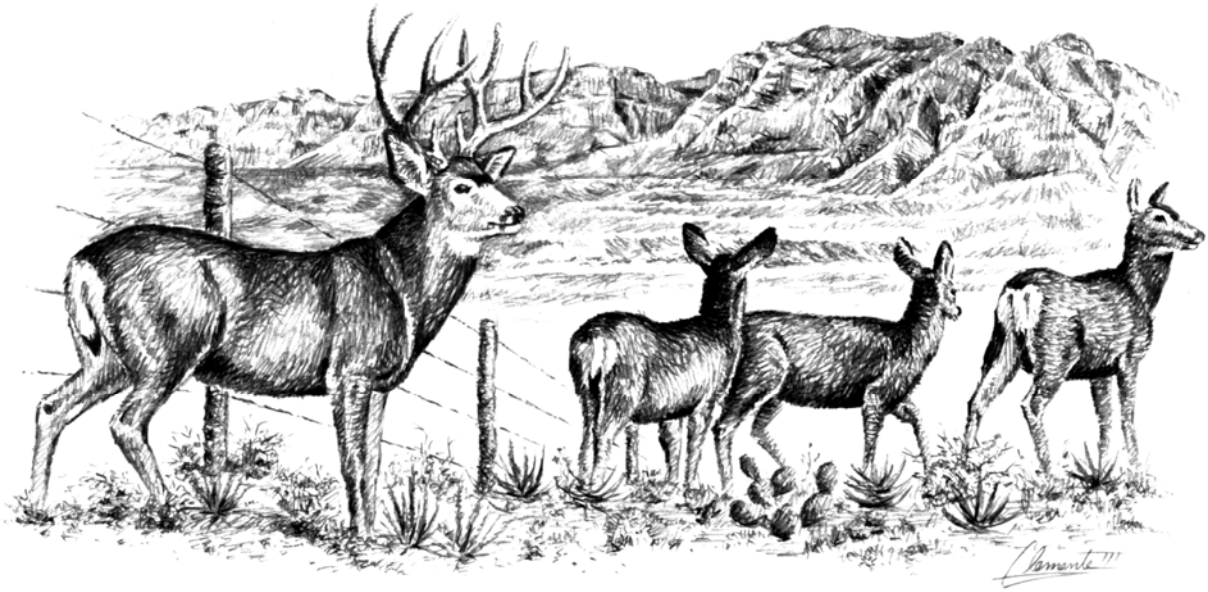
Proceedings of the Trans-Pecos Wildlife Conference-2008



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Bonnie J. Warnock, Philip H. Dickerson, and Louis A. Harveson

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Sul Ross State University
P.O. Box C-16
Alpine, TX 79832

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Wildlife Issues and Management in the Trans-Pecos

NATURAL RESOURCE CHALLENGES AND OPPORTUNITIES IN TRANS-PECOS, TEXAS

LOUIS A. HARVESON*, Borderlands Research Institute for Natural Resource Management, Sul Ross State University, Alpine Texas 79832;* *harveson@sulross.edu*

Abstract: Trans-Pecos Texas is a unique area of the Texas with unique natural resources. Managing those resources poses some new challenges and opportunities. Most of the natural resource challenges stem from changes on the landscape (brush encroachment, hydrology) and pressures from population growth (fragmentation, land-use changes). The future of the natural resources of the Trans-Pecos lies in the hands of the private landowners and resource agencies that are entrusted to manage these valuable resources.

A HISTORICAL PERSPECTIVE

Man has been making a living on the west Texas lands of the Trans-Pecos for over 10,000 years. Archeological studies have documented that around 8,000 B.C., Paleao-Indians subsisted on large game. As their environment changed, man changed accordingly becoming more resourceful with the tools they used and focusing on smaller game as the large species became more scarce (ca. 6500 B.C-1000 A.D.). Prehistoric man of the Big Bend started using agriculture as early as 1000 A.D. where farming was more prominent along the Rio Grande.

By the 1500s Indian tribes dominated the countryside. Tribes included the Chisos Indians, Concho Indians, and Jumanos. By the 1700s the Mescalero Apaches displaces these tribes and then the Commanches became prevalent and persisted until the mid 1800s. Unfortunately, our understanding of these historic societies and the natural world they lived in are imperfect. Our knowledge of historic Trans-Pecos prior to the 1500s is based on archeological finds that include artifacts discovered from dwellings and pack rat middens. Written records come in the form of pictographs and our understanding of those "stories" are incomplete.

Then came Cabeza de Vaca. As he and his band worked their way through northern Mexico and the Trans-Pecos, Cabeza de Vaca gave us our first glimpse of the Trans-Pecos. His manuscript "La Relacion" or "The Account" provides our first written record of the Chihuahuan Desert Region as seen by these wayward travelers (Justice 2001). Below is an excerpt taken from Maxwell (1971) describing Cabeza de Vaca's journey and written record of the Trans-Pecos:

> "De Vaca's description of the physical features in the Big Bend is vague. He did mention a river, presumably the Pecos, that he crossed before marching southwest across a wind-swept plain that was barren of game and water. Toward the southwest he saw lofty mountains of the northern Big Bend country and on reaching them, found that in the mountains there were magnificent valleys with game and water. Presumably he followed what in later years became known as the great Indian trail crossing the Pecos River at

> either the Horsehead or Sheffield Crossing, thence west to Comanche Spring at Fort Stockton, through the Davis Mountains, southward to Burgess waterhole near Alpine, and southwestward to Alamito Creek, following that valley southward to the Rio Grande near Presidio. Here he found the Indians living in fixed settlements along the river and cultivating small patches of corn, beans, and pumpkins"

The Trans-Pecos is rich in Mexican culture. Many of the Mexican inhabitants were descendants of early Indian tribes and Spanish settlers described above that stayed in the area or moved north into the borderlands region. There are many historical accounts of this early culture in the Trans-Pecos, but few provide a detailed view of the natural environment.

It wasn't until the 1870s when European settlers started settling in the Trans-Pecos for ranching purposes did our understanding on the ecology of the Trans-Pecos start forming. A new era of biological discovery came to the Trans-Pecos in 1899, when the U.S. Biological Survey was commissioned to survey the flora and fauna of Texas. This effort was led by Vernon Bailey and lasted until 1905; soon after he published a 200-plus page document *the Biological Survey of Texas* (Bailey 1905). Although this document referenced the natural history of the entire state of Texas, there was considerable mapping, cataloging, and discoveries relevant to the Trans-Pecos region. Bailey was accompanied by a handful of naturalists including Merriam, Attwater, Fuertes, and others (Schmidly 2002). In addition to the *Survey*, itself, most of the naturalists were prolific writers and their journals rest in various museums across on the nation. With the technological advances in photography, a visual history of their survey was archived during the *Survey*. The natural history of many of the west Texas landmarks we are familiar with (including Bloys Camp, Livermore, Mitre Peak, Chisos Basin, Sawtooth Mountain, Rockpile, and many others) are chronicled in the *Survey*. Many of the historic ranches of yesterday (Kokernot Ranch, Means Ranch, A.S. Gage Ranches, Brite Ranch) are still operational today.

Since that time, the Trans-Pecos has grown and changed. Mining, ranching, and oil and gas interests have driven much of the economy, broadening of the transportation infrastructure, and eventually the settlement of the Trans-Pecos. Since the early 1900s, we have had much better historical record of the natural history of the region. The uniqueness of the geology and biology of the Trans-Pecos became known across the nation by word of mouth and printed record. In response, the state of Texas established Texas Canyon State Park in 1935 which was eventually deeded to Big Bend National Park when it was established in 1944. Although the state and federal government have land holdings in the Trans-Pecos, private ranches dominate the landscape and are the backbone of conservation.

ECOLOGY OF THE TRANS-PECOS

Even today, the Trans-Pecos is known for its' contrast and diversity. The Trans-Pecos ecoregion is located within the Chihuahuan Desert Biotic Province and encompasses approximately 18 million acres. It is bordered to the east by the Pecos River, to the west and south by the Rio Grande, and to the north by New Mexico (Hatch et al. 1990). Desert mountains for islands and are scattered throughout the Trans-Pecos with elevations ranging between 2,500-8,750 feet. Mountain ranges in the Trans-Pecos include the Barilla, Baylor, Beach, Christmas,

Chinati, Chisos, Davis, Del Norte, Eagle, Franklin, Glass, Guadalupe, Santiago, Sierra Diablo, Sierra Vieja, Van Horn, and Wiley. Mountain ranges receive about 12-18 inches of precipitation, primarily in the form of monsoonal rains. The lower elevations received 8-12 inches of rain. Soils in the region vary with deep sands along desert washes, gravel mulch in desert lowlands, and shallow rocky soils on slopes and mountains.

The Trans-Pecos is diverse in both plants and animals. Over 2,188 plant species have been recorded in the region (Texas Parks and Wildlife Department 2002). Creosote (*Larrea tridentata*) and tarbush (*Flourensia cernua*) are the prevalent shrubs and dominate >80% of the plant communities in the region (Hatch et al. 1990). Other common plants in the lowlands include catclaw acacia (*Acacia greggii*), whitethorn (*A. constricta*), sotol (*Dasylirion* spp.), lechuguilla (*Agave lechuguilla*), dropseeds (*Sporobolus* spp.), gramas (*Boutelou* spp.), and threeawns (*Aristida* spp.). Juniper (*Juniperus* spp.) savannah, pinyon (*Pinus edulis*)-juniper-oak (*Quercus* spp.) woodlands, and ponderosa pine (*Pinus ponderosa*) forestlands become prevalent communities with increased precipitation and elevation (Harveson 2007).

POPULATION PRESSURES

Since the days of aboriginal man, Spanish explorers, and prehistoric Indians, the Trans-Pecos has experienced many changes in its population base. Prior to agriculture, the number of people (gathers-hunters) in the Trans-Pecos was influenced by the amount of game, fruits, and water that were available. As agriculture, ranching, and infrastructure to support importing goods grew, populations in west Texas followed suit. Information on the human population size prior to the industrialization age is nonexistent. In 1900, the U.S. Census Bureau estimated that the population in the 9-county (El Paso, Hudspeth, Culberson, Reeves, Pecos, Terrell, Brewster, Jeff Davis, and Presidio) Trans-Pecos region was <36,000. One hundred years later, the Trans-Pecos population had steadily risen to 735,000 in 2000 (Figure 1). Excluding El Paso County from these figures, the Trans-Pecos only supported 11,000 in 1900 and 56,000 in 2000 estimates. Presently, the Trans-Pecos is one of the least populated regions in the United States.

During the last century, Texas and the U.S. have experienced much more dramatic population growth with 2000 estimates standing at 281,000,000 and 20,000,000, respectively. Population growth across the U.S. is accelerated along the eastern and western coasts. For Texas, the human population is substantially greater in the eastern portion of the state. In fact, demographers have suggested that >75% of Texans reside east of a 30-mile buffer of I-35 running from Denton to Laredo. In addition to overall growth in the population, most Texans reside in urban areas as opposed to rural areas. This is a dramatic change considering in 1950 80% of Texans lived in small rural communities with strong ties to agriculture and natural resources and by 2000 only 20% of the population resided in rural communities (TSDC 2001).

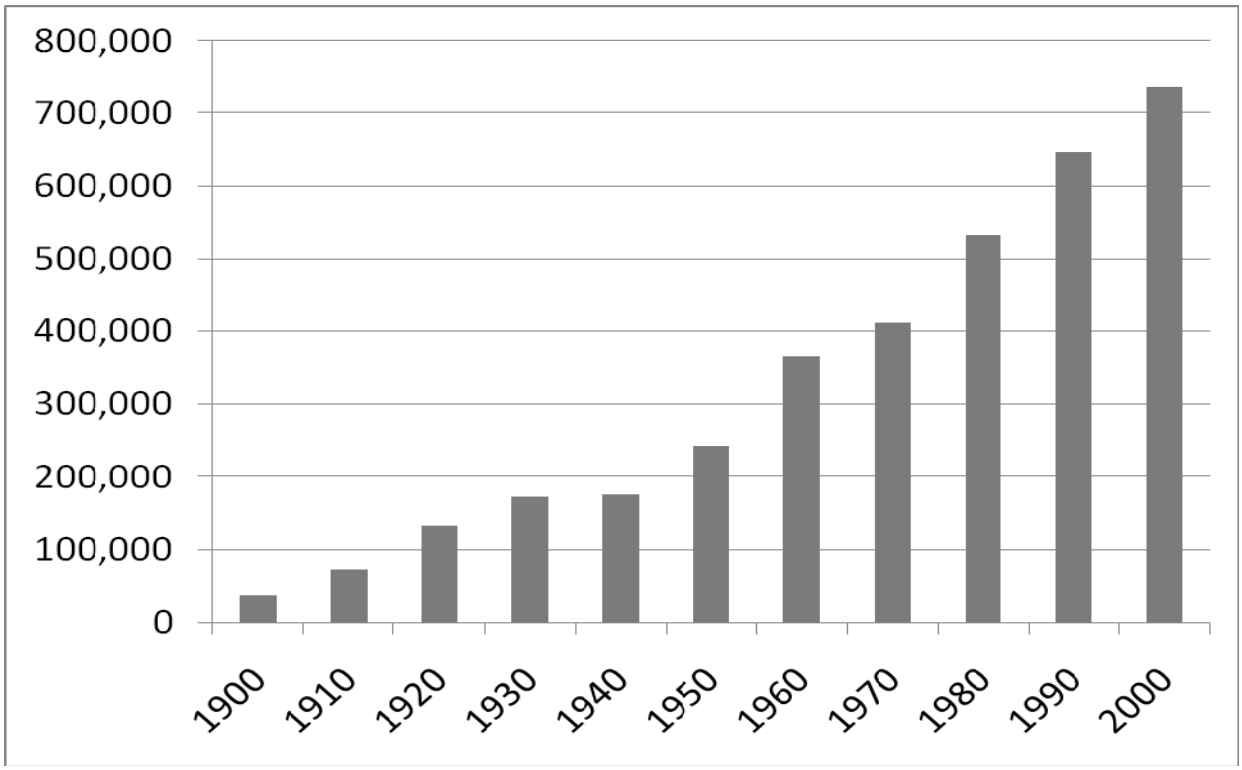


Figure 1. Population growth in the 9-county region of Trans-Pecos, Texas, 1900-2000.

LAND-USE CHANGES

The growth and redistribution of the population of Texas has had a dramatic affect on land ownership and ranch size (Wilkins et al. 2000). Cattle ranches are being subdivided and sold due to financial constraints and buyers are purchasing ranches primarily for recreational activities (e.g., wildlife). The shift is occurring across the state and the Trans-Pecos. Ranches in the Trans-Pecos in the 1950s averaged >25,000 acres and >90% of the region was used for farming and ranching purposes (Wallmo and Uzzell 1958). Wilkins et al. (2000) reported that in 2000 ranches in the Trans-Pecos averaged between 5,000-20,000 acres and 76% of the region was in farm or ranch land (Wilkins et al. 2003). Although the size of ranches in the Trans-Pecos has decreased, the rate of fragmentation is lower than other regions to the east (Wilkins et al. 2000).

Concurrently, livestock numbers have declined (Figure 2) in the past 30 years and are predicted to continue to decrease. The shift from livestock production to wildlife enterprises in the Trans-Pecos, can have positive effects as rangelands will likely recover more rapidly than with traditional ranching (e.g., livestock based enterprises; Nelle 2002). New landowners are considered to be more wildlife friendly with a renewed interest in restoring natural habitats (Warnock and Loomis 2002). With shifting demographics of landowners and land-use trends, wildlife recreation in the Trans-Pecos has started to receive more attention. Further, as hunting opportunities begin to decrease and prices increase in other regions of the state, hunting markets in the Trans-Pecos will also increase.

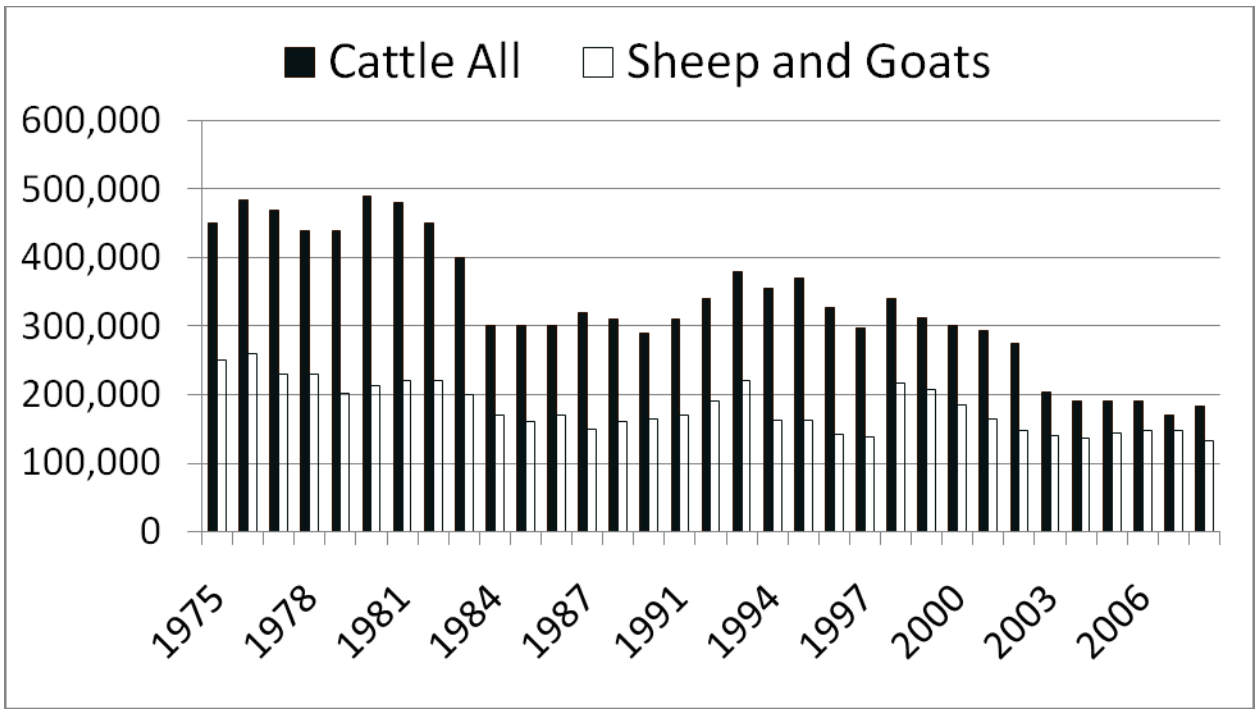


Figure 2. Livestock (cattle and sheep) numbers in Trans-Pecos, Texas, 1975-2008.

Prior to European settlement, the Trans-Pecos consisted of productive grasslands, savannahs, and woodlands. Currently, most rangelands in the Trans-Pecos are considered shrublands, have low grass production, and are highly erodible. Large, natural fires maintained the grasslands (Warnock and Loomis 2002, Wrinkle 2002), prevented encroachment of shrubs, and provided enough grass to support as much as 65 AU/section in wet years. Since 1900, droughts have been frequent and the large droughts of the 1950s and 1990s have impacted the rangelands of the Trans-Pecos. The once wide-spreading fires of the past soon came to an end as drought and overgrazing eliminated fine fuels (e.g., grasses) (Cottle 1931). The landscape of the Trans-Pecos over the past 150 years has changed because of the interaction of drought, overgrazing, and fire.

CONCLUSION

The confounding factors listed above have had and will continue to have positive and negative impacts on the natural resources of the Trans-Pecos. In my presentation, I will provide a quick review of some of the challenges and opportunities that landowners and resource managers are and will be facing in the Trans-Pecos. The challenges will focus on 4 broad categories including challenges and opportunities in the management of rangelands, big game, upland gamebirds, and nongame species. Ultimately, the future of the natural resources of the Trans-Pecos lies in the hands of the private landowners and resource agencies that are entrusted to manage these valuable resources.

LITERATURE CITED

Bailey., V. Biological survey of Texas. North American Fauna. 5:1-222.

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

Harveson, L. A. 2007. Quails on the Trans-Pecos. Pages 202-216 in L. A. Brennan, editor. Texas quails: ecology and management. Texas A&M University Press, College Station, Texas.

Hatch, S. L., K. N. Gandhi, and L. E. Brown. 1990. Checklist to the vascular plants of Texas. Publication MP-1655, Texas Agricultural Experiment Station, Texas A&M University, College Station.

Justice, G. 2001. Little known history of the Texas Big Bend: documented chronicles from Cabeza De Vaca to the era of Pancho Villa. Rimrock Press, Millersview, Texas.

Maxwell, R. A. 1971. The Big Bend of the Rio Grande: A Guide to the Rocks, Landscape, Geologic History, and Settlers of the Area of Big Bend National Park. Texas Bureau of Economic Geology. (http://www.nps.gov/history/history/online_books/geology/publications/state/tx/1968-7/intro.htm; accessed 12 July 2008)

Nelle, S. 2002. Ranching in the desert. Pages 81-87 *in* L. A. Harveson, P. M. Harveson, and C. Richardson (eds.). Proceedings of the Trans-Pecos Wildlife Conference. Sul Ross State University, Alpine, Texas, USA.

Schmidly, D. J. 2002. Texas natural history: a century of change. Texas Tech University Press, Lubbock, Texas.

Texas Parks and Wildlife Department. 2002. Land and water resources conservation and recreation plan. Texas Parks and Wildlife Department, Austin, Texas, USA.

Texas State Data Center. 2001. Projections of the population of Texas and counties in Texas by age, sex and race/ethnicity for 2000-2040. Texas A&M University, College Station, Texas, USA.

Wallmo, O. C., and P. B. Uzzell. 1958. Ecological and social problems in quail management in west Texas. Transactions of the North American Wildlife Conference 23:320-328.

Warnock, B. J., and L. Loomis. 2002. Was the Trans-Pecos a grassland?: past, present, and potential. Pages 94-97 *in* L. A. Harveson, P. M. Harveson, and C. Richardson, editors. Proceedings of the Trans-Pecos Wildlife Conference. Sul Ross State University, Alpine, Texas.

Wilkins, N., R. D. Brown, R. J. Conner, J. Engle, C. Gilliland, A. Hays, R. D. Slack, and D. W. Steinbach. 2000. Fragmented lands: changing land ownership in Texas. Publication MKT-3443, Texas Cooperative Extension, Texas A&M University, College Station, Texas, USA.

Wilkins, N., A. Hays, D. Kubenka, D. Steinbach, W. Grant, E. Gonzalez, M. Kjelland, and J. Shackelford. 2003. Texas rural land: trends and conservation implications for the 21st century. Publication B-6134, Texas Cooperative Extension, Texas A&M University, College Station, Texas, USA.

Wrinkle, J. 2002. Does fire have a role in the Chihuahuan Desert? Pages 98-100 *in* L. A. Harveson, P. M. Harveson, and C. Richardson, editors. Proceedings of the Trans-Pecos Wildlife Conference. Sul Ross State University, Alpine, Texas.

MONTEZUMA QUAIL, A GOVERNMENT BIOLOGIST, AND TRANS-PECOS RANCHERS: THE NATURE OF OUR RELATIONSHIP

DAVID A. HOLDERMANN*, Texas Parks and Wildlife Department, 109 S. Cockrell Street, Alpine, TX 79830; dholdermann@sbcglobal.net*

Abstract**:** The Montezuma Quail, commonly referred to as "crazy quail", is the most inconspicuous and least popularly recognized of the four quail species in Texas. Essentially a Mexican bird in origin and distribution, it is represented in Texas by a small relict population in the Edwards Plateau and a larger, naturally fragmented distribution in Trans-Pecos Texas. The Montezuma Quail is classified as a game bird in Texas, but with no open hunting season. Although uncommon to rare in many parts of its range (USA), the Montezuma Quail is not federally- or state-listed as threatened or endangered. The Wildlife Division initiated a modest study to define the historic and contemporary biogeographies of Montezuma Quail in 2003. Over a four-year period (2003-2007), I negotiated access agreements with 30 different landowners. From those 30 landowner contacts, 26 negotiations were completed, 22 landowners (85%) consented to allow me on their properties to look for Montezuma Quail, while only 4 (15%) declined permission. I made 67 detections of Montezuma Quail representing 115 individuals in 9 mountain ranges. Contemporary detections were recorded and stored at broad geographic- (i.e., mountain range) and county-levels rather than as point coordinates to accommodate the concerns of landowners. Within the Trans-Pecos region, my field work shows that Montezuma Quail can be considered common only in the Davis-Glass-Del Norte mountain complex and perhaps also in the Chinati Mountains. My search yielded 52 specimens (49 skins and 3 egg sets) collected before 1950 at 13 different museums. The discovery of 64 forgotten sight records (1858-1936) in the draft typescript (ca. 1947-1948) of Harry C. Oberholser's "The Bird Life of Texas" was a significant addition to the historic Texas record. My ongoing investigation of past and present biogeographies was initiated in anticipation that it would one day compliment a Texas conservation strategy for Montezuma Quail.

To my knowledge, there has never been a broad partnership involving the Wildlife Division and landowners for the conservation of a nongame species of wildlife in Trans-Pecos Texas. My relationship with some of you to investigate the biogeography of Montezuma Quail can best be characterized as a conservation "network" rather than a conservation "partnership". There is a human face to the mutual working relationships I have forged with Trans-Pecos landowners. If biogeography is the hard currency of Montezuma Quail conservation then "face time" is the currency of conservation relationships with Trans-Pecos landowners. Common property law and the dominance of private land converge in Texas to make landowners both the "gate keepers" and "custodians" of wildlife. The "gate keeper" endowment connotes control over the places wildlife live. The "custodian" endowment implies oversight authority, but also moral responsibility for the condition of wildlife habitats and ultimately of wildlife populations. It is noteworthy that custodial liability can be neutralized and even transformed into prestige through good land stewardship. It is a certainty that private land represents the dominant physical stage for the future of wildlife and the conservation of wildlife in Texas. Landowners who manage game for hunting recognize and operate within the framework of these principals to produce

economic, social, and political benefits for themselves. In contrast, the same landowners generally have not exercised the advantages of "gate keeper" and "custodian" endowments with respect to "nongame" or non-traditional wildlife. In the absence of clear market forces and real and perceived legal disincentives (i.e., ESA), landowners have tended to view these endowments largely in terms of liabilities; and, consequently, have locked down gates for most purposes related to non-traditional wildlife. If these roles are perceived as endowments rather than liabilities, then they confer social and political power - a rare form of wealth. Landowners so empowered might become tomorrow's leaders in matters of legislation (including ESA revision), policy, and the practice of conservation for non-traditional wildlife.

BACKGROUND

Life History, Natural History, and Reflection: An Eclectic Mixture

This is not a technical paper. It is an eclectic mixture of case history, natural history, and personal reflection. Montezuma Quail are the subject of the natural history and play the role of protagonist. The case history relates to my efforts as a state wildlife biologist to solicit Trans-Pecos landowners for permission to access their properties to study the biogeography of Montezuma Quail. In the context of agency-landowner relationships and non-traditional wildlife conservation, I offer some personal reflections on the human dimensions of my experience with Trans-Pecos landowners and the future of conservation for non-traditional wildlife in Texas.

Montezuma Quail: Profile of a Mexican Bird

The Montezuma Quail, commonly referred to as "crazy quail", is the most inconspicuous and least popularly recognized of the four quail species in Texas. Essentially a Mexican bird in origin and distribution, it is represented in Texas by a small relict population in the Edwards Plateau and a larger, naturally fragmented distribution in Trans-Pecos Texas. Montezuma Quail occupy a different branch of the family tree of Neotropical quail than other Texas quails. They descended from a tropical forest-adapted ancestor and their closest living relatives are the Singing and Spotted Wood quails of southern Mexico. Traits unique to Montezuma Quail include obligate feeding on underground plant organs such as enlarged rhizomes, tubers, and, bulbs which they excavate by digging; remarkably bold and tropical-like disruptive plumage patterns (male), a "crouch and freeze" behavioral response to potential predators, and delayed breeding that coincides with summer monsoonal rain patterns. Montezuma Quail are strongly associated with montane woodland habitats throughout their range along the Mexican Plateau. Many details of the quail's life history remain almost as obscure as they were when the species was first described by English zoologist, Nicolas A. Vigors, in 1830. Its ground dwelling habit, cryptic plumage, and secretive behavior contribute to the fact that Montezuma Quail are difficult to directly observe and study in the wild.

Regulatory and Conservation Statuses: A Disclaimer of Liability

The Montezuma Quail is classified as a game bird in Texas, but with no open hunting season. It was formerly hunted in Texas (ca pre-1940). In Arizona and New Mexico, it is also classified as a game bird and regulated hunting is allowed.

The Montezuma Quail is not federally- or state-listed as threatened or endangered. Although uncommon to rare in many parts of its range (USA), it is my honest opinion that the Montezuma Quail is neither endangered nor is it likely to be become endangered (biological listing criteria of the Endangered Species Act). This quail is designated as a "Watchlist Species" in the "North American Landbird Conservation Plan" (2004) that was prepared by Partners In Flight. Watchlist Species are considered to be in need of some sort of conservation action. Watchlist Species status was made on the basis of restricted distribution and small population size; however, those assessments were based on incomplete or no data and may overestimate the need for conservation action.

The "Texas Wildlife Action Plan" (2006) designated the Montezuma Quail as a medium priority species for conservation funding and action.

Amendment 65.62: Important Lessons Learned

In 2002-2003, the Wildlife Division proposed to open the hunting season for Montezuma Quail with a two-bird bag limit (Amendment 65.62). The proposal was strongly opposed by outdoor writers, bird watchers, and other conservationists; and consequently, it was dropped before being officially considered by the Texas Parks and Wildlife Commission. The Wildlife Division provided no biological grounds for opening the season and failed to identify important stakeholders or to measure stakeholder opinions regarding the proposal.

TOWARD A CONSERVATION STRATEGY

Biogeography: A Foundation Building Block

In 2003 after the quiet death of Amendment 65.62, the Wildlife Division gave me the opportunity to initiate a modest study to define the historic and contemporary biogeographies of Montezuma Quail. Biogeography is simply the study of where plants and animals live on the landscape, and it has many practical applications. We're all familiar with plant and animal range maps as depicted in nature field guides and reference books. Knowledge of biogeography is necessary to understand a species' ecology and it represents a fundamental building block in the practice of wildlife conservation.

The comparison of historic and contemporary distributions will yield a measurement of how the range of Montezuma Quail has changed over time. This consideration is particularly relevant to the Edwards Plateau where we know the historic range has undergone a significant reduction over the last 150 years. Definition and characterization of former ranges will provide insights into what factors caused quail populations to shrink and more importantly whether and how populations can be restored. Delineation of contemporary ranges will provide a real time

picture of the geographic space and variety of landscapes and habitats still occupied by Montezuma Quail and insights into how these places might be managed to sustain quail populations in the future.

Biogeography on Private Lands: "Gate Keepers" and "Government Agents"

In the new Republic of Texas (1836), it was a fundamental principal that citizens had the right to choose who stepped through their front gate. Further, it was a generally accepted view that all governments, including one's own, should be viewed with skepticism. Indeed, these views still prevail in Trans-Pecos Texas. Government biologists who work here know that it is a distinct privilege to pass through a ranch gate. The initial "right of passage" carries with it responsibility and opportunity. If you conduct your business in a fair and honest manner, there is a good chance that you will forge acceptance, trust, and meaningful relationships within the Trans-Pecos ranch community.

Some gates open easier than others depending on the nature, experience, and interests of the rancher. The nature of the biologist's business is also a critical factor. It is a reality that Trans-Pecos ranchers are reluctant to open gates for inquiries pertaining to non-traditional wildlife. The principal reason for the higher standard has its roots in the federal Endangered Species Act (ESA). The history behind guarded attitudes is complex but familiar to us all. It is a subject unto itself that I think is best left for discussion on another day.

Sampling Considerations: Looking in the Right Places

My sampling protocol for delineating the current range of Montezuma Quail in the Trans-Pecos is based on searching landscapes with elevations above 5,000 ft. This stratified approach, based on general knowledge of habitat preferences, directed me to the region's widely scattered desert mountain ranges. It also eliminated sampling in extensive low basins and plains – places not normally frequented by Montezuma Quail. The elevation model also helped to identify which private land holdings were likely to be associated with Montezuma Quail.

Landowner Permission for Wildlife Research: The Contract

All TPWD wildlife research activities on private lands must be secured by a contract between the landowner and the State of Texas. The contract is embodied in the "Landowner Permission for Wildlife Research" form, which sets forth mutually agreed terms for access and research activities. The landowner can chose whatever contract terms he or she wishes. Department biologists can not enter or conduct research on private property without a signed contract with the landowner.

The Compromise: A Matter of Scale

I was quick to learn that one of the fundamental pleasures of biologists who study rare plants and animals, namely putting dots on maps to represent sight observation or specimen collections, made ranchers extremely nervous. The system of recording point locations is a matter of standard training and second nature for biologists like me. Many of my early

negotiations with landowners stalled when they read the fine print of the research permission form which stated that quail observations would be recorded and stored as points. Their objection was logical. If a sighting was recorded as a map coordinate then it could be traced back to a specific property at a later date in time. As viewed by many ranchers in the context of ESA, point locations pose a threat to private property rights.

At first this presented a real dilemma for me. How was I supposed to map the geographic distribution of Montezuma Quail, if I couldn't plot point observations? The answer was pretty simple - I had to change to my expectations of how Montezuma Quail detections would be recorded, stored, and referenced. If detections were recorded and used at a much broader scale, say in reference to mountain ranges or counties, then ranchers largely agreed to allow me to perform detection surveys on their properties. This compromise was a critical turning point in the program.

Gate Openings: A Small Conservation Success Story

Negotiating access agreements became as important, and certainly more challenging, than looking for the quail themselves. Over a four-year period (2003-2007), I negotiated agreements with 30 different landowners. That sounds like a small number, but consider that the tables were turned this time. I was the government agent seeking an important favor. From those 30 landowner contacts, 26 negotiations were completed, 22 landowners (85%) consented to allow me on their properties to look for Montezuma Quail, while only 4 (15%) declined permission for access. The high success rate does not imply that the job was an easy one. Some negotiations stretched out over several years before finally ending in an agreement.

The study of Montezuma Quail biogeography forced me to reach out to ranchers, ranch managers, and other land owners who were, most often, not traditional contacts of the Wildlife Division. The surprising result was the beginning of many new and positive relationships that have the strong potential to mutually benefit landowners, the Wildlife Division, and ultimately the conservation of wildlife resources for years to come. My persistence, our mutual patience, and your good will melded to produce a small conservation success story.

Historic Records: "Re-Search" for Lost Treasures

Reconstructing the historic distribution of Montezuma Quail in Texas has been a satisfying personal experience because it is a blend of history and natural history: two of my favorite subjects. Studying the history of a wildlife species is not biological research in the traditional sense. Rather it represents a "re-search" for facts and information that were previously known, but lost or obscured to common knowledge with the passage of time. Museum specimens, mostly study skins but a few egg sets, form the backbone of the historic Texas record. Also, published scientific and popular literature and one very unusual unpublished manuscript contributed to the historic picture.

Col. George A. McCall, U.S. Army, appears to have been the first person to formally record his Texas observations of Montezuma Quail. In an account of Texas birdlife published in the Proceedings of the Academy of Natural Science of Philadelphia (1850), he described the

Massena (Montezuma) Quail as "frequently seen but not very common" along a 140-mile upland stretch between river crossings on the San Pedro (Devil's) and Pecos rivers. The earliest scientific collection of a Montezuma Quail in Texas appears to have been made in 1853 by C.W. Crawford at Las Moras (Ft. Clark, Kinney Co.); although, J.H. Clark (U.S.-Mexico Boundary Survey) collected a bird between 1850 and 1855 near Laredo (Webb Co.). A.J. Foard, U.S. Army Medical Corps, collected the first specimens in Trans-Pecos Texas at Ft. Davis (Jeff Davis Co.) in 1858. Many of the earliest specimen collections were made by members of the U.S. Army Medical Corps near frontier Texas forts.

I contacted 54 museums in the USA, Mexico, Canada, and Europe to determine whether their collections contained historic specimens from Texas. My search yielded 52 specimens (49 skins and 3 egg sets) collected before 1950 at 13 different museums. Twenty-five specimens were collected before 1900 and another 27 specimens were made between 1901 and 1950. There are more historic specimens from the Trans-Pecos (n=31) than from the Edwards Plateau (n=19). The Academy of Natural Sciences of Philadelphia, American Museum of Natural History, Carnegie Museum of Natural History, Mayborn Museum (Baylor University), the Museum of Zoology (University of Michigan), The Field Museum, Chicago, and the National Museum of Natural History at the Smithsonian are among major holders of Texas specimens. The bird collection at the Natural History Museum, Tring, England (formerly British Museum of Natural History) holds 4 Montezuma Quail specimens collected by H.E. Dresser in Bandera Co. (1863). The skins were shipped past the Union blockade in the Gulf of Mexico and back to Dresser's home in England during the height of the Civil War; a side product of trade between the son of a Manchester merchant and the Confederacy. The discovery of 64 forgotten sight records (1858-1936) in the draft typescript (ca 1947-1948) of Harry C. Oberholser's "The Bird Life of Texas" was an incredible find and addition to the historic Texas record.

Montezuma Quail Detection Surveys: Dogs, Boot Leather, and Desert Mountains

Almost everything I know of meaningful value about Montezuma Quail connects in some way to the hundreds of hours and hundreds of miles spent walking behind trained bird dogs in the desert mountain ranges of New Mexico and Texas (1991-2008). Montezuma Quail are spread thinly and unevenly across their northern peripheral range and this combined with the bird's elusive nature explains why so few researchers have studied them in comparison to other North American quail. A good bird dog takes the random luck out of searching for Montezuma Quail and increases the effective physical scope of the search area. Nonetheless, even with trained dogs and good scent conditions, on average one can expect to spend a matter of hours per quail detection in good habitats and up to tens of hours per detection in marginal habitats.

Playback: A New Detection Tool

After a 2-year trial period (2005-2007), I began using the "playback" technique to detect Montezuma Quail during the summer of 2007. Playback involves the use of recorded bird calls or songs to elicit the call response of a wild bird of the same species. In the Davis Mountains, my experimental playback trials showed the response rate of wild males was highest during July-September. Preliminary results strongly suggest that playback will be a highly effective tool to detect Montezuma Quail, especially low-density populations.

Montezuma Quail Detections: Hard Currency for Conservation

I used a combination of dog-assisted ground searches (2003-2007) and playback (2007-present) to detect Montezuma Quail in the Trans-Pecos. Detection surveys have been conducted in 15 different desert mountain ranges and included 35 dog-assisted ground surveys (totaling 153 hrs of search time) and 20 playback surveys. I made 67 detections of Montezuma Quail representing 115 individuals in 9 mountain ranges (Barrilla Mountains, Chinati Mountains, Chisos Mountains, Davis Mountains, Del Norte Mountains, Elephant Mountain, Glass Mountains, Oak Hills, and Stockton Plateau-West). I failed to detect quail in another 6 ranges (Delaware Mountains, Franklin Mountains, Guadalupe Mountains, Dead Horse Mountains, Sierra Diablo, and Sierra Vieja). As illustrated by my experience in the Sierra Vieja, a weakness of presence/absence survey data is that failure to detect an organism does not necessarily mean it is not present in the search area. I detected no quail in the Sierra Vieja during 1,403 min (23 hrs) of dog-assisted search effort, which certainly indicated they were extremely rare there. Nonetheless, Clay and Jody Miller have observed Montezuma Quail periodically at their ranch in the Sierra Vieja including as recently as the summer of 2006. Within the Trans-Pecos region, my field work shows that Montezuma Quail can be considered common only in the Davis-Glass-Del Norte mountain complex and perhaps also in the Chinati Mountains. Additional detection surveys are scheduled in 2008 for the Delaware Mountains, Guadalupe Mountains, Sierra Vieja, and Sierra Diablo.

Conservation Strategy for Texas: The Logical Next Step

My ongoing investigation of past and present biogeographies was initiated in anticipation that it would one day compliment a Texas conservation strategy for Montezuma Quail. The large reduction of range in the Edwards Plateau during historic times and the natural fragmentation of suitable habitat in the Trans-Pecos are sufficient reasons to undertake conservation planning for Montezuma Quail in Texas.

CLOSING STATEMENTS

The Nature of Our Relationship: An Honest Beginning

To my knowledge, there has never been a broad partnership involving the Wildlife Division and landowners for the conservation of a nongame species of wildlife in Trans-Pecos Texas. A conservation partnership exists when previously independent individuals or organized groups purposefully join forces to affect a common goal or outcome. My relationship with some of you to investigate the biogeography of Montezuma Quail can best be characterized as a conservation “network” rather than a conservation “partnership”. It is a collection of multiple independent relationships between landowners and the Wildlife Division in which I represent the only common party in each of the 22 individual relationships. Regardless, the network facilitated an important conservation goal and represented a significant step forward for nongame conservation in Trans-Pecos Texas. I hope these independent relationships have a long and reciprocal life. Based on what I know about the independent and cautious nature of Trans-Pecos landowners, I am inclined to believe that conservation networks rather than conservation

partnerships will always be the rule here. Nonetheless, it is tempting to speculate what a true partnership of Trans-Pecos landowners might achieve for Montezuma Quail or other non-traditional forms of wildlife.

There is a human face to the mutual working relationships I have forged with Trans-Pecos landowners. Their development was a slow and deliberate process initially attended by skepticism and caution on the part of the landowner and purpose, determination, and anxiety on my part. If biogeography is the hard currency of Montezuma Quail conservation then "face time" is the currency of conservation relationships with Trans-Pecos landowners. Most Trans-Pecos landowners are "traditional" in custom and want to see and know the person they are dealing with. Signed contracts and liability disclaimers aside, the human dimension is still a very important part of decision making in contemporary Trans-Pecos Texas.

Risk Taking: A Gift Not Wasted

I fully appreciate that many of you view the Endangered Species Act and its various interpretations and forms of implementation as a real threat to your properties and rights to property. In the context of the dilemma in which I put you, I am forced to consider what a ranch represents: among others, it is real property, equity, source of income, way of life, lifetime of hard work and commitment, your heritage, and a place called "home". Your individual decisions to accept risk in order to do something good for wildlife conservation were not wasted on me or my colleagues. It speaks mountains about your inner character and values. I reaffirm my promise to honor the commitments that I have made to you. On behalf of the Wildlife Division, I offer our sincere appreciation for the opening of gates to facilitate learning and the promotion of conservation for Montezuma Quail.

"Gate Keeper" and "Custodian" Endowments: Rare Forms of Wealth

Common property law and the dominance of private land converge in Texas to make landowners both the "gate keepers" and "custodians" of wildlife. Texas property law gives the landowner the right to impose conditions, including absolute denial, to citizens (including most government agents) who wish to enter their property. The thorough diminution of the historic public domain has resulted in near complete private ownership of Texas. Hence, it is a certainty that private land represents the dominant physical stage for the future of wildlife and the conservation of wildlife in Texas. Finally, "state ownership theory" extends the right of wildlife ownership to the State and not to individual citizens or special interests. However in an economic and practical sense, control of access to wildlife serves almost the same ends as ownership. Access fees and game hunting lease fees charged by private landowners are based on this logic.

The "gate keeper" endowment connotes control over the places wildlife live. The "custodian" endowment implies oversight authority, but also moral responsibility for the condition of wildlife habitats and ultimately of wildlife populations. It is noteworthy that custodial liability can be neutralized and even transformed into prestige through good land stewardship. Hence, for good land stewards, gate keeper and custodial endowments are additive and represent a rare form of wealth. Landowners who manage game for hunting recognize and

operate within the framework of these principals to produce economic, social, and political benefits for themselves. In contrast, the same landowners have generally not exercised the advantages of "gate keeper" and "custodian" endowments with respect to "nongame" or non-traditional wildlife. In the absence of clear market forces and real and perceived legal disincentives (i.e., ESA), landowners have tended to view these endowments largely in terms of liabilities; and, consequently, have locked down gates for most purposes related to non-traditional wildlife.

These premises lead me to conclude that, with one major attitudinal tweak, landowners could rewrite the script of non-traditional wildlife conservation in Trans-Pecos Texas. The pivotal change would have landowners view the "flip side" of their gate keeper and custodian roles. If these roles are perceived as endowments rather than liabilities, then they confer social and political power - that rare form of wealth. And landowners so empowered might become tomorrow's leaders in matters of legislation (including ESA revision), policy, and the practice of conservation for non-traditional wildlife.

SCALED QUAIL MANAGEMENT IN TRANS-PECOS TEXAS

KENNETH A. CEARLEY*, Texas AgriLife Extension Service, P. O. Box 60275, Canyon, Texas 79016, USA; kcearley@ag.tamu.edu*

Abstract: Scaled quail (*Callipepla squamata*) populations in the Trans-Pecos historically have not been the recipient of widespread intensive management efforts. A changing trend is apparent in the region with more operators showing an interest in managing land with priority given to scaled quail production. Management techniques and strategies for the species are not as thoroughly tested as with bobwhite quail (*Colinus virginianus*). However, even though preferred habitats differ for the two species, the primary factors associated with the successful production of either include adequate rainfall and appropriate grazing intensity. The effectiveness of rainfall can be enhanced by such practices as proper grazing and by water harvesting. Grazing management that favors scaled quail leaves enough grass cover year long, including during drought, to optimize nesting success. Other strategies and their relative merit and known degree of effectiveness are discussed.

INTRODUCTION

Scaled quail, commonly called blue quail or "blues", have often been relegated to secondary status in relation to bobwhite quail in years past but have enjoyed greater recognition recently. Hunter interest is on the upswing and likewise research activity. Running more often than flying, inhabiting more arid and more open country than bobwhites, they provide frustration for bird dog and hunter alike, thereby yielding greater bragging rights to those who get their bag limit of blues on a given day.

Lehman (1984) expressed that "blue quail seem somewhat more intelligent than bobwhites." He declared them to be more difficult to trap and quicker to flush from hunter noises. More shots were taken at near maximum shotgun range, and the birds often flushed from ¼ mile or more away. They usually "see and run", rather than "see and freeze" like bobwhites. Some hunters prefer the pursuit of blues because of these characteristics and the increased challenge.

Distribution

There are two subspecies of scaled quail in Texas: the Arizona scaled quail (*C. s. pallida*) and the chestnut bellied scaled quail (*C. s. castanogastris*) (Silvy et al 2007). As the name implies chestnut bellied quail have a patch of chestnut colored plumage on the belly, and are slightly darker and smaller than Arizona scaled quail. Chestnuts seem to prefer thorn-scrub vegetation and well-drained ridges or lowlands along drainages, Arizonas are found in greater numbers in open grassland with no more than 10-15 % brush canopy cover (Silvy et al 2007).

The 100th meridian, the east boundary of the Texas Panhandle and roughly the route of US Highway 83 in Texas, is the general line west of which reside more blues than bobs, though much of their range overlaps up to the Pecos River on the west (Cantu et al 2006, Silvy et al 2007). The portion of Texas west of the Pecos River, the Trans-Pecos, is home to mostly blues with comparatively small numbers of Montezuma (*Cyrtonyx montezumae*) and Gambel's quail (*Callipepla gambelii*), the other two species of quail endemic to Texas. Scaled quail find the region's more open habitat and more arid climate ideally suited to their needs.

Though blues and bobwhites utilize similar loafing cover, blues generally prefer a greater abundance of bare ground, a commodity seldom in short supply in the region. In contrast Reid et al (1979) found where sympatric with bobwhites, breeding blues selected the dense, shorter shrub height, whereas bobwhites were located in the more open, taller vegetation types. He explained that shrubland was negatively correlated with breeding quail numbers in the Trans-Pecos in his study not because it was unimportant but because mixed mesquite shrubland associated with wetter areas was of even greater importance.

Blue quail populations are believed to expand eastward during drought and are not as productive during normal precipitation years as bobwhites. Blues tend not to decline as quickly as bobwhites during dry years, but neither do they increase as quickly as bobwhites during wet years (Rollins 2000).

Population Status

Trans-Pecos blue quail population density varies widely year-to-year, partly in response to rainfall (Bridges et al 2001) and resultant herbaceous cover. However rainfall variations alone fail to explain the existing long-term downward trend. Southwestern US populations have declined by as much as 50% since 1960 (Bristow and Ockenfels 2006). In Texas scaled quail populations have declined by an average of 1.79% per year from 1966 to 2006 (Sauer et al 2007). The Trans-Pecos possessed the highest populations of blues in Texas during the years 1994 to 2003.

There is no clear understanding of what is causing the decline (Pleasant 2003). The decline can be attributed to rangeland deterioration and changing land use, according to Silvy et al (2007), who went on to say that excessive grazing has caused woody growth to increase, lowering the value of some land to blues, and that little evidence existed to support the hypothesis that changing precipitation patterns were responsible.

Kuvlesky et al. (2002) agreed that the decline of quail populations throughout Texas, including blues, may be attributed to habitat loss due to overgrazing, and added increasing intensity of crop production, urban development, and the loss of useable space due to exotic grasses encroachment as other contributing factors. Drought and overgrazing are also contributing factors to the reduced scaled quail populations in the Southern High Plains (Pleasant et al 2006).

Diseases may have played a role in a precipitous decline noted in the late 1980s (Cantu et al 2006, Rollins 1996, Rollins 2000), though no firm evidence exists (Silvy et al 2007).

Campbell and Lee (1953) found that blues in New Mexico suffered a marked decline in 1944, coincident with the appearance among quail of unusually large numbers of the louse fly known to transmit the organism responsible for quail malaria. No evidence was found that it was markedly pathogenic to adult scaled quail, but there was some evidence that it may be seriously pathogenic for the young.

Some observers currently report a general upsurge in blue quail population densities in the Trans-Pecos. Texas Parks and Wildlife Department roadside counts show populations above the long-term mean 13 of the most recent 30 years, 4 of which were the last 4 years (TPWD 2007) (Figure 1). An upward trend was noted since 1995, the second lowest density to 1990.

One particular contributing factor may be de-stocking by ranchers due to lack of forage in the face of extended drought which peaked in the late 1990s and early 2000s, and the subsequent return of normal to above-normal rainfall. When significant rainfall eventually returned livestock numbers remained relatively low region-wide at least in part to landowners' recognition that continued deferment was needed, and the high cost of re-stocking in an upward trending cattle market. The resulting improvement in nesting cover likely played a significant role in increasing nesting success and brood survival.

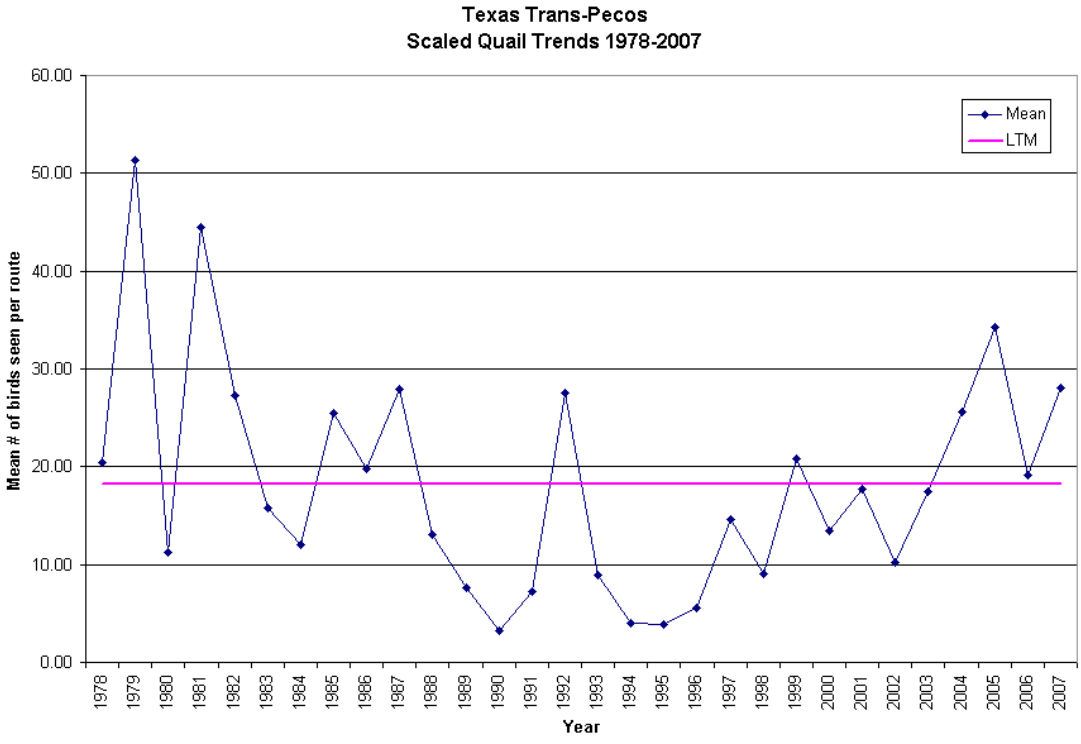


Figure 1. Texas Parks and Wildlife Department roadside count results showing numbers of scaled quail in the Trans Pecos region from 1978 to 2006 using randomly selected, 20-mile roadside survey lines.

DIGESTIVE PHYSIOLOGY

At least a cursory knowledge of quail digestive physiology is helpful in understanding the needs of blue quail for certain habitat components and specific structural requirements of those components. The quail digestive system, like other gallinaceous birds, allows for rapid filling of a storage organ called the crop or "craw", and quick return to protective cover. This function allows quail the ability to minimize exposure to predators and to environmental extremes (temperature, ice, etc.). In the relative safety and leisure of loafing (hence the term) cover the food passes from the crop into the gizzard for pulverization and entry into the remainder of the digestive tract, much like a cow chewing her cud. In order to take advantage of this behavior in fostering quail populations proper loafing cover must be supplied by the manager as a result of land management practices applied.

The crop is also a valuable means for managers to ascertain diet at harvest, providing a snap shot of the diet at that point in time. This knowledge can contribute to the overall understanding of quail dietary needs and utilization.

REPRODUCTION AND GROWTH

Nesting

Adequate herbaceous cover is crucial to nesting success and chick survival. Blue quail are highly protective of their young (Lehman 1984, Buntyn 2004) but sufficient nesting cover is nevertheless necessary for protection of the clutch from predation and weather extremes.

Nesting usually peaks in June, having begun as early as April, and typically lasting until early October (Cantu et al 2006). Blue quail nest on the ground in a depression lined with grass stems and leaves and under some form of shade, sometimes under plants such as tobosagrass (*Hilaria mutica*), prickly pear (*Opuntia spp*.), and yucca (*Yucca spp*.) (Silvy et al 2007).

A New Mexico study (Evans 1997) reported that eggs were laid at a rate of one per day, an hour later each day in the daylight hours. Clutch sizes averaged 14 in west Texas (Walmo 1956). Average clutch size in Pecos County, Texas, was 13 with a range of 5-16 (Buntyn 2004). Evans (1997) reported clutch sizes in 1994 of 12-16 eggs (n=7) and in 1995, 8-14 (n=13).

Incubation for a period of 22-23 days (Evans 1997) is mainly by the female, rarely by the male (Schemnitz 1961). Buntyn (2004) found nest success of 77% and a hatch rate of 75%. Pleasant et al (2006) reported in the Southern High Plains of Texas 50 nests with 44% success in 1999, 56 nests with 64% success in 2000. Males will incubate the nest when the mate is dead (Evans 1997).

Brooding and Growth

Immediately after hatching chicks follow the parents away from the nest site, possibly in an effort to avoid attracting predators by the associated sounds and smells of the nesting site.

Both parents accompany the brood, often with the male on a high perch serving as a sentinel, the female feeding with the young (Shemnitz 1961).

Double brooding is much less common with blues than bobs (Rollins 2000), though anecdotal evidence points toward the occasional occurrence. Evans (1997) reported no evidence of second broods.

In the Southern High Plains of Texas chick presence with the hen at 21 days was found to be negatively associated with cool and wet weather (Pleasant et al 2006). Juveniles usually reach 50% of adult body weight by 6 weeks, 90% at 13 weeks (Cain and Beasom 1983).

Diet

The diet of blue quail largely consists of seeds of forbs (commonly referred to as "weeds") and woody plants, and mast and fruits of plants such as tasajillo (*Opuntia leptocaulis*) (Rollins 2000) and leafy green plant material ("greens"). Insects, a high quality food for quail of all ages, is particularly important for chick survival and growth. Most chicks feed on insects during the first weeks of life, relying on them along with greens to such a degree that it is possible that chicks may die due to lack of insects and greens during drought (Silvy et al 2007).

A New Mexico study (Schemnitz et al 1998) found annual and perennial forb seeds were the main components of the diet, along with seeds of woody plants. Snakeweed (*Gutierrezia spp*.) seed ranked first, Russian thistle (*Salsola kali*) second. Most were eaten in similar amounts in dry, wet, and average precipitation years. Exceptions were insects and snakeweed, which were consumed in greater amounts in wet years, and white thorn acacia (*Acacia constricta*) and goosefoot (*Chenopodium spp*) were eaten in higher amounts in dry years.

Lehman (1984) reported that in South Texas, west of 98th meridian, bobwhites and blues ate many of the same foods, blues utilizing somewhat more mast (more than 61% of diet) and greens (3%).

HABITAT REQUIREMENTS

Successful management of blue quail is dependent on a site's "habitability" (Cantu et al 2006), or usefulness by way of the provision of suitable, useable habitat, year round, and in close proximity to one another (Rollins 1996, Cantu et al 2006). Rollins (2000) suggested that managers recognize existing habitat that contains high densities of blue quail and strive to maintain the integrity of those sites. To the extent possible managers should replicate those conditions across the landscape.

No studies have been done to determine the minimum population size or the minimum area required to sustain quail populations (Silvy et al 2007). But, regardless, food, cover, and water, well-interspersed across the landscape, are the essential habitat components. Cover is by far the most important of the three and must be addressed by the manager in an ongoing deliberate effort.

Schemnitz (1984) reported common shrubs in good quail habitat include yucca, four-wing saltbush (*Atriplex canescens*), littleleaf sumac (*Rhus microphylla*), skunkbush sumac (*Rhus trilobata*), beargrass (*Nolina microcarpa*), and various cacti (*Opuntia spp*.).

In Arizona Bristow and Ockenfels (2006) noted that greater amounts of visual obstruction and lower percentages of tree canopy cover best predicted scaled quail sites. They recommended that practices that reduce grass species (diversity) and cover and increase tree cover may reduce habitat quality and availability in southeastern Arizona. A maximum brush canopy cover of 6%, and greater than 25% grass canopy at the 8 inch height, was suggested as optimum.

Reid et al (1993) showed that mesquite (*Prosopis spp*.) habitats were especially important to scaled quail in the Trans-Pecos, by virtue of the greater density of breeding males that occurred there during the breeding season compared to other habitat types.

Nesting

Limited research involving relatively small sample sizes has shown an apparent benefit of pricklypear to quail for nesting sites (Cearley 1999). Carter (1995) found 8 of 12 scaled quail nests were located in prickly pear clumps. One explanation was the mechanical protection from predation that was provided by prickly pear spines, another was that in the drought conditions that persisted during the study the prickly pear provided relic stands of bunchgrass within the clumps. Slater (2001) likewise concluded that prickly pear provided a degree of mechanical protection against nest predators and protected grass growth for nesting, especially in areas of marginal nesting cover.

Blue quail seem to resort to pricklypear for nesting when other "traditional" bunchgrass sites are unavailable, e.g. after fire or overgrazing. On range typically over-grazed or in semi-arid, drought prone areas, some pricklypear should be maintained since the likelihood of an adequate density of bunchgrass nest sites may be low (Cearley 1999).

Evans (1997) working in southern New Mexico reported that 90% of blue quail nests found were in high mesquite dunes and the other 10% in soaptree yucca (*Yucca elata*). Of those in mesquite, 50% were in active pack rat nests. Buntyn (2004) radio-marked 207 blue quail hens in Pecos County and reported 85% of nests were in tobosagrass.

MANAGEMENT CONSIDERATIONS

Water Harvesting

A major consideration in the arid Trans-Pecos is making the most of the limited rainfall which is characteristic of the desert region. Management strategies aimed at accomplishing this can benefit overall rangeland health and may benefit scaled quail populations.

Soil ripping along landscape contours, perpendicular to slopes, on large scale bare areas has significantly increased grass production in and along the ripped areas (Ueckert and Petersen

2002). Water infiltration is increased, erosion reduced, and rangeland restored to better hydrological condition with this method. The specific effects on quail populations have not been studied thoroughly, but the practice stands to contribute significantly to successful scaled quail management in some areas.

Spreader dams and berms, originally employed for erosion control, have likewise yielded increased herbaceous production as a result of the concentration of rainfall runoff and improved conditions for infiltration. Buntyn (2004) studied the impact of moist soil management on scaled quail reproductive success and survival in Pecos County with radio-marked hens. Moist soil sites supported greater vegetation biomass and arthropod abundance, but nesting success and hen survival were similar among the two. Spreader dams did not appear to influence survival or hatch rates. He concluded that screening and nesting cover was more important than mesic microhabitats afforded by spreader dams. Conservative grazing management, providing abundant nesting cover across the landscape, may be a more important factor.

Moist Soil Management

The slight overflow of water troughs, or the earthen overflow pools nearby water storage tanks at windmills provide dependable production of greens, insects, and cover. Such small scale management can be effective when utilized in conjunction with landscape level strategies.

Grazing

Undoubtedly livestock grazing influences scaled quail populations in Texas. Especially important is the amount of herbaceous plant material left for cover after grazing. All periods of the year are important, even drought. There is little consensus on which grazing system is best (Silvy et al. 2007), but Rollins (2000) suggested moderate (40+ acres per animal unit) to light (>75 acres per animal unit) grazing intensity to benefit blue quail. Livestock grazing strategies should seek to increase availability of potential nesting sites if quail management is important (Slater 2001). Moderate livestock grazing may be beneficial by enhancing the variety and abundance of forb plants (Schemnitz et al 1998). Gambel's and Montezuma quail benefit from conservative grazing practices as well (Harveson 2004).

Predators

Predation likely has the greatest impact during nesting. Both hen and clutch are especially vulnerable during egg-laying and incubation. Prescribed trapping of potential nest predators holds promise for affecting quail production positively (Silvy et al 2007), though the practice remains unproven for blue quail (Rollins 2000). Intensive removal of mammalian predators in the western Rio Grande Plains resulted in no significant effect on blue quail (Guthery and Beasom 1977).

Fragmented habitats and higher predator populations may be overwhelming bobwhites' (and likely blues') ability to cope with predation (Rollins 1999). Pleasant et al (2003) showed precipitation was negatively associated with nest predation in the Southern High Plains, failing to

support the moisture-facilitated nest predation hypothesis, the idea that wetter conditions favor predation (Pleasant et al 2003).

Food Plots

Food has seldom been shown to be a limiting factor in quail populations. Typically food plots are more risky and hence less effective overall in the more arid regions in which blues reside. Rollins (2000) notes that they generally cannot be grown when needed most, unless irrigated, yet if successfully implemented they will probably be utilized, just as quail will readily use agricultural crops such as wheat and sorghum, given that the plots are no more than 75 yards or so from escape cover.

Supplemental Feeding

Supplemental feeding rarely results in increased production of bobwhites over unfed populations in controlled studies. However, as insurance against environmental extremes (cold, winter precipitation), at worst it is a neutral practice —it won't hurt (Cantu et al 2006). The effect of supplemental feeding is largely unknown in blues (Rollins 2000). Henson (2006) studied quail feeder use in Coke, Fisher, Stonewall counties. Fourteen mammals and 18 avian species were observed at feeders. Raccoons accounted for 43.2% of all time spent at feeders, bobwhite and scaled quail, 5.4%. Strategic implementation of feeders was suggested to minimize non-target consumption. Rollins (2000) observed ready use of quail feeders by quail, and noted their increased availability to hunters. He photographed 3 week-old chicks at quail feeders in Irion County. Adults frequently used deer feeders in fall and winter months. Supplemental feeding may increase predation of blue quail at or in the vicinity of feeders, but adequate research specifically addressing the issue is lacking at this point.

Brush

Blues may need less brush than bobwhites (Rollins 2000). The availability of loafing cover is a prime consideration/requirement, for example some growth forms of mesquite, and lotebush (Ziziphus obtusifolia). He suggested that managers recognize the structure of places that support high quail densities and maintain their integrity. Strive for at least one loafing covert per 50 ac., preferably up to 1 per ac. Leaving at least 10% of the brush intact is a good rule of thumb. Mechanical clearing is preferred over chemical use because of forb stimulation as a result of soil disturbance produced by mechanical methods. Track-mounted grubbers offer an effective selective means of mechanical brush removal. Individual plant treatment with herbicide is another preferred selective method.

Food production can be managed by brush manipulation. Early successional species which are primary food sources for blues are encouraged by the soil disturbance associated with mechanical brush control, winter disking, and livestock grazing (Rollins 2000). Strip disking during the months of December through February close to woody cover is effective. Mesquite, catclaw (Acacia spp.), hackberry (Celtis spp.), and chittam (Bumelia lanuginosa) are important shrubs/trees to maintain, supplying important foods seasonally.

Water

There is no evidence that water increases quail populations. Blue quail will drink water when it is available, but they can procure all of their water requirements from preformed water such as dew or metabolizable water in their food, such as insects and greens (Schemnitz 1961, Rollins 2000). Allowing livestock water troughs to overflow slightly provides ground level access to water and encourages weedy growth near the trough while enhancing insect populations.

Krausman et al. (2006) points out that water catchments—guzzlers—although useful tools, have not always yielded the expected results. Our understanding of the effects of water developments on wildlife populations is largely dependent on anecdotal observations and a few studies that have shown correlations, not cause-and-effect. He noted that wildlife water developments are used by a wide array of species and do not appear to present a high risk of predation for animals that visit them. The availability of natural and man-made water sources affects habitat use, though other factors can be more important.

Anecdotal evidence points to quail concentration around all types of water sources. Schemnitz (1961) found movements relative to known water sources to be ¼ mile to 1 ½ miles.

Harvest

Hunting is unlikely to significantly reduce blue quail populations in the Trans-Pecos due to the rough country they inhabit (Rollins 2000). Nevertheless if there is concern that hunting activity might be additive (birds are killed that would have otherwise survived through the winter), rather than compensatory (birds are killed that would have died before the next breeding season from other mortality factors) some adjustment in hunting tactics might be in order. Consider lessening hunting pressure during the months of January and February—that portion of the year when natural mortality is often high due to unfavorable weather and food and cover being in short supply.

The ratio of juvenile quail to adults in the bag can serve as a gauge of nesting success and breeding capital for the coming year. Adults and juveniles are too variable to use weight as a determining factor in judging their age (Cain and Beasom 1983). In fall and winter juvenile quail older than 20 weeks can easily be distinguished from adults by wing feather replacement. Primary covert feathers with buff colored tips are found on juveniles. Adults are a uniform slate gray (Cain and Beasom 1983). A high percentage of juveniles in the bag (e.g 70% or more) indicates a successful breeding season. A low percentage (e.g. less than 30%) suggests poor reproductive success (Cantu et al 2006).

Monitoring

To objectively assess the progress of management efforts aimed at enhancing quail populations a strategy of monitoring their impact on habitat should be employed (Wright et al 2005). Habitat monitoring is a useful activity which can include some or all of the following (listed in descending order of importance): fixed photo points to monitor brush management

effectiveness over time; precipitation records; nest clump surveys; cover surveys; forb and grass diversity measurements; and grass stubble-height surveys. Managers can choose which are feasible for their use.

Without some form of monitoring progress can be very difficult to determine. The information accrued can provide for more educated decisions, hopefully avoiding unnecessary expenditures of capital and effort, and will point out which are effective and feasible candidates for continuation. Wright et al (2005) outlines procedures for monitoring quail habitat, as does Reyna et al (2006), whose work also includes means to assess potential nest predation.

Rollins et al (2005) shows how to survey quail populations. Direct counts such as roadside counts, helicopter surveys, covey flush rates, drive counts, line-transect, and mark-recapture are discussed with particular attention to the relative usefulness of each to various situations and needs. Indirect counts such as call counts, age ratios, and artificial nests are likewise presented.

SUMMARY

Dedicated land managers who desire to enhance and/or and sustain scaled quail populations in the Trans-Pecos should give particular attention to grazing management, and the amount of grass remaining at all times of the year, even during drought. Nesting success is critical for healthy quail populations and is largely dependent on adequate nesting cover. In the drought-prone region, management efforts aimed at maximizing the effectiveness of rainfall may also contribute significantly to scaled quail production. Observe plant communities and structure in your area known to produce high scaled quail densities, and strive to replicate them to the degree feasible across the landscape.

LITERATURE CITED

Bridges, A. S., M. J. Peterson, N. J. Silvy, F. E. Smeins, and X. B. Wu. 2001. Differential influence of weather on regional quail abundance in Texas. Journal of Wildlife Management 65(1):10-18.

Bristow, K. D. and R. A. Ockenfels. 2006. Fall and winter habitat use by scaled quail in southeastern Arizona. Rangeland Ecology and Management 59(3)308-313.

Buntyn, R. J. 2004. Reproductive ecology and studies of scaled quail in the Trans-Pecos region of Texas. M.S. Thesis. Angelo State University, San Angelo, Texas. 58 pp.

Cain, J. R. and S. L. Beasom. 1983. A guide for aging scaled quail. Texas Agricultural Experiment Station, Texas A&M University, College Station. B-1447. 8 pp.

Campbell, H. and L. Lee. 1953. Studies of quail malaria in New Mexico and notes on other aspects of quail populations. New Mexico Department of Game and Fish, Santa Fe. Project W-41-R. 79 pp.

Cantu, R., D. Rollins, and S. P. Lerich. 2006. Scaled quail in Texas. Texas Parks and Wildlife Department, Austin. PWD BK W7000-1183. 32 pp.

Carter, P. S. 1995. Post-burn ecology of northern bobwhites in west Texas. Thesis. Angelo State University, San Angelo, Texas.

Cearley, K. A. 1999. Does pricklypear protect quail nests? Pages 96-98 *in* K. A. Cearley, ed., Proc. Preserving Texas' Quail Heritage into the 21st Century Symposium, 13-15 October 1999, Abilene. Texas Cooperative Extension, San Angelo. 163 pp.

Evans, C. A. 1997. Reproductive biology of scaled quail (Callipepla squamata) in southern New Mexico. M.S. Thesis. New Mexico State University, Las Cruces. 74 pp.

Guthery, F. S., and S. L. Beasom. 1977. Responses of game and non-game wildlife to predator control in South Texas. Journal of Range Management 30:404-409.

Harveson, L. A. 2004. Ecology and management of west Texas quail. Pages 26-28 *in* F. Hernandez and D. Doan-Crider, eds., Proc. Texas Quail Short Course III. Texas A&M University, Kingsville.

Henson, K. D. 2006. Species visitation at free-choice quail feeders in west Texas. M.S. Thesis. Texas A&M University, College Station. 61 pp.

Krausman, P. R., S. S. Rosenstock, and J. W. Cain III. 2006. Developed waters for wildlife: science, perception, values, and controversy. Wildlife Society Bulletin 34(3):563-569.

Kuvlesky, W. P., T. E. Fulbright, and R. Engel-Wilson. 2002. The impact of invasive exotic grasses on quail in the southwestern United States. Pages 118-128 *in* S. J. DeMaso, W. P. Kuvlesky Jr., F. Hernandez, and M. E. Berger, eds., Quail V: Proceedings of the Fifth National Quail Symposium. Texas Parks and Wildlife Department, Austin.

Lehmann, V. W. 1984. Bobwhites in the Rio Grande Plain of Texas. Texas A&M University Press, College Station. 371 pp.

Pleasant, G. D. 2003. Nesting ecology, health, and survival of scaled quail in the Southern High Plains of Texas. M.S. Thesis. Texas Tech University, Lubbock. 80 pp.

Pleasant, G. D., C. B. Dabbert, and R. B. Mitchell. 2003. Evaluation of the moisture-facilitated nest depredation hypothesis in a semi-arid environment. Wilson Bulletin 115(3)343-346.

Pleasant, G. D., C. B. Dabbert, and R. B. Mitchell. 2006. Nesting ecology and survival of scaled quail in the Southern High Plains of Texas. Journal of Wildlife Management 70(3)632-640.

Reid, R. R., C. E. Grue, and N. J. Silvy. 1979. Competition between bobwhite and scaled quail for habitat in Texas. Proc. Annual Conference Southeastern Association Fish and Wildlife Agencies 33:146-153.

Reid, R. R., C. E. Grue, and N. J. Silvy. 1993. Habitat requirements of breeding scaled quail in Texas. Pages 137-142 *in* K. E. Church and T. V. Dailey, eds., Quail III: Proceedings of the Third National Quail Symposium. Kansas Department of Wildlife and Parks, Pratt.

Reyna, K, D. Rollins, B. Taylor, and D. Ransom Jr. 2006. The Texas quail index: a citizen science effort to monitor ranch-level quail dynamics. Pages 4-11 *in* D. Ransom Jr., J. Sanders, and S. B. Lyda, eds., Proc. Red River Quail Symposium, 11-13 October 2006, Wichita Falls, Texas. Texas Cooperative Extension, San Angelo, and Oklahoma State University, Stillwater. 126 pp.

Rollins, D. 1996. Ecology and management of blue quail in Texas. Pages 93-103 *in* W. E. Cohen, ed., Proc. Texas Quail Short Course II. Texas Agricultural Extension Service, Texas A&M University, College Station.

Rollins, D. 1997. Applied landscaping: A primer for brush sculptors. Pages 127-32 *in* D. Rollins, D. N. Ueckert, and C. G. Brown, eds., Proc. Brush Sculptors Symposium. Texas Agricultural Extension Service. San Angelo.

Rollins, D. 1999. Is there a place for predator control in quail management?: a point. Pages 45-48 *in* K. A. Cearley, ed., Proc. Preserving Texas' Quail Heritage into the 21st Century

Symposium, 13-15 October 1999, Abilene. Texas Cooperative Extension, San Angelo. 163 pp.

Rollins, D. 2000. Status, ecology, and management of scaled quail in west Texas. Pages 165-172 *in* L. A. Brennan, W. E. Palmer, L. W. Berger, Jr., and T. L. Pruden, eds. Quail IV: Proceedings of the Fourth National Quail Symposium. Tall Timbers Research Station, Tallahassee, FL.

Rollins, D., J. Brooks, N. Wilkins, and D. Ransom Jr. 2005. Counting quail. Texas Cooperative Extension, Texas A&M University, College Station. B-6173. 11 pp.

Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966-2006. Version 10.13.2007. USGS Patuxent Wildlife Research Center, Laurel, MD.

Schemnitz, S.D. 1961. Ecology of the scaled quail in the Oklahoma panhandle. Wildlife Monographs 8.

Schemnitz, S. D. 1994. Scaled quail (*Callipepla squamata*) *in* A. Poole and F. Gill, eds., The Birds of North America, no. 106. Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Schemnitz, D. S., J. L. Dye, and M. Cardenas. 1998. Fall and winter foods of scaled and gambel's quail in southwestern New Mexico. New Mexico State University, Las Cruces. Agricultural Experiment Station Bulletin 777. 15 pp.

Silvy, N. J., D. Rollins, and S. W. Whisenant. 2007. Scaled quail ecology and life history. Pages 65-88 *in* L. A. Brennan ed., Texas Quails. Texas A&M Press, College Station. 491 pp.

Slater, C. S., D. Rollins, R. C. Dowler, and C. B. Scott. 2001. *Opuntia*: a "prickly paradigm" for quail management in west-central Texas. Wildlife Society Bulletin 29(2)713-719.

Texas Parks and Wildlife Department. 2007. Quail forecast: Trans-Pecos. http://www.tpwd.state.tx.us/huntwild/hunt/planning/quail_forecast/forecast/trans_pecos/. Accessed 10 June 08.

Ueckert, D.N. and Petersen, J.L. 2002. Water conservation for restoration of wildlife habitats. Pages 101-114 *in* Harveson, L.A., Harveson, P.M. and Richardson, C. eds., Proc. Trans Pecos Wildlife Conference. Aug. 1-2, 2002. Sul Ross State University, Alpine, Texas.

Wallmo, O. C. 1956. Ecology of scaled quail in west Texas. Texas Game and Fish Commision, Austin, and A&M College of Texas, College Station. Project W-57-R. 58 pp.

Wright, B. D., J. C. Cathey, and R. K. Lyons. 2005. Habitat monitoring for quail on Texas Rangelands. Texas Cooperative Extension, Texas A&M University, College Station. B-6172. 17 pp.

ELK RESEARCH IN TEXAS: PAST, PRESENT, AND FUTURE

***ABEL GUEVARA**, Sul Ross State University, Box C-16, Alpine, Texas 79832;*
ague391@sulross.edu

***BRENDAN R. WITT,** Sul Ross State University, Box C-16, Alpine, Texas 79832;*
thinair56@hotmail.com

***LOUIS A. HARVESON**, Sul Ross State University, Box C-16, Alpine, Texas 79832;*
harveson@sulross.edu

Abstract: Since the release of Rocky Mountain elk (*Cervus elaphus nelsoni)* into the Guadalupe Mountains in 1928, research has been conducted on elk in the Trans-Pecos Region, Texas over the last 30 years. Research has ranged from estimating elk populations and habitat use in the Guadalupe Mountains, to the current research being conducted in the Glass Mountains.

HISTORY OF ELK IN TEXAS

Merriam's elk (*Cervus elaphus merriami)* once roamed the West Texas landscape primarily in the Guadalupe Mountains. In 1905 Vernon Bailey reported that there were none in Texas, however this is based on stories told to him by old ranchers (TGFOC 1945). Other reports of Merriam's elk show their range from the northwestern Chihuahua and northeastern Sonoran desert (Carrera 2003).

In 1928, Judge J. C. Hunter imported 44 Rocky Mountain elk (*Cervus elaphus nelsoni)* from the Black Hills of South Dakota and released them at McKittrick Canyon in the Guadalupe's. By 1938 the estimated population size of elk was 400 (Davis 1994). Today there are 5 small elk herds that exist not only in the Guadalupe Mountains, but in 4 other Texas mountain ranges: Glass Mountains, Wylie Mountains, Davis Mountains, and Eagle Mountains. Elk populations were estimated in 1995 to be approximately 300 free ranging elk. In 1997 elk were designated as an exotic by the 75th Texas legislature (Toweill 2002).

First Record of Elk in Texas

Although there are reports of Merriam's elk in Texas, to date there are no fossil records to substantiate the reports. However on April 17, 1993, a portion of tibia was found in a small tributary of Pony Creek. This location is 11 km north of Seymour, Baylor County, Texas. The tibia was identifiable as an adult *C. elaphus.* A fragment was radiocarbon dated to 295+/-50 Years Before Present. It is hypothesized that there were reports of elk in Oklahoma, especially in the Wichita Mountains, and it is quite possible this elk wandered south from this area (Pfau 1994).

In 1994 Brian S. Shaffer recovered a proximal phalange of an elk at a Caddo Indian archeological site in Delta County, Texas. The specimen was radiocarbon dated at 520 to 980

Years Before Present. This discovery supported Pfau's theory that elk in North Texas were occasional transients (Shaffer 1995).

Additionally elk remains were believed to be discovered in a cave in Cuatrocienegas, Mexico. Those remains were radiocarbon dated to be around 7300 BC. However, further examination of the elk remains showed that they were not elk remains but the remains of a Pleistocene bighorn sheep (*Ovis catclawensis)* (Carrera 2003).

Elk Research – Brewster County, Texas and Jeff Davis County, Texas

A preliminary population census was conducted in the Glass Mountains, Brewster County, Texas in 1982-1983. The methods used to conduct the census were King's strip census, Kelker's strip census, and a pellet group count. Results showed an estimated population size of 161-168 elk (Grace 1983). Grace additionally observed that the elk in the Glass Mountains preferred oak woodland and riparian habitats based on observations.

Another study was conducted in the Wylie Mountains, Jeff Davis County, Texas to determine the movements of elk transplanted in 1988. Ninety-nine elk were released in 1988 and 9 cows were radio-collared to monitor their movements. The cows were monitored via ground telemetry but on a few occasions they were tracked via fixed wing aircraft. Based on telemetry, it was estimated that the elk dispersed <10 km from their release site (Coykendall 1990). The mortality rate of the elk released was 13% of which automobile collisions (23%) and mountain lion kills (15%) accounted for most of the known deaths.

Guadalupe Mountains National Park

Guadalupe Mountains National Park (GUMO) has been the focal point of many studies. This diverse area in West Texas was considered to be the home of Merriam's elk (*Cervus elaphus merriami*) before they were extirpated by hunting prior to 1900. Rocky Mountain elk (*Cervus elaphus nelsoni)* were reintroduced in Mckittrick Canyon in 1929.

The first study to determine the status of the elk population at GUMO was conducted by Moody and Simpson (1979). They noted that there was a severe reduction in the elk population from 350 in the mid-1960's to 108 during a 1976-1978 census (Moody and Simpson 1979). A second study was conducted by McAlpine (1990) to see if the population has continued to decline. The results of her study indicated that there was a continuing decline in the elk populations from 162 animals in 1978 to 58 in 1983. This is an 18% annual decrease in the population. The factors, although probable, for this decrease included human intervention, predation, and climatic conditions (McAlpine 1990).

Additionally a study conducted by Carpenter (1993) confirmed that the population has continued to decrease; he believes that this is due to forage quality, water loss, and predation (Carpenter 1993).

Carpenter (1983) also observed the habitat of elk in the Guadalupe Mountains and based on the observations of 2 non-interacting elk herds, it was determined that both herds preferred mountain shrub habitat and avoided pinion-juniper (*Pinus edulis*, *Juniperus* spp) habitat. Water

availability is very limited in the Guadalupe Mountains and this limited the range size of both elk herds.

The diet of elk at GUMO was analyzed via fecal and observational analysis by Krysl (1979). Based on seasonal analysis, the spring diet consisted of 50% browse, 12% forbs, and 37% grasses. The summer diet consisted of 49% browse, 39% grasses, and 12% forbs. Fall diets consisted of 47% browse, 25% grasses, and 28% forbs. And winter diets consisted of 48% browse, 29% forbs, and 24% grasses. The primary food source during all seasons was oak (*Quercus* spp) (Krysl 1979). Visual observations confirmed the fecal analysis that browse species such as oak and mountain mahogany (*Cercocarpus montanus*) were predominately utilized by elk during the study period. It is interesting to note that based on fecal and visual analysis, *Agave* spp. flower stalks were utilized by elk, when readily available, during the spring and summer seasons.

Mule deer (*Odocoileus hemionus)* diets were also analyzed by Krysl (1979) to determine the impacts of both species on the vegetation of the Guadalupe Mountains. During the summer season, mule deer diets consisted of 85% browse, 14% forbs, and 1% grasses. Fall diets consisted of 79% browse, 19% forbs, and 2% grasses. Winter diets consisted of 70% browse, 28% forbs, and 2% grasses. And spring diets consisted of 74% browse, 23% forbs and 3% grasses. The dominant browse was oak (*Quercus spp.)* (Krysl 1979).

Krysl (1979) concluded that since oak is the preferred browse for elk and mule deer, the continued utilization of this good browse species would lead to the abundance and distribution of poor browse species.

Krysl (1979) research is further validated by Carpenter (1993). As mentioned previously, Carpenter (1993) observed that elk preferred mountain shrub habitat with consisted mainly of oak and mountain mahogany, the preferred browse species. Furthermore Carpenter's (1993) analysis of habitat preference of elk in mountain shrub, showed browse lines of oak and mountain mahogany.

CURRENT ELK RESEARCH – GLASS MOUNTAINS, TEXAS

Research is presently being conducted in the Glass Mountains to 1) Determine the status and distribution of elk populations in the Glass Mountains of West Texas, 2) Assess landowner attitudes towards elk and elk management in West Texas, 3) Determine habitat selection and movement patterns (home ranges, travel corridors) of the radio-collared elk population in the Glass Mountains, 4) Estimate demographic characteristics (survival rates, natality rates, density, herd composition) of elk in the Glass Mountains.

LITERATURE CITED

Carpenter, J. A. 1993. Movements, habitat use, and population dynamics of elk in Guadalupe Mountains National Park, Texas. Dissertation, Texas A&M University, College Station, Texas, USA.

Carrera, R., and W. B. Ballard. 2003. Elk distribution in Mexico: A critical review. Wildlife Society Bulletin 31:1272-1276.

Coykendall, A. 1990. 1988 elk transplants in the Davis Mountains, Jeff Davis, County, and the Wylie Mountains, Culberson County, Texas. Thesis, Sul Ross State University, Alpine, Texas, USA.

Davis, W. B., and D. J. Schmidly. 1994. The mammals of Texas. Texas Parks and Wildlife, Austin, Texas, USA.

Grace, K. T. 1983. A preliminary ecological study of elk in the Glass Mountains, Brewster County, Texas. Thesis. Sul Ross State University, Alpine, Texas, USA.

Krysl, L. J. 1979. Food habitats of mule deer and elk, and their impact on vegetation in Guadalupe Mountains National Park. Thesis, Texas Tech University, Lubbock, Texas, USA.

McAlpine, S. 1990. Continued decline of elk populations within Guadalupe Mountains National Park, Texas. Southwest Naturalist 35:362-363.

Moody, J. D., and C. D. Simpson. 1979. Population status, habitat and movement of elk in Guadalupe Mountains National Park, Texas. Pages 151-158 in Proceedings of the 31st Annual Conference of the Southeast Association of Fish and Wildlife Agencies. Southeastern Association of Fish and Wildlife Agencies, 9 October – 12 October 1977, San Antonio, Texas, USA.

Pfau, R. S. 1994. First record of Native American Elk (*Cervus Elaphus)* from Texas. The Texas Journal of Science 48:189-190.

Shaffer, B. S., B. C. Yates, and B. W. Baker. 1995. An additional record of the native American elk (*Cervus elaphus)* from North Texas. Texas Journal of Science 47:159-160.

Texas Game, Fish and Oyster Commission. 1945. Principal game birds and mammals of Texas: Their distribution and management. Von Boeckmann-Jones Co. Press, Austin, Texas, USA.

Toweill, D. E., and J. W. Thomas, editors. 2002. North American Elk: Ecology and Management. Smithsonian Institution Press, Washington, D.C., USA.

USDA-WILDLIFE SERVICES PROGRAM IN WEST TEXAS

***SAIDOR (HOPPY) TURMAN**, District Supervisor, USDA – Wildlife Services, West Texas District*

Abstract: The USDA Texas Wildlife Services is a state agency created to help alleviate damage or other problems caused by or related to the presence of wildlife. Conflicts between wildlife and human interests require wildlife damage management expertise. The mission of Wildlife Services is to provide statewide leadership in the science, education and practice of wildlife damage management to protect the state's agricultural, industrial, health, safety and property.

The USDA Texas Wildlife Services is a state agency created to help alleviate damage or other problems caused by or related to the presence of wildlife. Wildlife is important to the economy and to the aesthetics and health of our environment. Yet, some types of wildlife do sometimes cause problems, which include damage to agricultural crops and to property, human safety hazards, and predation of livestock, cause millions of dollars in losses each year. Sometimes the presence of wildlife is simply a nuisance. Since wildlife is a publicly owned resource, government has a responsibility to respond to the problems it cause, while at the same rime protecting this resource.

Conflicts between wildlife and human interests require wildlife damage management expertise. Just as wildlife species vary greatly in their needs and behavior, so, too, do human populations.

Wildlife damage management is an integral component of professional wildlife management. The mission of Wildlife Services is to provide statewide leadership in the science, education and practice of wildlife damage management to protect the state's agricultural, industrial, health, safety and property.

CONSERVATION ASSISTANCE AND PROGRAMS AVAILABLE THROUGH USDA-NRCS

***WAYNE W. SEIPP**, District Conservationist, USDA Natural Resources Conservation Service, Alpine, Texas*

Abstract: The United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS) is a non-regulatory agency assigned to provide technical assistance to private landowners and operators and to implement the conservation programs in the current Farm Bill. A goal of NRCS is to accomplish conservation through partnerships. The role of NRCS is to lead individuals and/or groups through the conservation planning process to ensure that the objectives of the landowner/manager and natural resources are addressed. The NRCS has many programs that can be accessed by private landowners, as well as the general public (qualifications for some of the programs may be limited to agricultural producers).

INTRODUCTION

The United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS) is a non-regulatory agency assigned to provide technical assistance to private landowners and operators and to implement the conservation programs in the current Farm Bill. The USDA- NRCS, works through your local Soil and Water Conservation District (SWCD) which is a recognized local unit of state government. Its Board of Directors is comprised of local landowners whom have been elected to represent the conservation interests of the local landowners that reside in the District.

A goal of NRCS is to accomplish conservation through partnerships. These unique partnerships between federal, state, local units of governments and others allow NRCS to effectively assist landowners, operators and organizations to carry out voluntary conservation efforts on private lands.

As a result of the locally led conservation initiative of the SWCD, the NRCS, through a cooperative working agreement, provides trained personnel to provide direct voluntary technical assistance to the cooperators of the district. NRCS also provides program delivery of the conservation programs outlined in the current Farm Bill.

What can NRCS do for you?

The role of NRCS is to lead individuals and/or groups through the conservation planning process to ensure that the objectives of the landowner/manager and natural resources are addressed. NRCS personnel have the ability to plan, design and oversee the application of conservation practices to ensure that they are installed to serve the intended purpose. It is this ability that will assure the landowner/manager of the integrity and quality of the conservation practice being installed on their property.

NRCS can provide assistance on range and wildlife land such as: development of a grazing management plans, wildlife management plans, and improvements in water development, brush management plans, range seeding, or other applicable practices. NRCS also provides technical assistance on cropland, pastureland and irrigated land.

Every NRCS field office in Texas maintains a local Field Office Technical Guide that contains information on conservation practice standards and specifications, guidelines and management information that is tailored to the local resource needs. NRCS personnel work closely with other natural resource agencies (both state and federal) and universities to ensure that the latest or most current technology and information are included in the field office technical guide and made available to local landowners and operators.

PROGRAMS

The NRCS has many programs that can be accessed by private landowners, as well as the general public (qualifications for some of the programs may be limited to agricultural producers). Some of these programs will be discussed in more detail.

Conservation Technical Assistance

Technical assistance is the most popular and far reaching program that NRCS has to offer. Conservation Technical Assistance (CTA) may range from having a simple conservation question answered to the development of a complete conservation plan.

Conservation planning is a priority for NRCS. A conservation plan can be progressive, where only one or two practices are planned, or it can be comprehensive and include all practices needed to enhance the natural resources of the entire operating unit.

When NRCS works with a landowner and/or manager through the entire planning process, better conservation decisions can be made to address resource concerns.

<u>The Conservation Planning Process is as follows:</u>

Step 1 – Indentify Problems
Step 2 – Determine Objectives
Step 3 – Inventory Resources
Step 4 – Analyze Resource Data
Step 5 – Formulate Alternatives
Step 6 – Evaluate Alternatives
Step 7 – Make Decisions
Step 8 – Implement Plan
Step 9 – Evaluate Plan

A good basic conservation plan that includes all needed conservation practices is very beneficial if the landowner is interested and eligible to participate in an available conservation cost-share program.

Cost-Share Programs

The federal government recognizes that conservation practices are expensive to implement, and thus, has written cost-share programs into law during the most recent *Farm Bill* to help offset some of the expenses associated with protecting the nation's natural resource bas on private land.

* The Food, Conservation and Energy of 2008 was passed in May of 2008 and at this time specific rules particular to each program are being determined.*

The NRCS, with input from the local SWCDs works with other agencies, such as, the Farm Service Agency (FSA) to implement the programs at the local level.

If a person is interested in making an application to participate in a cost share program there are some steps that can make this process more effective.

- Contact the local FSA office to determine if all land and person records are complete and current.
- Investigate if there are any land and/or person eligibility requirements to participate in a particular cost-share program.
- Work with the local NRCS office to have a basic conservation plan on file with the SWCD that outlines the conservation objectives for the operating unit to determine which program will best address the resource needs.

Some of the most commonly used cost share programs that are applicable to landowners and operators in the Trans-Pecos are:

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a cost share program that is available to agricultural commodity producers that are interested in applying conservation practices on their land. The EQIP program is a voluntary program that provides a monetary incentive to apply conservation practices.

The EQIP program is tailored locally through Program Development Group and Local Work Group meetings at the county level. Interested producers, groups, organizations and agencies convene to make recommendations for natural resource conservation at the county level. The Local Work Group then considers these recommendations, sets priorities and develops ranking criteria to address the conservation practices that will be implemented through EQIP that year. NRCS develops payment schedules, takes applications, completes conservation planning, approves applications and awards contracts relative to priorities set at the county level.

In addition to county level funding, NRCS also accepts EQIP applications for Statewide Resource Concern Areas (SWRCA). The state technical committee which is made up of producer groups and others across the state convenes annually to determine which of these areas will be funded. In 2007, the Pronghorn Antelope SWRCA was approved and funded to enable

agricultural commodity producers to apply for federal cost-share funds to make rangeland improvements in identified pronghorn antelope habitat.

For more information on EQIP (both county level and state wide priority areas) contact your local NRCS office or go to our website at www.tx.nrcs.usda.gov/programs

Wildlife Habitat Incentives Program

The Wildlife Upland Habitat Incentives Program (WHIP) is a program that helps defray the cost of certain conservation practices that benefit wildlife habitat. Priority in this program is given to conservation practices that specifically deal with habitat improvement. In the Trans-Pecos, these practices include, brush management, range planting with natives species and improved grazing management.

Applications are ranked based on habitat restoration, likelihood of success, degree of restoration, benefits to threatened and endangered species, cost per acre, benefits to society and the percentage of the operating unit that is enrolled in the program. Generally WHIP applications are ranked and compete on a statewide basis.

For more information on WHIP contact your local NRCS office or go to our website at www.tx.nrcs.usda.gov/programs.

Conservation Reserve Program

The Continuous Conservation Reserve Program (CCRP) is a program that is administered by the Farm Service Agency (FSA) with technical assistance provided by NRCS to enroll marginal pastureland into the Riparian Buffer (CP-22) program. In Far West Texas, land classified as marginal pastureland is very similar to rangeland and areas of marginal pastureland that contain third order or larger streams or waterways may be eligible to participate in this program.

If the riparian area served by an adequate drainage is found not to be properly functioning under its current management, then it may be eligible to be enrolled in the program to enhance the functionality of the riparian area.

The Riparian Buffer component of the CRP program is similar to regular CRP on cropland, in that, a rental payment is paid annually on land meets the criteria of the program. Basically from 35 feet up to 180 feet of average width on either side of the watercourse is eligible for this program. There have been some additional payments in this program like a signing incentive payment, a practice incentive payment and an annual maintenance payment. Contact you local FSA office to find out what current rental, incentive and maintenance payments are in your area.

In order to make improvements in how the riparian area functions, no grazing by livestock will be allowed under this program. There is some cost-share practices under this program, such as, cross fence, water development and selective tree removal that may be included in these contracts to facilitate management of the riparian area. These contracts are for either a 10-or 15-year period and the signup has been on a continuous basis.

For more information on CRP (Riparian Buffer CP-22), contact your local FSA or NRCS office or go to FSA's website at www.tx.fsa.usda.gov/program or our website at www.tx.nrcs.usda.gov/programs.

THE TEXAS DEER LEASE

***JUDON FAMBROUGH**, Texas Real Estate Center at Texas A&M University*

Abstract: I will discuss landowner liability in general with emphasis on Chapter 75 of the Texas Civil Practices and Remedies Act, better known as the Recreational Guest Statute. I will explain how this statute changes the common law in favor of landowners. Finally, I will discuss the recent Texas Supreme Court Decision involving the Shumake Family and the drowning of their daughter. I will conclude by showing how landowners need additional protection with their waiver agreements to counter this Decision.

Mr. Fambrough has provided "Texas Deer Lease" for inclusion in the Proceedings it can be found in the Appendix on page 90.

Mule Deer Issues and Management in the Trans-Pecos

DESERT MULE DEER ECOLOGY AND HYBRIDIZATION WITH WHITETAILS

***JIM HEFFELFINGER**, Regional Game Specialist, Arizona Game and Fish Department, 555 N. Greasewood Road, Tucson, Arizona 85745; jheffelfinger@azgfd.gov*

Abstract: Mule deer (including the blacktails) are distributed throughout North America from the coastal islands of Alaska to the Mexican state of Zacatecas. With this wide latitudinal range, comes a great diversity of different climatic regimes and vegetation associations. Desert mule deer weigh less than their northern counterparts, with yearlings averaging only about 86 pounds, 2.5-year-olds about 119 pounds, 3.5 - 5.5-year-olds average 136 pounds, and those older than 6 years average about 165 pounds. Mule deer are primarily browsers, with a majority of their diet comprised of weeds and leaves/twigs of brush.

Different species of animals, even closely related ones, are normally kept from breeding by being geographically isolated from one another, or by separating themselves into different types of habitat. If the animals coexist in the same habitat then they generally have different courtship and breeding behavior to prevent interbreeding. In most areas where both whitetails and mule deer are found, they occupy different habitat. Habitat changes and land use practices have altered this relationship in some cases. Being able to accurately identify both species is especially important in areas where the ranges of whitetails and mule deer overlap. In some cases, the many barriers to interspecies mating fail and whitetails successfully mate with mule deer. For the most part, the resulting offspring show characteristics which are intermediate between the two species. The relative scarcity of confirmed hybrids among the hundreds of thousands of deer that have been seen throughout the area of range overlap illustrates how rare they are. Recent advances in DNA analysis technology has allowed us to look at more definitive things than ears and antlers.

Although the adaptable white-tailed deer have made steady gains in much of the country, mule deer populations ebb and flow from one decade to the next. Although some mule deer populations are improving now, the last decade has not been one of great mule deer abundance throughout their range. As the distribution of these species changes, it alters the dynamic relationship between them.

DESERT MULE DEER ECOLOGY

Distribution

Mule deer (including the blacktails) are distributed throughout North America from the coastal islands of Alaska to the Mexican state of Zacatecas. With this wide latitudinal range, comes a great diversity of different climatic regimes and vegetation associations. Mule deer are very adaptable in their ability to make a living in coastal rain forests (200 inches of rain per year), icy mountains, prairie grasslands, and hot southwest deserts (4 inches of rain per year). With this range

of habitats, comes an incredibly diverse diet that defies generalization.

Many species vary from one portion of its range to another. These variations come about as individuals in localized areas adapt to habitat, forage, or climatic conditions they are exposed to. Depending on the source, there have been between 7 and 11 subspecies of mule deer described in North America. Many of these were deemed "different" based on only a few individuals and the overlap in characteristics among most subspecies is so great that no list of differences can be written that will allow biologists or hunters to differentiate them. Without geographic separation between subspecies, maps of their boundaries are merely crude attempts to describe regional differences throughout the range mule deer.

Physical Characteristics

Desert mule deer weigh less than their northern counterparts, with yearlings averaging only about 86 pounds, 2.5-year-olds about 119 pounds, 3.5 - 5.5-year-olds average 136 pounds, and those older than 6 years average about 165 pounds. Antler growth begins within a few weeks of losing their last set of antlers and is underway by May. The scab which forms over the wound left by the shed antler heals and becomes covered with fine hairs. This finely haired skin forms the beginnings of the velvet which will nourish and protect the growing antlers. In September, the antlers become fully mineralized, and the continually increasing testosterone levels cause the drying and shedding of velvet in the latter part of the month. The antlers become fully hardened by late September and the velvet is shed from late September through mid October. When the tissue has dried somewhat, the buck rubs off the velvet on a sapling or bush. The stripping of velvet occurs rapidly once started, usually 24-48 hours. When freshly stripped, the antlers are very white. The brown pigment in tree bark called 'tannin,' along with some residual blood, stain the antlers with the familiar brown color seen in the fall. Desert mule deer shed their antler slightly later in late-March or early April. There are, of course, always some bucks which cast very early or very late because of nutritional conditions

Diet

Mule deer are primarily browsers, with a majority of their diet comprised of weeds and leaves/twigs of brush. Like cows and other animals with a 4-chambered stomach, deer process food by chewing cud (ruminating). This reprocessing of food, along with beneficial bacteria in the stomach, allows deer to digest fibrous leaves and twigs

The annual diet of desert mule deer in southwestern Arizona is comprised of over 75% browse (brush species) and 22% forbs (broad-leafed weeds). Browse (jojoba, ironwood) made up a majority of the diet in all seasons, but forbs (buckwheat, globemallow, lupine, filaree, desert vine) accounted for over a third of the winter-spring diet because of their availability after the winter rains. Grasses and cacti made up less that 5%.

Forbs like buckwheat, vetch, and spurge become important in winters when rains are adequate or above average. As early summer approaches, deer diets shift to shrub fruits (such as beans, nuts), cactus and cactus fruit, and the leaves of some browse, such as fairy duster. Shrub fruits provide a good source of phosphorus and browse leaves continue to be attractive and

nutritious because they can take advantage of deeper soil moisture that the shallow-rooted forbs.

Summer rains in July offer an increase in forbs from the abundant seeds which lie dormant in the soil. During this time the consumption of browse (range ratany, kidneywood, fairy duster) is supplemented with forbs such as ayenia, metastelma, buckwheat, spurge, deer weed, and penstemon as they remain available. As the summer's green forb growth begins to cure in the coming fall, deer switch more heavily to protein-rich browse (jojoba, fairy duster, catclaw acacia, mountain mahogany) and the fruits of prickly pear and barrel cactus. When fairy duster loses its leaves in early winter and the yellow fruits of the barrel cactus become scarce, deer become more reliant on cane cholla fruit, browse, and forbs produced by the winter rains (ayenia, metastelma, filaree, spurge, buckwheat).

Home range

In the Chaparral habitat, home ranges are smallest during the early summer dry period (May-June) that corresponds the period when resources are limited in quantity and/or distribution. Bucks (3.7 mi^2) used an area that was also nearly twice the size of the does' (2 mi^2) in this vegetation type.

In the desert grassland, home ranges average about 15 mi^2 for mule deer bucks and 5 mi^2 for does. Deer home ranges are usually larger at lower elevations where precipitation was less.

Deer in the arid southwestern deserts must maintain very large home ranges in order to obtain all the necessities for survival. One researcher documented average annual home ranges of up to 218 mi^2 in the King Valley in southwestern Arizona. Other studies in this region have estimated home ranges at 27-62 mi^2 for bucks and 5-52 mi^2 for does. Intensively monitored pregnant does in the Belmont and Big Horn mountains in Arizona were found to reduce their home range to 1.5-2.7 mi^2 for the 2 weeks before and after having their fawn.

Reproduction

The rut is somewhat later in the southern portions of desert mule deer range. Necks begin to swell in late November or early December, with some rutting in early December and continuing on through early February. The peak of rut throughout the southern portions in desert grasslands and central chaparral country is the last week in December and the first week in January.

The breeding season (rut) occurs in the late fall (November-December) with single or twin fawns born in the summer (June-August). Males grow antlers covered with a skin called 'velvet' throughout the summer. In the early fall (August-September) the velvet dries and is rubbed off to reveal the bony, sharp antlers in time for the rut. The antlers are shed in spring and regrown annually, with antler size increasing each year until peaking when the buck reaches 6-8 years of age.

Most fawns are born from mid-July through mid-August. Research in the deserts of southwestern Arizona, however, has revealed an even later fawning peak in August and

September. In the desert areas, mule deer does reduce their home ranges and move to mountainous areas to have their fawns. Some researchers found that does selected the upper one-third of steep (>30%) slopes to hide their fawns and always associated with vegetation to hide the fawn and keep it cool. The fawn's spotted coat will help camouflage it for about 2.5 months.

Population Dynamics

A good nutritional plane is heavily dependant on rainfall and where the deer population is in relation to the carrying capacity of the habitat. If nutrition prior to rut and throughout pregnancy is vital to healthy fawns and good fawn survival, then it should not be surprising that winter rains are closely correlated with mule deer fawn recruitment. Researchers analyzed 9 years of fawn:doe ratios, winter rainfall totals, and deer forage abundance from the Three-Bar Wildlife Management Area in Arizona. As expected, there was an extremely high correlation between the amount of October-April rainfall and forage (forbs and browse species) available to deer in mid-pregnancy (April). Rainfall after February, however, added little to the forage production since many of the forbs were mature by that time.

Further analysis showed that January fawn:doe ratios for mule deer are also highly correlated with the amount of forbs produced the previous spring. There was no significant relationship with forbs produced by the summer rains, however, in the case of a dry winter, an unusually wet summer may result in average mule deer fawn recruitment. This indicates that winter rainfall is much more important, but a combination of good winter and summer precipitation will result in even higher fawn production. Summer rainfall appears more important in the southeastern parts of desert mule deer range.

The browse plants that deer rely on the most for nutrition appear to have inadequate levels of protein and phosphorus except during the active winter growing season. After the annual growth stops in early spring (after April), protein and phosphorus drop below the level recommended for satisfactory growth for the remainder of the pregnancy. Deer supplement their diet with forbs, which are extremely important because they are highly digestible and supply a disproportionate amount of nutrients like protein and phosphorus. Precipitation is the main factor affecting deer nutrition in most southwestern areas, however, range conditions play a large role in determining how much of that nutrition is available to each deer. High levels of ungulates (cattle, elk, deer, burros, sheep, exotics, etc.) reduce the amount of forage available to each deer in the population and can negatively affect reproduction. Over-populations of deer occur periodically. These over-abundant deer populations were reduced to more appropriate levels through very high levels of outright mortality and reduced reproduction as a result of plummeting forage resources.

Livestock grazing can affect deer nutrition in some habitats. Light to moderate grazing in moist environments may not be detrimental to mule deer populations, but overgrazing in dry desert environments removes a majority of the herbaceous cover that is so crucial for fawning cover and doe nutrition. Overgrazing by cattle also removes some of the annual growth of browse twigs, further exacerbating the lack of forbs. In some areas, cattle eat key deer browse plants intensively. Some grazing allotments in the Sonoran desert are based on browse because grass is so scarce in this region. Some "browse allotments" allow the utilization of 50% of the

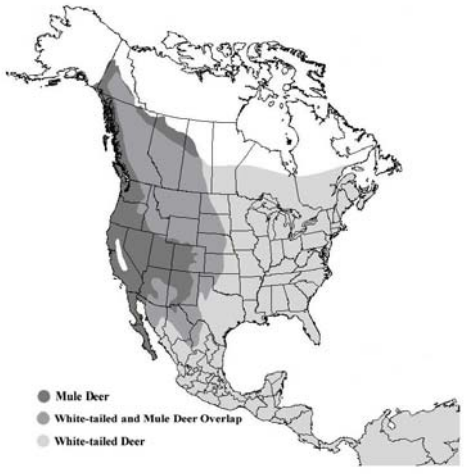
browse by cattle over large areas. Studies show cattle in these areas are browsing the very shrubs that desert mule deer rely on to sustain them through the dry periods. It is no surprise desert mule deer populations have plummeted in these areas. Deer generally avoid areas occupied by large numbers of cattle and are more abundant in ungrazed areas. Arizona Game and Fish researchers reported that grazing negatively impacted fawn survival, but only during drought years.

The introduction of some exotic plants such as Lehmann love grass (*Eragrostis lehmanniana*), red brome (*Bromus rubens*), and buffel grass (*Cenchrus ciliaris*) has not been beneficial to desert mule deer. The spread of Lehmann lovegrass and red brome throughout large areas of our desert grassland and Sonoran desert areas eliminates the natural diversity of native grasses and forbs. This dense and foreign ground cover provides very little benefit to native wildlife and out competes the natural herbaceous forages that once provided the nutritional base for deer. Although the knee-deep grass may look great, it has reduced the overall amount of nutrition that is available to the deer herd. Deer feeding in these areas are selecting mostly forbs growing among the grass rather than the grass itself. In addition, the consistent presence of abundant grass cover in the Sonoran desert increases the frequency of fire, which was not a natural component of the Sonoran desert ecosystem. Subtle changes in deer habitat, such as the encroachment of exotic plants, do not cause acute declines in deer abundance but incrementally reduce the quality of the habitat.

HYBRIDIZATION WITH WHITETAILS

Tale of two deer

Different species of animals, even closely related ones, are normally kept from breeding by being geographically isolated from one another, or by separating themselves into different types of habitat. If the animals coexist in the same habitat then they generally have different courtship and breeding behavior to prevent interbreeding. In most areas where both whitetails and mule deer are found, they occupy different habitat. Habitat changes and land use practices have altered this relationship in some cases. The zone where the two species coexist is extensive in some areas of North America, resulting in the animals being in close proximity to one another during the breeding season.



Being able to accurately identify both species is especially important in areas where the ranges of

whitetails and mule deer overlap. This is important for hunters because hunt permits are generally prescribed separately for each deer species. Mule deer differ from whitetails in several characteristics; however, there is enough variation of these characteristics in each species to periodically present some interesting specimens that can not be quickly identified. Some of the identifying characteristics, when used singly can be confusing or yield an incorrect identification. It is important to use all the information available when differentiating these deer species.

Tails

Whitetails have a wide, flattened tail that is broad at the base and narrower at the tip. The pure white underside is contrasted by a darker brownish back side. White-tailed deer tails are longer than mule deer tails and they lack a large, white rump patch surrounding the tail. Mule deer have rope-like tails that are usually (but not always) white on the back side with a distinctive black tip surrounded by a large, obvious white rump.

Antlers

Antlers are the least informative characteristic to use when trying to differentiate between these two deer species. This is because of the incredible variation in antler shape and conformation in both species. There are, however, differences that can be used in combination with other characteristics.

Mule deer antlers have small brow tines, if they have them at all. The main beams sweep out and upward, forking once and then each fork divides again in mature bucks. Mature bucks typically have 4 points on each side if you ignore the browtines. Typical whitetail antlers have several antler tines that arise independently off a main beam that sweeps outward and forward from the bases. The brow tines are nearly always present and usually prominent.

Ears

Whitetail ears are relatively shorter than those of mule deer, which measure a whopping nine and one half inches. The ears of a whitetail are generally two-thirds the overall length of the head (back of head to nose) while those of a mule deer are three-quarters the length of the head.

Metatarsal Glands

The only physical that can be used to accurately diagnose a hybrid is the metatarsal gland, which is located on the outside of the lower portion of the rear legs. The metatarsals on mule deer sit high on the lower leg and are 4 to 6 inches long and surrounded by light brown fur. The whitetail's metatarsals are at or below the mid-point of the lower leg, usually less than 1 inch, and surrounded by white hairs. A whitetail-mule deer hybrid has metatarsal glands that split the difference, usually measuring between 2-4 inches and encircled with white hair.

The Imperfect Union

In some cases, the many barriers to interspecies mating fail and whitetails successfully mate with mule deer. For the most part, the resulting offspring show characteristics which are intermediate between the two species. Facial features may be intermediate, but the tail is usually dark chocolate brown or black on top and white underneath. The tail of a hybrid looks very much like a typical whitetail, but is usually longer and darker on the back side. Ears are

normally larger than a whitetail and smaller than a mule deer. Antlers are typically more whitetail-like with antler tines arising from the mainbeam. Many hybrid antlers have "wavy" tines as if the antlers were receiving mixed signals about which way to grow!

Hybrids have been reported from captive facilities as early as 1898 when a whitetail-mule deer cross was produced at the Cincinnati Zoo. Occurrences were later reported from the Zoo in Minot, ND, deer pens in Alberta, and others. Researchers in Tennessee also successfully produced whitetail-blacktail hybrids in a captive situation. The male hybrids are usually sterile, as is the case in mammals; however, female hybrids are fertile and can be bred back to one of the parent species.

In the 1930s, biologists in Arizona produced hybrids by mating mule deer males to whitetail females and also whitetail males to mule deer females. These matings resulted in 9 hybrid fawns, of which only 4 survived the first few months. The research ended abruptly and the deer had to be released before any meaningful data could be collected. In the 1970s, Gerald Day also produced hybrids in captivity in Arizona. Ten hybrids were born but only 4 lived past 6 months of age. Survival is very low in hybrid fawns even when pampered in a captive facility.

Survival in the wild is even more difficult when food doesn't come from a feed trough and there's no fence between them and animals with sharp teeth. To complicate matters, hybrids inherit predator avoidance strategies from both types of parents; the problem is, whitetail and mule deer have drastically different techniques for escaping predators.

The whitetail's key to escaping is *speed*. They try to put as much distance between themselves and the predator as possible, as fast as possible. Mule deer, on the other hand, have developed a pogostick-like bounding called "stotting."

Research by Susan Lingle using captive animals in Alberta, has shown that stotting is so specialized that hybrids couldn't do it. She found the hybrid's escape behavior chaotic; hybrids would approach the threat and then jump around in confusion. Such behavior is not conducive to passing their genes on to another generation.

Whitetail-mule deer hybrids have also been reported in the wild from Alberta, British Columbia, Nebraska, Kansas, Colorado, Washington, Texas, and Arizona. Despite these widespread occurrences, true hybrids are actually very *uncommon*.

The relative scarcity of confirmed hybrids among the hundreds of thousands of deer that have been seen throughout the area of range overlap illustrates how rare they are. Every year numerous reports are received of "hybrid" deer from hunters but almost none are hybrids. Some of these hybrid reports come from hunters who have a whitetail tag on the leg of a mule deer and are trying to convince the Game Warden that they are at least half right!

Unraveling the DNA

Recent advances in DNA analysis technology has allowed us to look at more definitive things than ears and antlers. Although we know a lot about the physical features of hybrids,

there are cases where the whole animal or the diagnostic parts are not saved. Also, a first generation (50:50) female hybrid may breed with a mule deer buck and the offspring will be ¾ mule deer. This offspring may breed with a mule deer, resulting in deer that are 7/8 mule deer and these are probably not distinguishable from a pure mule deer. This scenario could also occur with back-crosses to whitetails.

In cases like this we have to stop using our low-tech ruler to measure relatively big things and turn to high-tech scientific methods to measure very tiny things like DNA molecules. The DNA molecule holds a tremendous amount of information and just in the last few decades have computers, software, and genetic analysis techniques allowed scientists to begin to unravel the data that is twisted up in that double helix molecule. Researchers have been able to identify some genetic markers that differ between the 2 species and use these genetic differences to look for evidence of hybridization in the field.

In West Texas, managers have reported an increasing trend in the number of hybrids they see on their ranches. In the early 1980s, whitetails and mule deer in a 5-county area were tested and researchers found that on the average 5.6% of the deer they tested had evidence of hybridization.

At the same time, other researchers were busy analyzing the genetic make-up of whitetails and mule deer on a ranch in west Texas with a different method. They found that hybridization had occurred in both directions – that is, mule deer bucks mating whitetail does and whitetail bucks mating mule deer does. The most common "direction" of hybridization seems to be between a whitetail buck and mule deer doe. This is because whitetails are much more aggressive in their breeding behavior and a mule deer doe that doesn't want to play the "run relentlessly" game is going to be bred in short order. The fact that most hybrids are found in mule deer groups supports this. Bill Wishart, who has done a lot of work with hybrids in Alberta, suggests the larger and more defensive mule deer doe groups may do a better job than whitetails in protecting the less-thrifty hybrid fawns from predators.

Another researcher in Montana used both of these methods (Albumin and mtDNA) to determine the extent of hybridization and found very little, if any, had occurred in that state.

The original genetic tests relied mostly on fresh tissue, but that is not always available. We actually don't have a solid genetic test to diagnose a suspicious animal as a hybrid using dried skin, bone or antler. I am currently involved in research cooperatively with several people including the Boone & Crockett Club, Roy Lopez, and Dr. Irv Kornfield at the University of Maine. We are using a group of molecular markers developed by Dr. Kornfield to analyze pure mule deer, pure whitetails, and some known hybrids of various fractions to develop a test that can be used for any deer suspected to be a hybrid.

Even studies mentioned above that documented the presence of past hybridization rarely found a first generation hybrid (50:50). There are conditions, however, where these barriers break down and a hybrid concentration develops. There are many conditions that may cause an increased incidence of hybridization. The relationship between our two species of North American deer is a complex one.

The Ebb and Flow of Deer

Although the adaptable white-tailed deer have made steady gains in much of the country, mule deer populations ebb and flow from one decade to the next. Although some mule deer populations are improving now, the last decade has not been one of great mule deer abundance throughout their range. As the distribution of these species changes, it alters the dynamic relationship between them.

The reasons for these changes in distribution are not always known and sometimes happen so slowly they are hardly noticed. Whitetails in the Rocky Mountain states are expanding to the point that agencies are changing regulations to take advantage of the more abundant game species in their midst. With this expansion in many places hybridization seems to be either on the rise or at least noticed more.

In southern Arizona there were complaints 20 years ago that mule deer were taking over whitetail habitat. Today the declining desert mule deer herds are vacating lower-elevation deer habitat and the Coues whitetail is using the non-traditional valley and desert grassland habitat formerly considered mule deer country. Along with this recent shift has come an unusual occurrence of hybrids reported and verified. It is very hard to pinpoint the cause of changes to deer distribution in most cases, it is a complex and dynamic situation and varies on a case by case basis that defies generalities.

Whitetails have been expanding in West Texas and the Panhandle for some time. This has raised concerns for the future of the desert mule deer there. As we saw above there are certainly areas of hybrid clusters in West Texas. The general feeling is that the increase in brush encroachment in that part of the world has turned mule deer habitat into whitetail habitat. At least 2 solid research projects have shown that when brush canopy coverage exceeds 50%, mule deer decline and whitetails increase.

The adaptable whitetail seems to be the deer family's version of the Energizer Bunny – it just keeps going amid advancing urban encroachment, habitat alteration, weather fluctuations, brush encroachment, and heavy doe harvest in some areas. Does that mean the mule deer is doomed? Not hardly. The mule deer will exist in what open spaces we leave it. The limited amount of hybridization that occurs in areas of range overlap is not great enough to affect either species on the whole. Our charge is to make sure we remain good stewards of the habitat and work to concentrate our attention to what needs to be done to preserve the historical ecological balance between these two species.

SUPPORTING LITERATURE

Anderson, A. E. and O. C. Wallmo. 1984. *Odocoileus hemionus*. American Society of Mammalogists, Mammalian Species Special Publication No. 219. 9pp.

Anthony, R. G., and N. S. Smith. 1977. Ecological relationships between mule deer and white-tailed deer in southeastern Arizona. Ecological Monographs 47:255-277.

Arizona Game and Fish Department. 2008. Hunt Arizona. Arizona Game and Fish Department, Phoenix. www.azgfd.gov

Beasom, S. L., and E. P. Wiggers. 1984. A critical assessment of white-tailed and mule deer productivity. Pages 68-79 *in* Krausman, P. R. and N. S. Smith eds. Deer in the southwest: A workshop. Arizona Cooperative Wildlife Research Unit and University of Arizona, Tucson. 131pp.

Brownlee, S. 1979. Water development for desert mule deer. Texas Parks and Wildlife Department, Austin, Texas. Not paginated.

Cantu, R., and C. Richarson. 1977. Mule deer management in Texas. Texas Parks and Wildlife Department, Austin. 22pp.

Cathey, J. C., J. W. Bickham, and J. C. Patton. 1998. Introgressive hybridization and nonconcordant evolutionary history of maternal and paternal lineages in North American deer. Evolution 52:1224-1229.

Day, G. I. 1980. Characteristics and measurements of captive hybrid deer in Arizona. Southwestern Naturalist 25:434-438.

Derr, J. N. 1990. Genetic interactions between two species of North American deer, *Odocoileus virginianus* and *Odocoileus hemionus*. Ph.D. Dissertation, Texas A&M University, College Station. 111pp.

Dickinson, T. G. 1978. Seasonal movements, home ranges and home range use of desert mule deer in Pecos County, Texas. M. S. Thesis, Sul Ross State University. Alpine, Texas. 156pp.

Dickinson, T. G., and G. W. Garner. 1979. Home range and movements of desert mule deer in southwestern Texas. Proceedings of the Annual Conference of Southeastern Fish and Wildlife Agencies 33:267-278.

Fox, K. B., and P. R. Krausman. 1994. Fawning habitat of desert mule deer. The Southwest Naturalist 39:269-275.

Hanson, W. R., and C. Y. McCulloch. 1955. Factors influencing mule deer on Arizona brushlands. Transactions of the North American Wildlife Conference 20:568-588.

Harmel, D. E., J. D. Williams, and W. E. Armstrong. 1989. Effects of genetics and nutrition on antler development and body size of white-tailed deer. Federal Aid Report Series No. 26, Texas Parks and Wildlife Department. 55pp.

Heffelfinger, J. R. 1997. Age criteria for Arizona game animals. Special Report 19, Arizona Game and Fish Department, 40pp.

Heffelfinger, J. R. 1999. Hybridization in large mammals. Pages 27-37 *in* P. R. Krausman and S. Demarais editors, Conservation and management of large mammals in North America. Stackpole Books, Harrisburg, PA.

Heffelfinger, J. R. 2000. Status of the name *Odocoileus hemionus crooki (Mammalia: Cervidae)*. Proceedings of the Washington Biological Society 113:319-333.

Heffelfinger, J. R., C. Brewer, C. H. Alcála-Galván, B. Hale, D. Weybright, B. F. Wakeling, and L. Carpenter. 2005. Mule deer habitat guidelines: Southwest Deserts. Western Association of Fish and Wildlife Agencies, Mule Deer Working Group, *in press.*

Heffelfinger, J. R, L. H. Carpenter, L. C. Bender, G. L. Erickson, M. D. Kirchhoff, E. R. Loft, and W. M. Glasgow. 2003. Ecoregional differences in population dynamics. Chapter 2 *in* J. C. deVos, M. R. Conover, N. E. Headrick, editors, Mule Deer Conservation: Issues

and Management Strategies. Western Association of Fish and Wildlife Agencies and Jack H. Berryman Institute, Logan, Utah. 240pp.

Heffelfinger, J. R. 2006. Deer of the Southwest. Texas A&M University Press, College Station, TX. www.deernut.com

Hervert, J. J., and P. R. Krausman. 1986. Desert mule deer use of water developments in Arizona. Journal of Wildlife Management 50:670-676.

Hobson, M. D. 1990. Effects of predator control on desert mule deer numbers. Federal Aid Project W-125-R-1, Job 50. Texas Parks and Wildlife Department, Austin, Texas. 60pp.

Hoffmeister, D. F. 1986. Mammals of Arizona. University of Arizona Press and Arizona Game and Fish Department, Tucson. 602pp.

Horejsi, R. G. 1982. Mule deer fawn survival on cattle-grazed and ungrazed desert ranges. Federal Aid Project W-78-R, WP2, Job 17. Arizona Game and Fish Department, Phoenix. 43pp.

Horejsi, R. G., and R. H. Smith. 1983. Impact of a high density deer population on desert vegetation. Federal Aid Project W-78-R, WP4, Job 20. Arizona Game and Fish Department, Phoenix. 15pp.

Jacobson, H. A., and S. D. Lukefahr. 1998. Case study: genetics research on captive white-tailed deer at Mississippi State University. Symposium proceedings: The role of genetics in white-tailed deer management. Texas A&M University, College Station.

Koenen, K. K. and P. R. Krausman. 2002. Habitat use by desert mule deer in a semidesert grassland. The Southwestern Naturalist 47:353-362.

Koerth, B. H. 1981. Habitat use, herd ecology, and seasonal movements of mule deer in the Texas Panhandle. M. S. Thesis, Texas Tech University, Lubbock, Texas. 61pp.

Koerth, B. H., and F. C. Bryant. 1982. Home ranges of mule deer bucks in the Texas Panhandle. Prairie Naturalist 14:122-124.

Koerth, B. H., B. F. Sowell, F. C. Bryant, and E. P. Wiggers. 1985. Habitat relations of mule deer in the Texas panhandle. The Southwestern Naturalist 30:579-587.

Krausman, P. R. 1978a. Forage relationship between two deer species in Big Bend National Park, Texas. Journal of Wildlife Management 42:101-107.

Krausman, P. R., B. D. Leopold, and N. S. Smith. 1984. Morphological Characteristics of desert mule deer in Texas and Arizona. Pages 35-41 *in* Krausman, P. R. and N. S. Smith editors. Deer in the Southwest: A workshop. Arizona Cooperative Wildlife Research Unit and University of Arizona, Tucson. 131pp.

Krausman, P. R., K. R. Rautenstrauch, and B. D. Leopold. 1985. Xeroriparian systems used by desert mule deer in Texas and Arizona. Pages *in* R. Johnson et al., editors. Riparian ecosystems and their management: reconciling conflicting uses. U. S. Forest Service General Technical Report RM-120:1-523.

Krausman, P. R., A. J. Kuenzi, R. C. Etchberger, K. R. Rautenstrauch, L. L. Ordway, and J. J. Hervert. 1997. Diets of desert mule deer. Journal of Range Management 50:513-522.

Kucera, T. E. 1978. Social behavior and breeding system of the desert mule deer. Journal of Mammalogy 59:463-476.

Lang, E. M. 1957. Deer of New Mexico. New Mexico Department of Game and Fish, Santa Fe. 41pp.

Leon, F. G., III, C. A. DeYoung, and S. L. Beasom. 1987. Bias in age and sex composition of white-tailed deer observed from helicopters. Wildlife Society Bulletin 15:426-429.

Leopold, B. D., and P. R. Krausman. 1987. Diurnal activity patterns of desert mule deer in relation to temperature. The Texas Journal of Science 39:49-53.

Leopold, A. S. 1959. Wildlife of Mexico. University of California Press, Berkeley, California. 568pp.

Ligon, J. S. 1927. Wildlife of New Mexico: Its conservation and management. New Mexico Department of Game and Fish, Albuquerque. 207pp.

Mahgoub, E. F. 1984. Seasonal food habits of mule deer in the foothills of the Sacramento Mountains, New Mexico. Ph.D. Dissertation, New Mexico State University, Las Cruces, New Mexico. 89pp.

Mahgoub, E. F., R. D. Pieper, J. L. Holecheck, J. D. Wright, and V. W. Howard, Jr. 1987. Botanical content of mule deer diets in south-central New Mexico. New Mexico Journal of Science 27:21-27.

McCulloch, C. Y. 1973. Seasonal diets of mule and white-tailed deer. Pages 1-37 *in* Deer nutrition in Arizona chaparral and desert habitats. Arizona Game and Fish Department, Phoenix. Special Report No. 3. 68pp.

McCulloch, C. Y. 1978. Statewide deer food preferences. Federal Aid Project W-78-R-5, WP4, Job 15. Arizona Game and Fish Department, Phoenix. 29pp.

Mearns, E. A. 1907. Mammals of the Mexican boundary of the United States. U. S. National Museum Bulletin 56:1-530.

New Mexico Department of Game and Fish. 1996. New Mexico mule deer: today and tomorrow. Special report, New Mexico Department of Game and Fish, Santa Fe, New Mexico. 5pp.

New Mexico Department of Game and Fish. 1997. Long-range plan for mule deer management in New Mexico, 1997-2002, New Mexico Department of Game and Fish, Santa Fe, New Mexico. 17pp.

O'Conner, J. 1939. Game in the desert. Derrydale Press, New York. 167pp.

Pittman, M. T., and T. Bone. 1987. Mule deer reproduction. Federal Aid Project W-109-R-10, Job 51, Final Report. Texas Parks and Wildlife Department, Austin. 13pp.

Ragotzkie, K. E. 1988. Desert mule deer ecology and habitat use on cattle-grazed grass-shrub range. M. S. Thesis, Colorado State University, Fort Collins. 51pp.

Ragotzkie, K. E., and J. A. Bailey. 1991. Desert mule deer use of grazed and ungrazed habitats. Journal of Range Management 44:487-490.

Ratliff, D. D. 1980. Seasonal food habits of desert mule deer on the Stockton Plateau, Texas. Masters of Science thesis, Sul Ross State University, Alpine, Texas. 40pp.

Rautenstrauch, K. R. 1987. Ecology of desert mule deer in southwest Arizona. Ph. D. Dissertation, University of Arizona, Tucson. 37pp.

Rautenstrauch, K. R., and P. R. Krausman. 1989. Influence of water availability and rainfall on movements of desert mule deer. Journal of Mammalogy 70:197-201.

Rosenstock, S. S., W. B. Ballard, and J. C. deVos, Jr. 1999. Viewpoint: Benefits and impacts of wildlife water developments. Journal of Range Management 52:302-311.

Rosier, W. S. 1987. Trends in percent cover and botanical composition of mule deer habitat at Fort Stanton, New Mexico. M. S. Thesis, New Mexico State University, Las Cruces, New Mexico. 56pp.

Russ, W. B. 1984. Muleys and whitetails side by side. Texas Parks and Wildlife 42(11):22-28.

Short, H. L. 1977. Food habits of mule deer in a semidesert grass-shrub habitat. Journal of Range Management 30:206-209.

Short, H. L. 1979. Deer in Arizona and New Mexico: Their ecology and a theory explaining recent population decreases. General Technical Report RM-70, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 25pp.

Smith, R. H., and A. LeCount. 1979. Some factors affecting survival of desert mule deer fawns. Journal of Wildlife Management 43:657-665.

Sowell, B. F., G. B. H. Koerth, and F. C. Bryant. 1985. Seasonal nutrient estimates of mule deer diets in the Texas panhandle. Journal of Range Management 38:163-167.

Stubblefield, S. S., R. J. Warren, and B. R. Murphy. 1986. Hybridization of free-ranging white-tailed and mule deer in Texas. Journal of Wildlife Management 50:688-690.

Swank, W. G. 1958. The mule deer in the Arizona Chaparral. Wildlife Bulletin No. 3, Arizona Game and Fish Department, Phoenix. 109pp.

Taylor, J. R. 1961. Deer food habits study. Federal Aid Project W-75-R-8, WP18, Job 8, New Mexico Department of Game and Fish, Santa Fe. 10pp.

Taylor, J. R. 1962. Deer food habits study. Federal Aid Project W-75-R-9, WP20, Job 12, New Mexico Department of Game and Fish, Santa Fe. 16pp.

Taylor, J. R. 1963. Deer food habits study. Federal Aid Project W-96-R-4, WP20, Job 4, New Mexico Department of Game and Fish, Santa Fe. 13pp.

Truett, J. C. 1971. Ecology of the desert mule deer, *Odocoileus hemionus crooki* Mearns, in southeastern Arizona. Ph.D. Dissertation, University of Arizona, Tucson. 64pp.

Wallmo, O. C. editor. Mule and black-tailed deer of North America. Wildlife Management Institute and University of Nebraska Press, Lincoln. 605pp.

Wampler, G. E. 1981. Seasonal changes in home range and habitat preferences of desert mule deer in Pecos County, Texas. Master of Science Thesis, Sul Ross State University, Alpine, Texas. 60pp.

White, G. C., and R. M. Bartmann. 1997. Mule deer management – what should be monitored? Pages 104-118 *in* J. C. deVos, Jr., editor, Proceedings of the 1997 deer/elk workshop, Rio Rico, Arizona. Arizona Game and Fish Department, Phoenix. 224pp.

EVALUATING HOME RANGE AND HABITAT USE OF DESERT MULE DEER IN THE APACHE MOUNTAINS OF THE CHIHUAHUAN DESERT, TEXAS

MISTY L. SUMNER, *Texas Parks and Wildlife, P.O. Box 3008, Kent, TX 79855*

LOUIS A. HARVESON*, Borderlands Research Institute for Natural Resource Management, Sul Ross State University, Alpine Texas 79832; harveson@sulross.edu*

Abstract: Landowners, managers, and hunters need reliable knowledge of the preferred habitats, home range size, and seasonal movements of desert mule deer for effective population management. In February 2006 we captured 20 mature bucks (≥4.5 yrs old) using helicopter and netguns. Upon capture, deer were aged and antler measurements were taken. Prior to release, deer were fitted with a global positioning system (GPS) radio collar programmed to obtain geographic fixes every 5 hours. Desert grassland and mixed desert scrub appeared to be key resources for desert mule deer selection. Although our analysis is in its preliminary stages, the large range sizes exhibited by mature buck mule deer in our study suggest that mule deer management should occur at a spatial scale much larger than previously practiced.

Desert mule deer represent the cornerstone of recreational and lease hunting in west Texas. Landowners, managers, and hunters need reliable knowledge of the preferred habitats, home range size, and seasonal movements of desert mule deer for effective population management. In February 2006 we captured 20 mature bucks (≥4.5 yrs old) using helicopter and netguns. Upon capture, deer were aged and antler measurements were taken. Prior to release, deer were fitted with a global positioning system (GPS) radio collar programmed to obtain geographic fixes every 5 hours. In March 2007, we recaptured 7 and remotely removed the collars on 5 bucks. Six of the recaptured deer were re-collared and 11 additional bucks (≥4.5 yrs old) were fitted with GPS radio-collars. All deer were aged and antler measurements taken. We classified the vegetation of the Apache Mountains and associated foothills in Culberson County, Texas using ArcGIS 9.1 and ERDAS Imagine 9.0 and created a digital vegetation classification map (4 vegetation classifications) with an overall accuracy of 90% and user's accuracy >82%. Home ranges (100% minimum convex polygons) averaged 15,399 acres, ranged from 4,312 to 30,028 acres, and were considerably larger than in previous research. Desert grassland and mixed desert scrub appeared to be key resources for desert mule deer selection. We tested resource selection across home ranges as well as within-home-ranges and found consistent selection at both scales. Seasonal movement analysis suggested that home ranges are similar in size but spatial distribution is noticeably different. Although our analysis is in its preliminary stages, the large range sizes exhibited by mature buck mule deer in our study suggest that mule deer management should occur at a spatial scale much larger than previously practiced.

PREDATION MANAGEMENT FOR WILDLIFE PROTECTION: WHY, WHEN, AND HOW?

***MICHAEL J. BODENCHUK**, State Director, Texas Wildlife Services Program, Box 100410, San Antonio, TX 78201, Michael.J.Bodenchuk@aphis.usda.gov*

Abstract: Predation management to benefit wildlife is a misunderstood process and may be viewed as unnecessary by some. Predation has positive and negative effects on prey populations and may be necessary to achieve and maintain human objectives. Predation impacts may be direct (actual predation of individual animals) or indirect (habitat shifts by prey population due to the risk of predation). Understanding what factors cause negative prey impacts aids in developing a predation management program which meets human objectives.

INTRODUCTION

Predators form a critical part of the ecosystem and past predation management was geared to predator elimination. Government and private predator programs eliminated wolves and grizzly bears from most of the continental US. Black bears and mountain lions were reduced in both their geographic range and in numbers. Coyotes were also reduced in abundance.

Wildlife management theories developed during this era held that predation management for wildlife protection was unnecessary and, in some cases, was counterproductive. Predation management and a cessation in sport hunting led to a large deer herd explosion on the Kaibab Plateau in Arizona. The deer herd subsequently over-browsed its range and died out, but not before long term habitat damage had occurred. Other examples exist within the literature.

Predator protection has occurred systematically across the West beginning in the 1960's. Black bears and mountain lions gained game status in most states and wolves and grizzly bears were protected by both the Endangered Species Act and state laws. Coyote populations benefitted from executive actions including policy changes within the US Fish and Wildlife Service beginning in 1970, a nationwide ban on toxicants in 1972, game or furbearer status in many states throughout the 1980's and, in some states, bans on trapping brought about by voter referendum. Combined with expansion of range as a result of intentional movements and a lack of competition with wolves, there are arguably more coyotes alive today than at any time in history.

PREDATION IMPACTS TO PREY SPECIES (WHY)

Predators have both positive and negative impacts on prey populations. Predation shapes both the predator and the prey. Predation may avoid overpopulation in some species of prey. Habitat loss may be avoided through movements of prey away from predators. Fitness in prey assures that only the strongest predators live to breed. Predation may also limit the abundance of invasive species such as feral hogs.

Negative impacts also exist. Prey numbers, already reduced by environmental stress or human factors, may not be able to increase due to predation. Prey may be kept at low abundance which allows unfavorable changes in the habitat such as an increase in invasive plants or increases in competitive species better suited to survive predation. Human objectives for the land and the wildlife may not be attainable due to predation pressure on key prey species.

Negative predation impacts can be either direct or indirect. Direct impacts (primary predation impacts) are related to the number of prey actually removed from a population by the act of predation. Examples include mule deer fawn predation by coyotes, adult deer predation by mountain lions or quail egg predation by ravens or feral hogs. Indirect impacts (secondary predation impacts) are those impacts caused by a change in the behavior of the prey animals which subsequently makes them less fit or causes non-predation mortality. Examples include a behavioral shift in elk away from meadow habitat due to predation pressure by wolves, which subsequently causes elk to die of starvation in even a mild winter.

The degree to which predation affects a prey population depend on a host of interrelated factors which can be grouped into 3 broad categories: habitat factors, prey population factors and predator population factors.

Habitat Factors

There are certain types of habitat (or features) which may increase the impacts of predation. Linear habitat exists when critical features are located in a more or less straight line which allows a predator to more effectively search the habitat for prey. Examples in the Trans-Pecos include rimrock bighorn habitat which can be hunted effectively by mountain lions and semi-riparian creek bottoms which provide insects and sedges for quail habitat. Another critical habitat feature is access to water. When water is relatively abundant (after summer rains) wildlife may disperse and are less vulnerable to predation. However, when free water becomes restricted, both predator and prey are concentrated on the few remaining sources of water. Fire may similarly concentrate both predator and prey in the same remaining habitat. Brush encroachment affects a pronghorn's ability to detect a predator. Artificial perches created by power poles provide an opportunity for raptors to more effectively nest and hunt cover.

Prey Population Factors

The number of prey animals is important, but predation affects are most pronounced when prey is far below carrying capacity. If the prey population is above capacity, saving them from predation may lead to habitat loss and in all cases will not be sustainable. Additionally, the length of the actual breeding season affects predation rates. Many prey animals are most vulnerable in the weeks following birth. If all the fawns are dropped in a short (3 week) window, fewer will be eaten than if the fawn drop is extended for 5-6 weeks. Buck to doe ratios can affect breeding synchrony. The group size and composition of prey animals affects their vulnerability to predation. Mule deer bucks are more vulnerable to mountain lion predation because the generally live in rough country and in small herds which are not as effective at detecting a lion.

Another prey factor is the availability of alternative prey. Alternative prey is any species which the predator may feed on other than the prey species of concern. The availability of alternative prey may work both either to the benefit or detriment of the species of concern. On one hand, when alternative prey is abundant, the impact to any one species is reduced. When alternative prey is reduced, the impacts to the species of concern are greater. On the other hand, high sustained populations of alternative prey can sustain higher than normal populations of predators, which can have a greater impact on the species of concern. Mountain lion populations have been documented to use cattle as a buffer prey species, allowing the to impact mule deer herds especially during a drought.

Predator Population Factors

The numbers of predators may be important, but is rarely the most important factor. As noted above, the ability of the predator to "bridge" to another prey species may be more important. The social structure of the predator also affects its impacts. Mountain lions, for example, are territorial and can hardly be crowded into a small area. Coyotes are also territorial, but exist in subpopulations of breeders/family groups and subadults which are not restricted to a territory. An older population of coyotes (5-6 year old territory holders which have been on their territories for 3-4 years) usually have a greater impact on prey than the same number of 2 year old coyotes on the territory for their first breeding season. Invasive predators, such as red fox, may have a devastating impact on prey populations which did not evolve with that type of predation pressure. Multiple predator species can impact prey, especially if they work on different life cycle stages. For example, neither nest predation by skunks nor adult mortality from raptors is likely to cause a quail population to decline, but the combination of both may lead to a sustained decline. Finally, individual predator behavior may affect predation rates. Individual lions may target mule deer exclusively while others are effective switching to javelina, jackrabbits and porcupines.

In the field, no one single cause of predation impacts may be identified as the culprit. As an example, drought is a recurring theme in the Trans-Pecos and no single factor affects mule deer more than drought. Mule deer predation is more pronounced in drought because (1) deer and predators are concentrated on the remaining water sources, (2) alternative prey is less available, so predators must forage for larger prey, (3) deer fawns are born lighter and are vulnerable to predation for a longer period of time, (4) deer need to spend more time feeding to gather the same amount of nutrition so they are exposed to predators more often and (5) predator populations at the start of a drought cycle are usually robust and have not declined due to a lack of prey.

PREDATION MANAGEMENT v. HABITAT IMPROVEMENT

Economics aside, there should be little debate regarding the need to conduct predation management as opposed to performing habitat improvement. Habitat improvement is a process rather than a goal, and habitat improvement needs to be performed to provide for future populations of wildlife. Predation management is something done today to bring prey populations up to the current carrying capacity. Predation management conducted to minimize secondary impacts will allow the prey access to the critical components of the current habitat.

While it is unlikely that predation pressure will drive game species to extinction, predation may drive populations below human objectives. The decision to invest in predation management should not be taken lightly. If necessary, predation management must be conducted at the right time and targeting the right segment of the population to be effective.

TIMING PREDATION MANAGEMENT (WHEN)

Predation management must be timed to prevent the negative impacts. For example, coyote removal in November may address secondary impacts if coyotes are keeping mule deer from critical feed during the winter. However, it will not address the most critical primary effects associated with neonatal fawn predation. To address fawn survival, territorial coyotes must be removed from those areas mule deer need to fawn (the heads of canyons or semi-riparian corridors) before the fawns are born in July. Because coyotes whelp in late March and April, conducting coyote control after that time is difficult. Therefore, to be the most effective, coyote removal should be conducted after pairs are established in January, but before the female goes into the den in March. Removing just the male coyote and leaving a bred female on the territory is the same as "no control."

Addressing secondary effects for nesting birds requires that managers initiate control before breeding season. The female bird selects nest sites based on the risk of predation and for some species if they encounter a predator before mating the may migrate on to another location to nest. Optimal results occur when the majority of the predators are removed in late winter before pairs are established.

CONDUCTING PREDATION MANAGEMENT (HOW)

Rarely can we attribute the benefits of predation management to just the number of predators removed. Yet, often, we count the dead animals as a show of our success. How we conduct predation management is more important than how many we kill.

As an example, all research indicates that territorial coyote pairs are responsible for most of the predation on livestock, as they need to feed not only themselves but also their young. It is believed that these territorial individuals are also responsible for much of the fawn mortality for pronghorn and mule deer. Targeting territorial coyotes includes the selective use of traps and snares along den trails and the use of howling to locate coyotes in the late winter (only the territorial adults will answer) accompanied by aerial hunting or calling.

To address secondary issues (such as deer protection in a drought) coyote removal needs to be targeted to critical areas (waterholes or critical food sources such as feeders or food plots). It must be conducted before and throughout the vulnerable period.

Bird protection needs to begin in late winter and continue through fledging. For quail, this means starting in February and continuing through June or July. If summer rains are available, predation management may cease once these start. Otherwise, control may be

necessary (though the number of predators removed will diminish) through late summer to protect late nesting.

SUMMARY

Predation management is different than the old "predator control." It is no longer practical to believe we can effect predator populations on a large landscape. We can, and should, manage the negative effects of predation on preferred prey species when all other necessary components of the environment are in place. Predation management has its place in wildlife management.

SUPPLEMENTAL FEEDING: UNDERSTANDING THE CHALLENGES

Philip H. Dickerson, *Texas Parks & Wildlife Department, 4500 W. Illinois, Ste 203 Midland, TX 79703,* *phdickers@suddenlinkmail.com*

Abstract: Providing supplemental feed to wildlife, especially deer, is a common practice implemented by landowners. A review of the current research on supplemental feeding is presented so that landowners may better understand the challenges. Additionally, important considerations associated with feeding programs are summarized to help managers be more effective and efficient if they decide to initiate a wildlife feeding program.

INTRODUCTION

In the Trans-Pecos Region of Texas, rainfall or lack of it seems to be the major controlling factor responsible for producing adequate forage for all wildlife. Landowners managing their deer herds for sustainable numbers and improved antler quality sometimes feel they must provide supplemental feed, especially when native forage is lacking. However, it is very important that managers understand how feeding can impact not only their deer herds but native forage plants as well if deer numbers exceed the carrying capacity of the property. Carrying capacity is commonly defined as "The number of animals a habitat can support with causing habitat deterioration". The carrying capacity for any property changes through time with management activities and weather patterns.

Nutritional supplementation should not be confused with "baiting" (attracting deer to locations to increase harvest, viewing, photography or other purposes). Baiting is usually conducted with spincast feeders that periodically dispense corn or other feed. The amount of feed available to wildlife when using this method is usually very small. Supplemental feeding, on the other hand, whether year round or seasonal involves free- choice feeders or feeding stations that allow continuous access to feed (Richardson 2006).

Supplemental feeding programs can improve the nutritional, health, and numbers of deer, as well as increase antler growth and post-rut survival of bucks. ***But in my opinion, the most important consideration for any landowner is to understand and manage their native habitat first***. ***Most landowners have limited resources to invest in their management program. I believe that the best place to start is with what I call the value -added practices.*** Such practices not only increase the value of the ranch but provide benefits for a variety of native wildlife species. They include practices such as brush management, water developments, soil and water conservation practices, range improvements and riparian management. Landowners seeking assistance regarding wildlife management can contact their local Texas Parks and Wildlife Biologist. This is a free service provided through our Technical Guidance Program.

Supplemental feeding is not a "cure all" solution to having lots of big deer. Most feeding operation managers learn the hard way that high deer numbers are counter-productive to producing large antlers. With this practice comes increased management responsibility for the landowner.

Problems or challenges that may be associated with feeding can be feed cost, labor, over use of native forage, over population, deer distribution, impacts to ground nesting birds, disease transmission and non-target animals.

An observation by biologists in West Texas and elsewhere is that feeding operations are most successful (more deer and bigger antlers) during the first 2-3 years of implementation. As deer numbers continue to increase, the best forage plants are overused and deer nutrition (and antler size) declines compared to initial 2-3 years.

DEER RESEARCH

In many hunting camps supplemental feeding is often considered as a way to improve antler quality; however, consumption and nutritional effects may vary widely by location (Verme and Ullrey 1984, Schmitz 1990, Doenier et al. 1997, Bartoskewitz et al. 2003). Bartoskewitz et al. (2003) found that the proportion of bucks that used feeders on three South Texas ranches ranged from 23% to 48% in summer and 29% to 56% in winter. Of bucks that actually consumed supplemental feed, body weights increased by 12-23%, but the effect on antler growth was inconsistent. The improvement in antler growth was 14% on one ranch and there was no significant effect on the other two ranches.

DeYoung et al. (2004) found the use of supplemental feed to range from 6-60% on the Comanche Ranch and 46-81% on the Faith Ranch. Both locations have 1,200 acre, high- fence enclosures.

Texas Experiment Station (1990) in Sonora, Texas. White-tailed deer in 1-acre enclosures were provided pelleted feed to observe their foraging behavior. Researchers found that deer being supplemented became more selective foragers and selected the "ice cream" plants at a higher rate than did the unfed deer. Their conclusions were that over time this could lead to changes in the plant community through losses of highly preferred plant species.

Drs. Tim Ginnett and Susan Cooper (1999) Texas Experiment Station in Uvalde, found home ranges for fed white-tailed does to be only half as large as unfed does. Ginnett and Dr. Keith Owens also placed seedlings in plots near feeders and found that deer browsed 7 times more heavily near feeders than at control sites without feeders. They concluded that fed deer used portions of their home range more intensively, still browsed and could possibly damage habitat near feeders.

Murden (1993) reported the feeding may cause animals to concentrate around feeding locations and result in localized overuse of desirable forage species.

Oswald (1986) found that when white-tailed deer in Ontario, Canada were provided supplemental feed during the winter, they continued to browse native vegetation.

Arnold and Dudzinski (1967) reported that free ranging deer tend to disperse from habitats where forage has been depleted. Supplementation tends to disrupt this natural process, allowing them to continue to concentrate in heavily utilized areas.

Miller et al. (1998) found if one or more animals is harboring infectious diseases, its transmission to uninfected individuals is facilitated by the increased frequency of contact among animals congregating at the feeding site.

Williamson (2000) Supplemental feeding has been suspected of contributing to the spread of tuberculosis in deer, chronic wasting disease in deer and elk, and brucellosis in elk and bison.

Susan Cooper (2000) Texas Experiment Station in Uvalde, conducted research with "*Easiflo*" cottonseed as a deer feed. She compared the use of non-target species around the feeders. She found that after 28 days, only 1 out of 120 dummy quail nests remained near the protein feeders, yet at the cottonseed feeders 23% remained intact. Raccoons were scarce due to a previous predator control program. Depredation was attributed to feral hogs. Using cottonseed as supplemental deer feed may reduce the impacts to ground nesting birds and mitigate the problem of inadvertently supplementing feral hogs.

In Michigan, Ozoga (1972) found that crowding can lead to increased aggression and fighting among bucks as well as does, which among bucks could lead to broken antlers, injuries and death.

Jacobson (1996) Mississippi State found that 70% of feeder use occurred at night. Feeding at night may require a raccoon reduction program to maximize feed availability to deer.

Raccoons have been documented as frequent users of feeders and have been identified as a serious nest predator of ground nesting birds such as quail and turkeys (Cook 1972, Baker 1978, Speake 1980, and Miller and Leopold 1992).

AFLATOXIN CONCERNS

Aflatoxins are a byproduct of the fungus *Aspergillus,* and can produce a wide variety of disease problems for wildlife and humans. Aflatoxins cause problems with liver function and suppress the immune system. Aflatoxins can be found on cereal grains (e g. corn, whole cottonseed and milo), feed pellets and hay. Texas state law requires that all *corn fed as wildlife feed* must be labeled indicating the level of aflatoxins, which can not exceed 50 parts per billion (ppb). Wilkins and Brown (1998) found illegal levels of aflatoxin in 40% of 100 randomly purchased bags of "deer corn" in Texas. Deer can be harmed by aflatoxins if the levels are high. Landowners should also be concerned that many species of birds and small mammals are also

potentially feeding on grain and, due to their smaller size, will be impacted at lower levels of aflatoxin.

2002 WILDLIFE CONFERENCE – LANDOWNER COMMENTS

Landowner A – Only provides feed when it's dry, been doing it over 20 years. Does not believe there has been an increase in numbers or antlers size.
Concerns (none given)

Landowner B – Providing free-choice feed for 12 years. Believes they have seen an increase in fawn survival and survival of post-rut bucks.
Concerns are cost, labor, impacts to native vegetation and predation. Feeding sites may provide ambush sites for predators.

Landowner C – Providing free choice, high-protein pellets for 10 years. Believes he has seen an increase in fawn survival, body weight and slight increase in antler size.
Concerns are cost, labor and deer overpopulation.

Landowner D – Providing free choice, high-protein pellets for 8 years. Believes he has seen increased body weights, increased antler size, increased fawn crop and deer numbers tripled.
Concerns are cost, labor and predation.

COMMON DEER FEEDS

High protein pellets, alfalfa, cottonseed, rice bran, corn, peas and milo.

Crude Protein

Alfalfa 18%
Corn 7-10%
Wheat/oats 12-15%
Milo 10%
Whole Cottonseed 24%
Rice Bran 14%

Tables 1 & 2 have been provided by Larry W. Varner, with Land O'Lakes Purina Feed.

Table 1. Estimated Nutrient Needs of Deer (Concentration in dry matter).

	Growth					Gestation		Lactation	
	Maint.[1]	Velvet	3-6 Mo.	6-9 Mo.	9-12 Mo.	Mid	ate	1st ½	2nd ½
Crude Protein (%)	7-10	16	18-20	16-18	12-14	12-14	14-16	14-16	12-14
DE (Mcal/lb)	1.00	1.10	1.40	1.30	1.20	1.10	1.20	1.30	1.25
TDN (%)	50-52	55	68	64	59	57	59	64	61
Calcium (%)	0.35	1.40	0.60	0.55	0.50	0.50	0.50	0.70	0.60
Phosphorus (%)	0.25	0.70	0.30	0.30	0.30	.040	0.40	0.40	0.40
Potassium (%)	0.65	1.0	0.65	0.65	0.65	0.65	0.65	1.0	1.0
Magnesium (%)	0.20	0.40	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Copper (ppm)	15	25	20	20	20	20	20	20	20
Manganese (ppm)	40	100	75	75	75	75	75	75	75
Zinc (ppm)	50	150	100	100	100	100	100	100	100
Iron (ppm)	50	200	200	200	200	200	200	200	200
Iodine (ppm)	0.30	1.0	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Cobalt (ppm)	0.10	0.30	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Selenium (ppm)	0.20	0.30	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin A IU/lb)	1500	2000	1800	1800	1800	2000	2000	2000	2000
Vitamin D (IU/lb)	250	500	450	450	450	500	500	500	500
Vitamin E (IU/lb)	10	20	15	15	15	20	20	20	20

[1] Maint. = Maintenance

Table 2. Average Composition of Deer Antlers (Content in dry matter).

Mineral	
Calcium, %	19.0
Phosphorus, %	10.1
Magnesium, %	1.1
Sodium, %	0.5
Potassium, %	0.1
Iron, ppm	55.0
Manganese, ppm	6.6
Zinc, ppm	116.0

Organic	
Organic matter %	48
Protein %	36.3
Energy (Kcal/gram)	2.1

CONSIDERATIONS FOR SUPPLEMENTAL FEEDING DEER

- Understand specifically the problems you are attempting to solve when providing feed to deer or other wildlife.
- Maintain deer numbers at carrying capacity or below.
- Conduct annual evaluations on native browse plants to determine deer numbers compared to carrying capacity.
- Feed only during the antler growing period (March thru August) to reduce the cost and minimize impacts to local vegetation near feeding areas.
- If focusing on antler size, choose a feed with a minimum of 20% digestible protein and proper mineral/vitamin composition.
- Feed during the daylight hours to reduce the use by some non-target species (e.g. raccoon, porcupine, javalina and feral hogs).
- Be patient, it may take 1-2 years for deer to learn to eat pelleted feed.
- Buy feed from a reputable dealer and keep it clean and dry as possible.

LITERATURE CITED

Bartoskewitz, M. L., D. G. Hewitt, J. S., Pitts, and F. C. Bryant. 2003. Supplemental feed use by free-ranging white-tailed deer in south Texas. Wildl. Soc. Bull. 31:1218-1228.

Brown, D., and M. S .Cooper. 2006. The Nutritional, Ecological, and Ethical Arguments Against Baiting and Feeding White-Tailed Deer. Wildl. Soc. Bull. 34(2):519-524; 2006.

Cantu, R. and C. Richardson, 1997. Texas Parks and Wildlife Department. Mule deer management in Texas. Wildlife Management Publication.

Cooper, M. and F. Ginnett. 2000. Potential effects of supplemental feeding of deer on nest predation. Wildl. Soc. Bull. 2000, 28(3):660-666.

Davis, D. S. 1996. Aflatoxins and disease concerns. Pages 143-145 *in* C. W. Ramsey, ed., Supplemental feeding for deer: Beyond Dogma. Texas A&M Univ., College Station. 153pp.

Murden, S. B., and K. L. Risenhoover. 1996. Forage used by white-tailed deer: Influence of supplemental feeding. Pages 131-141 *in* C. W. Ramsey, ed., Supplemental feeding for deer: Beyond dogma. Texas A&M Univ., College Station. 153 pp.

Schmitz, O. J. 1990. Management implications of foraging theory: Evaluating deer supplemental feeding. J. Wildl. Manage. 54(4):522-532.

Varner, W. L. 2002. Basic Deer Nutrition. Pages 46-52 in Proceedings of the Trans-Pecos Wildlife Conference. Sul Ross State University, Alpine, TX 79830

TPWD MULE DEER BUCK HARVEST AND ANTLER DEVELOPMENT DATA IN THE TRANS-PECOS

***SHAWN S. GRAY**, TEXAS PARKS AND WILDLIFE DEPARTMENT, 2003 W. 6TH STREET, FORT STOCKTON, TX 79735, USA; shawn.graytpwd@sbcglobal.net*

***CALVIN L. RICHARDSON**, TEXAS PARKS AND WILDLIFE DEPARTMENT, 4500 W. ILLINOIS, SUITE 203, MIDLAND, TX 79703, USA; c.richardson@suddenlinkmail.com*

Abstract: Texas Parks and Wildlife Department (TPWD) biologists annually collect mule deer harvest data by management compartment, which include age, number of antler points, antler inside spread and basal circumference, and field-dressed weight. In the Trans-Pecos, more than 14,000 harvested mule deer bucks have been aged since 1980, which showed a mean age of 4.9 years. On average, the 7.5 year-old bucks demonstrated the greatest number of points (9.6), largest inside spread (19.5"), greatest antler basal circumference (5.0"), and heaviest field-dressed weight (157.5 lbs). However, the 8.5 year-old age class was similar to the 7.5 year-old age class in antler basal circumference. Antler development in bucks has three major contributors (nutrition, age, and genetics). Techniques influencing deer nutrition and age are well documented; however, genetic improvement in mule deer can be challenging for a variety of reasons. In recent years, the issue of yearling spike[1] harvest has been of interest to some land managers. Some studies indicate yearling spikes will produce poorer quality antlers compared to fork-antlered yearlings. Other data suggest that factors such as nutrition and timing of birth can influence the development of antlers in yearling bucks. Drought can also affect antler development in older age bucks. Deer managers should be aware of all factors influencing spike development in yearling bucks and poor antler quality in older bucks before intensive culling is implemented. TPWD mule deer harvest data may assist landowners in identifying the proper age classes and antler characteristics upon which to focus culling efforts.

DATA COLLECTION

Since 1980, TPWD biologists in the Trans-Pecos have collected harvest data (i.e., age by tooth wear and replacement, total antler points ≥ 1", antler inside spread and basal circumference, and field-dressed weights). Data are collected annually by management compartment from mule deer harvested during the hunting season. The vast majority of measurements are collected from deer in meat locker plants, taxidermy shops, and private land cooperators. Harvest data is collected from a proportion of mule deer bucks harvested in the Trans-Pecos, averaging more than 500 deer annually. Data are separated into 27 harvest management compartments based upon soil and habitat characteristics, as well as mule deer population densities (Figure 1). Data are used to monitor harvest intensity, herd condition and age structure, and to develop revisions in regulations. Antler measurements are collected in millimeters but have been converted to inches for land manager applicability.

[1] A single unbranched antler on both sides.

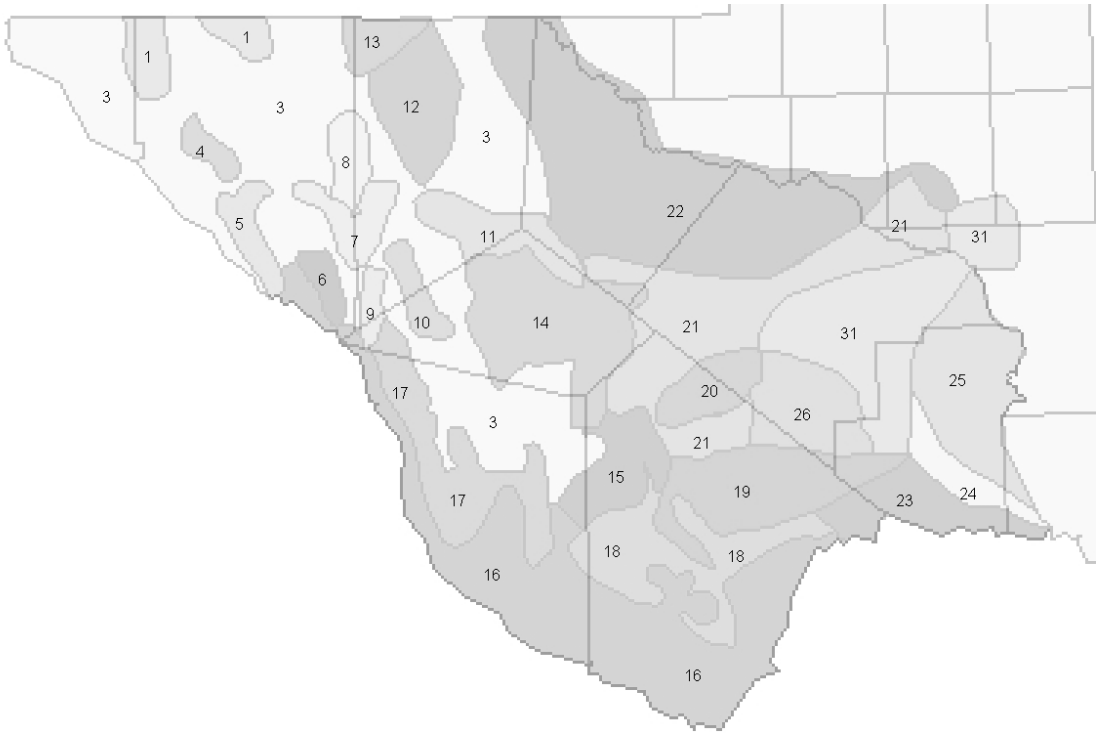


Figure 1. TPWD mule deer harvest management compartments.

MULE DEER BUCK AGE DATA

Texas Parks and Wildlife Department biologists estimate ages of harvested mule deer by using the tooth wear and replacement method (Severinghaus 1949, Russ 1993). The method is not perfect; however, most estimates by trained biologists are within 1-2 years of the actual age on mature mule deer. Younger mule deer ≤ 4.5 years old are aged more accurately. Collecting accurate ages of harvested mule deer is the corner stone for comparing harvest data and monitoring harvest intensity. From 1980-2007, 14,004 mule deer bucks have been aged in the Trans-Pecos, which showed an overall average of 4.9 years. More than 67% of bucks harvested are ≥ 4.5 years old (Table 1). Most deer managers understand that, in general, bucks continue to increase antler characteristics and body size with age (long bone growth is complete by 4 years of age and bucks will put more nutrients into subsequent years of antler development). Therefore, to produce quality or trophy class bucks, deer managers should apply a conservative harvest strategy on the buck segment of the herd to allow bucks to reach maturity.

Table 1. Number of mule deer bucks by age class sampled for harvest data (Trans Pecos, 1980-2007).

Age Class	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	Total
Sample Size	714	1,389	2,431	2,634	2,620	2,507	1,196	513	14,004
%	5.1%	9.9%	17.4%	18.8%	18.7%	17.9%	8.5%	3.7%	100.0%

MULE DEER BUCK ANTLER DATA

Several antler characteristics of harvested mule deer bucks are measured each season by TPWD biologists, which include number of points ≥ 1", greatest inside spread, and basal circumference. The total number of points ≥ 1" are recorded for both antlers, and the greatest inside distance is measured between the left and right main beams. The basal circumference measurement is taken immediately above the burr on one antler. On average, yearling bucks harvested in the Trans-Pecos have 2.8 points. This may not be representative of the actual number of points of mule deer yearlings (e.g., some hunters may select spikes for harvest over ≥ 3 point yearlings) but is probably somewhat close. Bucks continue to gain points until 7.5 years old (9.6 points). Almost 1 point on average is gained from 4.5 to 5.5 years of age. However, only 0.1 of a point separates the mean between 6.5 and 7.5 age classes (Table 2). When considering harvest management, most bucks have reached their potential for producing points at 6.5 to 7.5 years of age.

Mule deer bucks achieve their greatest inside spread and basal circumference at 7.5 years. However, bucks 8.5 years old average the same basal circumference as bucks 7.5 years old. Bucks continue to gain antler width and mass as they mature, but little gain in antler size occurs after 6.5 years of age (Table 3).

Table 2. Mean number of points ≥ 1" recorded for harvested Trans-Pecos mule deer bucks by age class (1980-2007).

Age Class	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	Total
Mean Number of Points	2.8	5.1	7.1	8.2	9.1	9.5	9.6	9.4	
Sample Size	714	1,388	2,431	2,634	2,620	2,506	1,196	513	14,002

Table 3. Mean inside spread and basal circumference (inches) of harvested Trans-Pecos mule deer bucks by age class (1980-2007).

Age Class	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	Total
Mean Inside Spread	7.2	11.8	14.9	17.0	18.4	19.3	19.5	19.2	
Mean Basal Circumference	2.2	3.0	3.7	4.2	4.6	4.8	5.0	5.0	
Sample Size	713	1,389	2,431	2,634	2,620	2,507	1,196	513	14,003

MULE DEER BUCK WEIGHT DATA

Field-dressed weights have been obtained from 4,282 mule deer bucks by TPWD biologists since 1980. This information indicates that bucks gain weight until 7.5 years of age. Yet, on average only 4.1 pounds are gained between 6.5 and 7.5 years of age (Table 4). Many nutritional and physiological factors (i.e., rainfall, livestock and deer stocking rate, livestock class, exotics, supplemental feeding, range site diversity, rutting activity, etc.) affect body weights, but maturity is a significant factor in producing large-bodied bucks.

Table 4. Mean field-dressed weights (pounds) from harvested Trans-Pecos mule deer bucks by age class (1980-2007).

Age Class	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	Total
Mean Field-Dressed Weight	79.4	99.3	120.4	138.2	147.5	153.4	157.5	151.5	
Sample Size	136	272	547	738	917	944	514	214	4,282

TPWD MULE DEER ANTLER DEVELOPMENT STUDY

TPWD conducted a small field study to observe antler development in mule deer bucks throughout their life during 1986-1993. A total of 51 known-age mule deer buck fawns and yearlings were trapped and marked during the winters of 1986, 1987, and 1988. Thirty-five of these bucks were trapped as yearlings with 29 (83%) having spike antlers and 6 (17%) having forked antlers (≥ 3 points). However, only 32 yearlings survived to maturity, of which 26 were spikes and 6 were forked. At maturity, fork-antlered yearlings produced more points than spike-antlered yearlings (Russ 1993b; Table 5). These data indicate similar results as the white-tailed deer genetic study conducted at the Kerr Wildlife Management Area (Ott et al. 1998). Caution should be used when interpreting these data largely because of such a small sample size. In addition, nutrition and timing of birth (buck fawns born late; Jacobson 1995) can contribute to yearlings producing spikes instead of forks. Therefore, managers should be aware of all factors influencing spike development in yearling bucks before intensive culling is implemented.

Table 5. Mean number of points for spike- and fork-antlered yearlings as each group matured from 1986-1993.

Age Class	1.5	2.5	3.5	4.5	5.5	6.5
Spike-Antlered (n = 26)	2.0	4.0	5.0	7.0	7.7	7.7
Fork-Antlered (n = 6)	3.3	5.3	7.7	8.0	9.5	No Data

MULE DEER YEARLING SPIKE OCCURRENCE IN TPWD HARVEST DATA

Nutrition, age, and genetics are the major ingredients that contribute to antler development. Nutrition and age are well documented to help improve antler characteristics; however, genetic improvement is more challenging because of several issues such as yearling buck dispersal (McCoy et al. 2005), contribution of genes from does (Harmel et al. 1998), and buck breeding dominance (DeYoung et al. 2006, Frels and Ott 2007). Geneticists still poorly understand various factors about deer genetics. In addition, many deer managers incorrectly believe that genetic improvement in a deer herd can easily be obtained because of 1) familiarity with principles of livestock genetics (which are not comparable to deer genetics), 2) misinterpretation of genetic research results, or 3) selection and implementation of reported results out of context. A harvest management option some managers utilize is the harvest of yearling spikes to help improve buck antler genetics. TPWD data from the Kerr Wildlife Management Area (Ott et al. 1998) and Russ (1993b) indicate most yearling spikes will produce lower quality antlers compared to fork-antlered yearlings. Additionally, during years when nutrition is lacking during antler development, most bucks will produce lower quality antlers than if nutrition levels are high or adequate. This is especially true for yearling bucks that are using the vast majority of nutritional intake for body growth.

Nutritional intake during antler development may contribute to the incidence of spike yearlings in the Trans-Pecos (Figure 2). The Palmer Drought Severity Index (PDSI) was used to demonstrate climatic conditions during antler development (March-August), which is a comprehensive numerical rating associated with overall soil moisture and plant growth. The rating uses cumulative temperature and rainfall in a formula to determine dryness. A rating of "0" depicts normal conditions, numbers above "0" indicate favorable conditions, and negative numbers identify drought (National Oceanic and Atmospheric Administration 2008). Figure 2 illustrates an inverse relationship between the percentage of mule deer yearling spikes in TPWD harvest data and the PDSI. As the PDSI increases and decreases, the percentage of mule deer yearling spikes decreases and increases, respectively. Yearling spike occurrence percentages ranged from 25.0% in 1981 (PDSI = 16.5) to 89.5% in 2000 (PDSI = -26.8). The Trans-Pecos average for frequency of yearling spikes is 61.2% from 1980-2006. Although a small sample was collected (total yearlings = 705; yearling spikes = 409), a negative correlation (an inverse relationship) between yearling spikes and the PDSI was indicated ($r = -.52$; -1.0 would indicate a perfect negative correlation). These data suggest that during drought years (spring and early summer) a higher proportion of yearling bucks will be spikes. For managers implementing spike harvest as a genetic improvement strategy, they should consider monitoring annual rangeland conditions in the spring and summer before intensively culling yearling spikes, especially if having numerous mature bucks in the future is a goal.

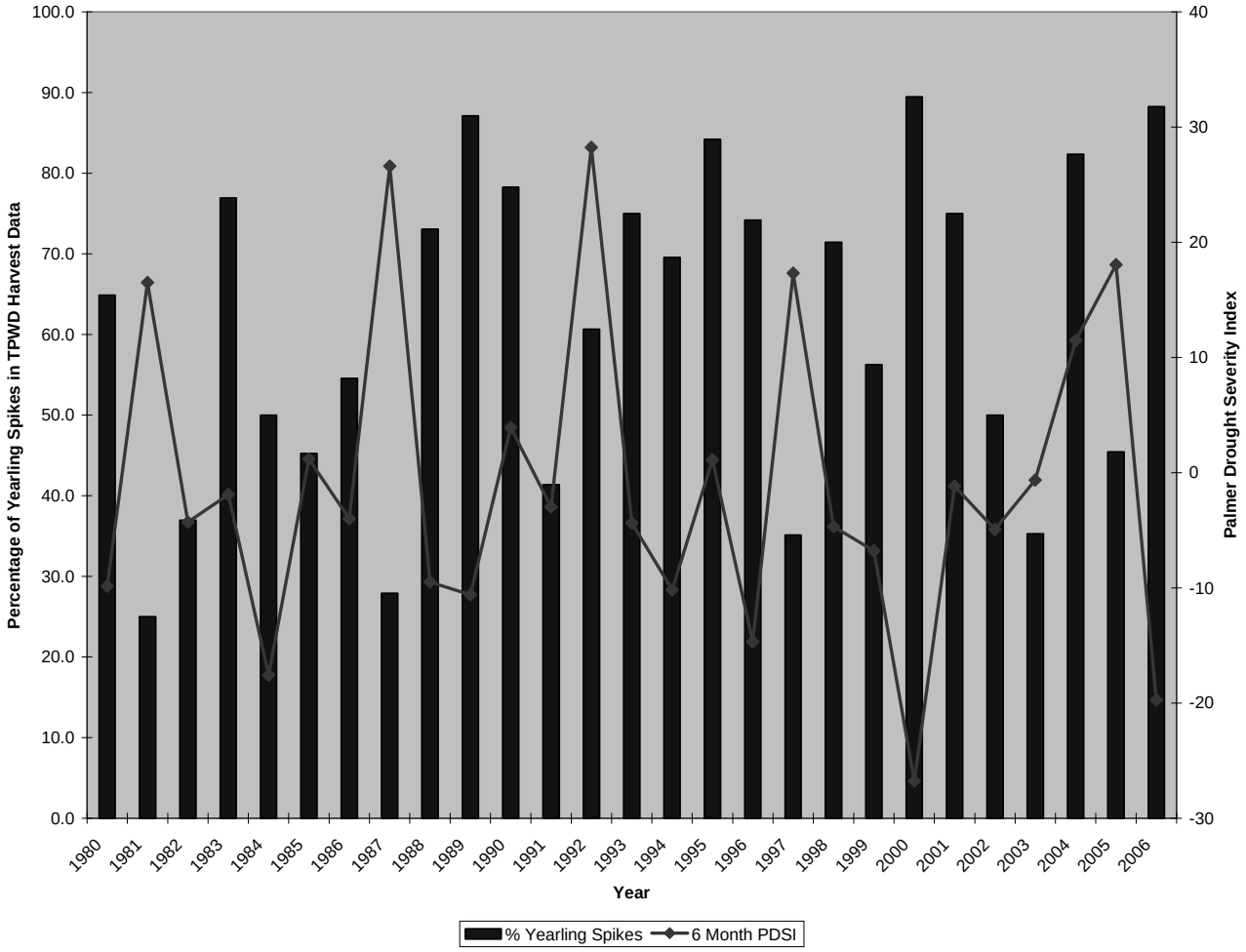


Figure 2. Mule deer yearling spike occurrence in TPWD harvest data compared with the Palmer Drought Severity Index for March-August during 1980-2006.

INFLUENCE OF PDSI ON MULE DEER BUCK ANTLER CHARACTERISTICS AND FIELD-DRESSED WEIGHTS

As stated previously, nutrition is a key component in antler development. Harmel et al. (1989) found that white-tailed deer bucks fed a 16% protein diet developed better antlers and gained more weight than bucks fed a 8% protein diet. It is important for deer managers to understand the influence drought has on antler characteristics and weights before culling intensively. To compare antler measurements and field-dressed weights we combined years with March-August PDSI values $\leq$ -10 to represent drought years, and favorable rainfall years were signified by March-August PDSI values $\geq$ 10. Field-dressed weights were not collected in 1981; therefore, it was not included in the sample for wet PDSI years.

Mean number of points for bucks 1.5-5.5 years old (ranged from 0.5-0.7 points) was impacted more by climatic conditions than bucks ≥ 6.5 years old (ranged from 0.2-0.3 points). Mean inside spread of bucks ≥ 4.5 years of age differed more during dry vs. wet PDSI years than immature bucks. The age class with the greatest inside spread difference was 8.5 years (2.1"). Mean basal circumference for most age classes was influenced slightly by drought severity; however, the 4.5-6.5 and 8.5 year old age classes increased 0.4-0.5" between dry and wet PDSI years (Table 6, 7). Average field-dressed weights fluctuated with PDSI values; the greatest variation occurred in mature bucks (5.5 year olds = 16.3 pounds) (Table 8, 9). Our data indicates climate has an affect on antler measurements and weights. When comparing inside spread, basal circumference, and field-dressed weight, older age classes are more impacted by drought; however, the influence of drought on antler points is more dramatic in the younger age classes. Therefore, deer managers should be cautious when applying intensive culling practices during drought, especially when using points as culling criteria for younger bucks. A good culling strategy may involve broad culling criteria on middle-age and mature bucks, while possibly including some poor-quality young bucks in favorable rainfall years. In drought years, a very selective culling strategy could be used on middle-age and mature bucks. Attempting to cull young bucks during drought could be detrimental if deer management goals include a balanced age structure and abundant mature bucks.

Table 6. Mean antler measurements (inches) of harvested Trans-Pecos mule deer bucks by age class from dry PDSI (PDSI values ≤ -10) years (1984, 1989, 1994, 1996, 2000, 2006).

Age Class	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	Total
Mean Number of Points	2.4	4.8	6.9	8.0	8.8	9.2	9.6	9.2	
Mean Inside Spread	7.0	11.6	14.5	16.4	17.6	18.3	19.0	17.9	
Mean Basal Circumference	2.0	3.0	3.6	4.0	4.4	4.6	4.9	4.8	
Sample Size	127	304	510	549	587	484	223	92	2,876

Table 7. Mean antler measurements (inches) of harvested Trans-Pecos mule deer bucks by age class from wet PDSI (PDSI values ≥ 10) years (1981, 1987, 1992, 1997, 2004, 2005).

Age Class	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	Total
Mean Number of Points	3.1	5.5	7.5	8.5	9.4	9.5	9.8	9.5	
Mean Inside Spread	7.7	12.4	15.4	17.8	19.3	20.1	20.3	20.0	
Mean Basal Circumference	2.3	3.2	3.8	4.4	4.8	5.1	5.2	5.2	
Sample Size	201	315	544	590	658	646	353	133	3,440

Table 8. Mean field-dressed weights (pounds) of harvested Trans-Pecos mule deer bucks by age class from dry PDSI (PDSI values ≤ -10) years (1984, 1989, 1994, 1996, 2000, 2006).

Age Class	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	Total
Mean Field-Dressed Weight	78.6	95.7	118.8	133.1	140.1	148.0	155.5	145.8	
Sample Size	22	72	136	178	229	215	118	43	1,013

Table 9. Mean field-dressed weights (pounds) of harvested Trans-Pecos mule deer bucks by age class from wet PDSI (PDSI values ≥ 10) years (1987, 1992, 1997, 2004, 2005).

Age Class	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	Total
Mean Field-Dressed Weight	80.9	104.2	123.9	143.1	156.4	157.6	163.7	161.9	
Sample Size	39	44	95	163	212	252	146	51	1,002

LITERATURE CITED

DeYoung, R. W., S. Demarais, R. L. Honeycutt, K. L. Gee, and R. A. Gonzales. 2006. Social dominance and male breeding success in captive white-tailed deer. Wildlife Society Bulletin. 34(1):131-136.

Frels, D., and J. R. Ott. 2007. Comparative mating success of male white-tailed deer in relation to age and perceived quality. Page 31 in M. Cox, editor. Proceedings of the 6th western states and provinces deer and elk workshop-2005, Nevada Department of Wildlife, Reno, Nevada.

Harmel, D. E. 1989. Effects of genetics and nutrition on antler development and body size of White-tailed deer. Federal Aid Report Series No. 26. Texas Parks and Wildlife Department, Austin, Texas. 55 pp.

Harmel, D. E., W. E. Armstrong, E. R. Fuchs, E. L. Young, and K. D. McGinty. 1998. Case study: the Kerr area penned deer research facility. Pages 40-46 in K. A. Cearley, editor. Proceedings of the symposium on the role of genetics in white-tailed deer management, 2nd edition, Texas A&M University, College Station, Texas.

Jacobson, H. A. 1995. Age and quality relationships. Pages 103-111 in K. V. Miller and R. L. Marchinton, editors. Quality whitetails: The way and how of quality deer management. Stackpole books. Mechanicsburg, Pennsylvania. 322 pp.

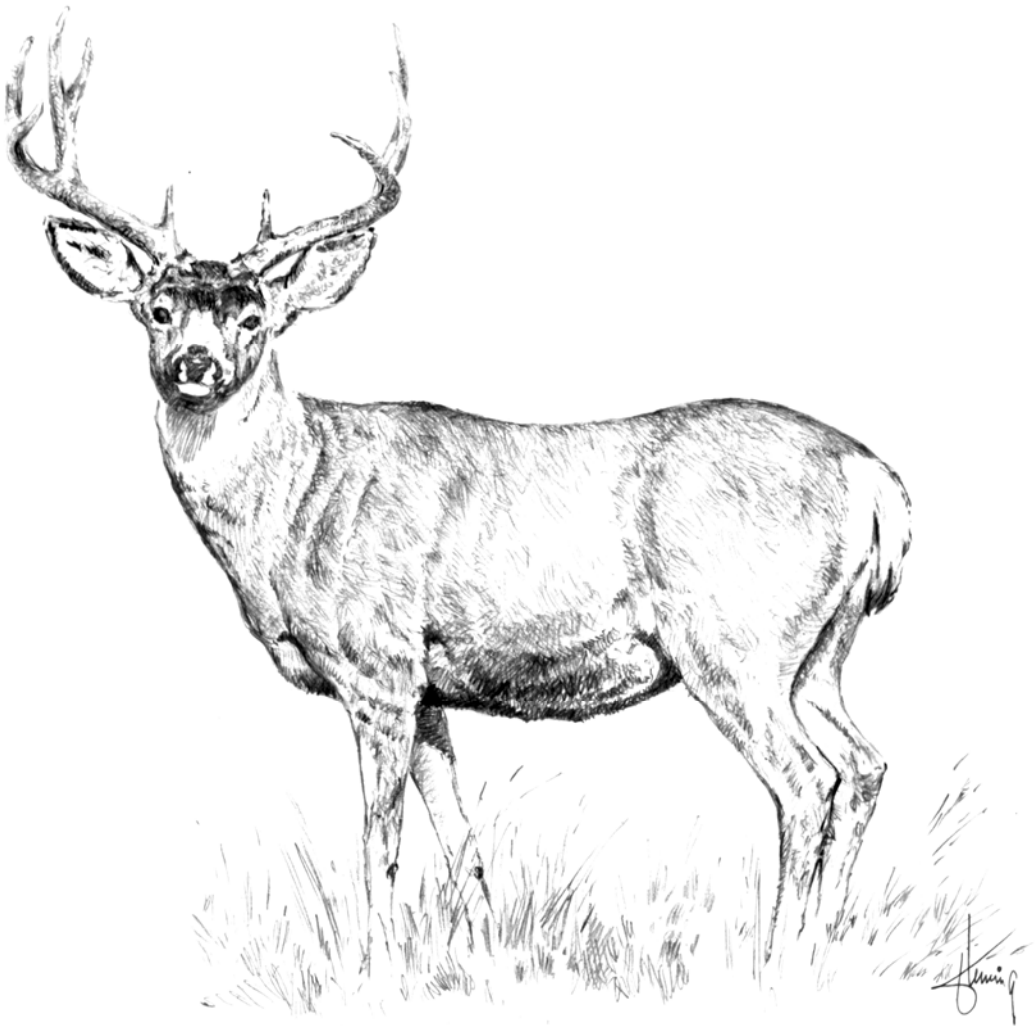
McCoy, J. E., D. G. Hewitt, F. C. Bryant. 2005. Dispersal by yearling male white-tailed deer and implications for management. Journal of Wildlife Management. 69:366-376.

National Oceanic and Atmospheric Administration. The Palmer drought severity index, drd964x.pdsi.txt. May 27, 2008. ftp://ftp.ncdc.noaa.gov/pub/data/cirs/drd964x.pdsi.txt. (May 15, 2008).

Ott, J. R, J. T. Baccus, S. W. Roberts, D. E. Harmel, E. Fuchs, and W. E. Armstrong. 1998. The comparative performance of spike- and fork-antlered yearling white-tailed deer: the basis for selection. Pages 22-32 in K. A. Cearley, editor. Proceedings of the symposium on the role of genetics in white-tailed deer management, 2nd edition, Texas A&M University, College

Station, Texas.
Russ, W. B. 1993. Big game research and surveys: mule deer age determination. Federal Aid Project W-127-R-2, Job 53. Texas Parks and Wildlife Department, Austin, Texas. 9 pp.
_____. 1993b. Big game research and surveys: mule deer antler development under field Conditions. Federal Aid Project W-127-R-2, Job 57. Texas Parks and Wildlife Department, Austin, Texas. 10 pp.
Severinghaus, D. W. 1949. Tooth development and wear as a criteria of age in white-tailed deer. Journal of Wildlife Management. 13:195-216.

Poster Abstracts



STUDY OF THE ECOLOGY, HARVEST FACTORS, AND POPULATION OF *FOUQUIERIA SPLENDENS* (OCOTILLO) IN THE CHIHUAHUAN DESERT

***CATHERINE BROWN**, Department of Natural Resource Management, Sul Ross State University, Box C-16, Alpine, TX 79832*

***BONNIE J. WARNOCK**, Department of Natural Resource Management, Sul Ross State University, Box C-16, Alpine, TX 79832*

Abstract: Literature research conducted on *Fouquieria splendens* (ocotillo) will determine background information on ocotillo life cycle and role in supporting biodiversity within the community. The rèleve method will be used to estimate density based on reference stands. Known ocotillo stands will be mapped and modeled in GIS and will be used as reference stands. Baseline data will be obtained from reference stands; modified timber cruising instruments will be used to collect population and ecology data. The reference stands will define categories based on: density, quality, and accessibility of ocotillo. A hand drawn field map will document the total known ocotillo stands for the O2 Ranch. The field map stands will be assigned categories based on the reference stand categories. This information will be used to extrapolate the ocotillo population on the O2 Ranch. The field map will be used to ground truth the predictive model that will be created using Logistic Regression technique. Reference stands close to tipping rain gauges will be monitored; growth rate, precipitation, and seed production data will be collected and analyzed. This data should identify, if and when, critical stages of seed production occur in ocotillo. This data will provide insight into harvest recommendations for different habitat sites in Brewster and Presidio counties. We will begin a preliminary harvest study to determine survival rate of single stems cut from living ocotillo plants. A fast technique for cruising ocotillo stands will be developed to obtain data and so that future monitoring can be maintained which may reveal actual recruitment from seed production. Further information will be collected on the market for harvested ocotillo including: market potential, size class and shape targeted for market, and market cost/return for harvest and sale of ocotillo.

PREDICTIVE HABITAT MODEL FOR THE BLACK-TAILED PRAIRIE DOG IN BREWSTER COUNTY, TEXAS.

***STACY M. DUCKETT**, Department of Natural Resource Management, Sul Ross State University, Box C-16, Alpine, TX 79832, USA*

***BONNIE J. WARNOCK**, Department of Natural Resource Management, Sul Ross State University, Box C-16, Alpine, TX 79832, USA*

Abstract: Black-tailed prairie dogs *(Cynomys ludovicianus)* were once abundant in short and mixed grass prairies of the United States. Their decline in numbers can be attributed to poisoning, recreational shooting, plague, and habitat fragmentation and conversion. Currently in Texas they occupy less than 0.5% of their former geographic range. Records indicate an historical distribution of black-tailed prairie dog colonies in the Trans-Pecos region. Translocation to known areas of habitat or to potential areas of habitat can facilitate recovery of their populations. We developed a predictive model for habitat of the black-tailed prairie dog in Brewster County, Texas, using logistic regression modeling and analyzed 6 habitat variables with 5 of the variables included in the final model. The model can be used in fine-scale assessment of potential habitat.

DEMOGRAPHICS OF AN URBAN DEER POPULATION, TRANS-PECOS, TEXAS

***DANIEL A. FERRIS**, Department of Natural Resource Management, Sul Ross State University-Alpine, TX 79832 mojobobsue@gmail.com*

***LOUIS A. HARVESON**, Department of Natural Resource Management, Sul Ross State University-Alpine, TX 79832*

***PATRICIA MOODY HARVESON**, Department of Natural Resource Management, Sul Ross State University-Alpine, TX 79832*

Abstract: Management of urban deer has become a priority in many parts of the country in recent years. Few studies have evaluated mule deer use of urban areas. We analyzed habitat use, survival rates, and recruitment of desert mule deer in and near Alpine, Texas. Thirteen desert mule deer does *(Odocoileus hemionus)*, were captured and radio-collared during the winter of 2006-07 at 4 trap locations in or near the city of Alpine, 7 more were radio-collared during the winter of 2007-08. Deer were radio-located 8 times a month during 4 time blocks during the day and night. Fawn production was monitored by walk-ins on collared deer during August and September. The Kaplan Meier survival rate for 19 mule deer does captured and tracked during the first 1.5 years was .70833 (S.E. = 0.109966). Annual home ranges sizes of these mature (2.5 year old+) doe (n=8) ranged from 2575.06 acres to 4893.65 acres. 8 of the 11 does gave birth to fawns during the first summer of the study. Three does had twins and 5 had singles. Typical fawn sights included were gravelly hill sites (n=6) and draw and loamy sites away from the hillside to a lesser degree (n=2). Habitat use was figured with point-study area selection, to find critical habitats for urban deer by season, by time block and both time block with in a season. Habitats most utilized by urban mule in trans-pecos, Texas were gravelly hillsides, parklands, draws and urban draws

OCCUPANCY MODELING AS A METHOD FOR MONITORING MONTEZUMA QUAIL POPULATIONS IN WESTERN TEXAS

CRISTELA GONZALEZ *, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

FIDEL HERNÁNDEZ*, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

STEPHEN J. DEMASO*, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

ERIC J. REDEKER*, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

LOUIS A. HARVESON*, Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79830*

DAVE A. HOLDERMANN*, Texas Parks and Wildlife Department, Alpine, TX 79830*

FROYLÁN HERNÁNDEZ*, Texas Parks and Wildlife Department, Alpine, TX 79830*

LEONARD A. BRENNAN*, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

ROBERT M. PEREZ*, Texas Parks and Wildlife Department, Alpine, TX 79830*

Abstract: Little information exists regarding the life history and ecology of Montezuma quail (*Cyrtonyx montezumae)* in Texas. The secretive nature and cryptic plumage of this species makes obtaining basic ecological information difficult. Developing an effective population monitoring program for Montezuma quail is a challenge because the technique must be practical for surveying vast landscapes and provide reliable population trends while taking into account the quail's low detectability. We propose to use a presence-absence approach to estimate occupancy, detection probability, and abundance of Montezuma quail. We also will quantify vegetation type, elevation, aspect, slope, and food-plant density at each monitoring site to develop resource-selection functions for the species. Research will be conducted on Elephant Mountain Wildlife Management Area (Brewster County) and Davis Mountains Preserve (Fort Davis County) during July–August 2007 and 2008. Thirty monitoring sites will be surveyed 5 times per season with the following data collected: time of day, temperature, humidity, number of calling individuals, and total number of calls. A playback recording of a male buzz call will be played for a duration of 10 minutes to detect presence. This study will provide the necessary data to assess the current status of the Montezuma quail, monitor population trends, and guide conservation efforts.

BIODIVERSITY OF MESOCARNIVORES ALONG RIPARIAN AREAS OF THE BIG BEND NATIONAL PARK

LORNA HERNANDEZ-SANTIN, *Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79832*

LOUIS A. HARVESON, *Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79832*

BONNIE J. WARNOCK, *Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79832*

Abstract: Most of Big Bend National Park's (BBNP) data for presence and distribution are based on tourist and employee observations (Raymond Skiles and Vidal Davila, National Park Service, personal communication). The objective of this study was to document and describe mesocarnivore biodiversity and relative periods of activity, based on presence and absence data. We selected 6 camera trap-lines of 6 km each (using 3 cameras per trap-line); and 9 cameras, which were shifted between sites. Species accumulation curves were created using EstimateS. Relative periods of activity were recorded based on 3 classes: pictures taken during the night, day, or crepuscular hours. A total of 126 days were sampled between fall 2006 and spring 2007. During this time, 142 pictures were taken; with 51% represented by medium-sized carnivores (n = 80). Of these, 63 pictures were considered as different individuals. Seven mesocarnivore species were documented: grey fox (48% of the mesocarnivore pictures), coyote (17%), bobcat (13%), western hog-nosed skunk (10%), striped skunk (8%), ringtail (3%), and raccoon (2%). The most diverse sites were Panther Junction (n = 4), Dog Canyon area (n = 4), followed by Rio Grande west side (n = 3), Terlingua Creek (n = 2) and Rio Grande east side (n = 2), and finally Fossil Exhibit area with only one species. The species accumulation curve reached the asymptote for the study area. Of the 63 pictures taken, 57 were taken during the night, 4 during day, and 2 at crepuscular hours. Problems encountered during this study include low number of sample sites, wind triggering cameras through moving vegetation, animals crossing too fast to appear on the picture, and triggering cable cut at one site. Moreover, most of spring data was lost due to flooding. This makes it inappropriate to compare seasons or sites. This study provides evidence for most of the medium-sized carnivores registered in BBNP (1973), where 7 out of 13 were documented. Those not documented here are considered rare or very rare. This shows that low-budget monitoring studies such as this can provide good data that can be used to better inventories and provide insight into the natural status of these species which contribute to "estimate" the health of this and similar environments.

AN EVALUATION OF LANDSCAPE CHANGES OF MULE DEER HABITATS IN TRANS-PECOS, TEXAS.

DUSTIN L. HOLLOWELL*, Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79832*

LOUIS A. HARVESON*, Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79832*

Abstract: Desert mule deer (*Odocoileus hemionus)* populations throughout the western United States have experienced unprecedented declines. According to unpublished Texas parks and wildlife data, Texas desert mule deer have shown a decline over the last 20 years. Although the decline is likely an indirect result of prolonged drought, little information exists on causative factors leading to the decline. Mule deer populations have declined at a landscape-level, indicating a need for an assessment of causative factors at a broader scale than previous research on Trans-Pecos mule deer. We initiated a landscape-level study to evaluate region-wide declines of desert mule deer in Trans-Pecos, Texas. Our objective is to evaluate habitat changes (e.g. brush encroachment, habitat fragmentation, and changes in land-use patterns) relative to trends of desert mule deer populations in the 9-county area of the Trans-Pecos. Remotely sensed imagery will be acquired from 3 time periods corresponding to changes in mule deer abundance: mid-1980's, mid-1990's, and mid-2000's. Imagery will be registered and classified in a GIS database and change-detection analysis will be performed to assess habitat change. We will evaluate relationships between landscape features and mule deer demographics at management compartment, county, and region-wide scales. The result of this project will be important to resource managers as they begin to actively manage desert mule deer habitat in the Trans-Pecos region of Texas.

GENETIC VARIATION OF PRONGHORN HERD UNITS IN TRANS-PECOS, TEXAS

***RENEE KELEHER**, Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79832*

***LOUIS A. HARVESON**, Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79832*

***RANDY W. DEYOUNG**, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

***BILLY TARRANT**, Texas Parks and Wildlife, 109 S Cockrell St., Alpine, TX 79830*

***CALVIN L. RICHARDSON**, Texas Parks and Wildlife Department, 4500 W. Illinois, Suite 203, Midland, TX 79703; c.richardson@suddenlinkmail.com*

Abstract: Pronghorn *(Antilocapra americana)* movements are restricted by topographic barriers such as mountain ranges, canyons, railroads, highways and fences. It is plausible to predict that such restrictions could influence population structures and genetic variation of pronghorn in west Texas. Further, pronghorn numbers have steadily declined over the last 10 years and reached a 20-year low of 5,000 animals in 2001. An evaluation of pronghorn population dynamics and movement barriers may identify factors contributing to their population decline. Information from this study can be utilized in future management recommendations. Genetic techniques are becoming more common in management and conservation strategies. Relatively new molecular markers such as DNA microsatellites have greater resolution for characterizing individuals. Also, microsatellites are useful in examining fine-scale population structure such as herd unit relatedness, dispersal, inbreeding, immigration, and isolation. Our goal is to identify geographic patterns of genetic similarity in order to delineate management units that reflect current aggregations of pronghorn in west Texas. Based on our results, management strategies will be able to focus on identified isolated areas and current barriers to herd movements. Tissue samples were collected from 165 harvested pronghorn during the 2007 hunting season. Eight microsatellite markers were used in molecular analysis of the pronghorn population. Genetic variation of pronghorn in the Trans-Pecos may be more complex than current evidence suggests. An updated study will provide a foundation for formulating management recommendations to ensure the health and viability of pronghorn in Texas.

EVALUATION OF A RENITRODUCED DESERT MULE DEER POPULATION IN THE CHIHUAHUAN DESERT ECOREGION OF MEXICO.

***ALFONSO ORTEGA-SANCHEZ**, Department of Wildlife and Fisheries Sciences, 318 Nagle Hall, Texas A&M University, College Station, TX. 77843*

***JOSE DE LA LUZ MARTINEZ GARCIA**, Department of Natural Resources Management, Box C-16, Sul Ross State University, Alpine, TX. 79832*

***LOUIS A. HARVESON**, Department of Natural Resources Management, Box C-16, Sul Ross State University, Alpine, TX. 79832,*

***ROEL R. LOPEZ**, Deptartment of Wildlife and Fisheries Sciences 318 Nagle Hall, Texas A&M University College Station, TX 77843*

***BILLY PAT MCKINNEY**, Proyecto El Carmen, Del Rio, TX 78840*

Abstract: Most of the Chihuahuan Desert in Mexico and the United States was historically populated by desert mule deer. Very few studies have been conducted on their ecology. In an effort to reintroduce desert mule deer Northern Coahuila, Mexico, we initiated a study investigating habitat preferences, site fidelity, home ranges, and post-release movements of radio-collared mule deer in northern Coahuila. A total of 82 radio-collared deer have been transolcated from the Trans-Pecos region of Texas to the Sierra del Carmen region in Mexico. The release sites included Rancho Guadalupe and Maderas del Carmen. Release methods included soft and hard release. Radioed mule deer were located 3 to 5 times a week. Mortalities were investigated immediately to ascertain cause of death. Preliminary data shows that following release, mule deer tended to be in groups ranging from 4 to 8 deer. Soft-released mule deer showed difference ($P < 0.05$) in fidelity to the release site from hard-released mule deer. Homeranges showed great variation among individuals and seems to be affected by predation events. Mountain lions and capture myopathy were the 2 primary causes of death in our study.

SIGHTABILITY MODELS FOR AERIAL SURVEYS OF MULE DEER IN TEXAS

***CODY J. ZABRANSKY**, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

***DAVID G. HEWITT,** Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

***RANDALL W. DEYOUNG,** Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

***LOUIS A. HARVESON**, Department of Natural Resources Management, Box C-16, Sul Ross State University, Alpine, TX. 79832*

***CALVIN L. RICHARDSON**, Texas Parks and Wildlife Department, 4500 W. Illinois, Suite 203, Midland, TX 79703*

***ERIC J. REDEKER**, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

***CHARLES A. DEYOUNG,** Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

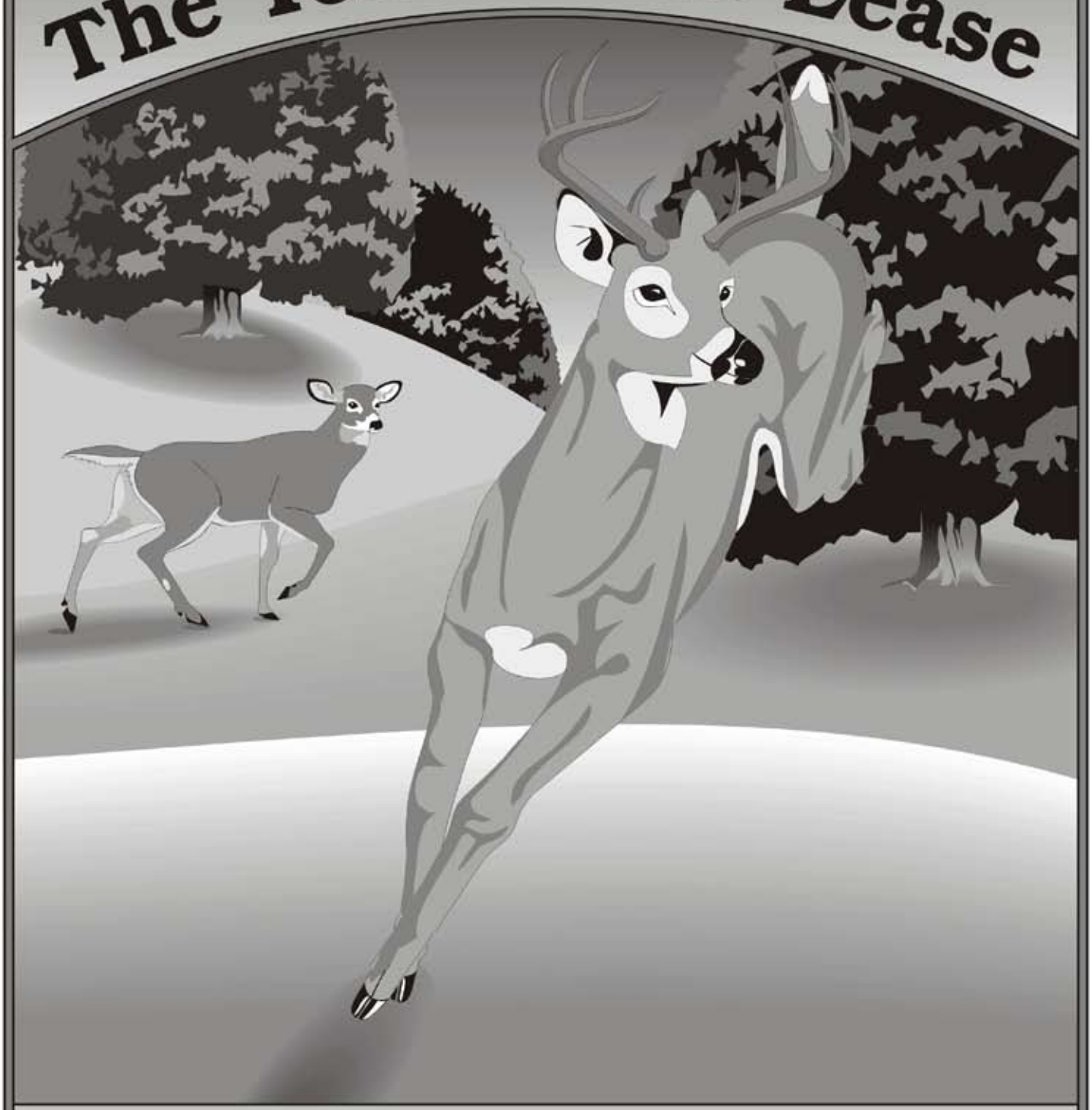
Abstract: Effective wildlife management requires knowledge of population size and composition. Such information has become particularly important in management of mule deer given range-wide population declines. The value of currently used mule deer population data is limited as not all deer are seen during aerial surveys. The resulting trend data are not nearly as valuable as unbiased population estimates in setting regulations and goals for mule deer management in Texas. The objective of this research project is to develop a sightability model for use in estimating mule deer population size and composition. Thirty-six collared deer on each of two study sites will be used to identify and quantify factors affecting visibility of mule deer during helicopter surveys. This study design will be used in each of 3 years in different parts of the mule deer's range in Texas.

Preliminary data suggest that doe visibility (52%) averages slightly higher than visibility of bucks (46%). Half (49%) of collared mule deer were seen in rolling piñon-juniper whereas about 40% of collared deer were seen in rolling terrain with denser, varied vegetation. These preliminary results suggest that uncorrected aerial survey data may not accurately estimate mule deer population size in Texas.

Appendix

REAL ESTATE CENTER

The Texas Deer Lease



Judon Fambrough
Senior Lecturer and Attorney at Law

Technical Report 570

The Texas Deer Lease

Judon Fambrough
Senior Lecturer and Attorney at Law

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The Texas Deer Lease

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The Real Estate Center staff appreciates the contributions of the late D. Dean Patton, an attorney with Morrill, Patton and Bauer in Beeville. He allowed the Center to use his materials and consulted in drafting this report. Patton wrote "Agricultural, Hunting and Grazing Leases," 13th Annual Advanced Real Estate Law Course, 1991, sponsored by the State Bar of Texas Professional Development Program.

The Texas Deer Lease

Judon Fambrough

Senior Lecturer and Attorney at Law

Deer hunting is big business in Texas. Hunting leases continue to be a constant source of revenue for many Texas land-owners following cycles in the agriculture and petroleum sectors.

Texas landowners hold a unique position. Unlike many other states, Texas has little federally or state-owned land available for public hunting. Thus, private landowners control the major supply of huntable land. This position affords Texas landowners a unique source of income.

Location of the deer and not the ownership of the animals, however, generates the revenue. In Texas, all indigenous wild animals such as white-tailed deer belong to the state. As such, the state regulates the taking of game through hunting laws.

Although the state regulates when, how and the number of deer that may be taken, the state cannot authorize trespassing on privately owned land. Independent permission from the landowners must be secured. Granting the right to enter and hunt generates the income.

Historically, permission to hunt was granted for the asking. Recently, however, Texas landowners began exacting a price for this privilege in the form of an agreement commonly referred to as a *hunting lease*. Depending upon the size of the lease tract, the abundance of game and the amenities available to the hunter, prices may range from a few dollars per day to thousands of dollars per season. The lease may last a few hours, a few days, several weeks or the duration of the hunting season.

The so-called Texas hunting lease is not, in fact, a lease but rather a license. Technically, a lease is a contract that conveys exclusive possession or control of land to another for a specified period. A license, on the other hand, grants permission to do something that otherwise would not be allowed or would be illegal. Because the typical Texas hunting lease does not grant the hunter exclusive possession or control of the land, it is better characterized as a license. However, in this publication, the term *lease* is used.

The hunting lease takes numerous forms. It may be granted orally on the payment of a specified amount of money. Or, it may be given by way of an elaborate written document covering all aspects of the hunt, including how the landowner's property may be used.

Whether the lease is oral or written, the landowner and hunter should concur on key issues before consenting to the agreement. By doing so, each party knows what to expect and thereby avoids possible misunderstandings. The terms of the agreement may affect the lease price.

Duration of Lease Term

The agreement should specify the beginning and end of the lease term. If the hunter has the privilege to scout the premises, set up feeders, erect blinds or conduct other similar projects before the season, this should be stated.

Description of Lease Tract

The exact area on which the hunting privilege is granted, to the exclusion of all others, should be described. If a legal or metes-and-bounds description is not available, a sketch or plat is the next best thing. The lease should prohibit the hunter from entering other property except to access the hunting premises.

Access to Lease Tract

If the land does not have a public access, the specific route or routes for the hunter's ingress and egress should be designated. When there is more than one public access, the landowner may wish to restrict the hunter's use to only one or two.

Game to Hunt

Generally, the primary game animal is white-tailed deer. Other game may be present such as doves, quail, ducks, turkeys, pigs, exotics and varmints. The agreement should state what game may be taken and when. Some leases may deny quail hunting until the deer season closes. Other limitations may apply. The price of the hunting lease may rise with the permission to hunt more game.

Hunting Weapons

The parties need to agree on types of weapons that may be used. The list may include all legal weapons or may be limited to centerfire rifles, muzzleloaders, shotguns or bows, depending on the game hunted.

Hunting Method

The hunting method, in part, is related to the types of weapons that may be used. The agreement may limit shooting to blinds only, may restrict shooting from a vehicle or may allow stalking only during bow season. Some leases may allow certain types of hunts only when a guide or designated individual accompanies the hunter.

Dogs may be prohibited or limited to pursuing quail and doves or trailing wounded deer.

It is against the law to hunt deer at night. However, it is legal to hunt some other game such as raccoons. The lease should state whether night hunting is permitted. It may be prohibited during deer season.

Number of Hunters and Guests

The number of hunters who participate in a particular lease needs to be specified. Generally, the landowner will specify the maximum number or enter individual agreements with each hunter or group of hunters. However, the lease needs to state whether guests

of hunters will be allowed and when. If hunting guests are allowed, the quantity of game the guests may take must be determined. For instance, if the game limit on deer is four per hunter per season–i.e., two bucks and two does, can a guest hunter harvest a deer in addition to the four allowed the lease hunter who invited the guest?

Also, if guests are permitted, must the host hunter accompany (or be on the premises with) the guests? Children below a certain age may not be permitted to hunt, or the landowner may require that they be physically accompanied by an adult at all times. Landowners assume additional risks and liability for children on the premises. (See pages 5 and 6 for more details.) Are hunters responsibile and liable for the acts of their guests?

Finally, the maximum number of both hunters and guests present on the leased premises at one time should be stipulated.

Order of Deer Taken

Many Texas hunters want trophy deer only. For those hunters, harvesting a doe is out of the question; however, to ensure that an adequate number of does is harvested, the landowner may require one or more does to be taken before a buck.

Harvesting Surplus Does

Much of Texas is overrun by does. The buck-to-doe ratio in some areas exceeds 1 to 10. Even with hunters taking their limit, the surplus persists. For this reason, the landowner and hunters may wish to address the problem.

Here are two possible solutions. First, the landowner and hunters may agree to allow a special doe hunt sponsored by the Texas Game Warden Association for underprivileged children. The children are introduced to hunting, and surplus does are harvested at the same time.

Second, hunters may donate unwanted does to the Hunters-for-the-Hungry Program. The hunter must pay a nominal fee to a participating locker to process the meat for needy families. For more information on the program, contact the local chamber of commerce or the local game warden or call the Texas Parks and Wildlife Department's toll free number, 800-792-1112.

The landowner and hunters may agree that if a certain number of does is not harvested by a given date, guests of either the hunters or landowner may take a specified number before the season ends. The meat may be kept by the guests or donated to the Hunters-for-the-Hungry Program.

Lease Price

The price of the lease per year, per day, per hunter or per animal needs to be set. The price may vary according to the lease terms. For instance, the lease price may rise as the duration of the lease, the number and variety of game animals allowed, the lease tract size, the types of weapons and permitted hunting methods increase.

Some deer leases are priced by the sex and quality of the deer. For example, there may be one price for each doe, while the price for bucks varies with antler quality.

Payment Schedule

The lease may be paid either in lump sum when privileges begin or periodically throughout the year. Generally, the landowner will require partial payment before the hunting season to ensure that the hunter will honor the contract on opening day. The agreement should address the consequences of missing an installment payment. Are all prior payments forfeited or may the landowner pursue the hunter in court for the balance?

Effective September 1, 1997, landlords have a duty to mitigate rent if the tenants breach the lease by leaving early. The Texas courts may apply this rule to hunting leases.

Use of Facilities

The lease price should reflect the quantity and quality of hunting facilities available to the hunter. Any hunting facilities on the lease usually are at the disposal of the hunter, but this should be clarified before hunting begins. The manner in which the facilities are maintained should be specified. For instance, which party has the duty to clean the premises, repair broken appliances, windows, plumbing or maintain the roads?

If the lease does not have overnight accommodations, or if they are not available to the hunter, the parties need to decide if overnight camping will be permitted and where. Fires may be restricted and cleanup required.

Clearing Senderos and Improving Premises

If the lease permits the hunters to maintain and improve the lease by clearing and maintaining senderos (cleared lanes for shooting), improving the roads and crossings, bringing in electricity, digging water wells, erecting a camphouse and so forth, the tasks may be at the hunter's discretion. The expenses, however, may be borne solely by the hunter, solely by the landowner or shared, depending on the agreement.

If the hunter is entirely or partially liable for the expenses, the lease agreement should prohibit the attachment of any liens on the property by virtue of the improvements.

Vehicular Travel

On certain parts of the lease, vehicular travel may be restricted. Landowners may prefer that the hunter use only existing roads. The use of off-road or four-wheel drive vehicles, except on existing roads, may be prohibited. Others may allow off-road travel but not across improved pastures, cropland, wet ground or other inappropriate areas. Depending on the terrain, speed limits may be imposed.

Blinds and Game Feeders

Most Texas deer are taken from blinds. The blinds may be provided by the landowner or erected by the hunter. Permission to use pre-existing blinds should be discussed as well as the hunter's installation of new ones.

In particular, an agreement should stipulate the:

- landowner's liability, if any, for injuries incurred by hunters using the blinds;
- necessity of obtaining the landowner's permission for both the construction and location of blinds and game feeders installed by the hunter and the construction of any senderos incidental thereto;
- fate of blinds and feeders installed by the hunter but not removed within a designated period after the lease terminates; and

- duty of the landowner, if any, to fill and maintain feeders both before and during the hunting season.

To lure game off adjacent property, hunters may erect feeders on fence lines and harvest crossing game. Although the practice is legal, it may create hard feelings. For this reason, landowners may require prior permission for locating and installing game feeders and blinds near boundary fences.

Also, to ensure the presence of game and a fairer hunt, the landowner may prohibit hunting within a certain distance from watering holes and feeders. Alternatively, the landowner may restrict hunting around certain feeders maintained exclusively by the landowner.

Regardless of the location of blinds, the agreement should prohibit shooting across boundary fence lines.

Handling Harvested Game

Landowners may stipulate where deer may be hung and cleaned. Likewise, the disposal of the carcass and other inedible parts may be restricted if deer are cleaned and quartered on the leased premises.

Gates and Keys

The lease usually requires the hunter to keep all gates shut and possibly locked. If the hunter is given a key, it should be returned at the termination of lease privileges.

Right of Inspection

The landowner may reserve the right to inspect the camphouse, motor vehicles and the game bags of hunters and guests on the leased premises for compliance both with the lease terms and game laws. The same privilege extends to any game warden with the Texas Department of Parks and Wildlife.

Camp Safety

The agreement may impose certain safety rules around the camphouse. In particular, procedures to ensure that all guns are checked and unloaded should be implemented. Also, consumption of alcohol may be prohibited.

Transferability of Lease Rights

The lease should address whether the rights and obligations of either party to the agreement may be transferred or assigned. The lease may permit a transfer but only with the other party's prior consent. If all or a part of the leased premises are sold—i.e., transferred, during the lease term—the impact, if any, on the lease should be addressed.

Hunting Rights of Landowner

Generally, the lease grants the hunter or hunters the exclusive right to hunt. However, if it is not stated, some understanding should be reached concerning the right of the landowner, the landowner's family and guests to hunt.

Right of Renewal

The hunter and the landowner may want to undertake long-term projects to enhance the habitat and hunting facilities. Because most leases are on a short-term basis, the hunter may want to include a right of renewal in the lease so the hunter can reap the long-term benefits from such projects. Likewise, the landowner may insert a renewal clause because of the favorable relationship the two parties have established.

Compliance with Game Laws and Recordkeeping

Obviously, the hunter must comply with state hunting laws. The agreement should state this so a game law violation breaches the contract.

Until September 1, 1997, hunters had to complete a daily hunting ledger required by Section 43.0485 of the Texas Parks and Wildlife Code. The name, address and hunting license number of each hunter was entered along with the number and type of game harvested each day. The ledger is now optional with the landowner.

In addition to the ledger, landowners may initiate a sign-in and sign-out sheet posted at the entry to the property. Upon entering the property, the landowner determines who is on the property and where.

Finally, the landowner may want other pertinent information concerning each harvested deer. The landowner may require the hunter to:

- measure and record the spread and number of antler tines;
- record the weight;
- furnish photographs of the front, back and sides of each buck;
- save and provide to the landowner the lower jaw or one side of the lower jaw; and
- identify on a map the approximate location where each deer was taken.

In some trophy-hunting areas, landowners require hunters to mount the head of a trophy buck and display it at the ranch's headquarters for a specified period.

Cooperation with Other Surface Users

Hunters must share the use of the surface with the landowner or with other lessees. This includes those with grazing leases, farming leases and oil and gas leases. The lease needs a cooperation clause whereby the hunters agree to cooperate with other surface users and not infringe on their rights.

At the same time, conflicts may arise. For example, hunters using roads built by oil companies; oil companies drilling in prime hunting areas; landowners clearing habitats for agricultural use; livestock ruining or destroying feeders and blinds; and hunters killing or injuring livestock or damaging fences and gates all create potential problems.

The lease needs to address how to resolve the conflicts.

Filing Lease of Record

In some areas of the state, it is customary to record the lease agreements in the official county records. The lease can be recorded only if the parties sign the document before a notary public. Recording gives notice of the hunter's rights to the leased premises. The lease is effective, however, without being recorded.

The lease agreement may address recording. If either party insists on recording, a memorandum of the hunting lease may be prepared, executed by the parties before a notary public and recorded in lieu of the actual agreement. A memorandum gives effective notice of the hunter's rights without disclosing the details of the agreement.

Use for Non-Hunting Purposes

The hunter may want to use the leased premises for non-hunting purposes both in and out of hunting season. The activities may include camping, fishing, photography, target shooting and other recreational activities.

The activities permitted need to be described. Some limitation may apply as to where and when certain activities may be conducted in relation to the hunting season. Using bottles for targets should be prohibited.

Resolving Disputes

Probably one of the most difficult issues is establishing the consequences for breaching the lease agreement. If neither party abides by the agreement, the agreement is useless. To ensure compliance, some method of resolution needs to be established. Mediation or arbitration is a possibility.

Depending on the severity of the violation, the consequences may range from immediate termination of the lease without refunding the lease fees to the denial of certain privileges granted under the lease. This may include forfeiting the right to take a full limit of deer during the season or denial of the right to conduct off-season activities such as camping and fishing.

Obviously, the dispute resolution will be the most difficult issue to negotiate, yet it is vital to the overall agreement.

Imparting 'No Trespass' Notice

Texas landowners wishing to prevent trespassing and poaching should be aware of the methods described by the statutes. The Texas Penal Code (Section 30.05) states that a person commits criminal trespass in one of two ways. First, after receiving notice that entry is forbidden, a person enters and remains on the property without effective consent. Second, a person enters or remains on the property after receiving notice to depart.

Entry is defined as the intrusion of a person's entire body.

The statute describes five ways that landowners may impart notice that entry is forbidden. These include:

(1) oral or written communication by the owner or agent;

(2) fencing or other enclosures obviously designed to exclude intruders or to contain livestock;

(3) signs posted at places reasonably likely to come to the attention of an intruder;

(4) visible presence of crops grown for human consumption that are under cultivation, in the process of being harvested or marketable if already harvested; and

(5) identifying purple paint marks on trees or posts.

The statute elaborates on the last measure added September 1, 1997. The purple paint mark must be a minimum of one inch wide and eight inches long, placed three to five feet above the ground and readily visible to anyone approaching the property. The marks must be placed every 100 feet on forest land and every 1,000 feet on all other land. *Forest land* means land on which trees are potentially valuable for timber products.

The statute excludes fire fighters and emergency medical services personnel while discharging their official duties in an emergency.

A violation of the statute is a Class B misdemeanor unless the intruder carries a deadly weapon. Then, the violation is a Class A misdemeanor. Class A misdemeanors are punishable by a fine not to exceed $4,000, confinement in jail for no longer than one year or both. Class B misdemeanors are punishable by a fine not to exceed $2,000, confinement in jail for no longer than 180 days or both.

Hunting and Fishing Over Submerged Private Property

Effective September 1, 2005, a new statute imposes limits on hunting and fishing over certain submerged lands. The new law is found in Section 62.002 of the Texas Parks and Wildlife Code.

Basically, no person may hunt or take wild animals or wild birds over privately owned land that is submerged by public fresh water caused by seasonal or occasional inundation or by public salt water located above the mean high tide line of the Gulf of Mexico, its bays and estuaries. However, the prohibition applies only where the land is conspicuously marked as privately owned by a sign or signs saying "Posted," "Private Property," "No Hunting" or similar messages.

As for fishing, no person may fish or take other aquatic life on the same type of submerged lands except when the:

- person owns the submerged land,
- person obtains consent from the owner of the submerged land,
- land is dedicated to the permanent school fund and is located within the tidewater limits of Texas,
- land is dedicated to the permanent school fund and is located within the gradient boundaries of a navigable stream or
- land is submerged by public water and is located below the mean high tide line of the Gulf of Mexico, its bays and estuaries.

Poaching and Poachers

Many landowners and hunters believe poaching involves taking game out of season. In contrast, Texas statutory law defines poaching as trespassing to fish or hunt whether in or out of season. According to Section 61.022(a) of the Texas Parks and Wildlife Code, a person may not hunt, catch or possess a wildlife resource at any time or place without the consent of the landowner.

Poaching carries different penalties depending on the game killed and the number of times the poacher is caught. Generally, the first violation is a Class A Parks and Wildlife Code misdemeanor. This is punishable by:

- a fine between $500 and $4,000 and/or
- confinement in jail not to exceed one year.

However, if the first violation involves killing a desert bighorn sheep, pronghorn antelope, mule deer or white-tailed deer, the offense is a Parks and Wildlife Code state felony. This is punishable by:

- a fine between $1,500 and $10,000 and
- confinement in a state jail ranging from 180 days to two years.

The second violation shall be classified one category higher than the first violation or a Parks and Wildlife felony, whichever is less. The Texas Parks and Wildlife Code provides three

punishments for a violation. They are, in ascending order:

- Class A Parks and Wildlife Code misdemeanor,
- Parks and Wildlife Code state jail felony and
- Parks and Wildlife Code felony.

Consequently, the second violation will be either a Parks and Wildlife Code state jail felony or a Parks and Wildlife felony depending on the circumstances of the first offense.

The punishment for the third and subsequent violations is a Parks and Wildlife Code felony. This is punishable by:

- a fine between $2,000 and $10,000 and
- imprisonment for a term of two to ten years.

Other rules bear on the offense and the punishment. For example, each offense carries with it the automatic revocation or suspension of the poacher's current hunting and fishing license for one to five years. If the person applies for a hunting or fishing license during the term of the revocation or suspension, this is a separate offense punishable as a Class A Parks and Wildlife Code misdemeanor.

Also, each fish, bird or animal taken, killed or possessed is a separate violation. Consequently, if a poacher takes three white-tailed deer illegally, the punishment could go as high as the third offense.

To report poachers, call the Texas Parks and Wildlife Department at 800-792-1112.

Discharging Firearms Across Property Lines

Property owners and hunters alike should be aware of a change to Section 62.0121 of the Texas Parks and Wildlife Code effective September 1, 2005. The new law makes it a Class C Parks and Wildlife misdemeanor to "knowingly discharge" a firearm while hunting or engaging in recreational shooting when the projectile travels across a property line. A Class C Parks and Wildlife misdemeanor is punishable by a fine not less than $25 or more than $500.

The discharge across a property line is permissible as long as the same person owns the property on both sides of the line or has written permission from the other owner to fire on, over or across the property. The written agreement must contain the following:

- name of the person or persons allowed to hunt or engage in recreational shooting,
- identification of the property on either side of the property line and
- signature of the property owner whose land the projectile crosses.

Hunting in Fringe Areas in and Around Cities

The rule regarding the discharge of firearms across property lines needs to be read in conjunction with another new law permitting hunting on the fringe areas in and around municipalities. The statute took effect on September 1, 2005.

Basically, the statute provides that a city's governmental requirements (its ordinances) do not apply to any agriculture operations located outside the corporate limits that are subsequently annexed or otherwise brought within the city's jurisdiction.

The city may limit such agriculture operations as long as the requirements are reasonably necessary to protect persons in the immediate vicinity of the operations.

The definition of "agriculture operations" was expanded to include wildlife management.

Changes in the statute deleted the discharge of firearms from the list of activities a city may regulate but modified the prohibition to some degree. The law (Section 229.002 of the Local Government Code) now provides that a municipality may not regulate the discharge of firearms or other weapons in its extraterritorial jurisdiction or in an area annexed by the municipality after September 1, 1981, if the firearm or other weapon is a shotgun, air rifle, pistol, BB gun or bow and arrow and is discharged:

- on a tract of land 10 acres or more and beyond 150 feet from a residence or occupied building located on another property and
- in a manner not reasonably expected to cause a projectile to cross the boundary of the tract.

However, if the weapon is a center fire or rim fire rifle or pistol of any caliber, the municipality may not regulate the discharge if it occurs:

- on a tract of land 50 acres or more and beyond 300 feet from a residence or occupied building located on another property and
- in a manner not reasonably expected to cause a projectile to cross the boundary of the tract.

The end result is that hunting (the discharge of a weapon) is now permitted in and around the fringe areas of cities. However, the projectile cannot cross a property line whenever the weapon is "knowingly discharged."

Landowner's Liability to Hunters

A landowner's liability (or responsibility) for the safety of anyone entering the property depends on the legal classification of the person at the time of injury. There are four categories: an *invitee,* a *licensee,* a *trespasser* and *children under the attractive nuisance doctrine*. Theoretically, a hunter could fit in any one of these.

Fee-paying hunters are classified as invitees. Landowners have a legal duty to keep the premises safe for the invitee's protection. The landowner must give the fee-paying hunter adequate and timely notice of concealed or latent perils (dangerous conditions) that are personally known or that a reasonable inspection would reveal. Injuries caused by dangerous conditions that are apparent or that could be revealed by reasonable inspection are the landowner's responsibility, but comparative negligence may lessen the liability. (See reprint 893, "Landowner Liability for Hunters," for a complete explanation of comparative negligence.)

Nonpaying hunters with permission to hunt are classified as licensees. Landowners have a legal duty to warn licensees of known dangerous conditions or to make the conditions reasonably safe. No inspection is required.

Hunters who enter without permission are classified as trespassers. The landowner owes them no legal duty. The law prohibits the landowner from willfully or wantonly injuring a trespasser except in self-defense or when protecting property. The landowner is liable for gross negligence or for acts

done with malicious intent or in bad faith.

Trespassing children are protected by the attractive nuisance doctrine. (See reprint 475, "Landowners, Children and Perilous Conditions," for details.) An attractive nuisance exists when: the child is too young to appreciate or realize a dangerous condition; the location of the condition is one that the landowner knew or should have known children frequent; and the utility of maintaining the condition is slight compared to the probability of injury to children. The landowner may avoid liability if any one of these conditions is missing.

According to present revisions to Chapter 75 of the Texas Civil Practices and Remedies Code, agricultural landowners owe a recreational guest (hunter) no greater degree of care than is owed a trespasser if there is no charge for entry.

If there is a charge, the trespassory degree of care remains until the total charges collected during the previous calendar year exceed 20 times the total amount of ad valorem taxes imposed on the premises during the same period. Prior to September 1, 2003, the limit on charges was four times the amount of the ad valorem taxes.

However, even if the fee limit is exceeded, the trespassory degree of care continues if the landowner has specific amounts of liability insurance coverage in effect. These amounts are $500,000 for each person, $1 million for each single occurrence of bodily injury or death and $100,000 for each single occurrence for injury to or destruction of property.

Landowners achieve two advantages by having the minimum amounts of liability insurance. First, the trespassory degree of care continues to hunters when charges exceed 20 times the amount of the ad valorem taxes. Second, the stipulated amounts serve to cap the landowner's liability if sued for an act or omission relating to the premises.

If the fee limit is exceeded without the minimum liability coverage in effect, then the landowner faces the degree of care owed to either an invitee or licensee, whichever the case may be. The amount charged has no effect on the attractive nuisance doctrine.

The hunting lease becomes a two-edged sword. Landowners receive an economic benefit for allowing entry to hunt. At the same time, they bear the risk and responsibility for the hunter's safety.

What, then, are the landowner's alternatives for limiting liability?

First, the landowner may charge no fee or charge no more than four times the amount of ad valorem taxes imposed on the hunting premises. This is not a viable option for large-scale hunting operations or where agricultural-use valuation is taken.

Second, landowners who charge more than 20 times the amount of the ad valorem taxes may purchase liability insurance according to the specified minimum amounts.

Third, the landowner can do as the law dictates: inspect the property routinely and either warn the hunters of the dangerous conditions or make the conditions safe. This may be difficult because conditions change rapidly. Notifying all hunters of a dangerous condition may prove impossible.

Fourth, the landowner may require the hunters to purchase and assign a liability insurance policy to the landowner covering the landowner's liability to the hunters. The minimum coverage should equal or exceed the limits mentioned earlier. Again, the premiums may cause the lease price to become prohibitive.

If the hunters or recreational guests have insurance that covers them while on the property, the landowner must insist that he or she be designated an additional insured under the policy. Otherwise, the landowner may be sued by the insurance company after paying for any injuries sustained by the hunters or guests.

Fifth, the landowner may secure waivers from the hunters releasing the landowner from liability. A *waiver* is defined as the intentional relinquishment of a known right. To be effective, the release provision must meet seven standards.

First, the agreement must be based on an offer and acceptance between parties who have equal bargaining power. For this reason, a recent Texas appellate court ruled that parents cannot release, in advance, a minor's right to recover for personal injuries caused by the negligence of another *(Munoz v. II Jaz Inc. d/b/a Physical Whimsical, 863 S.W. 2d 207 [1993])*.

Second, the release agreement must be based on consideration, but it need not be monetary. The agreement not to sue in exchange for the right to hunt may be sufficient.

Third, the Texas Supreme Court requires an effective waiver agreement to state that the hunter indemnifies (releases) the landowner from any acts arising "from the landowner's negligence." This is sometimes referred to as the Express Negligence Doctrine *(Ethyl Corp. v. Daniel Const. Co., 725 S.W. 2d 705 [Tx. S. Ct., 1987])*.

Fourth, the written contract must give the hunter fair notice of the release provision. The fair-notice principle focuses on the appearance and placement of the provision, not its content. However, the fair-notice requirement is not necessary if the landowner can prove the hunter had actual notice or knowledge of the provision *(Spense & Howe Constr. Co. v. Gulf Oil Corp., 365 S.W. 2d 631 [Tx. S. Ct., 1963])*.

Fifth, the release provisions must be conspicuous. The element of "conspicuousness" is tied to the previous "fair-notice" requirement. Basically, the release provision must be conspicuous enough to give the hunter fair notice of its existence *(Dresser Industries, Inc. v. Page Petroleum, Inc., 853 S.W. 2d 505 [Tx. S. Ct., 1993])*.

How "conspicuous" is conspicuous? No absolute answer can be given. However, the following suggestions may be useful.

- Make the written provision noticeable.
- Emphasize the entire paragraph—not just a portion. Better still, place the waiver at the end of the contract on a separate sheet of paper.
- Use headings but not misleading ones.
- Italicize the headings.
- Ask the hunter to initial the waiver provisions of the contract or sign the page if placed on a separate sheet.

Note. The next two requirements are mentioned in post-injury release cases. However, under the right circumstances, the court could apply them to pre-injury releases.

Sixth, the document must specifically name the parties or individuals being released. "The mere naming of a

general class of tortfeasors in a release does not discharge the liability of each member of that class. A tortfeasor (one who commits a civil wrong) can claim the protections of a release only if the release refers to him (or her) by name or with such descriptive particularity that his (or her) identity or his (or her) connection with the tortious event is not in doubt. In this way, a plaintiff would not inadvertently release nonsettling wrongdoers." *Duncan v. Cessna Aircraft Co., 665 S.W. 2d 414 (Tex. 1984)*.

Seventh, the document must mention or specify the type of claim being released. "To release a claim, the releasing document must mention it" *Victoria Bank and Trust Co. v. Brady, 811 S.W. 2d 931 (Tex. 1991)*.

For some protection from the attractive nuisance doctrine, the landowner or lease agreement may require all children to be accompanied by an adult.

A waiver form was presented by the late Dean Patton, an attorney with Morrill, Patton and Bauer in Beeville, Texas, at the 13th Advanced Real Estate Law Course sponsored by the Texas State Bar in 1991. The Real Estate Center has edited the form and included it at the end of this report. While this is the Center's best effort at a viable form, users are advised that the form has not been tested in a court of law.

Texas Supreme Court Update

In June 2006, the Texas Supreme Court ruled that under certain circumstances a landowner may be held liable for failing to warn of a dangerous condition in spite of the language in the Recreational Guest Statute.

The case involved a young girl who was swept into a culvert and drowned while tubing on a river. Because several people had nearly succumbed to the same fate at the same location weeks earlier, the plaintiffs alleged gross negligence for failing to warn.

The high court agreed that sufficient facts existed for a jury to hear the case even though the statute provides that landowners do not assure the property is safe for the intended recreational use. Here is how the court ruled.

"A landowner has no duty to warn or protect from obvious defects or conditions. Thus, the landowner may assume that the recreational user needs no warning to appreciate the dangers of conditions, such as a sheer cliff, a rushing river, or even a concealed rattlesnake. But the landowner can be liable for gross negligence in creating a condition that a recreational user would not reasonably expect to encounter in the course of the permitted use."

According to the court, gross negligence is defined as "an act or omission involving subjective awareness of an extreme degree of risk, indicating the conscious indifference to the rights, safety or welfare of others."

Another important aspect of the case involved contemporaneous acts by the landowner in connection with the dangerous condition. In an earlier 2001 appellate case, the Waco Court of Appeals required a contemporaneous act by the landowner in connection with the dangerous condition before negligence could be proven. The Texas Supreme Court overruled that decision. The condition of the property itself is sufficient to raise a claim for either negligence or gross negligence. *(State v. Shumake, 131 S.W.3rd 66, Tex. 2006)*.

Conclusion

This report lists some of the more important issues that the landowner and hunter should resolve prior to or in conjunction with granting permission to hunt. Not all items apply to every lease. The terms must be tailored to the particular situation.

Preferably the lease agreement should be written and signed to establish the exact terms and conditions. A lease agreement allows all parties to realize the privileges both being granted and received for the consideration paid.

This report is for information only; it is not a substitute for legal counsel.

1098-100-570

(Provided as a Sample only)
RELEASE OF LIABILITY, CONSENT FOR EXPOSURE TO DANGEROUS AND HAZARDOUS CONDITIONS, AND ASSUMPTION OF THE RISK

I (we) hereby acknowledge that I (we) have knowingly and willingly entered a Hunting Lease Agreement, or become a party bound by the terms and conditions of a Hunting Lease Agreement by and between **(Name of Landowner, Ranch, Farm or Business)** _____ _____, (hereinafter referred to as the **Lessor,** whether one or more), and **(Name[s] of Hunter[s])** bound by the Hunting Lease Agreement) _____ _____, dated _____, 20_____.

I (we) understand the terms, provisions and conditions of the Hunting Lease Agreement. I(we) agree to abide by its terms and conditions and also by the terms and conditions of this Release, Consent and Assumption-of-the-Risk Agreement.

I (we) acknowledge and understand the Lessor makes no warranties, either express or implied, as to the condition and/or safety of the hunting lease and the improvements located thereon (hereinafter collectively referred to as the leased premises) located in _____ County, Texas.

Warning of the Dangerous Conditions on Leased Premises

The dangerous conditions listed below serve to warn me (us) and make me (us) aware, appreciate and understand that dangerous conditions, risks and hazards exist, both obvious and latent, both natural and man-made, that can cause serious bodily injury or death and damage or destruction of my (our) personal property. My (our) presence and activities on the leased premises expose both me (us) and my (our) personal property to these dangerous conditions, risks and hazards, both obvious and latent and both natural and man-made, including, but not limited to, poisonous snakes, insects and spiders; elevated blinds and tree stands, whether or not erected by Lessor; eroded areas, holes, uncovered wells, steep inclines, sharp and jagged rocks located both on and off roadways and trails that create rough, hazardous and dangerous driving and walking conditions; animals both wild and domestic that maybe diseased and/or possessed with propensities to injure or kill; rushing and still water with perils lurking above and beneath the surface; persons with firearms or other lethal weapons both on or off the leased premises; and the use of vehicles, boats and ATVs both on and off roadways, waterways, ponds and lakes.

Waiver and Release of Claims

In consideration for the right to enter the leased premises, I (we) hereby waive and release all claims and agree to indemnify, defend and hold harmless the Lessor named above, his or her (or the) respective owners, heirs, agents, employees and assigns from and against any and all claims, demands, causes of action and damages, including, but not limited to, court costs, judgments and attorneys' fees resulting from any accident, incident or occurrence arising out of, incidental to or in any way resulting from the use of or my (our) exposure to the conditions of the leased premises or the Lessor's active or passive negligent conduct thereon. These include, among other things, injury or death to the undersigned and damage or destruction of the undersigned's personal property.

Also, I (we) hereby further covenant and agree that I (we), my (our) heirs, successors and assigns will not make any claim or institute any suit or action at law or in equity against the Lessor named above or his or her (or the) respective owners, heirs, agents, representatives, employees, successors or assigns by reason of the Lessor's active or passive negligent conduct or by reason of the condition(s) of the leased premises, whether natural or man-made and whether the condition is caused by the Lessor's active or passive negligence.

ASSUMPTION OF THE RISK

Furthermore, I (we) declare I (we) are aware of *State v. Shumake, 131 S.W. 3d 66 (Tex. App. –Austin 2003), affirmed, 2006 WL 17;16304 (Tex.2006)* decided by the Texas Supreme Court in 2006. In that case, the landowner's failure to warn of an extremely dangerous man-made condition may give rise to a cause of action for gross negligence.

I (we) hereby agree and declare that the written notices stated above in this agreement **serves to warn me (us) of any actual or potentially dangerous natural or man-made** condition(s) that I (we) may or may not reasonably expect to encounter on the leased premises that may cause serious bodily harm or death or cause damage to or destruction of my personal property.

I (we) hereby state that I (we) am (are):

(1) aware of these and other associated dangerous conditions, risks and hazards on the leased premises;
(2) understand, appreciate and acknowledge the nature and extent of the risks and dangers by being exposed to these and other associated dangerous conditions on the leased premises; and
(3) voluntarily, expressly and knowingly consent to the exposure of myself (ourselves) and my (our) personal property to these and other associated dangerous conditions.

By affixing my (our) signature(s) below, I (we) knowingly and expressly **ASSUME THE RISK** of my (our) exposure to obvious and latent, natural and man-made dangerous conditions or activities that I am (we are) apt to encounter expectedly or unexpectedly. This assumption of the risk may be used by the Lessor as a defense in a court of law as outlined by the Texas Supreme Court in *Farley v. M.M. Cattle Co., 529 SW 2d 751,* against any allegations claiming the Lessor failed to warn of any dangerous natural or man-made conditions whether I am (we are) apt to encounter them expectedly or unexpectedly. **This assumption of the risk does not extend to Lessor's reckless or intentional conduct.**

The Severability Clause

If any term, provision, covenant, release, assumption or condition of this agreement is held by a court of competent jurisdiction to be invalid, void or unenforceable, the remainder of the provisions shall remain in full force and effect and shall in no way be affected, impaired or invalidated.

Length of Agreement

This release applies during the time that I (we) am (are) permitted on the leased premises, now and in the future, and until this agreement is revoked in writing.

Parental, Guardian and Supervisory Responsibility for Minors and Indemnification for Injuries or Deaths

In consideration for allowing minors to enter the leased premises, I (we) agree to keep close supervision of the minor(s) in my (our) watch and care at all times. I (we) further agree to indemnify the Lessor for all claims stemming from the injury or death of a minor in my (our) watch and care caused by my (our) lack of or negligent supervision.

Consent or Denial for Use of Testimonial, Pictures, Etc.

In the event photographs, slides or videos are made of me (us) while on the leased premises, I (we) consent to the Lessor's use of the to the photographs, slides and videos in promoting and marketing the Lessor's hunting and recreational activities on the leased premises. Likewise, by sending any testimonials or pictures via letters, emails or otherwise of my (our) experiences on the leased premises to the Lessor, I (we) consent to the Lessor's using them in like manner.

_____ Yes. You May Use the Material _____ No. You May Not Use the Material

List of Recent Accidents and Incidents Occurring on the Lease Premises

According to Texas Case law, the Lessor needs to warn hunters and guests of accidents and incidents occurring on the leased premises that may influence their decision to enter. The following is a list of all accidents and incidences that involved injury or death to a hunter or guest or to the damage or destruction of his or her personal property. The list covers all accidents and incidences occurring during the past two years. _____

_____

_____

_____

Dated and signed this _____ day of _____ 20_____.

_____ _____

(Hunter's or Guest's Signature) (Hunter's or Guest's Printed Name)

Hunter's or Guest's Address:

_____

_____

Dated and signed this _____ day of _____ 20_____.

_____ _____

(Hunter's or Guest's Signature) (Hunter's or Guest's Printed Name)

Hunter's or Guest's Address:

_____

_____

Portions of this waiver form was presented by the late Dean Patton, an attorney with Morrill, Patton and Bauer in Beeville, at the 13th Advanced Real Estate Course sponsored by the Texas State Bar in 1991. It has been edited by the Real Estate Center at Texas A&M University and is offered as a sample only.

MAYS BUSINESS SCHOOL

Texas A&M University
2115 TAMU
College Station, TX 77843-2115

http://recenter.tamu.edu
979-845-2031

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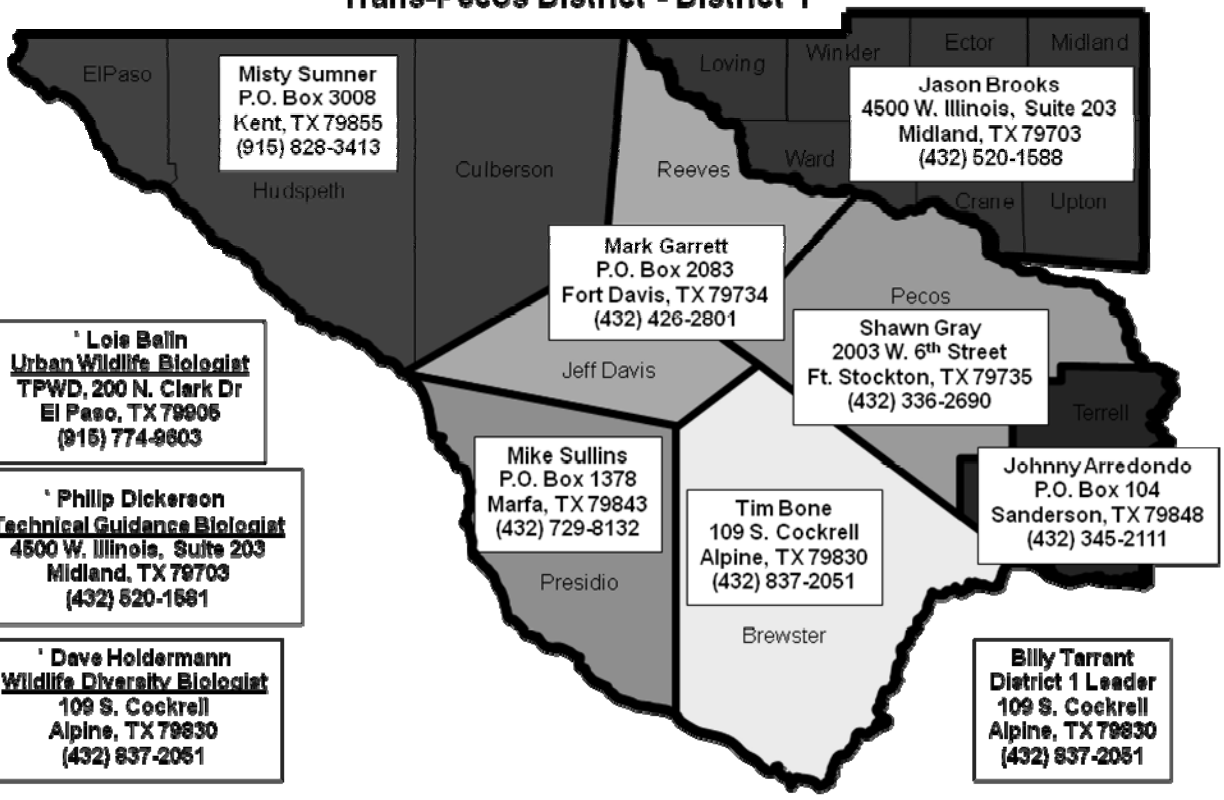
Trans-Pecos District - District 1



*** Lois Balin**
Urban Wildlife Biologist
TPWD, 200 N. Clark Dr
El Paso, TX 79905
(915) 774-9603

*** Philip Dickerson**
Technical Guidance Biologist
4500 W. Illinois, Suite 203
Midland, TX 79703
(432) 520-1581

*** Dave Holdermann**
Wildlife Diversity Biologist
109 S. Cockrell
Alpine, TX 79830
(432) 837-2051

Billy Tarrant
District 1 Leader
109 S. Cockrell
Alpine, TX 79830
(432) 837-2051

*** District-Wide Responsibility**

Updated August 30, 2007

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Sul Ross State University

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