TEXAS PARKS & WILDLIFE

APPENDIX HH

June 2003

Trans-Pecos Vegetation: A Historical Perspective

Calvin Richardson
Technical Guidance Biologist

Trans-Pecos Wildlife Management Series
Leaflet No. 7

The Trans-Pecos region is the only part of Texas where mountain and desert habitats are found. This unique combination contributes to the tremendous vegetation diversity in the region, which includes at least 268 grass species and 447 species of woody plants. The vegetation diversity is also influenced by the Edwards Plateau eco-region in portions of Terrell, Pecos, and Brewster counties. In addition, there are vegetational influences in the northeast Trans Pecos by the plains ecosystem and in the southeast Trans Pecos by the Tamaulipan Province (south Texas plains). Like other ecosystems, the Trans-Pecos region is dynamic and has experienced gradual shifts in climate and vegetation. For example, there is strong paleoecological evidence that much of the Trans-Pecos region was once covered (approx. 11,000 years ago) by a mesic woodland (Van Devender 1995). However, the vegetation and wildlife has changed more rapidly in composition, abundance, and distribution over the past 120 years than at any other time in recorded history. The major influences behind these dramatic changes were (and continue to be) livestock grazing and the suppression of fire combined with frequent drought.

Vegetation Changes

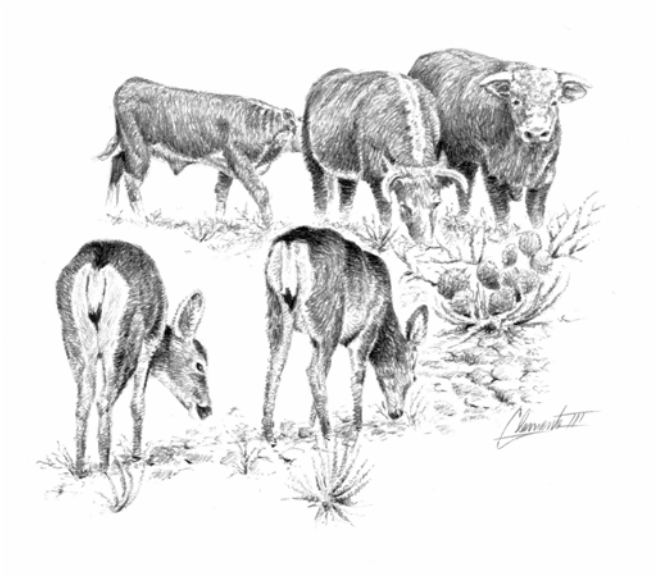
Considerable information about historical Trans-Pecos landscapes (prior to Anglo settlement) has been accumulated from survey records, journals, photographs, and various other records from early explorers of the region. All early accounts provide evidence that the Trans-Pecos grasslands were quite expansive and that grasslands were lightly interspersed with shrubs and desert succulents (Bartlett 1854, Parry 1857, Echols 1860, Bray 1901, Cottle 1931, Humphrey 1958, Wondzell 1984, Hall 1990). Waste-high grass was reported along Terlingua Creek and in Tornillo Flats (Echols 1860), where eroded desert exists today. Extensive grass cover was described in the Big Bend area about 1900 when high numbers of livestock were being grazed in the region (Langford and Gipson 1952). In 1885 Terlingua Creek was described as a running creek full of beaver and lined with cottonwood trees (Wauer 1973, Wuerthner 1989). Evidently, mesquite was not nearly as abundant or widespread as today, existing only as scattered shrubs among the grasslands and occurring in small isolated stands (Humphrey 1958, Johnston 1963). There is no mention of the dense stands of whitethorn acacia or catclaw mimosa that dominate some areas of the Trans Pecos today. One account in the early 1850's from the Pecos River near Horsehead Crossing noted that there were no trees or shrubs along the banks of the river (Humphrey 1958). Today, the Pecos River at Horsehead Crossing is choked with saltcedar, mesquite, and other woody plants.

By all accounts, it is evident that desert grasslands throughout the southwestern United States, including the Trans-Pecos Region, have changed since Anglo settlement. Furthermore, it is well documented that grasslands have decreased and given way to increases in woody plant abundance and bare ground in some areas (Cottle 1931, Parker and Martin 1952, Buffington and Herbel 1965, Grover and Musick 1990). Prominent woody invaders and increasers of the low elevation desert grasslands include creosotebush, tarbush, mariola, whitethorn acacia, honey mesquite, and cacti. Prominent woody invaders and increasers of the higher elevation plains grasslands include juniper, catclaw mimosa, sacahuiste, cane cholla, adolpia, and prickly pear species. Numerous studies have been conducted to evaluate the causes responsible for the rapid changes in the vegetative communities. Most investigators attribute the increase in shrubs to overgrazing of grasslands by livestock, and considerable evidence has been cited in support of this concept (Humphrey 1958, York and Dick-Peddie 1969, Grover and Musick 1990, Gillis 1991). Several additional factors have been hypothesized as contributing significantly to vegetation changes in semi-desert grasslands. The factors most often considered, in addition to heavy grazing, are changes in climate, suppression of grassland fires, short and long drought periods, plant competition, and erosion of topsoil in areas where vegetation has been removed. All of these factors probably have been and are contributing to a reduction in desert grasslands and an increase in shrubs.

Healthy grassland savannas exist today on sites where wildfires have occurred or where prescribed burning is practiced, as well as on ranches that have been conservatively grazed and properly managed for decades. Most of these healthy grassland savannas occur at moderate to high elevations (cooler temperatures and greater average rainfall) in Hudspeth, Jeff Davis, Presidio, and Brewster counties.

Early Ranching Activity

Livestock grazing in the southwestern United States dates back to the 1500's (Humphrey 1958, Bahre 1991). In the mid-1500's cows, sheep, and horses were brought into the southwest from Mexico. Some of the animals were lost or strayed and gave rise to feral herds that grazed the region. The number of cattle, sheep, and horses increased steadily after 1598, although for many years Indian hostility forced the herders to concentrate their grazing activity near the towns of El Paso, Santa Fe, Taos, and Tucson (Humphrey 1958). Spanish missionaries and farmers gradually increased the number of sheep and goats along the Rio Grande between El Paso and present day Presidio, herding sheep into the Trans-Pecos high country during the summer (Carlson 1982). The number of sheep and goats gradually declined after 1767, when the Spanish decided to retreat from most of Texas and New Mexico. In the Big Bend region, Milton Faver was reportedly the first Anglo rancher, who moved into southern Presidio County in 1857. He subsequently built a sizeable cattle herd (10,000-20,000 head), along with 5,000



sheep and 2,000 goats.

Extensive ranching in the Trans-Pecos began in the early 1880's when the first Anglo Americans settled in the Big Bend region. Livestock numbers peaked in the late 1880's soon after completion of the Texas and Pacific Railroad (in 1883) through the region. By 1885 relatively large herds of livestock were being raised in the Trans-Pecos. But it was not long before drought and severe winters (1885-1895) drastically reduced the herds. Many of the cattle companies that began their

operations in the 1880's were out of business by 1905. Range conservation and management was born subsequent to the "apalling" losses of cattle from drought and starvation, the lowered rangeland productivity, and "the associated evils of soil erosion, water loss, and encroachment by noxious weeds" (Gould 1951).

Given the descriptions of the vegetation by early explorers, it is not difficult to understand what attracted these early ranchers to the Trans-Pecos region. For example, Juan Mendoza in 1864 (in present day Presidio County) describes "a beautiful plain, with plentiful pasturage of couch grass." Captain John Pope in 1854 described the Trans-Pecos area as " . . .destitute of wood and water, except at particular points, but covered with a luxuriant growth of the richest and most nutritious grasses known to this continent. . . The gramma-grass, which exists in the most profuse abundance over the entire surface of these table-lands is nutritious during the whole year, and . . . seem intended by nature for the maintenance of countless herds of cattle" (Weniger 1984). What the early ranchers could not have understood is the complexity of interacting factors that allowed this sensitive ecosystem to support the vast expanses of grasslands and grassland-savannas. The first settlers were probably unaware of the brutal droughts that frequently occur in this region. They probably did not comprehend the critical role of periodic natural fires in maintaining the health and integrity of the grassland systems. Finally, a concept they could not have understood is that an ecosystem maintained by frequent drought, periodic fire, and very low numbers of grazing animals is not capable of supporting high numbers of grazing animals on a continuous or long-term basis without rangeland degradation.

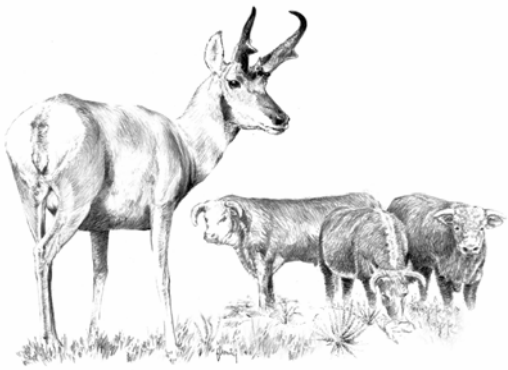
To provide some idea of the livestock densities that were grazed in the region, some specific examples are described below (present day stocking recommendations normally range from 75 to 200+ acres/animal unit[1]):

- In 1881 the Iron Mountain Ranch near Marathon was stocked with 27,000 head of sheep on 45,000 acres, a stocking rate of 8.3 acres/animal unit (Clayton 1993).

- In the mid-1880's, Lawrence Haley was running 15,000 sheep on 37,000 acres south of Alpine, a stocking rate of 12.3 acres/animal unit (Carlson 1982).

- In the mid-1890's, the Downie Ranch in Pecos County was stocked with 20,000 head of cattle, 80,000 sheep, 2,000 goats, 500 horses on 234 sections, a stocking rate of 4.1 acres/animal unit (Downie 1978).

- In the mid-1890's, the Western Union Beef Company stocked 400 sections near Fort Stockton with 30,000 head of cattle (8.5 acres/animal unit), but only 22,000 head (11.6 acres/animal unit) could be found in 1897 after the Indians, rustlers, and predators had their share (Downie 1978).



The high stock densities during the 1880's and 1890's certainly had an impact on vegetation and on rangeland productivity, including soil erosion-- as was indicated by descriptions of drought and starving animals. However, high stocking rates in many areas of the Trans Pecos during the next 4 or 5 decades continued to deteriorate rangelands and permanently reduce rangeland productivity. Sheep and goat numbers in the Trans Pecos gradually increased during the early 20th century and peaked in the 1940's. The sheep and goat industries in West Texas remained strong through the 1950's and 1960's and then steadily declined.

Suppression of Grassland Fires

[1] 5 sheep = 1 animal unit, 6 goats = 1 animal unit, 1 cow = 1 animal unit, 1 horse = 1.5 animal units

Historically, fire played a major role in shaping and maintaining the Trans-Pecos grasslands (Wright and Bailey 1982, McPherson 1995, Frost 1998, Van Auken 2000), just as fire has influenced and maintained other grasslands of North America. Although periodic fire is an integral component of healthy rangelands, it is not the only process that has shaped the grasslands and savannas of the desert Southwest. Frequent drought, insects, disease, rodents, rabbits, and other browsers/grazers serve a role in maintaining grassland integrity by interacting with fire to control woody plants. In the absence of fire, grasslands gradually revert to dominance by woody plants. In arid environments, grass plants can often survive during drought and they thrive during periods of good rainfall with 2 very important provisos: 1) the density of shrubs and succulents (cholla, yucca, cacti, etc.) does not become excessive and 2) top-removal of grass plants does not occur too frequently.

Fire is a natural mechanism for controlling encroachment by woody plants and succulents, involving only periodic top-removal of herbaceous vegetation (7-12 year frequency in the higher elevations; 10-20 year frequency in the desert grasslands). If woody plants are allowed to increase, their deep, spreading root systems eventually out-compete grasses with the interacting effect of repeated droughts. If grass plants are continually defoliated (e.g., continuous heavy grazing), the photosynthetic structures (green leaves) are not allowed to replenish root with starches and carbohydrates. The result is declining root health, weakened plants, and eventual mortality, especially during drought. In addition, excessive grazing pressure prevents reproduction of herbaceous plants, especially problematic in areas of frequent and persistent drought.

The greatest impact of reduced herbaceous cover, whether through overgrazing, woody plant competition, or their combined effect, is exposure of bare soil. When the soil surface is not covered by grasses/forbs and exposed to the elements (wind and rainfall), erosion is inevitable. The immediate effect of increasing bare ground is substantial loss of water that otherwise would be conserved through soil infiltration, deep percolation, and absorption by grass roots. The loss of grass cover and increasing loss of water through runoff (reduced percolation into water table) is the primary reason that Trans-Pecos springs and creeks described in historical documents have dried up (the increasing number of water wells developed for irrigation, livestock, and human use also contributed to the problem). Another “immediate” effect is that exposed soil quickly becomes encrusted or "capped," which hinders water infiltration, moisture retention, and seed germination. The long-term effect of increasing bare ground is soil loss through erosion, which reduces the capability of the land to support vegetation and permanently decreases the carrying capacity of the land for livestock and wildlife.

A less apparent effect of fire suppression and heavy grazing pressure in West Texas is a gradual shift in species composition of herbaceous plants. Deep-rooted perennial bunchgrasses (blue grama, sideoats grama, bluestems, Arizona cottontop, tanglehead, green sprangletop, tobosagrass) gradually give way to less desirable, shallow-rooted species (threeawn, burrograss, fluffgrass, red grama, slim tridens). Not only do the leafy bunchgrasses receive more pressure through repeated selection by grazers, but perennial bunchgrasses are fire tolerant (fire dependent, to some extent). The growing points of most bunchgrasses are protected beneath the soil, and periodic fire tends to stimulate seed germination of perennial, warm-season bunchgrasses. Timely grazing deferment and periodic fire can reverse this trend in the species composition of herbaceous plants. Although shallow-rooted species are better than bare soil, the value of maintaining deep-rooted bunchgrasses is 2-fold: 1) bunchgrasses support greater livestock numbers and greater wildlife numbers and

diversity, and 2) bunchgrasses are superior in maintaining the soil hydrology (better water infiltration, retention, and deep percolation)

Today, the most common barrier to wildfire in desert grasslands is inadequate quantity and continuity of fine fuels. Livestock grazing over the past 120 years has reduced the herbaceous biomass enough to prevent the spread of fire in most years. Other constraints on the use of fire as a management tool include lack of knowledge about fire benefits, lack of experienced assistance, liability concerns, potential threat to ranch facilities and structures, and short-term financial considerations associated with grazing deferment before and after the fire. Opportunities currently exist for use of prescribed fire in desert grasslands to prevent further shrub invasion and, to some degree, reverse the trend. In many areas of the Trans-Pecos, however, a major reclamation program involving brush control and grazing deferment would be required to partially restore desert grasslands before fire could be

implemented in a management program.

Current Habitat Management Practices

For long-term benefits to wildlife in West Texas, no habitat management practices are more important than those that restore and/or maintain healthy, native, herbaceous vegetation. Every wildlife species in the Trans-Pecos, whether a game or nongame species, depends upon grasses and forbs to satisfy at least one essential requirement-- whether it's nesting cover, fawning cover, nutritious "greens," seeds, insects, or a source of water. Just as important, grasses and forbs stabilize the soil and conserve precious moisture that comes infrequently. And certainly not least, herbaceous plants provide fuel for prescribed fire, the only "natural" tool and the lowest cost practice for long-term prevention of shrub encroachment.

The emphasis on the restoration and maintenance of herbaceous cover (grasses and forbs) does not diminish the importance of trees, shrubs, and desert succulents. Prior to settlement in the late 1800's, woody plants and succulents were sparsely scattered across the desert grasslands, with increased abundance along wet draws, rocky outcroppings and steep slopes. Their extensive root systems serve the important function of stabilizing soil on these potentially erosive sites (these areas seldom burn and are unable to support protective stands of grass). Woody plants also provide valuable food and cover for many wildlife species and livestock. Woody plants shift from a valuable habitat component to an ecosystem threat only when one or more of the "balancing" processes are removed (e.g., fire or herbaceous vegetation via overgrazing).

Maintenance of healthy grasslands and savannas in West Texas is best accomplished through periodic fire and timely light to moderate grazing, limited to years during and after favorable rainfall. Prescribed fires promote perennial forbs and perennial, warm-season bunchgrasses and prevent detrimental increases in woody shrubs. Repeated prescribed fires during the proper season (late spring or early summer) can inflict mortality on woody species that have already encroached in desert grasslands (restoration will initially require greater fire frequency than that occurring historically for grassland maintenance). Light to moderate grazing during favorable years, using no more than 1/3 of grass production (Holechek et al. 1994), will allow use of excess forage production without weakening root systems and causing plant mortality during drought years. Flexibility with livestock numbers and grazing deferment are critical tools in managing vegetation in the Trans Pecos where weather fluctuations are more dramatic than in

any other region of Texas.

Degraded rangelands where soils and water (precipitation) are being lost annually can often be improved through a number of soil and water conservation techniques. Erosion control techniques such as water diversions and sediment traps should be implemented. Header dams, rangeland ripping (Ueckert and Petersen 2002), and berms are water conservation techniques that can partially restore the hydrology on specific sites and initiate seed germination. Other habitat improvement practices that may apply to specific situations in the Trans Pecos include the following:

- Mechanical brush management
- Chemical brush management
- Riparian habitat management (fencing to control time/intensity of grazing; native shrub and tree planting; control invading shrub species)
- Grazing management (light to moderate grazing in favorable years; pasture deferment)
- Water distribution
- Improved water access for birds and small mammals
- Windmill/trough overflows to create oases of green forbs/grasses, seeds and insect production
- Irrigated food plots
- Fence modification to allow unimpeded movement of pronghorn antelope and bighorn sheep
- Reduction of deer in certain areas where numbers are high
- Reduction of exotic or feral animals that are impacting and/or competing with native species

Acknowledgements: The following individuals provided helpful comments and suggestions on this management leaflet in draft: Ruben Cantu (TPW), Philip Dickerson (TPW), Scott Lerich (TPW), Steve Nelle (NRCS), Mike Sullins (TPW), Misty Sumner (TPW), and Jason Wrinkle (TNC).

Literature Cited

Bahre, C. J. 1991. A legacy of change. Univ. of Arizona Press, Tucson.

Bartlett, J. R. 1854. Personal narrative of explorations and incidents in Texas, New Mexico, California, Sonora, and Chihuahua.

Bray, W. L. 1901. The ecological relations of the vegetation of western Texas. Bot. Gaz. 32: 99-123.

Buffington, L. C., and C. H. Herbel. 1965. Vegetation changes on a semidesert grassland range from 1858 to 1963. Ecological Monographs 35: 139-164.

Carlson, P. H. 1982. Texas Woollybacks: The Range Sheep and Goat Industry. Texas A&M Univ. Press, College Station.

Clayton, L. 1993. Historic Ranches of Texas. Univ. of Texas, Austin.

Cottle, H. J. 1931. Studies in the vegetation of southwestern Texas. Ecology 12: 105-155.

Downie, A. E. 1978. Terrell County, Texas, its past- its people. Rangel Printing, San Angelo, Tex.

Echols, W. H. 1860. Camel expedition through the Big Bend country. U.S. 36th Congress, 2nd Session, Senate Ex. Doc., doc. 1, pt. 2, U.S. Serial Set No. 1079, pp. 36-50.

Frost, C. C. 1998. Presettlement fire frequency regimes of the United States: a first approximation. Pages 70-81 *in* T. L. Pruden and L. A. Brennan, eds. Fire in ecosystem management: shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall

Timbers Research Station, Tallahassee, FL.

Gillis, A. M. 1991. Should cows chew cheatgrass on commonlands? Bioscience 41:668-675.

Gould, F. W. 1951. Grasses of the Southwestern United States. Univ. of Arizona Press, Tucson.

Grover, H. D., and H. B. Musick. 1990. Shrubland encroachment in southern New Mexico, U.S.A.: An analysis of desertification processes in the American Southwest. Climatic Change 17: 305-330.

Hall, S. A. 1990. Pollen evidence for historical vegetational change, Hueco Bolson, Texas. Tex. J. Sci. 43: 399-403.

Holechek, J. L., A. Tembo, A. Daniel, M. J. Fusco, and M. Cardenas. 1994. Long-term grazing influences on Chihuahuan Desert rangeland. The Southwestern Naturalist 39: 342-349.

Humphrey, R. R. 1958. The desert grassland: A history of vegetational change and an analysis of causes. Bot. Review 24: 193-252.

Johnston, M. C. 1981. Past and present grassland of southern Texas and northeastern Mexico. Ecology 44:456-466.

Langford, J. O., and F. Gipson. 1952. Big Bend, a homesteader's story. Univ. of Texas Press, Austin.

McPherson, G. R. 1995. The role of fire in desert grasslands. Pages 130-151 *in* M. P. McClaran and T. R. Van Devender, eds. The Desert Grassland. The Univ. of Arizona Press, Tucson.

Parker, K. W., and S. C. Martin. 1952. The mesquite problem on southern Arizona ranges. Circular No. 908. U.S. Department of Agriculture, Washington, D.C.

Parry, C. C. 1857. *In* Emory, W. H. 1985. United States and Mexican Boundary Survey. U.S. 34th Congress, 1st and 2nd Session, Senate Ex. Doc., doc. 108, vol. 2, pt. 1, U.S. Serial Set. No. 833, pp. 9-26.

Ueckert, D. N., and J. L. Petersen. 2002. Water conservation for restoration of wildlife habitats. Pages 101-114 *in* L. A. Harveson, P. M. Harveson, and C. L. Richardson, eds. Proceedings of the Trans-Pecos Wildlife Conference. Sul Ross State Univ., Alpine.

Van Auken, O. W. 2000. Shrub invasions of North American semiarid grasslands. Annu. Rev. Ecol. Syst. 31: 197-215.

Van Devender, T. R. 1995. Desert grassland history. Pages 68-99 *in* M. P. McClaran and T. R. Van Devender, eds. The Desert Grassland. The Univ. of Arizona Press, Tucson.

Wauer, R. H. 1973. Naturalist's Big Bend. Texas A&M Univ. Press, College Station.

Weniger, D. 1984. The Explorers' Texas: The Lands and Waters. Vol 1. Eakin Press, Austin, Tex.

Wondzell, S. M. 1984. Recovery of desert grasslands in Big Bend National Park following 36 years of protection from grazing by domestic livestock. M. S. Thesis, New Mexico State Univ., Las Cruces.

Wright, H. A., and A. W. Bailey. 1982. Fire ecology: United States and Southern Canada. John Wiley and Sons, New York.

Wuerthner, G. 1989. Texas' Big Bend country. American Geographic Publishing, Helena, Mont.

York, J. C., and W. A. Dick-Peddie. 1969. Vegetation changes in southern New Mexico during the past 100 years. Pages 157-166 *in* W. G. McGinnies and B. J. Goldman, eds., Arid Lands in Perspective. Univ. of Arizona, Tucson.