chorus frog (*P. triseriata feriarum*).

Because so few plant and animal species are restricted to Gulf Coastal Grassland, most recent works regard this biotic community as a fasciation of tall-grass prairie within Plains Grassland or ignore it entirely despite its warmer climate (see e.g., Barbour and Billings 1988, 2000). Nonetheless, representative examples of Gulf Coast Grassland need to be preserved if the continent’s biodiversity is to be retained. This need has been well recognized in Texas where The Nature Conservancy has been instrumental in acquiring approximately 5,460 ha (13,500 acres) of Gulf Coast Grassland at six sites intended to be managed by federal and state conservation agencies or TNC itself. Significant areas of this grassland are also protected in the numerous coastal refuges managed by the U. S. Fish and Wildlife Service, and still others are included within state and private refugia. One of the best and largest remaining examples is the 3,238 ha (8,000 acre) Attwater Prairie Chicken National Wildlife Refuge located in Colorado County, TX.
Semidesert Grassland

This large and highly diverse biotic community was originally described and mapped by Forrest Shreve (1917) as a “desert-grassland” transition. Subsequently, ecologists have referred to various portions of Semidesert Grassland as “desert savanna” (Shantz and Zon 1924), “mesquite grassland” (Brand 1936, Leopold 1950), “desert plains grassland” (Weaver and Clements 1938, LeSueur 1945), “desert shrub grassland” (Darrow 1944), “grassland transition” (Müeller 1947), and most frequently as “desert grassland” (Nichol 1937, Büechner 1950, Benson and Darrow 1954, Castetter 1956, Humphrey 1958, Lowe 1964, McLaren and Van Devender 1995). In Mexico, these and other grasslands are known collectively as pastizals (Rzedowski 1988) while Burgess (1996) proposed the designation “Apacherian shrub-savanna-grassland” despite this biotic community extending far beyond the historic range of these native peoples. We prefer to use the term Semidesert Grassland (Little 1950), which, while perhaps less euphonious, is more descriptive from an ecological and geographical perspective. Whatever the terminology, Semidesert Grassland is a perennial grass-scrub dominated landscape positioned adjacent to or above desertscrub and below Plains Grassland, Madrean Evergreen Woodland, or Interior Chaparral in which up to 50% of the potential ground cover may be bare ground or occupied by annual and/or herbaceous vegetation. Although Semidesert Grassland adjoins the southeastern portions of the Mohave Desert, and abuts the eastern and northern reaches of the Sonoran Desert, the main interactions of this biotic community are with Chihuahuan Desertscrub. Semidesert Grassland not only surrounds the Chihuahuan Desert, large areas of former grassland within and adjacent to this biotic community have recently been replaced by desert plants along with their animal constituents. Hence, Semidesert Grassland is largely a Chihuahuan Semidesert Grassland with fasciations extending westward into west-central Arizona, eastward into Texas, and southward into the Valley of Mexico (Map 1). Expansive and composed of numerous regional fasciations, Semidesert Grassland also serves as a biogeographic catch-all for a variety of shrub or “mattoral”-invaded communities situated between desert and grassland.

Extensive areas of Semidesert Grassland occurred in the United States in central and southeastern Arizona, in southern New Mexico, and in west Texas where it has expanded diagonally to the northeast toward the Red River and the Oklahoma border (Brown et al. 2007) (Figure 56). In Mexico, this biotic community occupies extensive portions of northeastern Sonora, Chihuahua, Coahuila, Nuevo Leon, San Luis Potosí and Durango before continuing southward on the Central Plateau to the Valley of Mexico after which it
Figure 56. Semidesert Grassland between Lordsburg and Silver City, New Mexico ca. 1,450 m (4,750 ft). These “yucca grasslands” of soap-tree yucca or palmilla (*Yucca elata*) cover extensive areas of southeastern Arizona, northern Chihuahua, west Texas, and southern New Mexico, where this plant is the state flower. The bunch grass is sideoats grama (*Bouteloua curtipendula*), drying after an above average monsoon in 2006. The shrubs are mostly creosote (*Larrea tridentata*) with scattered velvet mesquite (*Prosopis velutina*). April 2007, E.M.

Figure 57. Semidesert Grassland near its southern extremity in the vicinity of Perote in the state of Puebla, Mexico, ca. 2,400 m (7,875 ft). Here, on this limestone slope, one encounters many of the same genera if not species of such dry tropic-scrub Semidesert Grassland indicators as *Agave*, *Dasylirion*, *Juniperus*, *Prosopis*, and *Yucca*. The bunchgrasses are also such widely dispersed species as *Bouteloua curtipendula*, with species of *Muhlenbergia* and *Sporobolus* also participating. March 2001, D.E.B.
reaches its southernmost limits in the vicinity of Tehuacán in northern Puebla and near Nochixtlán in northeastern Oaxaca (Rzedowski 1975, 1988) (Figure 57).

In the northwest and in the northeast, the lower elevation limits of **Semidesert Grassland** may be as low as ca. 1,100 m (3,600 ft). More often, however, the grassland’s lower limits are above 1,100 m and below 1,500 m (4,900 ft) where its contact with **Chihuahuan Desertsrub** is complex and manifested in alternating landscape mosaics (Figure 58). Upper elevations are typically between 1,500 and 1,700 m (5,500 ft), reaching altitudes of 2,200 (7,200 ft) to 2,500 m (8,200 ft) in the Valley of Mexico and other southern locales. Within the generally lower **Chihuahuan Desertsrub**, **Semidesert Grassland** also occupies the numerous enclosed drainages and/or alluvial terraces of tobosa grass (**Hilaria mutica**) and sacaton (**Sporobolus wrightii**) (Figures 59, 60).

Most **Semidesert Grassland** locations have a mean annual precipitation of between 300 mm (12 in) and 450 mm (18 in) with the more southerly stations exceeding 600 mm (24 in). More than half of this total falls between August and September, with at least 130 mm (5 in) arriving during the April through August growing season (Table 10). This is important as studies have shown that perennial grass growth depends on the amount and predictability of the rainfall received during this “monsoon” period (Cable 1975). Unlike **Plains Grassland**, which is generally situated northward and above **Semidesert Grassland**, winters are mild and freezing temperatures average less than 150 days a year. Summers are warm to hot with several days over 38° C (100° F) being recorded nearly every year. With the exception of storm periods, relative humidities are low. Winds are prevalent during the late spring and early summer, with another less active period occurring in fall. These winds are, or were, important to the grassland’s maintenance, as they carry the lightning-caused fires that historically occurred in **Semidesert Grassland** prior to the onset of the “summer monsoon” (Humphrey 1958, Bahre 1991). As a consequence, this biotic community is best developed in valleys, open hills, slopes, and ridges (Figure 61).
Figure 59. Semidesert Grassland of sacaton (*Sporobolus wrightii*) along the San Pedro River near Lewis Springs in southeastern Arizona ca. 1,260 m (4,130 ft). Sacaton grasslands cover large areas of lower alluvial terrace not previously converted to agriculture. The flowering panicle can reach heights of greater than 2 m (7 ft). August 2001, E.M.

Figure 60. Semidesert Grassland of tobosa (*Hilaria mutica*) with catclaw (*Acacia greggii*), clock-face prickly-pear (*Opuntia chlorotica*), and snakeweed (*Gutierrezia sarothrae*), between Date Creek and Hillside, Yavapai County, Arizona, ca. 975 m (3,198 ft). This low elevation, northwestern extension of Semidesert Grassland, photographed by R. R. Humphrey in 1950, has been virtually destroyed by the construction of stock tanks, which has led to intensive livestock grazing and soil erosion, causing the grasses to be replaced by creosote and mesquite. Humphrey (1958) was one of the first ecologists to understand that grazing and fire suppression were the primary reasons for brush encroachment in Semidesert Grassland.

Figure 61. Excluded from grazing for perhaps 30 years, this luxuriant and diverse grassland near Ft. Bowie, Cochise County, Arizona ca. 1,500 m (5,000 ft) may represent site potential for Semidesert Grassland communities. Perennials in this photo include southwestern needlegrass (*Achnatherum eminens*), *Aristida* spp., cane beardgrass (*Bothriochloa barbinodis*), a number of gramas (*Bouteloua chondroiodes*, *B. curtipendula*, *B. eriopoda*, *B. gracilis*, *B. hirsuta*, *B. radicosa*, *B. repens*), Arizona cottontop (*Digitaria arizonica*), *Eragrostis* spp., especially *E. intermedia*, wolftail (*Lycurus setosus*), muhlys (*Muhlenbergia arenicola*, *M. porteri*, et al.), burrow-grass (*Scleropogon brevilobius*), and false Rhodes grass (*Trichloris crinita*). Bristle-grass (*Setaria leucopila*) is the conspicuous grass with the spike-like inflorescence. August 2008, E.M.
The grasses present were originally mostly bunch-grasses, the bases of the clumps often separated by intervening areas of bare ground and rarely forming a continuous sod cover (Figure 62). Reproduction of these grasses was principally from seed. In areas of heavy to moderate rainfall, livestock grazing reduced these bunch-grasses and encouraged the growth of low-growing sod grasses such as curly mesquite (*Hilaria belangeri*). In lower summer rainfall areas the shift has been from bunch-grasses to annual grasses and/or shrubs. Only where soils are deep, protected from grazing and erosion, and possessed of few shrubs and cacti, do perennial grasses continue to cover extensive landscapes.

Thrifty, extensive grass landscapes stand in marked contrast to the appearance of most Semidesert Grassland communities today—especially the lower elevation sites having a history of heavy grazing. More often than not, the original grass cover as well as species composition has been much altered and/or reduced by a wide array of competing shrubs, trees, weeds, and cacti (Figure 63). And despite numerous efforts at range rehabilitation, it remains to be seen whether such areas can be restored to their former character through the use of reduced grazing pressures, brush eradication, and controlled burns. Reseeding alone has generally failed to restore native Semidesert Grasslands (Munda and Pater 2003).

Although Semidesert Grassland is transitional in the sense of being geographically positioned between Plains Grassland and desertscrub, and shares some of the floral and faunal constituents of both, it is a distinctive biotic community in its own right. As such, it is an evolutionary and biogeographic center for a distinguishable array of plant and animal representatives. Many of the grama grasses, for example, sprucetop grama (*B. chondrosioides*), black grama (*B. eriopoda*), hairy grama (*B. hirsuta*), and purple grama (*B. radicans*), maintain a presence from east to west, and from north to south (see Rzedowski 1981). A number of other summer-active perennial grasses, while sometimes local in distribution are even more representative—three-awns (*Aristida divaricata*, *A. purpurea*), slender grama (*B. repens*), gypsum grama (*B. breviseta*), Arizona cottontop (*Digitaria californica*), New Mexico needle-grass (*Hesperostipa neomexicana*), tanglehead (*Heteropogon contortus*), bush muhly (*Muhlenbergia porteri*),
vine mesquite (Panicum obtusum), pappus grass (Pappophorum vaginatum), desert needle-grass (Stipa mucronata), finestem needle-grass (S. tenuissima), slim tridens (Tridens muticus), and others.

Two especially diagnostic grasses are black grama (Bouteloua eriopoda) and tobosa grass (Hilaria mutica), the former generally favoring gravelly upland sites, the latter usually found on heavy, lowland soils. Also frequently present, especially at the higher elevations, are any number of Plains Grassland grasses–sideoats grama (Bouteloua curtipendula), blue grama (B. gracilis), buffalo grass (Buchloe dactyloides), Plains lovegrass (Eragrostis intermedia), wolftail (Lycurus setosus), little bluestem (Schizachyrium scoparium), bristlegrasses (Setaria spp.), and several more–any of which may be intermixed with Semidesert Grassland grasses, or even locally dominate. Still other areas may possess regional dominants such as Stipa ichu in the Sierra de Catorce, San Luis Potosí, Mexico (Rzedowski 1988). Oftentimes only the less palatable species are present—grasses such as purple threeawn (Aristida purpurea), fluffgrass (Dasyochloa pulchella), the bottom-dwelling burrograss (Scleropogon brevifolius, often persisting in prairie dog communi-
ties), and hairy tridens (Tridens pilosus). Lehmann’s lovegrass (Eragrostis lehmanniana), an early “green-up” grass purposely introduced from South Africa, now occupies extensive areas in some northwestern portions of Semidesert Grassland and appears to be spreading at the expense of more palatable native grasses, and must now, for better or worse, be considered as part of this biotic community’s flora. Generally speaking, as is the case in Plains Grassland, the russet-colored grasses provide more nutritious forage to livestock than the lighter, yellowish or “white” species, the former almost always outnumbered by the latter.

Forbs or herbs may be seasonally abundant with different suites of species usually flowering in spring–Cryptantha spp., tansy mustards (Descurainia spp.), filaree (Erodium spp.), lupines (Lupinus spp.), pepperweeds (Lepidium spp.), and mallows (Sphaeralcea spp.)—than during the summer–amaranth (Amaranthus spp.), spiderlings (Boerhaavia spp.), paintbrush (Castilleja spp.), sandmats (Chamaesyce spp.), and woolly tidestromia (Tidestromia lanuginosa).

And, although the species of shrub, tree, and cacti associates present may appear to vary more than the grasses, many
are more or less found throughout. When present, dry-tropic stem and leaf succulents are especially important in determining the biotic community’s composition and landscape character. Examples include the desert spoons or sotols (Dasylirion leiophyllum, D. wheeleri), beargrasses or sacabnistas (Nolina erumpens, N. microcarpa, N. texana), century-plants and shin-daggers (Agave lechuguilla, A. parryi, A. parviflora, A. schottii, etc.), and especially the yuccas (Yucca baccata, Y. decipiens, Y. elata, Y. faxoniana, Y. thompsoniana, Y. torreyi, etc.).

Short leguminous trees, mostly mesquite and acacia or huisachos (Acacia constricta, A. schaffneri) commonly attain aspect dominance, thus giving the grassland or former grassland an African savanna-like appearance (Figure 64). Other generally or locally important scrubs or shrubs components, several of which may share or even assume dominance, are catclaw acacia (Acacia greggii), Wright’s lippia (Aloysia wrightii), barberry or algerita (Berberis spp.), false mesquite (Calliandra eriophylla), desert hackberry or granojo (Celtis pallida), netleaf hackberry (Celtis reticulata), Mormon tea (Ephedra trifurca), ocotillo (Fouquieria splendens), one-seed juniper (Juniperus monosperma), allthorn (Koeberlinia spinosa), javelina-bush (Condalia erioides), mimosa (Mimosa aculeaticarpa, M. dysocarpa), little-leaf sumac (Rubus microphylla), greythorn (Zizyphus obtusifolia), and many others. All of these plants were natural inhabitants of Semidesert Grassland, and remain so, albeit now often presenting greater densities than formerly. Semidesert Grassland has naturally high shrub diversity, most species being taller than the grasses. The result is therefore often one in which the grass plants are overtopped by their dry-tropic shrub associates, giving a multi-tiered aspect to the landscape physiognomy. Also, such characteristic Chihuahuan Desertsurb shrubs as whitethorn acacia (Acacia constricta, A. neovernicosa), tarbush (Flourensia cernua), and creosote (Larrea tridentata) have invaded, and continue to invade, extensive areas of Semidesert Grassland, thereby adding to the grassland’s broken character (Figure 65).

In the north and west, where significantly greater winter precipitation can be expected, smaller invasive shrubs such as turpentine bush (Eriocentrum lariciofolium), certain buckwheats (Ergonum fasciculatum, e.g.), snakeweed (Gutierrezia sarothrae), collequeflower (Hymenopappus flavescens), burroweed (Isocoma tenisesta), matriola (Parthenium incanum), threadleaf groundels (Seneio flaccidum), crownbeards (Verbesina spp.), desert zinnia (Zinnia acerosa), and herbaceous sages such as Artemisia ludoviciana may be present to various degrees, and depending upon location and grazing history, even assume local dominance (Figure 66).

In Mexico, and in parts of Arizona and Texas, it is not unusual for a suite of thornscrub components to be present. Depending upon the location, these may include baby-bonnets (Coursetia glandulosa), hopbush (Dodonaea viscosa), kidneywood (Eysenhardtia orthocarpa), desert cotton or algodön (Gossypium thurberi), Wright’s mock buckthorn (Sageretia wrightii), gum bully (Sideroxylon lanuginosum), or almost any other species found in Tamaulipan, Sinaloan, or Guerreran thornscrub.

Cacti, while not always conspicuous, are important in the structure and composition of Semidesert Grassland (Figure 67). Species well represented in this biotic community, include the chollas (e.g., Cylindropuntia acanthacarpa, C. imbricata, C. kleiniae, C. leptocaulis, C. spinosior), several hedgehogs including the rainbow cactus (Echinocereus rigidissimus), barrel cactus or bisonaga (Ferocactus pilosus, F. wislizeni, Thelocactus conothelos, T. hexaedrophorus), the pincushions (Echinomastus erectocentrus, E. intertextus, Mammillaria graminii, M. heyderi, M. mainiae, M. wrightii) and numerous prickly-pears including Opuntia dorothea, O. macrocentra, O. phaeacantha, O. streptacantha, etc.

Trees, except for mesquites, acacias and one-seed junipers, are usually restricted to drainageways where one may encounter desert willow (Chilopsis linearis), cymero (Celtis reticulata), Western soapberry (Sapindus saponaria), or one of the
oaks from the Madrean Evergreen Woodland higher up, e.g. *Quercus chihuahuensis, Q. emoryi, Q. grisea*, et al.

Although many Semidesert Grassland areas in the north have been subject to investigation, see e.g., the extensive works summarized in McLaran and VanDevender (1995), much less is known about Semidesert Grassland communities in central Mexico. Rzedowski (1988) illustrates and briefly describes Semidesert Grassland sites near Vallejo, San Luis Potosí inhabited by *Muhlenbergia purpusii*, a halophytic community of *Distichlis spicata* near Coacalco, Mexico; a grassland composed of *Abildgaardia mexicana, Bouteloua radicosa*, and *Hilaria cenchroides*, near Tepoztotlan, Mexico; a pastizal...
of *Bouteloua*, *Hilaria*, and *Muhlenbergia* with *Acacia schaffneri* near Tepeji del Río, Hidalgo; a *pastizal* community of *Bouteloua gracilis* (navajita) near Ojuelos, Jalisco; a *pastizal* of *Axonopus* and *Paspalum* near de Lolotla, Hidalgo; a *pastizal* of *Bouteloua*, *Cathestecum* and *Trachypogon* near Iguala, Guerrero and a *pastizal* of *Aristida*, *Bouteloua*, *Eriovenenon*, and *Lycurus*, with *Opuntia streptacantha* (nopal cardón) and *Schinus molle* (pirul) near Tepexpan, Mexico. Of these, only the communities of *Distichlis spicata* and *Bouteloua gracilis* have close counterparts in the U. S. or northern Mexico. One community discussed but not illustrated by Rzedowski (1988), which is composed of *Aristida* spp., *Bouteloua chondrooides*, and other species of *Bouteloua* is in extreme northeastern Oaxaca between 2,100 and 2,500 m (6,900 and 8,200) elevation. This community is likely the southernmost *Semidesert Grassland* location in North America.

**Semidesert Grasslands** on Burro Mesa and other sites in west-central Arizona, while formerly populated by perennial warm-season grasses, are today often comprised largely of introduced annuals (Figure 68). Red brome (*Bromus rubens*) may sometimes be the most abundant grass, with wild oats (*Avena*) and bristlegrass (*Setaria*) also prevalent depending on the site and year. Except for the steeper hillsides, the only native grass remaining is often tobosa (*Hilaria mutica*), and these grasslands now have the composition and growth-form appearance of **California Valley Grassland**. Agaves, chollas, palmillas, and sotols, may be lacking as are several characteristic *Semidesert Grassland* animals. Even mesquite, so ubiquitous in so many of these grasslands, is only locally common, and the principal scrub components are acacias (*Acacia* spp.), barberry (*Berberis* spp.), crucifixion thorn (*Canotia bolacantha*), one-seed juniper (*Juniperus monspessula*), prickly-pears (*Opuntia* spp.), and scrub oak (*Quercus turbinella*). Annual forbs, both native and alien, are of great importance in the composition, and snakeweed (*Gutierrezia* spp.) is often the most conspicuous perennial.

Mammals indicative or representative of **Semidesert Grassland** include, in the appropriate locations, the Mexican pronghorn (*Antilocapra americana mexicana*), hispid and silky pocket mice (*Chaetodipus hispidus*, *Perognathus flavus*), yellow-faced pocket gopher (*Crotogomys castanops*), black-tailed prairie dog (*Cynomys ludovicianus*), Merriam, Ord’s Phil-
lips, and banner-tailed kangaroo rats (Dipodomys merriami, D. ordii, D. phillipsii, D. spectabilis), black-tailed and white-sided jack rabbits (Lepus californicus, L. callotis), Southern plains and white-throated wood rats (Neotoma cinerea, N. albigula), Southern grasshopper mouse (Onychomys torridus), fulvous harvest mouse (Reithrodonontys fulvescens), the cotton rats (Sigmodon hispidus and S. fulviventer), and Mexican and spotted ground squirrels (Spermophilus mexicanus S. spilosoma).

The variety of bird-life is also great, and a list of characteristic nesting species would include the black-throated, Botteri’s, Cassin’s, and rufous-crowned sparrows (Amphispiza bilineata, A. botterii, A. cassini, A. ruficeps), scaled quail (Callipepla squamata), Lucifer’s hummingbird (Calothorax lucifer), cactus wren (Campylorhynchus brunneicapillus), lark sparrow (Chondestes grammacus), Chihuahuan raven (Corvus cryptoleucus), Chihuahuan sparrow (Passerella sandwichensis), Say’s phoebe (Sayornis saya), Worthen’s sparrow (Spizella wortheni), Eastern and Western meadowlarks (Sturnella magna, S. neglecta), curve-billed thrasher (Toxostoma curvirostre), Cassin’s kingbird (Tyrannus vociferans), and Bell’s vireo (Vireo bellii).

Reptiles are well represented and include a number of characteristic taxa, especially at the subspecific level. See Appendix 3 for a list from Morafka (1977) and Stebbins (1985) that applies to a variety of habitats within Semidesert Grassland. As befits this grassland’s generally arid environment, indicative amphibians are less numerous, but include a number of species of more or less regional occurrence. These include the Great Plains toad (Bufo cognatus), green toad (Bufo debilis), Texas toad (Bufo speciosus), Couch’s spadefoot (Scaphiopus couchii), Plains spadefoot (Spea bombifrons), Western spadefoot (Spea hammondii), and the New Mexico spadefoot (Spea multiplicata).

As is to be expected, many Semidesert Grassland species also occur in adjacent scrublands and desertlands, e.g., black-throated sparrow (Amphispiza bilineata), Gambel’s quail (Callipepla gambelli), desert mule deer (Odocoileus hemionus), and Bell’s vireo (Vireo bellii). Others such as the black-tailed prairie dog (Cynomys ludovicianus) and aplomado falcon (Falco femoralis), are equally or more representative of other grassland biotic communities, while a few species such as the Oaxaca sparrow (Aimophila nototctica) and Worthen’s sparrow (Spizella wortheni) are endemic to certain communities within Semidesert Grassland.

In general, Semidesert Grassland and other open landscape-adapted species have fared less well than their scrub-adapted counterparts (see e.g., Brown and Davis 1994). Pronghorn (Antilocapra americana), for example, are now absent from large areas of their former range in Semidesert Grassland whereas mule deer (Odocoileus hemionus) and javelina (Pecari tajacu) greatly expanded their ranges during the 20th Century. Such changes in distribution are symptomatic of an increase in the densities of dry-tropic scrub species in this biotic community over the last century. This replacement of marginal grasslands by dense stands of shrubs and trees occurs in a number of ways. Livestock grazing removes the grass cover, thus opening the country to not only erosion but an invasion of desert plants by increasing the evaporation rate, thus decreasing the effective precipitation (desertification). Also, by opening the stands of grass, livestock deposit seeds of mesquite and other shrubs, increasing shrub density. Further, fire suppression allows the establishment of woody plant seedlings. Once begun, this cycle of change is almost irreversible due to changes in surface soil, a lack of fine fuels to carry fire, and the competitive advantage of deep rooted shrubs and trees over shallow-rooted grasses (see e.g. McAullife 1997, McLaren et al. 2003).
Table 10. Mean precipitation totals for stations located within or adjacent to Semidesert Grassland.

<table>
<thead>
<tr>
<th>Location - Lat./Long.</th>
<th>Altitude (m)</th>
<th>Precipitation (mm)</th>
<th>J</th>
<th>F</th>
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<th>Total</th>
<th>Apr - Aug %</th>
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</thead>
<tbody>
<tr>
<td>Hillside, Arizona, USA</td>
<td>1012 (3320')</td>
<td>40 38 46 19 9 6 41 62 37 25 39 38 400 (15.8&quot;)</td>
<td>137</td>
<td>34</td>
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<tr>
<td>Roswell, New Mexico, USA</td>
<td>1101 (3649')</td>
<td>9 12 8 12 26 41 43 66 51 27 13 11 319 (12.6&quot;)</td>
<td>188</td>
<td>59</td>
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<td>Lordsburg, New Mexico, USA</td>
<td>1324 (4250')</td>
<td>22 15 17 6 7 14 51 53 32 30 18 29 294 (11.6&quot;)</td>
<td>131</td>
<td>45</td>
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<tr>
<td>Big Spring, Texas, USA</td>
<td>762 (2500')</td>
<td>16 20 19 34 71 59 43 52 99 40 20 15 488 (19.2&quot;)</td>
<td>259</td>
<td>53</td>
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<td>Sasabe, Arizona - Sonora, USA-MEXICO</td>
<td>1094 (3590')</td>
<td>30 32 26 9 6 7 102 77 50 34 23 47 443 (17.5&quot;)</td>
<td>201</td>
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<td>Fronteras, Sonora, MEXICO</td>
<td>1136 (3727')</td>
<td>24 11 13 5 3 13 96 87 30 14 12 21 329 (12.9&quot;)</td>
<td>204</td>
<td>62</td>
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<td>Valentine, Texas, USA</td>
<td>1347 (4420')</td>
<td>12 11 7 8 19 51 57 74 78 30 15 13 375 (14.8&quot;)</td>
<td>209</td>
<td>56</td>
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<tr>
<td>Buenaventura, Chihuahua, MEXICO</td>
<td>1545 (5069')</td>
<td>8 17 3 12 9 26 89 108 46 29 9 21 377 (14.8&quot;)</td>
<td>244</td>
<td>65</td>
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<td>Chihuahua, Chihuahua, MEXICO</td>
<td>1431 (4695')</td>
<td>4 5 8 8 11 25 80 96 95 37 8 21 398 (15.7&quot;)</td>
<td>220</td>
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<tr>
<td>Sierra Mojada, Coahuila, MEXICO</td>
<td>1263 (4144')</td>
<td>7 9 8 7 23 46 80 67 84 29 9 14 383 (15.1&quot;)</td>
<td>223</td>
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<td>Monclova, Coahuila, MEXICO</td>
<td>615 (2018')</td>
<td>13 13 9 18 38 39 47 42 78 32 15 14 358 (14.1&quot;)</td>
<td>184</td>
<td>51</td>
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<tr>
<td>El Rodeo, Durango, MEXICO</td>
<td>1340 (4397')</td>
<td>8 4 2 5 12 48 89 88 81 25 7 9 377 (14.8&quot;)</td>
<td>242</td>
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<td>Cuencame, Durango, MEXICO</td>
<td>1580 (5183')</td>
<td>10 5 4 6 16 47 75 98 73 26 9 1 370 (14.6&quot;)</td>
<td>242</td>
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<td>Canatlán, Durango, MEXICO</td>
<td>1950 (6398')</td>
<td>11 4 2 5 9 62 135 133 102 32 7 11 513 (20.2&quot;)</td>
<td>344</td>
<td>67</td>
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<td>Charcas, San Luis Potosi, MEXICO</td>
<td>2020 (6628')</td>
<td>11 7 9 12 40 64 59 51 61 39 16 14 383 (15.0&quot;)</td>
<td>226</td>
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<td>Zacatecas, Zacatecas, MEXICO</td>
<td>2612 (8570')</td>
<td>5 3 2 5 13 49 46 67 51 28 6 12 287 (11.3&quot;)</td>
<td>180</td>
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<tr>
<td>Leon, Guanajuato, MEXICO</td>
<td>1809 (5935')</td>
<td>11 7 9 7 29 112 147 134 112 39 13 11 631 (24.8&quot;)</td>
<td>429</td>
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<td>Querétaro, Querétaro, MEXICO</td>
<td>1813 (5948')</td>
<td>11 5 7 10 44 98 121 103 93 35 9 10 546 (21.5&quot;)</td>
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<tr>
<td>Mixquiahuala, Hidalgo, MEXICO</td>
<td>2050 (6726')</td>
<td>10 6 13 32 61 83 85 71 72 35 13 9 490 (19.3&quot;)</td>
<td>332</td>
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<tr>
<td>Distrito Federal, Mexico, MEXICO</td>
<td>2234 (7330')</td>
<td>8 5 12 19 49 106 129 121 110 44 15 7 625 (24.6&quot;)</td>
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<tr>
<td>Tehuacán, Puebla, MEXICO</td>
<td>1676 (5499')</td>
<td>3 4 18 71 89 76 59 111 38 4 5 2 480 (18.9&quot;)</td>
<td>406</td>
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Grasses in many former areas of Semidesert Grassland have been replaced by noxious weeds and woody shrubs and trees, documented by authors such as Leopold (1924), Humphrey (1958), and Martin (1975). Both mesquite and juniper have invaded large areas of former grassland, and a continued increase in shrubbery is indicated by time lapse photography (e.g., Parker and Martin 1952, Hastings and Turner 1965, Turner et al. 2003). Many of these changes are striking, especially in the increase in abundance of certain shrubs and cacti. Less discussed, but of equal or greater importance, is the disappearance and replacement of soil-binding perennial grasses by shallow rooted shrubs and annuals, both native and introduced. Two especially successful native half-shrubs, burroweed (Isocoma spp.) and snakeweed (Gutierrezia spp.), are now the dominant understory cover over millions of hectares and the only understory indicators of the former presence of a grassland community. Burroweed may germinate with either fall or spring precipitation, but grows primarily in the spring. And although extensive areas of former Semidesert Grassland in Arizona and southwestern New Mexico have been taken over by burrowed, snakeweed (another cool-season germinator), is even more widespread (Martin 1975). Both compete directly with the grasses. For this reason, much of the grassland in these states is now in a disclimax state and has taken on the appearance of an open “soft chaparral” composed of semidesert shrubs and scrub (Figures 69, 70). Eastward, the primary invaders of Semidesert Grassland tend to be
Chihuahuan Desert species, and much former grassland in southern New Mexico, Texas, and northern Mexico is now populated by *Acacia*, tarbush (*Flourensia cernua*), creosote (*Larrea tridentata*), or mesquite (*Prosopis* sp.). Other areas have been converted to thickets of cacti, *Mimosa*, and other thorny plants where not reduced to bare ground. Other invasions to the south have been equally pervasive, and it is often difficult to accept that much of this change was accomplished within the last 100 years.

Despite its large areal extent and enormous biotic diversity, no national parks have been created to specifically protect Semidesert Grassland communities. There are, however, a number of both public and private areas under sustained use management, along with a few areas closed to grazing. One of the largest and best examples of the latter is the 46,540 ha (115,000 acre) Buenos Aires National Wildlife Refuge along the Arizona-Sonora border, which has been protected from grazing since 1985. Other publically managed Semidesert Grasslands are contained within the 23,155 ha (57,215 acre) San Andreas National Wildlife Refuge in south-central New Mexico; the 1,436 ha (3,549 acre) San Bernardino N.W.R. in southeastern Arizona; the 18,211 ha (45,000 acre) Las Ciénegas National Conservation Area in southeastern Arizona; and the 28,733 ha (71,000 acre) Agua Fria National Monument in south-central Arizona. Other long standing study areas such as the Sevilleta National Wildlife Refuge in New Mexico and the Jornada and Santa Rita Experimental Ranges in New Mexico and Arizona, while extremely valuable from a rangeland study perspective, have had their Semidesert Grassland communities compromised by the introduction of exotic grasses and a long term emphasis on range management and fire suppression (see e.g., McClaren et al. 2003). Still other grasslands such as those present on White Sands Missile Range in New Mexico and Fort Bliss in Texas, while protected from grazing, are subject to anthropomorphic disturbances. There are, unfortunately, no grassland refugia in Mexico, even though a number of conservatively managed sites are worthy of long-term protection.
The original nature and composition of California Valley Grassland can only be surmised. Where not under cultivation or urbanized, it is now mostly an annual grassland much disrupted by more than 200 years of grazing, plowing, alien plant introductions, changing fire regimes, and other man-caused disturbances. And although there has been much speculation on the grassland’s make-up prior to European settlement, and many investigators believe that the original vegetation was dominated by perennial grasses, historic evidence is meager and the earliest references are to “annual prairies.” Whatever the case, today, more than 400 alien forbs and grasses comprise from 50 to 90% of the grassland’s vegetative cover (Talbot et al. 1939, Bentley and Talbot 1948, Biswell 1956, Burcham 1956, McNaughton 1968, Heady 1988).

Also called “California annual grassland,” “California prairie,” “California steppe,” and “Valley grassland” (Munz and Keck 1949, Küchler 1964, 1977; Heady 1988), this biotic community is restricted to the Californias where it resides from sea-level to an elevation of ca. 1,200 m (3,950 ft). This grassland formerly occurred throughout California’s Central Valley and its surrounding foothills, in coastal valleys, and on coastal mesas and hillsides from the vicinity of San Francisco Bay southward to at least Valle de Trinidad in Baja California Norte. It is also an important vegetation type on southern California’s off-shore islands including Isla Guadalupe (Figure 71). California Valley Grassland examples can also be found on the east side of the Tehachapi Mountains in portions of Antelope Valley and in other locations on the eastern edge of the Mohave Desert (Figures 72). Parts of the Los Angeles Basin were formerly California Valley Grassland, as were portions of the low, interior valley around Riverside, CA, and most of the coastal mesa in Orange County on which Irvine Ranch (now Irvine) is situated. Other southern locales include the Carrizo Plains in San Luis Obispo County, CA; Warner, Ramona, and Coahulla valleys in San Diego County, CA; and Valle San Rafael and Valle del Rodeo in Baja California.

Although the grassland itself has greatly changed, its exterior boundaries appear to remain much the same as when California was acquired from Mexico in the middle of the 19th Century (Heady 1977). Upslope in some valley bottoms, California Valley Grassland commonly grades into California Evergreen Woodland where it may form savannas with California buckeye (Aesculus californica), California walnut (Juglans californica), blue oak (Quercus douglasii), valley oak (Q. lobata), or other overstory trees. In the south, and near the coast, it often occurs with California Coastalscrub at lower elevations and with California Chaparral in higher locations (Figure 73).
Figure 71. Disclimax California Valley Grassland on the northeastern portion of Guadalupe Island 250 km (160 mi) off the Pacific coast of Baja California. Here as elsewhere in this biotic community the native grassland flora has given way to adventive annuals; in this case and year (1979), wild oats (*Avena fatua*) was the grassland’s principal participant. April 1979, D.E.B.

Figure 72. California Valley Grassland and tule elk (*Cervus canadensis nannodes*) on Wind Wolves Preserve, San Luis Obispo County, California, ca. 1,155 m (3,790 ft). The residual brown colored grasses are probably perennial species of needlegrasses (*Achnatherum* spp., *Nassella* spp.) whereas the new flush of green vegetation is mostly composed of Mediterranean annuals. January 2004, Kevin Clark.
The climate is warm-temperate Mediterranean characterized by mild, moderately wet winters with warm to hot, dry summers. The growing season is from seven to 11 months with 200 to 325 frost-free days (Munz and Keck 1949). Annual rainfall averages range from as low as 120 mm (5 in) on the Carrizo Plain to more than 500 mm (20 in) in some northern coastal locations with more than 80% of the total falling during the October through March period (Table 11). Summer temperatures frequently exceed 41 degrees C (105 F), and while winter temperatures rarely drop below -4 °C (25 F), winter frosts may be heavy (Biswell 1956).

After studying California Valley Grassland for more than 25 years and examining a number of relict sites, Heady (1977) concluded that the original vegetation was dominated by perennial bunch-grasses. Of these, the principal species were thought to be needlegrasses – primarily foothill needlegrass and purple needlegrass (Nassella lepida, N. pulchra) with nodding needlegrass (N. cernua) more prevalent in the south and desert needlegrass (Pappostipa speciosa) in Antelope Valley. Other perennial grasses included spidergrass (Aristida ternipes), squirreltail (Elymus elymoides), blue wildrye (Elymus glaucus), Idaho fescue (Festuca idahoensis), junegrass (Koeleria macrantha), beardless wildrye (Leymus triticoides), California melicgrass (Melica californica), smallflower melicgrass (M. imperfecta), and Sandberg bluegrass (Poa secunda). Interspersed among these bunchgrasses were a number of native annuals including such grass species as prairie threeawn (Aristida oligantha), annual hairgrass (Deschampsia danthonioides), several Orcutt grasses (Orcuttia spp.), rat-tail fescue (Vulpia myuros), and Pacific fescue (Vulpia microstachya). A number of broad-leaf herbs, many having bulbs, were also present and included both annuals and perennials (Heady 1977, Sawyer and Keebler-Wolf 1995).

Because purple needlegrass often comes in after burning, this perennial is thought to have occupied extensive
areas prior to fire suppression (Biswell 1956). Certainly the absence of large herbivores other than tule elk (*Cervus canadensis nannodes*), and the periodic fires set by Native Americans prior to the introduction of livestock permitted this possibility.

Whatever the pre-European vegetation, California Valley Grassland is now largely annual grassland composed of “alien” forbs and grasses (Figure 75). The changes that have occurred appear to be irreversible, and both the annual and alien aspects of the vegetation are now permanent characteristics of this biotic community save a relatively mesic and protected sites (Figures 76, 77). Several studies, including one on the San Joaquin Experimental Range in the western Sierra Nevada foothills, which was in an area that had been protected from grazing for more than 50 years, showed virtually no return to a “native prairie.” Although none of the native bunchgrasses have been entirely eliminated, these species are now confined to relict areas and dominate only locally (Sawyer and Keeler-Wolf 1995). Indeed, one wonders if large areas of California Valley Grassland may not have always been populated principally by annuals.

Today the principal introduced annuals according to Heady (1977) are silver hairgrass (*Aira caryophyllea*), slender oat (*Avena barbata*), wild oats (*A. fatua*), ripgut brome (*Bromus diandrus*), soft brome (*B. bordeaeus*), compact brome (*B. madritensis*), several ryegrasses (*Lolium* spp.), and rat-tail fescue (*Vulpia myuros*). Forbs commonly present include mustards (*Brassica* spp.), owl’s clover (*Castilleja etserta* et al.), star-thistles (*Centaurea* spp.), stork’s bill (*Erodium botrys*), fialree (*E. cicutarium*), the native California poppy (*Eschscholzia californica*), California goldfields (*Lasthenia californica*), lupines (*Lupinus biolor*, et al.), and johnny-tuck (*Triphysaria eriantha*). These forbs, together with the grasses, often occur within a diverse environment and it is not uncommon for 50 or more species to be present in a relatively small area.

Not all of the introduced species arrived at the same time. Early alien arrivals prior to the California Gold Rush included *Erodium cicutarium*, *Hordeum murinum*, *Lolium perenne*, *Poa annua*, *Rumex crispus*, and *Sonchus asper*. The following years probably saw the most significant period of change, and ubiquitous species as *Avena fatua* and *Brassica nigra* were well established by the Civil War. Since then, *Aira caryophyllea*, *Aegilops triuncialis*, *Brachypodium distachyon*, *Bromus rubens*, *Centaurea melitensis*, *Chondrilla juncea*, *Gastridium phleoides*,

![Figure 74. California Valley Grassland on Cosumnes River Preserve, Sacramento County, California, ca. 15 m (50 ft). The trees in background along the drainage are valley oaks (*Quercus lobata*). Note the vernal pool in left center of photo. 1995, Ron Cole.](image-url)
Figure 75. Spring aspect of California Valley Grassland on Potrero Mesa north of Mystic Lake Wildlife Area, Riverside County, California, ca. 600 m (1,970 ft). A former test site for Lockheed Aircraft, this grassland community is composed primarily of spring annuals, many of them introduced forbs such as filaree (*Erodium cicutarium*), which turns brown during the summer months and constitutes a fire hazard that prevents this biotic community from becoming California Coastalscrub. Undated, D.E. B.

Figure 76. Spring aspect of California Valley Grassland showing both annual forbs and perennial grasses on Jepson Prairie Preserve, Solano County, California, ca. 23 m (75 ft). 1995, Ron Cole.
**Hordeum murinum**, and several *Sisymbrium* species have all become established, some like *Bromus hordeaceus* becoming important grassland constituents. Most of the alien species are from southern Europe and the Middle East with Spain being heavily represented (Heady 1977).

Grazing appears to favor some forbs over grasses and other herbs, and fields of *filaree* are indicators of heavy grazing and are probably successional to the grasses. Tall species such as *Avena fatua* and *Bromus hordeaceus* prosper best under light grazing. Some species also mature and set seed earlier in the year than others—*Agoseris heterophylla*, *Castilleja* spp., *Hypochoeris radicata*, *Lasthenia californica*, *Lotus* spp., and *Trifolium* spp. Others tend to flower and set seed during the summer months—*Aristida oligantha*, *Croton setigerus*, *Gastridium phleoides*, and *Madia* spp. (Heady 1977).

Unlike the also-warm temperate Semidesert and Gulf Coastal grasslands, shrubs are not usually important landscape features of California Valley Grassland. The exceptions are mostly in the more arid south where allscale (*Atriplex polycarpa*), sages including big sage (*Artemisia tridentata*), and goldenweed (*Pyrrocoma racemosa*) may be present along with any of a suite of coastalscrub shrubs (Heady 1977).

According to Philbrick and Haller (1977) the grasslands of the Channel Islands are somewhat different from those on the mainland in that such non-grass associates as yarrow (*Achillea millifolium*), bluedicks (*Dichelostemma capitatum*), California buttercup (*Ranunculus californicus*), and Western blue-eyed grass (*Sisyrinchium bellum*) are likely to be present. Perhaps because of its status as a gunnery range and grazing refugium, San Clemente Island contains impressive areas of needlegrass (*Nassella* spp.) grassland.

The slogan to keep “California Green and Golden” is an appropriate moniker for California Valley Grassland. Most of the annuals germinate with the first significant rains in early fall, gradually turning the landscape into a soft green carpet (Heady 1977). Growth through the winter is slow due to the cool temperatures, but greatly accelerates with the coming of spring, most plants maturing between April and early June. The composition, height, and character of the grassland thus changes not only annually but throughout the year, and depends on precipitation amounts and chronology, temperatures, grazing history and intensity, relative humidity and other factors. In some serendipitous years, especially those following copious fall rains, a great show of wildflowers may present a brief mosaic of oranges, yellows, and purple with the appearance of California poppies, lupines, owl’s clover, etc. (Figure 77). Herbs may dominate in some years, grasses in others. By the end of June, however, the countryside is a golden brown and will remain so until the rains come and the cycle begins anew. Most of the seeds remain through the summer, some remaining viable for years.

Only recently have a few areas of California Valley Grassland received what will hopefully be long term protection, and even now, the number of reserves and protected areas containing this biotic community are few. Some nota-
ble exceptions are the Hastings Reservation in Carmel Valley managed by the University of California, and the U.S. Forest Service’s San Joaquin Experimental Range on the west slopes of the Sierra Nevada. There are also a number of excellent county parks, and growing number of private, state, and Federal reserves: The Wind Wolves Preserve (Figures 72, 77), 38,445 ha (95,000 acre) managed by the California non-profit Wildlands Conservancy; the 58,276 ha (144,000 acre) Carrizo Plains National Monument, and the 52,000 ha (70,000 acre) Cache Creek Natural Area, both managed by the Bureau of Land Management. A limited number of state and private reserves also protect vernal pools and other grassland features such as the small but noteworthy 500 ha (1250 acre) Colusa Bypass Wildlife Area managed by the California Department of Fish and Game.

As befits a relatively recent evolutionary history, the number of endemic mammals in California Valley Grassland are few and these limited to the San Joaquin/Nelson's antelope squirrel (Ammospermophilus nelsoni), San Joaquin Pocket mouse (Perognathus inornatus), the California ground squirrel (Spermophilus beecheyi), and San Joaquin kit fox (Vulpes velox mutica). Otherwise, the mammal constituents are chiefly those open country species of more general distribution such as and the recently re-introduced tule elk and pronghorn antelope.

Birds too, with the exception of the California condor (Gymnogyps californianus) and yellow-billed magpie (Pica nuttalii) and are principally those of more general grassland distribution— the rufous-crowned sparrow (Aimophila ruficeps), grasshopper sparrow (Ammobracus savannarum), burrowing owl (Athene cunicularia), white-tailed kite (Elanus leucurus), prairie falcon (Falco mexicanus), and savannah sparrow (Passerculus sandwichensis). Reptiles and amphibians in California Valley Grassland are also mostly “generalists” with the exception of such “California” species as the California (Western) whiptail (Aspidoscelis tigris), California toad (Bufo boreas halophillus), Western yellow-bellied racer (Coluber constrictor mormon), the Southern and Northern Pacific rattlesnakes (Crotalus oreganus belleri, C. o. oreganus), coast horned lizard (Phrynosoma coronatum), and Western spadefoot (Spea hammondii).