

153.2 Chihuahuan Desertscrub

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First delineated and described by Forrest Shreve (1942a, 1951), the Chihuahuan Desert is the largest of the three Creosotebush dominated deserts in North America. It covers large tracts of eastern Chihuahua, western Coahuila, San Luis Potosí, southern Nuevo Leon, northeast Zacatecas, eastern Durango, southwest Texas, and southern New Mexico, as well as smaller but equally distinctive areas in southeast Arizona and northeast Sonora. It is also one of the least known biomes. This incongruous fact has been somewhat alleviated lately by the recent compendium of available knowledge on the Chihuahuan Desert's living resources edited by Wauer and Riskind (1977). The contributing authors to this and other recent works now allow a reasonable discussion of the region's geography, climate, flora, and fauna.

The Chihuahuan Desert boundaries used here are based on floristic criteria and agree well with those of Henrickson and Straw (1976) and the climatological based outline of Schmidt (1979) (Fig. 98). Although the Desert's eastern and southern regions are outside the delineated boundaries, these outlying areas are within the scope of the Southwest and will be treated as such. Indeed, the actual delineation of the Chihuahuan Desert is a matter for some discussion (Shreve, 1942a; Morafka, 1977; Schmidt, 1979). Its boundaries are further complicated by the desert's recent dynamic expansion into former semidesert grassland—much of which has happened not only within the memory of living people, but continues to be readily observed today (Castetter, 1956; Hastings and Turner, 1965b; York and Dick-Peddie, 1969).

The heart and center of the Chihuahuan Desert is the arid highland plains and basins of north-central Mexico, between the Sierra Madre Occidental and the Sierra Madre Oriental and their outliers. More than 80% of this desertscrub resides on limestone, and the gray gravel plains of this substratum are the characteristic landscape feature over hundreds of kilometers. Although there are more than 1,000 species of plants endemic to the Chihuahuan Desert (Johnston, 1977), many of these are local in distribution and restricted to one or several portions of the desert. As a result the vegetation maintains a recognizable homogeneity in its dominants from west to east and north to center—much more so than in the Sonoran Desert. A greater appearance of large succulents (e.g., *Ferocactus pringlei*, *Echinocactus platyacanthus*), takes place southward, below the Rio Nazas. This region has simply been crossed by the author, the southeastern portions not having been visited. Because the literature is incomplete on this subject, little can be said about the nature and extent of this change in the physiognomy.

Basin and range landscapes prevail throughout, and the desert occupies a vast expanse of rain shadowed basins, outwash plains, low hills, and bajadas. Many of the mountains are large anticlines, some of which rise 2,000 m or more from the barrier of the valley floor and capped in chaparral, pines, oak, and even fir (Fig. 104). After rains, these barren limestone edifices may take on a green appearance with the new growth of the appropriately named Resurrection Plant, *Selaginella lepidophylla*. Drainages are gash-like, without perennial streams; bajadas are steep and often of meager development. Except for local situations along the upper Gila, San Pedro, and Bavispe watersheds in southeast Arizona and in northeast Sonora, the principal external drainage is via the Rio Grande (Bravo) and its major tributaries, the Conchos,

Table 22. Precipitation data for 19 stations in the Southwest within and adjacent to Chihuahuan Desertscrub.

Station Lat./Long.	Elevation (in m)	Mean monthly precipitation in mm												Total Ppn (mm)	Total May through Sept. Ppn	Total Annual Ppn May through Sept. Ppn x 100
		J	F	M	A	M	J	J	A	S	O	N	D			
Socorro, NM 34°05' 106°53'	1,398	8	9	9	10	11	14	35	37	26	22	6	15	201	122	61
Elephant Butte Dam, NM 33°09' 107°11'	1,395	9	7	6	7	7	15	40	49	31	18	6	13	207	141	68
White Sands Nat. Monument, NM 32°47' 106°11'	1,218	12	8	8	7	6	15	39	35	30	18	7	13	197	125	63
Jornada Exp. Range, NM 32°37' 106°44'	1,303	12	9	8	5	5	11	45	43	33	22	9	14	215	137	64
Carlsbad, NM 32°25' 104°14'	951	11	8	13	12	38	37	41	45	41	37	9	10	303	202	67
San Simon, AZ 32°22' 109°08'	1,100	21	13	13	6	3	9	43	55	20	16	10	15	224	131	58
N Lazy H Ranch (Pantano, AZ) 32°07' 110°41'	930	27	21	22	10	4	6	66	65	31	18	17	29	314	171	54
Hachita, NM 31°56' 108°20'	1,370	16	12	12	6	2	9	55	55	31	19	8	15	240	152	64
El Paso, TX 31°48' 106°24'	1,194	10	11	10	6	8	15	39	28	29	20	8	13	197	120	61
Fairbank, AZ 31°21' 109°32'	1,173	18	12	11	5	3	12	87	75	30	13	9	18	391	206	71
Tombstone, AZ 31°42' 110°03'	1,405	20	14	15	7	3	11	96	83	31	16	9	19	324	224	69
Pecos, TX 31°25' 103°30'	796	11	8	8	15	27	27	34	23	35	24	10	9	232	146	63
Douglas, AZ 31°21' 109°32'	1,211	17	17	13	6	5	13	83	73	30	19	16	20	311	203	65
Candelaria, TX 39°09' 104°41'	876	11	7	6	7	17	27	47	50	38	27	8	10	253	178	70
Ojinaga, Chih. 39°34' 104°25'	849	3	6	4	3	9	12	27	45	41	32	14	12	209	134	64
El Mulato, Chih. 29°23' 104°10'	789	8	9	4	11	13	22	26	35	34	14	7	13	196	130	66
Panther Jct., TX 29°19' 103°13'	1,140	11	12	9	10	38	40	54	44	61	42	14	13	348	237	68
Meoqui, Chih. 28°16' 105°29'	1,162	17	3	4	2	12	26	71	64	40	23	13	20	294	213	72
Camargo, Chih. 27°42' 105°10'	1,663	13	4	4	5	8	25	80	59	54	31	14	21	318	228	71

Nazas, and Pecos. Otherwise, most of the region has no outlet to the sea, the drainages ending in closed basins or bolsones. As in the Mohave and Great Basin Deserts, the smaller, ephemeral watershed drainages are without distinctive vegetative development.

Hot in summer, the Chihuahuan Desert can be cold in winter. Summer temperatures over 40°C are common and a low of -30°C has been recorded at Ahumada, Chihuahua (Schmidt, 1975). Freezing temperatures can be expected in its northwestern reaches on more than 100 nights a year, and some days do not get above freezing. Even at the desert's lowest elevations along the Rio Grande, and in the south, the climate is distinctly warm temperate with only an expected 200-250 days between the last 0°C temperature in March and

the first frost of autumn.

Precipitation means range from a low of ca. 200 mm per annum to more than 300 mm (Table 22). Those stations receiving more than this are usually at the edge of the desert or are areas that historically were semidesert grassland. These rainfall amounts are relatively generous for desertscrub. However, most of the precipitation falls during summer thunderstorms when evapotranspiration rates are high, thereby losing much of its effectiveness—well over half of the precipitation is received during the months of May through September. Variability is also high, and the area that received 500 mm during one summer may get only 50 mm the next. Although Chihuahuan desertscrub is characterized by distinctly summer rainfall regime, low intensity precipi-

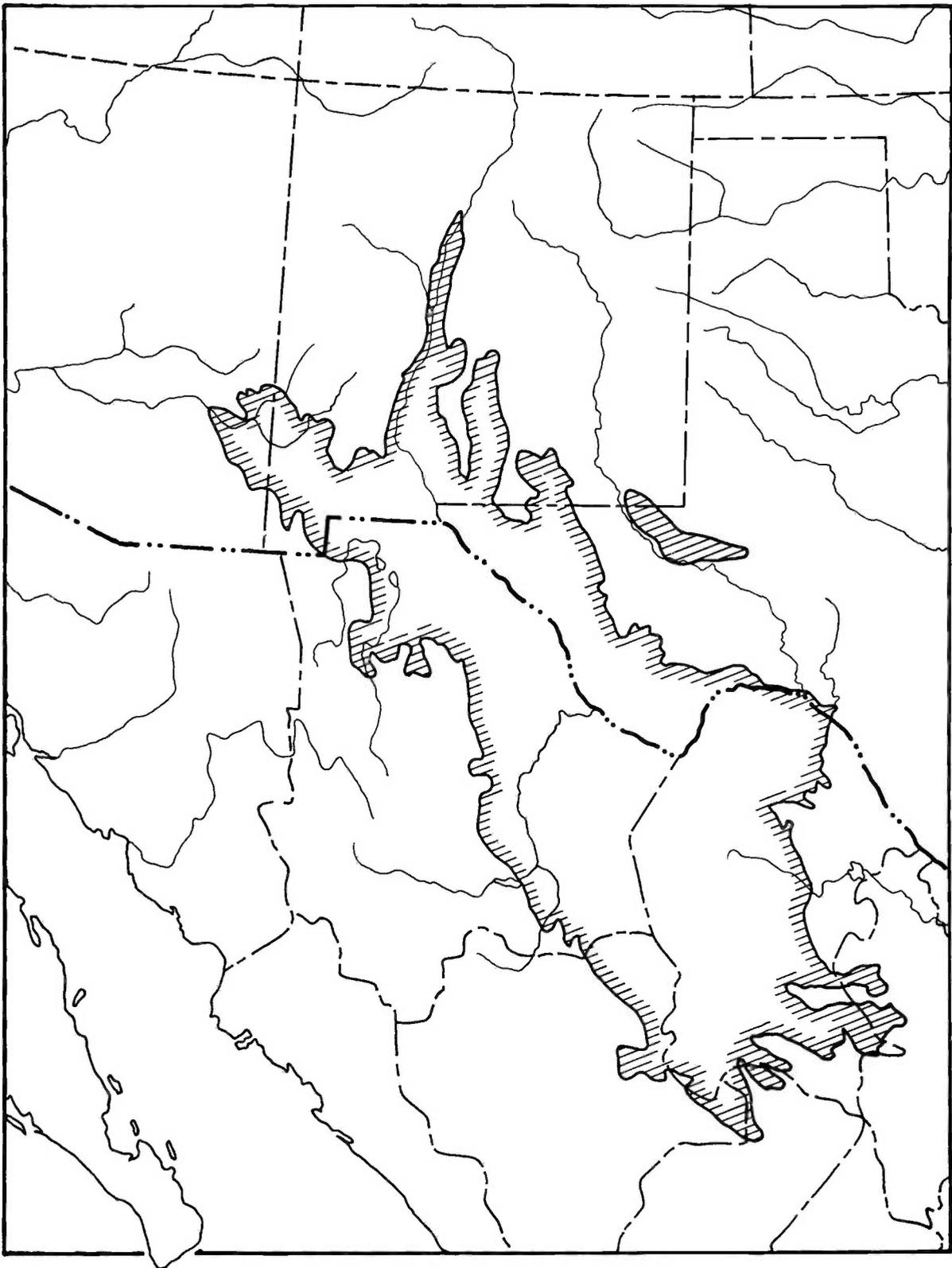


Figure 98. Generalized outline of the "real Chihuahuan Desert" according to Schmidt (1979). Based on mean temperature and precipitation data, the general outline and extent of Schmidt's climatic 'desert' agrees well with our delineation of Chihuahuan desertscrub based on floristic criteria.





Figure 99. Ecotype portraits of *Larrea tridentata* characteristic of three divisions of desertscrub. Upper left: Mohave ecotype. Lower left: Sonoran ecotype. Upper Right: Chihuahuan ecotype. Plants with the "typical" Chihuahuan growth form are shorter, have sparser foliage and straighter stems, and are more open at the base than their Sonoran counterparts. The latter have a fuller, less angular appearance. The Mohave Desert ecotype is shorter and bushier (more "shrub-like") than the Sonoran Desert form. Each ecotype also has a characteristic number of chromosomes, — $n=13$ in the Chihuahuan Desert, $n=26$ in the Sonoran Desert, and $n=39$ in the Mohave Desert (Yang, 1970). Photographs by R.M. Turner.

tation associated with Pacific frontal storms occurs with some regularity. It is, therefore, an oversimplification to consider the Chihuahuan Desert as being without meaningful winter precipitation. This is especially true at the north, where winter precipitation is consistent enough to support several taxa of spring annuals (Burgess, 1980).

The Chihuahuan Desert is a "high" desert. Even its lowest elevations near Langtry, Texas along the Rio Grande are at ca. 400 m. Altitudes gradually increase up the Rio Grande and Rio Conchos to as high as from 1,400 m to 1,600 m. All of the interior basin locales are higher than 700 m, and most are well over 1,000 m. The upper limits in the Southwest are commonly between 1,400 m and 1,500 m (somewhat higher in the south to over 2,000 m) where the desert intergrades with and is finally replaced by semi-desert grassland.

Large expanses of outwash plains, low hills and valleys are characterized by the diploid form of *Larrea tridentata* (Yang,

1970; Fig. 99). Here this phenotypically recognizable form of Creosotebush often shares or temporarily relinquishes dominance with Tarbush (*Flourensia cernua*) or Whitethorn Acacia (*Acacia neovernicosa*) (Fig. 100). Except for the occasional appearance of Ocotillos (*Fouquieria splendens*) and an individual Allthorn (*Koeberlinia spinosa*) or clump of mesquite, these three shrub species are the dominants over hundreds of miles of "plains communities" Chihuahuan Desert. The only other desertscrub communities of widespread occurrence on these valley locales are saltbushes on fine grained soils and open stands of shrub Mesquite (*Prosopis glandulosa* var. *torreyana*) on sandy, wind eroded hummocks (Fig. 101).

Major understory associates on the "plains" are Mariola (*Parthenium incanum*), Guayule (*P. argentatum*), Goldeneye (*Viguiera stenoloba*), *Coldenia canescens*, desert zinnias (*Zinnia acerosa*, *Z. grandiflora*), dogweeds (*Dyssodia* spp.), cacti, and locally, to the east, *Jatropha* (*Jatropha dioica*). At higher

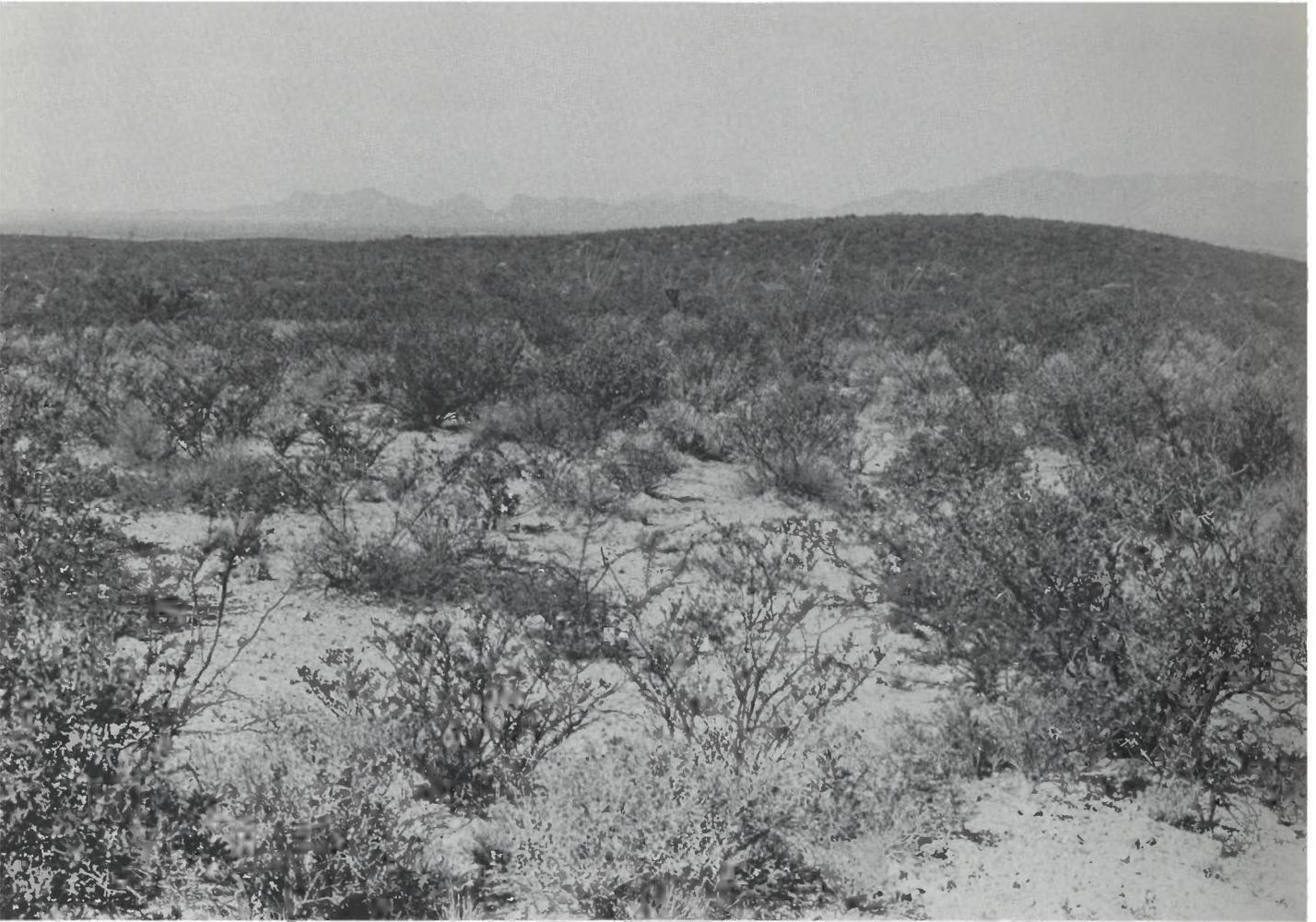


Figure 100. "Plains" community of *Larrea tridentata* and *Flourensia cernua* near Fairbanks, Arizona, ca. 1,250 m elevation. *Larrea tridentata* is the most prevalent plant followed by *Flourensia cernua* and lesser numbers of *Acacia neovernicosa*, *Fouquieria splendens*, *Koeberlinia spinosa*, *Parthenium incanum* and small cacti. Such landscapes, with alternating dominants, characterize millions of hectares of calcareous plains, low hills and bajadas in the Chihuahuan Desert in Arizona, New Mexico, Texas, Chihuahua and Coahuila.

elevations and in areas having more relief, species of the more diverse "succulent-scrub" community increasingly make their appearance—the economically valuable Candelilla (*Euphorbia antisyphilitica*), used for making wax, a bromeliad (*Hechtia scariosa*), Lecheguilla (*Agave lechuguilla*), Ocotillo, dogweeds (*Dyssodia pentachaeta*, *D. acerosa*), Ratany (*Krameria parvifolia* var. *glandulosa*), condalials (*Condalia* spp.), and many, many more.

Upslope, above the shrubby plains, outcrops, arroyo, bajada, and foothill habitats are populated by an increasingly rich assemblage of scrub in which leaf succulents (*Agave*, *Hechtia*) and stem succulents (*Yucca*, *Dasyliirion*) are well represented (Fig. 102). One of the most prevalent of these is the low growing Shindagger or Lecheguilla (*Agave lechuguilla*) which covers thousands of acres of ridges, slopes, and benches. Other succulents usually present as local dominants or representatives include a number of yuccas (*Yucca elata*, *Y. rostrata*, *Y. thompsoniana*, *Y. filifera*, *Y. carnerosana*, *Y. torreyi*, etc.), sotols

(*Dasyliirion leiophyllum*, *D. wheeleri*), agaves (*Agave scabra*, *A. falcata*, *A. neomexicana*, *A. parryi*, *A. striata*, etc.), and nolinacs (*Nolina microcarpa*, *N. erumpens*, *N. texana*).

A great variety of large woody shrubs and cacti are also present in these "succulent-scrub upland" communities and include such species as Ocotillo, Coldenia (*Coldenia greggii*), Catclaw (*Acacia greggii*), cenizos (*Leucophyllum minus*, *L. frutescens*), condalials (*Condalia* spp.), *Zizyphus obtusifolia*, Lippia or Oreganillo (*Aloysia wrightii*), and Little Leaf Sumac (*Rhus microphylla*). Another species, Sandpaperbush (*Mortonia scabrella*) may be locally abundant in southeast Arizona and dominate limestone hills to the exclusion of most other species (Fig. 103). Other species dominate locally elsewhere.

These succulent-scrub communities grade into semi-desert grassland at their upper limits. Consequently, their herbaceous components are varied and abundant as compared to the lower and more depauperate plains communities. Clumps of species of *Bouteloua* and other summer growing grasses may therefore



Figure 101. Mesquite scrub community south of Deming, New Mexico, ca. 1,280 m elevation. Classification of these hummock forming Mesquite communities as disclimax semidesert grassland or Chihuahuan desertscrub is moot.

be common along with a myriad of soft-stemmed shrubs and forbs. An occasional juniper (*Juniperus monosperma*, *J. pinchottii*), as well as any of several chaparral species may also be encountered at the desert's upper limits.

The usual upper and lower elevation contacts with Chihuahuan desertscrub are with semidesert grassland—mixed bunch grasses and scrub above, Tobosa (*Hilaria mutica*) swales or mogotes below (Fig. 104). In the east as near the junction of the Rio Grande and Devil's River, and near Puerto Sacramento east of the Cuatro Ciénegas Basin, the lower elevational contacts are (or were) with Tamaulipan thornscrub. Much of this region of contact is now under cultivation. Occasionally Chihuahuan desertscrub comes in contact directly with Madrean evergreen woodland or interior chaparral as on the northeast slopes of the Chiricahua Mountains where it butts up against *Quercus grisea* woodland. Another unusual intermingling is the gradual replacement of Chihuahuan desertscrub by Sonoran desertscrub along the Bavispe River in Sonora and along the San Pedro River in southeast Arizona (Fig. 105).

The areas drained by the Rio Grande, Gila, and Yaqui rivers

and their tributaries are less than one-third of the desert's total area (Henrickson, 1977). Most of the drainage is internal, ending in enclosed basins with no access to the sea. These bolsón depressions receive infrequent runoff and are therefore more mesic than the surrounding desertscrub plains. Accordingly, the bottom of even the smallest basins is often an island of semi-desert grassland clothed in *Hilaria mutica* or sacatons [*Sporobolus wrightii*, *S. airoides*] with associated semidesert grassland species of scrub, e.g. Mesquite (*Prosopis glandulosa*), Mormon Tea (*Ephedra trifurca*), or Palmilla (*Yucca elata*). In the center of the larger basins, these grasslands may encircle a saline marsh, or, as is more likely, a playa—an intermittently flooded wetland almost devoid of vegetation.

These barren playas were once Pluvial lakes, and on their downwind side, dune fields have often developed as a result of wind carrying the finer dried deposits. These "sand dunes" are of quartz in the volcanic areas or, as is most often the case in this calcereous region, are composed of gypsum (hydrous calcium sulfate). Some of the larger and better known examples are the "White Sands" in New Mexico, the dunes west of Cuatro Ciénegas, Coahuila, and the large dune fields



Figure 102. "Foothill" or mixed succulent-scrub community on slopes of Sierra San Marcos, Coahuila, ca. 825 m elevation. A diverse scrub, the composition at this locale includes *Yucca macrocarpa*, *Dasyliirion leiophyllum*, *Agave lecheguilla*, *Hechtia spp.*, *Opuntia leptocaulis*, *Euphorbia antisiphilitica*, *Leucophyllum frutescens*, *Dyssodia pentachaeta*, *Fouquieria splendens*, and *Larrea tridentata*.



Figure 103. "Mattoral" of Sandpaperbush (*Mortonia scabrella*) and other Chihuahuan desertscrub species (*Larrea tridentata*, *Fouquieria splendens*, *Nolina microcarpa*, *Yucca baccata*, and in immediate right foreground, *Rhus microphylla*) on limestone in the Tombstone Hills, Cochise County, Arizona, ca. 1,425 m elevation. These relatively dense and local desertscrub communities are restricted to calcareous soils at the Chihuahuan Desert's upper limits in southeastern Arizona, where annual precipitation approaches or exceeds 300 mm.

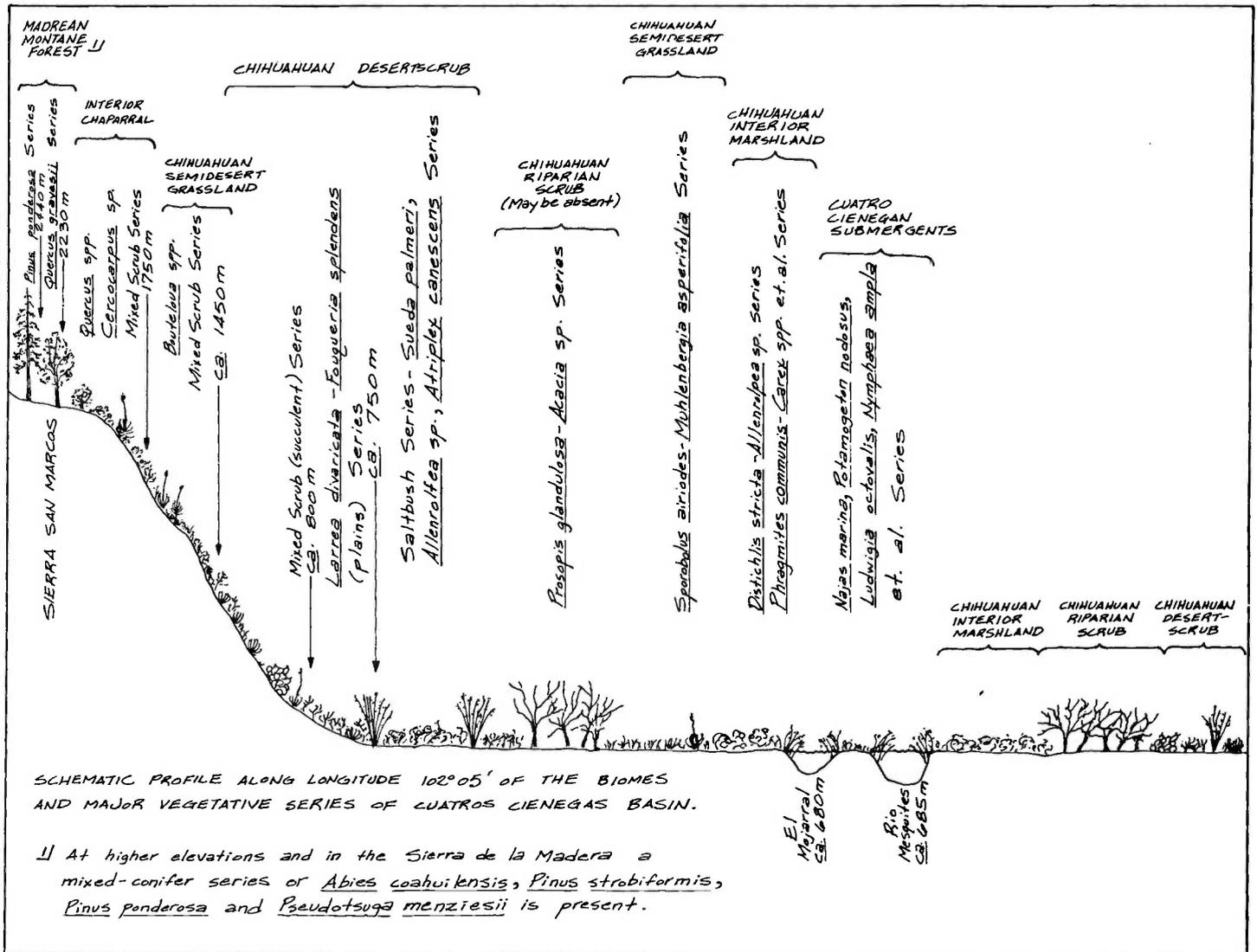


Figure 104. Schematic profile along Longitude 102°05' of the biomes and major vegetative series of Cuatro Ciénegas Basin.

near Samalayuca, Chihuahua [Fig. 106]. These dunes are populated by open assemblages of *Artemisia filifolia*, *Yucca elata*, *Prosopis glandulosa*, *Ephedra trifurca*, *Tiquilia hispida*, *Atriplex canescens*, *Varilla mexicana*, and *Hymenoclea monogyra* as well as a number of gypsophilous endemics, more or less local in distribution (Powell and Turner, 1977). Grasses such as *Sporobolus airoides*, *S. flexuosus*, *S. contractus*, *S. giganteus*, and *Oryzopsis hymenoides* may be important associates depending on the stability of the dunes and on grazing history. Annuals (e.g., *Croton*, *Helianthus*, *Euphorbia*, *Tidestromia*) are seasonally abundant.

Saline depressions not clothed in grasses (e.g., *Distichlis spicata* var. *stricta*) or marsh plants take on an open desertscrub appearance. These low communities occupy extensive acreages in and adjacent to playas and are dominated by a number of halophytes of general distribution—species of *Suaeda*, *Allenrolfea*, and *Atriplex*.

Cacti are only locally dominant and not often conspicuous, at least not to the extent that they are in the Arizona Upland and Gulf Coast subdivisions of the Sonoran Desert. The

Chihuahuan Desert is essentially a shrub dominated biome in which leaf and stem succulents sometimes heavily participate. Nonetheless, small cacti are well represented and a diligent search along a rocky canyon, bajada, or other suitable environment will usually result in the discovery of a surprising number of species over even a small area. It should not go unnoticed, then, that there are almost as many species of cacti in the Chihuahuan Desert in Texas as in the rest of the United States combined. A definitive work on the cacti of the entire region is much needed.

The only prominent cacti in the "Southwest" portion of the Chihuahuan Desert are local populations of *Opuntia bradleyana* in Coahuila, the Cane Cholla (*Opuntia imbricata*), and prickly pears (*Opuntia violacea* var. *macrocentra*, *O. phaeacantha* var. *major*, *O. p.* var. *discata*). Otherwise the cacti are mostly low growing and often clumped or prostrate. These include a number of widespread and endemic forms of Turk's heads and hedgehogs (e.g., *Echinocactus horzonthalonius*, *E. texensis*, *Ancistrocactus uncinatus*, *Ferocactus hamatacanthus*), claret cups, rainbows, and strawberries (*Echinocereus triglo-*



Figure 105. Passing from Chihuahuan desertscrub to Sonoran desertscrub north of Colonia Morelos, Sonora, ca. 1,017 m elevation. Of the dominants shown, *Acacia neovernicosa* is an indicator of Chihuahuan desertscrub and *Opuntia bigelovii* is a Sonoran desertscrub species. The shorter life span of the cholla and the area's recent semidesert grassland history probably make the Chihuahuan desertscrub designation more appropriate at this locale; Sonoran desertscrub is entered farther to the south with the advent of *Stenocereus thurberi* and a host of other Sonoran Desert species prior to entry into Sinaloan thornscrub.

chidiatus, *E. pectinatus* var. *rigidissimus*, *e.p.* var. *neomexicanus*, *E. chloranthus*, *E. enneacanthus* var. *stramineus*], hedgehog coryphanthas [e.g., *Coryphantha strobiliformis*, *C. scheeri* var. *valida*, *C. echinus*, *C. macromeris*, *C. pottsii*, *C. vivipara*, *C. ramulosa*], pincushions and nipple cactus (*Mammillaria gummifera* var. *meiacantha*, *M. pottsii*, *M. gummifera* var. *applanata*), a fish-hook cactus (*Ancistrocactus scheerii*), Texas Cactus (*Neolloydia intertexta*), Button Cactus (*Epithelantha micromeris*), Texas Pride (*Thelocactus bicolor*), and several low statured or prostrate chollas (*Opuntia leptocaulis*, *O. kleiniae*, *O. schottii*, *O. tunicata*). Several others, such as the Night Blooming Cereus (*Peniocereus greggii*), and the infamous Peyote (*Lophophora williamsii*), while widespread, are often local and can be difficult to locate. A truly bizarre species is the Living Rock or Star Cactus (*Ariocarpus fissuratus*) which may go virtually unnoticed until after a rain when a greatly increased moisture content expands its size.

Because of its recent origin, few warm-blooded vertebrates are centered in, or restricted to Chihuahuan desertscrub. A few mammals such as the Desert Pocket Gopher (*Geomys arenarius*), Yellow-faced Pocket Gopher (*Pappogeomys castanops*), Nelson's Kangaroo Rat (*Dipodomys nelsoni*), Nelson's Pocket Mouse (*Perognathus nelsoni*), Southern Grasshopper Mouse (*Onychomys torridus*), Goldman's Woodrat (*Neotoma goldmani*), Texas Antelope Squirrel (*Ammospermophilus interpres*), and Desert Pocket Mouse (*Perognathus penicillatus*) are resident there, but mostly the desert represents a southeastern extension for more general desert-adapted species, e.g., Desert Shrew (*Notiosorex crawfordi*), Desert Mule Deer (*Odocoileus hemionus crooki*), Desert Bighorn Sheep (*Ovis canadensis mexicana*), Merriam's Kangaroo Rat (*Dipodomys merriami*), and Desert Cottontail (*Sylvilagus auduboni*). This is true of the birds also; only the Scaled Quail (*Callipepla squamata*) and White-necked Raven (*Corvus cryptoleucus*)



Figure 106. Dunes near Estación Samalayuca, Chihuahua, ca. 1,340 m elevation. Principal plants are *Artemisia filifolia* (shown); *Prosopis glandulosa*, *Atriplex canescens* and *Ephedra* spp.

can be considered as “characteristic species,” and both of these exceed the range of desertscrub. The Scaled Quail, while periodically one of the desert’s most abundant birds, is equally or more at home in semi-desert grassland, and the desert’s avifauna is largely a mixture of “grassland” species and desert birds of wider distribution—Mourning Dove, Roadrunner (*Geococcyx californianus*), Lesser Nighthawk (*Chordeiles acutipennis*), Scott’s Oriole (*Icterus parisorum*), Cactus Wren (*Campylorhynchus brunneicapillus*), Curve-billed Thrasher (*Toxostoma curvirostre*), and Black-throated Sparrow (*Amphispiza bilineata*).

A Chihuahuan Desert herpetofauna is more apparent. Lizards characteristic of, or at least centered in, the Chihuahuan Desert, according to Morafka (1977), include Texas Banded Gecko (*Coleonyx brevis*); Reticulated Gecko (*C. reticulatus*); Greater Earless Lizard (*Cophosaurus texanus*); Round-tail Horned Lizard (*Phrynosoma modestum*); the spiny lizards, *Sceloporus cautus*, *S. maculosus*, *S. merriami*, *S. ornatus*, *S. poinsetti*, and *S. magister bimaculosus*; the Fringe-footed Lizard (*Uma exsul*) and the Little Striped and Marbled

Whiptails (*Cnemidophorus inornatus*, *C. tigris marmoratus*). Of special interest are two other whiptails (*C. neomexicanus* and *C. tessellatus*), which occur as all female parthenogenic clones in select disturbed habitats within the Chihuahuan Desert (see e.g. Wright and Lowe, 1968). Representative snakes include the Trans-Pecos Ratsnake (*Elaphe subocularis*), Western Hooknose Snake (*Gyalopion canum*), Texas Black-headed Snake (*Tantilla atriceps*), and whipsnakes (*Masticophis taeniatus* and *M. flagellum lineatus*). The Mohave Rattlesnake (*Crotalus scutulatus*) is, along with the Western Diamondback (*C. atrox*), the commonly encountered rattler, both occurring here as well as in the Mohave Desert and Sonoran Desert.

A number of species such as the amazing Bolson Tortoise (*Gopherus flavomarginatus*), while contained within the boundaries of the Chihuahuan Desert, are in fact relict grassland species. These and other grassland animals, e.g., the Pronghorn (*Antilocapra americana*) face deteriorating habitats throughout most of the Chihuahuan Desert region, and several can be expected to disappear in the foreseeable future.