New Mexico Geological Society

Downloaded from: https://nmgs.nmt.edu/publications/guidebooks/31



Vegetation of Trans-Pecos Texas

A. Michael Powell
1980, pp. 299-302. https://doi.org/10.56577/FFC-31.299

in:

Trans Pecos Region (West Texas), Dickerson, P. W.; Hoffer, J. M.; Callender, J. F.; [eds.], New Mexico Geological Society 31st Annual Fall Field Conference Guidebook, 308 p. https://doi.org/10.56577/FFC-31

This is one of many related papers that were included in the 1980 NMGS Fall Field Conference Guidebook.

Annual NMGS Fall Field Conference Guidebooks

Every fall since 1950, the New Mexico Geological Society (NMGS) has held an annual Fall Field Conference that explores some region of New Mexico (or surrounding states). Always well attended, these conferences provide a guidebook to participants. Besides detailed road logs, the guidebooks contain many well written, edited, and peer-reviewed geoscience papers. These books have set the national standard for geologic guidebooks and are an essential geologic reference for anyone working in or around New Mexico.

Free Downloads

NMGS has decided to make peer-reviewed papers from our Fall Field Conference guidebooks available for free download. This is in keeping with our mission of promoting interest, research, and cooperation regarding geology in New Mexico. However, guidebook sales represent a significant proportion of our operating budget. Therefore, only *research papers* are available for download. *Road logs*, *mini-papers*, and other selected content are available only in print for recent guidebooks.

Copyright Information

Publications of the New Mexico Geological Society, printed and electronic, are protected by the copyright laws of the United States. No material from the NMGS website, or printed and electronic publications, may be reprinted or redistributed without NMGS permission. Contact us for permission to reprint portions of any of our publications.

One printed copy of any materials from the NMGS website or our print and electronic publications may be made for individual use without our permission. Teachers and students may make unlimited copies for educational use. Any other use of these materials requires explicit permission.

This page is intentionally left blank to maintain order of facing pages.

VEGETATION OF TRANS-PECOS TEXAS

A. MICHAEL POWELL
Department of Biology
Sul Ross State University and Chihuahuan Desert Reseaach Institute
Alpine, Texas 79830

INTRODUCTION

Trans-Pecos is the region west of the Pecos River in the extreme western part of the State. There are nine relatively large counties completely within the Trans-Pecos, and one of them, Brewster Co., is larger than the state of Connecticut. There are about 51,500 km² in the Trans-Pecos, an area roughly equal to the state of Maine. Most of the Trans-Pecos is under private ownership in the form of relatively large ranches. Cattle ranching is emphasized in most areas, particularly where there are abundant desert grasslands. There are two national parks, Guadalupe Mountains National Park in northern Culberson County, and Big Bend National Park in southern Brewster County.

PHYSIOGRAPHY AND CLIMATE

Most of the Trans-Pecos is physiographically diverse and different from the rest of Texas, mainly because of its Basin and Range topography. The lowest elevation in the Trans-Pecos is about 305 m at the mouth of the Pecos River, and the highest elevation is 2,667 m at Guadalupe Peak. In all there are 90 peaks that are a mile (1.6 km) or more in elevation. The mountains consist of either igneous or sedimentary rocks and in some areas both are present. In El Paso County the Franklin Mountains are predominantly limestone. In Hudspeth County the Hueco and southern Quitman Mountains and Sierra Diablo are limestone, whereas the northern Quitman and Eagle Mountains are igneous. In Culberson County the Guadalupe, Delaware, and Apache Mountains are limestone. The Van Horn Mountains are igneous as are the Davis Mountains that dominate Jeff Davis County and northern Brewster County. Igneous mountains, Sierra Vieja, the Chinatis, and the Bofecillos, also dominate Presidio County. In Brewster County, the Glass, Del Norte, Santiago, Del Carmen and Dead Horse Mountains are limestone, while the magnificent Chisos Mountains are of igneous origin. Much of the eastern Trans-Pecos consists of highly dissected limestone-capped mesas and deep canyons. In overall profile the Trans-Pecos can be pictured as extensive lower elevation flats, slopes, dunes, basins, hills, and ridges surrounding the higher, island-like mountains, plateaus, and basins.

The soils in general are basic and variable in texture and profile. Salt lakes and alkali flats in poorly drained areas are spotted throughout the region, most conspicuously in northern Hudspeth and Culberson Counties and near the Pecos River in Reeves and Pecos Counties. Extensive or localized gypsum substrates are scattered throughout the region, perhaps best exemplified by the gypsum plains of the Castile Formation south of the Guadalupe Mountains in northern Culberson and Reeves Counties. Deep clay, sand, and gravel deposits predominate in certain areas.

The climate of the Trans-Pecos is generally arid. It is cool and dry during the winter and hot and dry during the summer. The average annual precipitation is about 304 mm with most of the rainfall coming in the form of thundershowers in July, August, and early September. Annual precipitation generally decreases from east to west and increases with elevation. El Paso annually records less than 203 mm of precipitation while Presidio averages 216 mm and Alpine 393 mm; and up to 410 mm is usual in the higher elevations. Average mid-summer high temperatures range from about 29° to 35°C, depending largely upon elevation, to 38°C in Presidio, where the highest recorded temperature is 47°C. Average mid-winter low temperatures are from -3° to 0°C, with a record low temperature of -23°C in Fort Davis.

VEGETATION

Ten vegetational areas are recognized for Texas (Correll and Johnston, 1970), one of them being the Trans-Pecos, Mountains and Basins. In reality the Trans-Pecos Vegetational Area is more a geographic distinction than a vegetative one because there is extreme diversity of habitats and vegetation in the region.

Perhaps the most unique vegetative aspect of the Trans-Pecos is the Chihuahuan Desert. About one-third of the Chihuahuan Desert, and its only representation in the United States, is in the Trans-Pecos and parts of southern New Mexico (Rio Grande and Pecos River drainages). Two-thirds of the Chihuahuan Desert is in Mexico. In the Trans-Pecos essentially all of the lower elevation vegetation is part of the northern Chihuahuan Desert flora. Desert plants have slowly encroached upon grasslands of the Trans-Pecos as overgrazing of ranges worsened soil erosion and permitted establishment of new habitats suitable for desert species. Van Devender and Spaulding (1979) have presented paleoecological data, plant fossils from ancient packrat middens, that the Chihuahuan Desert achieved much of its present northerly distribution less than 8,000 years ago when the climate started to become arid.

In Texas another unique aspect of the Trans-Pecos vegetation is the higher mountain flora. The Trans-Pecos mountains are considered by some to be the southern end of the Rocky Mountains, while the Glass Mountains in the central Trans-Pecos may be near the end of the Appalachian range. Present floristic surveys suggest phytogeographic connections between certain mountains of the Trans-Pecos and the southern Rocky Mountains of New Mexico, the mountains of southeastern Arizona, the Sierra Madre Occidental of Mexico, and the Del Carmen-Sierra Madre Oriental of Mexico.

Although the flora of the Trans-Pecos is diverse and complex, at least five general vegetation types may be recognized.

Chihuahuan Desert Scrub

At lower elevations where precipitation ranges from 176 mm to nearly 304 mm, about half of the Trans-Pecos is dominated by various shrub species and semisucculents (fig. 1) such as Lechuguilla (*Agave lechuguilla*), Sotol (*Dasylirion* spp.), and Yucca (*Yucca* spp.). Paleoecological and contemporary ecological data suggest that the desert scrub has gained its present distribution to a large extent through invasion of eroded grassland. Creosotebush (*Larrea tridentata*) is a prominent element of the desert scrub, occurring with mixed shrubs or in some areas forming extensive, almost pure stands. Present evidence suggests that Creosotebush was in-



Figure 1. Chihuahuan Desert Scrub, southern Brewster Co. Lechuguilla (Agave lechuguilla) *is evident in the foreground while Creosotebush* (Larrea tridentata) *predominates the expansive desert flats in the background (photo by Harry Gordon, Chihuahuan Desert Research Institute).*

troduced from South America (Argentina) to the Chihuahuan Desert region, probably in Mexico, from whence it spread to the western Sonoran and Mohave deserts. Other common shrub species include Catclaw Mimosa (*Mimosa biuncifera*), Acacias (*Acacia constricta* and *A. neovernicosa*), Mariola (*Parthenium incanum*), Honey Mesquite (*Prosopis glandulosa*), Fourwing Saltbush (*Atriplex canescens*), Tarbush (*Flourenia cernua*), Javelinabush (*Condalia ericoides*), Skeletonleaf Goldeneye (*Viguiera stenoloba*), Allthorn (*Koeberlinia spinosa*), and Ocotillo (*Fouquieria splendens*). Among the common grasses are Gramas (*Bouteloua breviseta, B. ramosa, B. gracilis, B. curtipendula,* and *B. eriopoda*), Threeawns (*Aristida* spp.), Tridens (*Tridens* spp.), and Fluffgrass (*Erioneuron pulchellum*).

Grassland

Desert grassland areas, some of them extensive, are scattered throughout the Trans-Pecos, and they are best developed at 1067-1585 m on plateaus, rolling hills, and basin floors (fig. 2) where the soils are relatively deep and fertile and annual precipitation is 252 mm to 450 mm. Much of the original grassland in the Trans-Pecos is now covered by desert scrub vegetation, or is severely invaded by a mixture of desert scrub species. The invasion of desert scrub into grassland began when livestock were introduced to the Trans-Pecos and when subsequent overgrazing soil erosion, and periodic droughts allowed the opportunistic desert plants to become established. Encroachment of desert scrub has proceeded most successfully in marginal grassland areas at lower elevations, but many scrub species, such as Catclaw Mimosa, Cane Cholla (*Opuntia* spp.), Honey Mesquite, Soaptree Yucca (*Yucca elata*), Torrey Yucca (*Yucca torreyi*), Sacahuiste (*Nolina* spp.), Sotol, and Broomweeds (*Xanthocephalum* spp.) can be found scattered throughout most grassland areas at any elevation.

Perhaps the best remaining grassland area in the Trans-Pecos is the "highland grassland" of the Davis Mountains near Valentine, Marfa, Alpine, and Fort Davis. Blue Grama (*Bouteloua gracilis*) is the dominant species but several other Gramas and many other grasses are interspersed. Other grassland areas with relatively good cover or grassland remnants are associated with almost every mountain range or large plateau in the Trans-Pecos. Blue Grama still dominates in most areas but soil conditions and other factors promote various dominant species such as other Gramas, Tobosa Grass (*Hilaria mutica*), Threeawns, Needlegrass (*Stipa* spp.) Bluestems (*Bothriochloa* spp.; *Schizachyrium* spp.), Burrograss (*Scleropogon brevifolius*); and Tridens. Extensive Tobosa flats occur particularly in lower elevation grassland basins where runoff water tends to accumulate.

Oak–Juniper–Pinyon Woodland

In the major mountain systems of the Trans-Pecos, where annual precipitation exceeds 308 mm, a woodland association begins characteristically at middle elevation slopes and valleys (fig. 3) intergrading with upper grassland, and extending to upper mountain slopes and valleys. About 8,000 years ago woodland vegetation extended across much of the Trans-Pecos (Wells, 1966; Van Devender and Spaulding, 1979). Dense woodland usually is found on north slopes, east slopes, in valleys, and on some mesas while south and west slopes typically support rather open woodland with scattered trees. The lowest woodland association

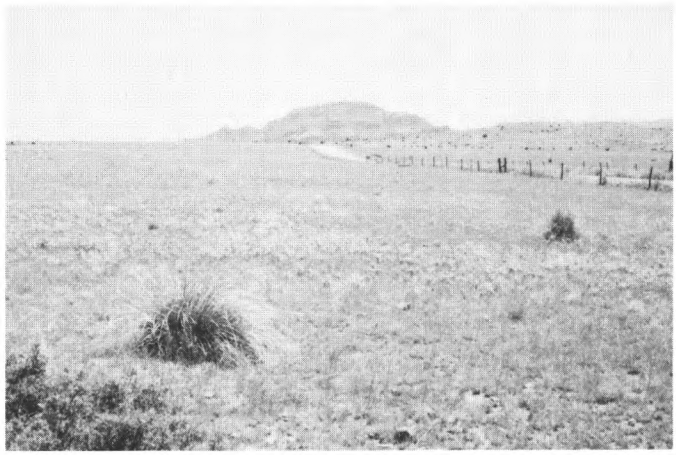


Figure 2. High basin grassland, southwest of Marfa, with Chinati Peak in the background. Blue Grama (Bouteloua gracilis) *is the dominant grass. Clumps of Sacahuiste* (Nolina texana) *are scattered in the foreground and throughout the high grassland.*



Figure 3. Woodland association of Oak (Quercus *spp.), Juniper* (Juniperus erythrocarpa), *and Pinyon Pine* (Pinus cembroides) *at mid-elevation in the Chisos Mts. (photo by Harry Gordon, Chihuahuan Desert Research Institute).*

in the Davis Mountains is usually oak-juniper at about 1340-1676 m. The dominant oaks are Gray Oak (*Quercus grisea*) and Emory Oak (*Q. emoryi*). The dominant juniper trees are Rose-Fruited Juniper (*Juniperus erythrocarpa*) and Red Berry Juniper (*J. pinchotii*). A pinyon-juniper association occurs at an even lower elevation, 975-1524 m, in the limestone-floored southeast portion of the Trans-Pecos from Altuda Peak, the Glass Mountains and the Del Norte Mountains southeastward along the western edge of the Stockton Plateau. Here the dominant juniper is Red Berry Juniper and the pine is Papershell Pinyon (*Pinus remota*).

A pinyon-juniper-oak association occurs on upper mountain slopes and valleys, about 1676-2286 m. Alligator Juniper replaces the other junipers at higher elevations. At higher elevations in the Davis Mountains the pine species is Mexican Pinyon Pine (*P. cembroides*), while in the Guadalupe Mountains and Sierra Diablo the pine is Colorado Pinyon (*P. edulis*). The dominant oaks are Silverleaf Oak (*Q. hypoleucoides*), Gray Oak, and Emory Oak. Various grasses including Pinyon Rice Grass (*Piptochaetium fimbriatum*) are found beneath the trees and in open areas. Chisos Red Oak (*Q. gravesii*), Texas Madrone (*Arbutus xalapensis*), and Bigtooth Maple (*Acer grandidentata*) are locally common, especially in moist canyons.

Conifer Forest

At the highest elevation of the Guadalupe , Davis (Mt. Livermore), and Chisos Mountains there are remnants of coniferous forests mixed with oaks (fig. 4). The pine-oak forest also has been referred to as a montane woodland (Schmidly, 1977). The trees are thought to be relics of the widespread coniferous forest in western North America, although there are some phytogeographical differences among the three mountain ranges. Characteristic forest trees are Ponderosa Pine (*Pinus ponderosa*), Southwestern White Pine (*P. strobiformis*), Douglas Fir (*Pseudotsuga menziesii*), Quaking Aspen (*Populus tremuloides*), and Chinquapin Oak (*Quercus muhlenbergii*). In the Chisos Mountains Arizona Cypress (*Cupressus arizonica*) is also present. Douglas Fir is not known to occur in the Davis Mountains but is present in both the Guadalupe and Chisos Mountains. In the Chisos a large Mexican pine is found in place of Ponderosa Pine (D. K. Bailey, personal communication). Quaking Aspen is more common in the Guadalupe Mountains than in the Davis and Chisos Mountains, where the plant is known only from one small population in each range. Other characteristic plants of the conifer forest are Birchleaf Buckthorn (*Rhamnus betulaefolia*), Snowberry (*Symphoricarpos* spp.), and Needlegrass (*Stipa* spp.). The large pines are not restricted to the higher elevations but may also occur on north and east slopes and in protected canyons at intermediate elevations.

Riparian Communities

Riparian vegetation occurs along the only two major rivers of the Trans-Pecos and the Rio Grande (fig. 5), along ephemeral streams such as Limpia Creek (Jeff Davis Co.) and Alamito Creek (Presidio Co.), and along many watercourses (canyons, arroyos, draws) that carry run-off from the mountains. The introduced Salt Cedar (*Tamarix* spp.) is thick along upper portions of the Pecos and Rio Grande. Honey Mesquite and Desert Willow (*Chilopsis linearis*) are also common trees along these rivers. Screwbean (*Prosopis pubescens*), Rio Grande Cottonwood (*Populus wislizenii*), Willows (*Salix* spp.), and two cane grasses, Common Reed (*Phragmites australis*) and Giantreed (*Arundo donax*) also prevail along the Rio Grande.

In the mountain areas riparian vegetation may consist of many different trees including Oaks (*Quercus* spp.), Cottonwoods (*Populus* spp.), Willows (*Salix* spp.), Little Walnut (*Juglans microcarpa*), Texas Madrone, Bigtooth Maple, Velvet Ash (*Fraxinus velutina*), Netleaf Hackberry (*Celtis reticulata*), and Seepwillow Baccharis (*Baccharis glutinosa*).

SPECIAL HABITATS AND VEGETATION

Within each general vegetation type there are specific kinds of plant associations that may be differentiated. These are often associated with local edaphic (soil) conditions. Examples include the characteristic vegetation of stabilized gypsum, gypsum sand (Powell and Turner, 1977; Burgess and Northington, 1977), quartz sand (Burgess and Northington, 1977), and saline habitats (Hendrickson, 1977). These particular habitats are all found within Chihuahuan Desert Scrub, and two of them are discussed further because of their proximity to the field trip area.

Gypsum Habitats

Crusty gypsum exposures are scattered throughout the Trans-Pecos, often in the basins near salt lakes. Characteristic assemblages of plants, called gypsophiles, are restricted to these areas. The most extensive gypsum exposures are the rolling plains



Figure 4. Large conifers, Ponderosa Pine (Pinus ponderosa) *and Southwestern White Pine* (Pinus strobiformis), *in the protected upper Madera Canyon of Mt. Livermore, Davis Mts.*

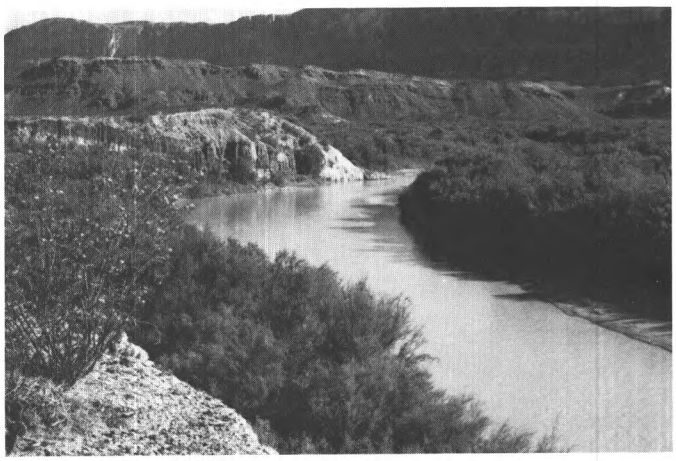


Figure 5. Riparian vegetation along the Rio Grande southeast of Presidio, in this view dominated by Salt Cedar (Tamarix *sp.) (photo by Harry Gordon, Chihuahuan Desert Research Institute).*

of the Castile Formation south and east of the Guadalupe Mountains. Parts of this huge gypsum deposit are exposed along U.S. Hwy. 62-180 south of Whites City in southern New Mexico, and Farm Road 652 to Orla in Reeves County, Texas transects the gypsum plains. The grayish, crusty, Castile (Permian) gypsum and whitish Pleistocene gypsum are exposed along Texas Hwy. 54 between U.S. Hwy. 62-180 and the Salt Lake, about 30 to 50 miles north of Van Horn (fig. 6). Characteristic gypsophiles are *Tiquilia hispidissima,* Gyp Gaillardia (*Gaillardia multiceps*), Gypgrass (*Sporobolus nealleyi*), Gyp Grama (*Bouteloua breviseta*), Gyp Moonpod (*Selinocarpus lanceolatus*), and *Anulocaulis gypsogenus*.

Saline Habitats

Soils with high salt content are scattered throughout the Trans-Pecos, particularly around some prominent salt lake areas near U.S. Hwy. 62-180 and Texas Hwy. 54 in northern Culberson and Hudspeth Counties. These saline habitats exhibit characteristic halophytic vegetation including Alkali Sacaton (*Sporobolus airoides*), Pickleweed (*Allenrolfea occidentalis*), Fourwing Saltbush (*Atriplex canescens*), Frankenia (*Frankenia jamesii*), Winged Sesuvium (Sesuvium verrucosum) and Seepweed (*Suaeda* spp.).

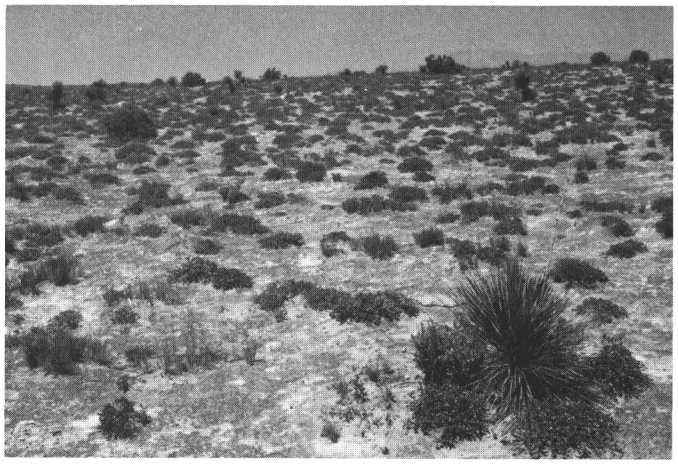


Figure 6. A classic gypsum exposure, this one about 35 miles N of Van Horn. The prominent low, mound-like plants, Tiquilia hispidissima, *are characteristic gypsophiles. Other gypsophiles such as Gypgrass* (Sporobolus nealleyi) *are present but not necessarily identifiable in the photograph. Soaptree Yucca* (Yucca elata), *normally a species of grasslands is evident in the right foreground.*

REFERENCES

Burgess, T. L. and Northington, D.K., 1977, Desert vegetation in the Guadalupe Mountains, *in* Wauer, R. H. and Riskind, D. H., Symposium on the Biological Resources of the Chihuahuan Desert Region: U.S. Department of Interior, NPS, no. 3.

Correll, D. S. and Johnston, M. C., 1970, Manual of the vascular plants of Texas: Renner, Texas, Texas Research Foundation.

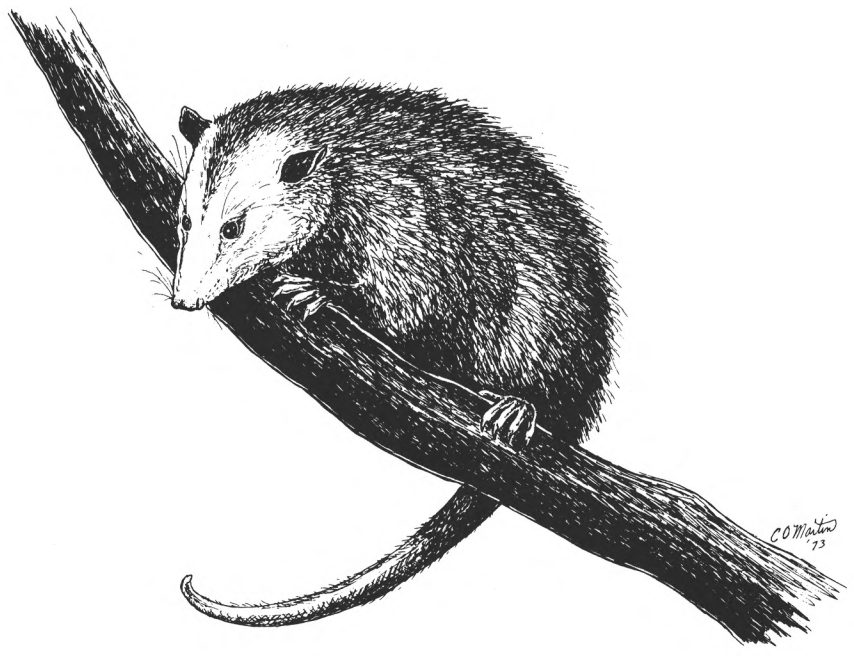
Hendrickson, J., 1977, Saline habitats and halophytic vegetation of the Chihuahuan Desert region, *in* Wauer, R. H. and Riskind, D. H., Symposium on the Biological Resources of the Chihuahuan Desert Region: U.S. Department of Interior, NPS, no. 3.

Powell, A. M. and Turner, B. L., 1977, Aspects of the plant biology of the gypsum outcrops of the Chihuahuan Desert, *in* Wauer, R. H. and Riskind, D. H., Symposium on the Biological Resources of the Chihuahuan Desert Region: U.S. Department of Interior, NPS, no. 3.

Schmidley, D. J., 1977, The mammals of Trans-Pecos Texas: College Station, Texas A&M University Press.

Van Devender, T. R. and Spaulding, W. G., 1979, Development of vegetation and climate in the southwestern United States: Science, v. 204, p. 701-710.

Wells, P. V., 1966, Late Pleistocene vegetation in degree of pluvial climate change in the Chihuahuan Desert: Science, v. 153, p. 970-975.



Virginia opossum, *Didelphis virginiana*.