



Wildlife Research Highlights

1997



**Edited by Matthew W. Wagner
Nongame Program Leader**

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Texas Parks and Wildlife Department
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WILDLIFE DIVISION

Texas Parks and Wildlife Department

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COVER PHOTO

Wildlife Biologists Lee Miller and Ruben Cantu assist with desert bighorn sheep restoration - a project spanning over 40 years in Texas. Photo by Leroy Williamson.

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May 1997

One of the greatest challenges facing wildlife professionals today is increasing the use of technology while remaining in touch with the natural world. Computers, telemetry, global positioning systems and many other devices have opened up new realms for wildlife scientists to explore. Yet the greatest mysteries remain in front of our eyes and under our feet. The Wildlife Division of the Texas Parks and Wildlife Department is continuing to develop a new, coordinated approach to wildlife research. Over the years, the Division has funded numerous wildlife research studies through universities, and Department biologists have conducted some excellent studies of their own. However, with ever expanding responsibilities for wildlife management, the Wildlife Division has recognized the need for additional emphasis on wildlife research. Consequently, the Division is developing a more coordinated statewide approach to wildlife research, scheduling more staff time to conduct research and publish research results, and seeking more consistent funding for this activity.

Each year, the Wildlife Division identifies its top research priorities, and research proposals on these topics are solicited from qualified department and university personnel. A multi-discipline research review committee selects the best proposals, contracts are prepared, and projects are conducted. Department personnel take the lead on some of the projects; university personnel lead others. In cases where a university is selected to conduct the research, Department biologists are selected to serve as field advisors, graduate committee staff, and publication coauthors.

The Wildlife Division budgeted over \$1,644,000 for 57 research projects during Fiscal Year 97. Funding for this research has come from several sources including: 1) Texas hunting license revenue, 2) federal excise taxes on sporting arms and ammunition (Pittman-Robertson), 3) Texas waterfowl, white-winged dove, and wild turkey stamps, 4) nongame funds, 5) mitigation, 6) state parks conservation series funds, 7) federal endangered species funds (Section 6), and 8) grants and donations. For more information on donations, see inside back cover.

Funding Sources

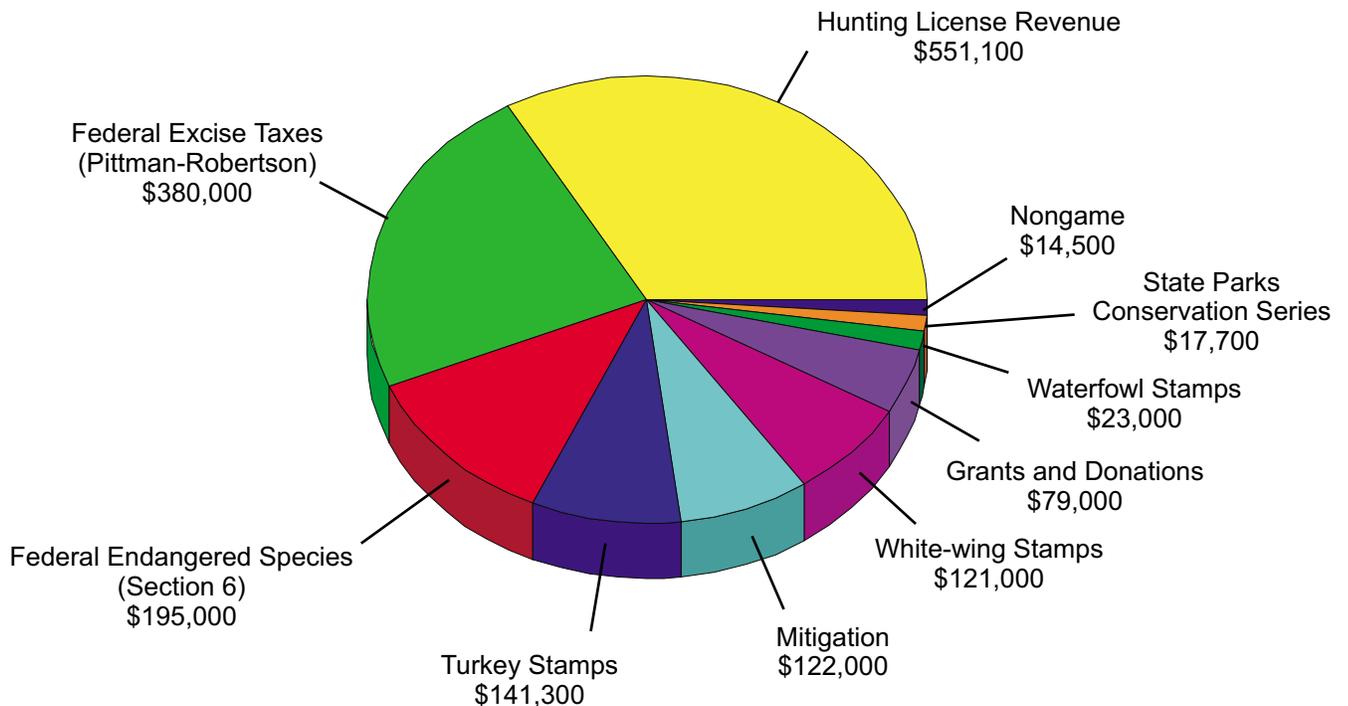


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UPLAND WILDLIFE ECOLOGY

Evaluation of Desert Bighorn Sheep Habitat in the Sierra Diablo, Beach, and Baylor Mountains, Texas

Tim E. Fulbright, Randy W. DeYoung, and W. Frank Robbins - Caesar Kleberg Wildlife Research Institute, Eric C. Hellgren - Oklahoma State University, and Doug Humphreys - Texas Parks and Wildlife Department



Photo by Earl L. Hilpiker

Information on food habits and carrying capacity of desert bighorn sheep (*Ovis canadensis*) habitat in West Texas is limited. We estimated seasonal nutritional carrying capacity of bighorns in the Baylor and Beach Mountains, Texas, and in Victorio Canyon in the Sierra Diablo Mountains. We also tested the hypotheses that diet composition, plant species richness, and diet selectivity differ between sexes during periods of the year when males and females are segregated (winter-summer) but not during aggregation (fall).

We collected fecal samples from male and female bighorns seasonally for 2 years in 3 separate mountain ranges in western Texas. Subsamples from each sex-site-season combination were combined and botanical composition was estimated by microhistological analysis. Biomass of forage species in each sampling area was estimated seasonally during 1995.

Fractional similarity of male and female diets did not differ significantly between seasons. Diets of males contained more (23) plant species than diets of females (19). Females and males had similar selectivity index values during segregation, but females were more selective during aggregation.

Our data suggested that diet quality was at or below maintenance during summer-winter of 1995 when rainfall was 48% below normal. Forbs were highly preferred by bighorns, but less than 2 pounds of forbs/acre were available in the study areas. Bighorn sheep habitat management should include increasing forb availability, particularly during periods of low rainfall.

Funding for this project is provided by the Texas Parks and Wildlife Department and Federal Aid in Wildlife Restoration Grant W-127-R.

Genetics and Environmental Interaction in White-tailed Deer

John D. Williams - Texas A&M University, College Station, and William E. Armstrong, Eugene R. Fuchs and Donnie Harmel - Texas Parks and Wildlife Department



Photo by Eugene Fuchs

Research studies conducted on the Kerr Wildlife Management Area have demonstrated that genetics have an effect on body size and antler characteristics in white-tailed deer. Further research in penned deer indicated that in the presence of an optimum ad libitum 16% protein diet, some deer consistently produced yearling offspring with spike antlers while others consistently produced yearling offspring with forked antlers.

Departmental check station data indicate that the incidence of spike antlers increased during extended periods of drought and poor habitat conditions. This supports the hypothesis that one of the causes of poor antler characteristics can be nutritional stress. We hypothesize that there may be a group of deer which are genetically capable of producing good antler characteristics in the presence of severe nutritional stress, another group which produce good

antler characteristics in periods of "good" nutrition and poor antler characteristics in periods of "poor" nutrition, and a third group which will produce poor antler characteristics regardless of available nutrition.

This study is being conducted in a 16-acre research complex consisting of 6-2/3 acre breeding pens and 3-4 acre holding pens. Deer used in the study have pedigrees which date back to 1973.

Since 1991, known pedigreed bucks have been placed with 8-12 pedigreed does using single sire herds. Fawns are ear tagged and matched with their respective dams for pedigree records. In October, fawns are removed from their dams, segregated according to sex and placed in 2 separate pens. Starting in December, buck fawns are placed on a limited 8% protein diet to simulate nutritional stress conditions. The following October, 6 males which have the best antler production and body size under these nutritional stress conditions are used as herd sires. Since the study was initiated, 22 different single sire breeding herds have produced 107 yearling males which have been reared on an 8% protein ration while growing their first set of antlers. Forty-one yearling bucks (38%) have produced antlers with 6 or more points while 29 (27%) have produced spike antlers. The percentage of fork antlered yearling bucks in the sample has increased each year due to sire selection (Table 1).

Table 1: Antler point classification for 107 yearling white-tailed bucks reared on a limited 8% protein ration

Birth year	No. Bucks @ 1.5 years	No. (%) Forked	No. (%) Spike	No. with 6 or more points
1992	29	18 (62%)	11 (38%)	11 (38%)
1993	19	12 (63%)	7 (37%)	7 (37%)
1994	25	18 (72%)	8 (28%)	5 (20%)
1995	34	31 (91%)	3 (9%)	18 (53%)

Blood samples have been obtained from over 300 deer involved in the study for DNA analysis. A separate research grant has been provided by the Bass Foundation through Texas A&M University to conduct DNA gene mapping and Y chromosome marker research from this population of known pedigreed deer.

This study has been funded by the Texas Parks and Wildlife Department.

Molecular Genetic Approaches to Management of White-tailed Deer

Loren C. Skow, Rodney Honeycutt, and John Williams - Texas A&M University-College Station and E. L. Young and Donnie Harmel - Texas Parks and Wildlife Department

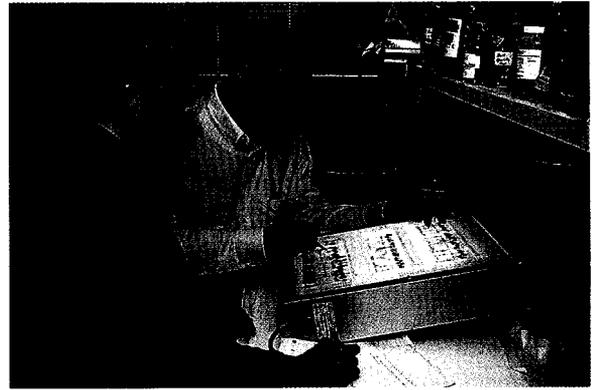


Photo by Media Resources, College of Vet. Medicine, Texas A&M Univ.

Assessment of the quality of the gene pool and efforts to improve the genetic stock are important components in the development of successful management programs to produce quality white-tailed deer herds in Texas. In this study, modern DNA techniques are being developed and applied to white-tailed deer using the closed, pedigreed wildlife herd at the Kerr Wildlife Management Area. The goal of this research is to produce DNA genetic markers for use in wildlife forensics and as management tools to determine reproductive structure of natural populations, identify biologically distinct stocks, evaluate the effects of deer introductions on the gene pools of existing populations, and determine the genetic fitness of free-ranging and closed deer herds.

The first year of this study resulted in the development and characterization of thirty five genetic markers in deer that can be used for individual identification in archeological and post-mortem samples (museum mounts, carcasses, processed meat, antler or hair) as well as fresh or frozen specimens. Currently, samples from herds in six regions representing major geographical areas of Texas, are being analyzed to assess levels of genetic health and determine geographic diversity of Texas white-tailed deer. Studies are also underway on two high-fenced deer populations to evaluate historical changes in gene pools and to determine reproductive structure of the herds.

This research is part of the international Deer Genetics program of the International Society for Animal Genetics (ISAG). Texas A&M has been designated the Coordinating Laboratory for the ISAG 1996-1998 Deer Genetics Workshop. The purpose of this workshop is to develop an internationally accepted panel of genetic markers for use in different species of deer. Researchers from Europe, Asia, Australia, New Zealand, Japan and North America are participating in the Workshop.

This is the second year of a three year study funded by the Bass Foundation in cooperation with the Texas Parks and Wildlife Foundation and the Texas Parks and Wildlife Department.

Seasonal Food Habits/Preference of White-tailed Deer in the Cross Timbers and Prairies Region of North Texas

John D. Baccus and Randy Simpson - Southwest Texas State University and James Dillard and E. L. Young - Texas Parks and Wildlife Department



Photo by Ron George

Deer numbers and physical condition can be limited by the available food supply. Knowledge of the food habits and preferences of white-tailed deer would allow landowners and deer managers to manipulate conditions to benefit important plant species. Preferred foods vary throughout the white-tailed deer range in Texas. In the Cross Timbers and Prairies Region, deer food habits on two major soil types supporting different plant regimes will be compared by site and seasonality of use.

Rumen samples were collected from five white-tailed deer during May, August, and November 1996 and February 1997 on each of the six study sites located in Bosque, Brown, Jack, Erath, Parker, and Wise Counties. Data was collected on

age, weight, sex, date of collection, locality, body condition, antler measurements, pregnancy, number of fetuses and lactation. Other data collected included blood samples, ectoparasites, rumen fluid, rumen contents, and internal parasites. Vegetative transects were used to sample herbaceous and woody vegetation on each study site.

Seasonal and spatial changes in food availability and preferences will be analyzed to determine correlation with rainfall, soils, vegetation distribution and species composition. A TPWD bulletin will be prepared at completion to disseminate information to deer managers and hunters.

This three-year study is funded by Texas Parks and Wildlife Department through Federal Aid in Wildlife Restoration Grant W-127-R.

Effect of Baiting on Female White-tailed Deer Movements and Harvest

Royce W. Jurries - Texas Parks and Wildlife Department

A majority of the Post Oak Savannah landownership consists of small tracts of land. Hunting pressure is heavy on many of these small tracts. Attracting deer with corn and food plots is the normal method of hunting.

A 70-acre study area was selected in Colorado County to determine the effects of baiting on doe deer movement and harvest. Two corn feeders and one oat patch were used to attract deer to two hunting blinds. Observations were made prior to the hunting season to determine approximately how many deer were using the feeders and oat patch. A spotlight census line was conducted on the study area and surrounding ranches 3 times each fall to determine the deer population in the area. The population estimate was one deer per 11.8, 8.6, and 9.5 acres in 1994, 1995, and 1996, respectively.



Photo by Leroy Williamson

The baited areas were hunted each morning and evening for the first 6 days of the hunting season. Normal hunting procedures were followed and only does were harvested. Six, 10 and 3 does were harvested in 1994, 1995, and 1996, respectively. This was 1 doe harvested per 11.7, 7 and 23.3 acres in 1994, 1995, and 1996, respectively.

This is the third year of a three-year study funded by Wildlife Division Region 4 funds.

Inheritability of Breeding Dates for Female White-tailed Deer

Bob K. Carroll - Texas Parks and Wildlife Department

The Texas Parks and Wildlife Department (TPWD) has trapped and transplanted thousands of deer in Texas during the past 40 years. The majority of deer restocking involved trapping deer in South-central Texas and moving them to the eastern half of Texas. Breeding and fawning dates were not considered when relocating deer from one ecological area or climate to another. A better understanding of white-tailed

deer breeding dates and how they are impacted by relocating a deer herd to a different ecological area could influence future policies on trapping and transplanting.

The objective of this study is to determine if breeding dates can be significantly altered by trapping a group of white-tailed deer on a South Texas ranch and relocating them on a ranch in the Post-Oak Savannah. A 300-acre high-fenced pasture of the Crier Creek Ranch in Colorado County was selected as the study site. TPWD personnel eradicated almost all of the native deer herd on the study site during the fall of 1993.

A total of 14 bucks, 52 does, and 10 doe fawns were trapped on 3 South Texas ranches and transported to the study site in February of 1994. All South Texas deer were ear-tagged to enable field identification and selective harvest in following years. Between July 5 and August 26, 1994, 32 male and 27 female fawns were captured on the study area and ear-tagged with color coded ear tags to indicate year of capture. An additional 18 male and 27 female fawns were captured and ear-tagged between June 27 and July 28, 1995.

Following the first breeding season of the transplanted South Texas deer herd, 5 ear-tagged does were collected in February and March 1995, and embryos were measured to determine breeding dates. These breeding dates were December 9, 15, 25, 31, 1994 and January 24, 1995. Breeding dates for 6 ear-tagged does collected in March 1996 were December 13, 24, 24, 29, 1995 and January 4, 6, 1996. Seven does were collected in February and March of 1997. Three of the does were from the first generation of fawns born on the study area and had breeding dates of December 9, 13, 17, 1996. Four does were from the second generation of fawns and had breeding dates of December 4, 14, 16, 1996 and January 13, 1997. Data from the "Breeding Chronology Study" conducted by TPWD in the western counties of the South Texas Plains indicated the earliest breeding date in a 3-year study was November 29 and the latest breeding date was February 1. The mean breeding dates for each of the 3 years were December 21, 22, and 28, respectively. Mean breeding dates for the Crier Creek Ranch deer herd in 1995, 1996, and 1997 were January 1, December 25, and December 25, respectively. Breeding chronology data collected in Colorado and Lavaca Counties in 1991 and 1992 indicated the earliest breeding date was September 28 and the latest breeding date was November 22. The mean breeding dates for 1991 and 1992 were October 28 and October 24, respectively.

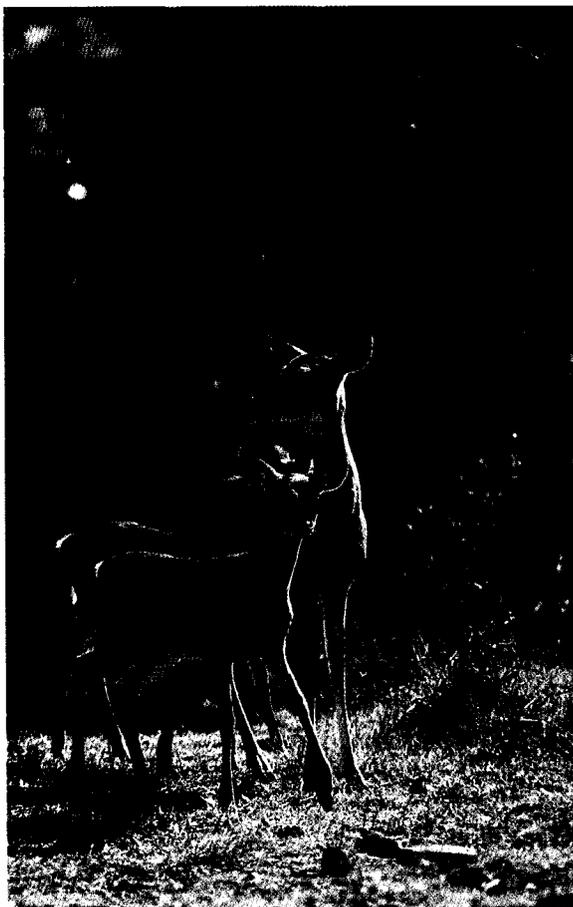


Photo by Bill Reaves

Data collected during this study indicate that the breeding dates of the transplanted South Texas deer herd have remained consistent with the breeding dates of the deer in the western counties of the South Texas Plains.

The study is being funded by Crier Creek Ranch and TPWD Wildlife Region 4 budget.

Mortality and Reproduction of Eastern Wild Turkeys Relocated into the Post Oak Savannah of Texas

Jeffrey W. Gaine, Charles K. Feuerbacher, John K. Thorne, and Nova J. Silvy - Texas A&M University, College Station and John D. Burk and Markus J. Peterson - Texas Parks and Wildlife Department

During 1994-95, 102 eastern wild turkeys (*Meleagris gallopavo silvestris*) of Midwest origin were released into 5 study areas in the Post Oak Savannah of Texas. Prior to release, all birds were fitted with a battery-powered radio transmitter, and mortality, reproduction, and movements were monitored. High mortality and zero reproduction kept these populations from expanding during the first 2 years. The effectiveness of supplemental releases of gobblers was evaluated and survival was compared to non-supplemental gobblers. The hypothesis that survivorship of supplemental and non-supplemental gobblers was equal was rejected ($P > 0.05$), suggesting that supplemental releases increase bird survivorship. Hens supplementally released in 1996 also showed an increase in survivorship but no poult survival has been documented. The hypothesis that Texas brood stock has higher survivorship and reproductive potential in restoration efforts also was evaluated in 1996. Initial findings indicate there is no difference in survivorship or reproduction of Texas and Midwest brood stocks ($P > 0.05$).



Photo by Kirk Feuerbacher

Funding and support for this project has been provided by Texas Parks and Wildlife Department (Turkey Stamp funds), Federal Aid in Wildlife Restoration Grant W-126-R, and the Texas A&M University System.

Eastern Turkey Restoration in the Pineywoods of East Texas

R. Montague Whiting Jr. and James R. George - Stephen F. Austin State University and John D. Burk - Texas Parks and Wildlife Department



Photo by James George

In East Texas, early attempts to restore eastern wild turkeys failed. However, in the late 1970s, eastern wild turkeys from Louisiana and Mississippi were successfully stocked at several intensively managed sites. In 1987, the Texas Parks and Wildlife Department (TPWD), in cooperation with the National Wild Turkey Federation (NWTf), began an intensive restoration program using broodstock from several midwestern and southeastern states for relocation. Between 1987 and 1995, over 4,600 turkeys were released in 49 counties in the Pineywoods and Post Oak Regions of East Texas. Approximately 88% of these birds were acquired from midwestern states. This study, and a parallel study in the Post Oak Region, were initiated to evaluate the restocking efforts that began in 1987. Specifically, this study compares survival, reproduction, and movements among Iowa, Georgia, and Texas broodstock. Also, the habitat composition of release sites where restoration has been successful will be extrapolated from home ranges of radio-tagged turkeys.

In February 1994, groups of 12 hens and 3 gobblers were released at each of 4 sites in Tyler County, Texas. Approximately equal number of Georgia and Iowa broodstock were released at each site. All birds were fitted with backpack transmitters and have been radio-located at least

twice a week since release. In February 1995, 8 Texas resident hens were captured, radio-tagged, and released at the capture site on Boggy Slough Hunting Club in Houston and Trinity Counties. In February 1996, 15 Iowa hens were also radio-tagged and released at Boggy Slough. These birds have been monitored on a schedule similar to that of the Tyler County birds.

Annual mortality from August 1, 1995 through July 31, 1996 for Georgia, Iowa, and Texas broodstock has been 7.7%, 18.2%, and 20.0%, respectively. Mammalian predators took 18 of the 38 birds killed; 14 of these were from Iowa, including 4 gobblers. A fifth Iowa gobbler was lost to avian predation and the sixth is missing. Losses to avian predators, undetermined predators, disease, and other causes were 3, 7, 4, and 6 turkeys, respectively.

During 3 nesting seasons, only 4 hens had any reproductive success; hatching 7 broods and fledging only 11 poults. Twenty-five established nests were known to have been destroyed during the 3 nesting seasons and an additional 52 nests were suspected of being established. The 25 unsuccessful nests were lost to mammals (10), snakes (11), unknown (2), and abandonment (2).

Phase II of this project will involve supplementally stocking 80 midwestern and southeastern wild turkeys in the Tyler County region. This extension will conceivably take the project to the year 1999.

This study is funded by the Texas Parks and Wildlife Department using Turkey Stamp revenue, Federal Aid in Wildlife Restoration Grant W-126-R, the College of Forestry, Stephen F. Austin State University, and the National Wild Turkey Federation.

Developing Biological Control of Imported Fire Ants

Lawrence E. Gilbert and Lloyd Morrison - The University of Texas, Austin and Markus J. Peterson - Texas Parks and Wildlife Department

During the past 50 years the spread of the imported fire ant (*Solenopsis invicta*) has resulted in dramatic negative consequences for wildlife and overall biological diversity in the eastern half of Texas and the southern United States. Recently it has become increasingly apparent that the spread has been accelerated by indiscriminate use of broad spectrum pesticides. In the native range of *S. invicta* in South

America, it is "just another ant." An important reason for its lack of dominance on its home continent is the presence of specific biological agents such as phorid flies of the genus *Pseudacteon*, species of which are specific parasitoids of *Solenopsis* species. In Texas the native fire ant *S. geminata* is harassed by two *Pseudacteon* species, neither of which have shown interest in the imported pest. Our research is focused on "leveling the playing field" for native ants by introducing *S. invicta*-specific *Pseudacteon* phorids from Brazil and Argentina.

Funds from the Texas Parks and Wildlife Department, University of Texas and several private foundations are helping to construct the first experimental rearing facility for these tiny flies, which are currently the best prospect for biological control of the imported fire ant. Our research to date has been funded by National Science Foundation, Fondren, Ewing Halsell, R. J. Kleberg and H. C. Kleberg Foundations, and the Houston Livestock Show and Rodeo Education Committee.



Fire ants in Brazil (left) assume defensive posture in response to phorid fly (right). Photo by L.E. Gilbert

Time Difference of Arrival: A New Method of Wildlife Radio Location

Shane Nelson - Applied Research Laboratories, University of Texas, Austin and Jerry Cooke - Texas Parks and Wildlife Department

Position information has been, and continues to be, valuable data for better understanding the behavior of animals. It gives insight into animal movements, habitat use, species distribution, feeding and breeding behaviors. To this end, radio location techniques have been used for decades to monitor animal locations. Applied Research Laboratories has undertaken the design of a new animal radio location system

which promises to be highly accurate, operable in most terrains, and confirmable to automatically measure and record 3 dimensional positions in real time.



Photo by Duane Kurtin

Position calculations will be based on measurements of signal transit times between an animal's radio transmitter and 3 or more unmanned listening nodes (antennae). The novelty of the approach is in using Global Positioning System (GPS) receivers at each of the listening nodes to provide highly synchronized timing, (10's of nanoseconds) without which such a system could not achieve required accuracy levels. Because GPS receivers also provide position information, these listening nodes are not required to be static and could therefore be moved around to optimize coverage in certain areas or track animals in otherwise inaccessible regions.

Operation of this system will require that animals be fitted with radio transmitters similar in size, weight, and power consumption to those now used for conventional direction-finding radio location techniques. Trends in decreasing size of radio transmitters will allow the tracking of very small animals, and transmission frequencies which are not heavily affected by foliage can continue to be used. System operation will not be as disturbing to the animal as conventional techniques, and it can be configured so that the transmitted signal is unusable to potential poachers.

A Time Difference of Arrival (TDOA) animal tracking system is not a labor intensive tracking method. It can be automated with the data routed to an office computer, and be made to satisfy virtually any sampling interval requirements. Moreover, the output positions require no further processing and will facilitate direct integration of the tracking system with a GIS database.

This project will include a proof of concept demonstration of this system and documentation of both

component level system design and likely implementations of a fully developed system. This work is funded as an internal Research and Development project at Applied Research Laboratories in cooperation with the Texas Parks and Wildlife Department.

Genetic and Environmental Parameters for Antler Development Traits in White-tailed Deer Using an Animal Model

Steven D. Lukefahr - Texas A&M University-Kingsville, and Donnie E. Harmel and E. L. Young - Texas Parks and Wildlife Department

Sport hunting for trophy bucks is a multi-million dollar industry in Texas, and interest in white-tailed deer genetics is high. An earlier heritability study on the Kerr Wildlife Management utilized antler characteristics of 150 penned deer. Our objective was to estimate heritability for antler characters involving measurements and pedigree records recorded for all bucks born from 1986 through 1994 in the closed deer herd at the Kerr Wildlife Management Area.

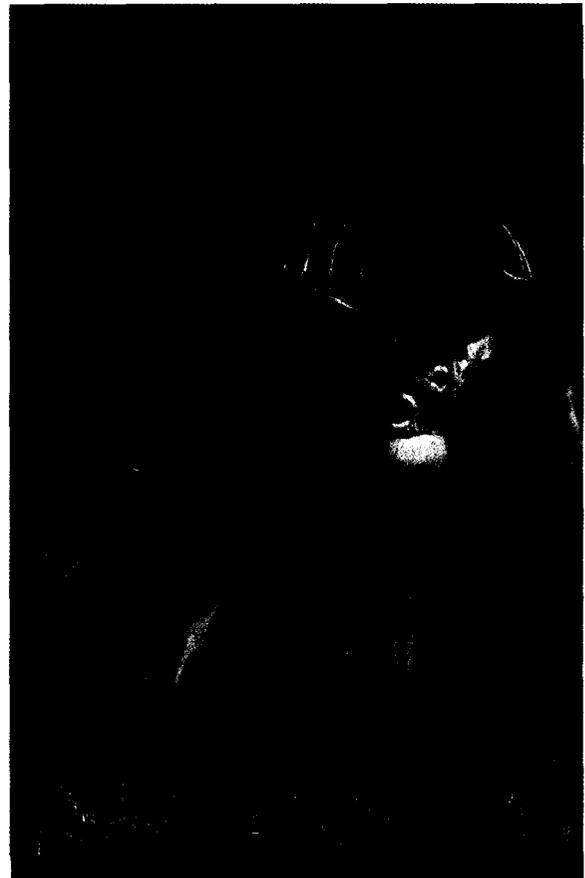


Photo by Ed Dutch

Information gained from this investigation will further understanding of heritabilities. The results of this study will aid in selective breeding management of penned deer, compare heritability estimates generated by differing statistical techniques, and use Kerr Area data to determine breeding values and environmental correlations.

Data were subdivided into yearling, 2.5 year-old and mature (>2.5 years) age groups. The yearling model consisted of fixed birth year and linear covariates of age at measurement (mean of 163 d, range of 118 to 226 d), and inbreeding level (mean of 0.081, range of 0.000 to 0.300), and random effects of additive genetic, maternal and/or litter sources of variation. A Multiple Trait Derivative Free Maximum Likelihood (MTDFREML) animal model was used which accounted for genetic relationships among 385 deer (244 and 141 deer with or without records), selection bias and inbreeding trends. A total of 45 sires and 127 dams were involved. Analyses are currently in progress.

Funding was provided by the Texas Parks and Wildlife Department and the Caesar Kleberg Wildlife Research Institute.

Is Quail Hunting Self-regulatory? Northern Bobwhite and Scaled Quail Abundance and Quail Hunting in Texas

Markus J. Peterson and Robert M. Perez - Texas Parks and Wildlife Department



Photo by Martin T. Fulfer

Wildlife managers generally maintain that quail hunting is self-regulatory because they assume hunters spend fewer days hunting, and bag fewer quail per day, when hunting is "poor," while hunting more frequently, and bagging more

quail per day, when hunting is "good." For this reason, managers conclude that minor changes in hunting season length and bag limit would be inconsequential. We used August quail abundance (1978-96) and harvest (1981-83, 1986-96) data collected by Texas Parks and Wildlife Department employees to test this hypothesis for both northern bobwhite (*Colinus virginianus*) and scaled quail (*Callipepla squamata*). Specifically, we first tested the hypothesis that quail abundance in August could account for the total numbers of quail bagged by hunters during the subsequent hunting season. We then tested the hypotheses that quail abundance could account for the number of days people hunted quail, the number of quail bagged by hunter by day, and the number of persons hunting quail during the subsequent hunting season. Quail abundance in August was sufficient to account for the number of northern bobwhite and scaled quail bagged during the following hunting season [$R^2=0.769$ and 0.874 ($P<0.0005$), respectively]. Texas hunters typically hunted quail for approximately 2.5 to 3 days annually despite quail abundance. Quail abundance in August, however, could account for the number of quail bagged per hunter per day and the number of people hunting quail during the subsequent hunting season [northern bobwhite: $R^2=0.895$ and 0.868 ($P<0.0005$), respectively; scaled quail: $R^2=0.833$ and 0.740 ($P<0.0005$), respectively]. These results are consistent with the hypothesis that both northern bobwhite and scaled quail abundance in August can regulate quail hunting effort and success within the framework of the hunting regulations in effect.

Funding for this project was provided by Texas Parks and Wildlife Department and Federal Aid in Wildlife Restoration W-126-R.

MIGRATORY GAME BIRDS

Habitat Selection of Wood Duck and Cavity-nesting Nongame Birds in Northern Rolling Plains Riparian Zones

Robert T. Magill and Loren M. Smith - Texas Tech University and James D. Ray-Texas Parks and Wildlife Department



Photo by Jim Ray

Little information exists on habitat of wood ducks or other cavity-nesting birds in the Rolling Plains, particularly in the northern and western Rolling Plains. Cottonwoods and other trees are abundant on riparian areas in the northern Rolling Plains. These maturing forests, in concert with riparian wetlands (streams, beaver ponds, man-made impoundments) are providing habitat to an expanding population of wood ducks and cavity-nesting nongame species. Our objectives for this study are to: (1) characterize wood duck and cavity-nesting nongame bird habitat in the northern Rolling Plains, (2) evaluate habitat/placement characteristics affecting occupancy and nest success of man-made boxes, and (3) compare success of nests in natural cavities versus nests in boxes.

Potential nest sites in natural tree cavities are being located in randomly-selected plots during the winter months. Cavities are revisited during and immediately following the nesting season to determine occupancy and nest success. Wood duck and cavity-nesting nongame bird habitat will be characterized by such variables as cavity orientation, tree species, diameter at breast height, densities, basal area, and distances to water, permanent water, and nearest forest openings. Cavities occupied by wood ducks or nongame

species will be characterized by type, orientation, entrance size, and bole size.

Eighty wood duck boxes with compartments for small nongame birds are being monitored for occupancy and nest success. Comparisons will be made of nest success of nests in boxes vs. in natural cavities, and between boxes with predator guards and those without. Effects of independent variables (cavity orientation, box height, depth of water under the box, distance to water, distance to shore, distance from nearest permanent water, distance from nearest tree canopy) on nest box occupancy and nest success will be examined.

Only three of 127 natural cavities were used by wood ducks or nongame birds during the first field season (1996). Occupancy rates and nest success for wood ducks in nest boxes were 6% and 80%, respectively, and for nongame species were 56% and 62%, respectively. Nests of nine bird species were observed in 1996.

Information gained from this study will aid in the development of region-specific recommendations for managing wood duck and cavity-nesting nongame bird habitat, including placement of nest boxes for maximizing occupancy and nesting success. This is a 2-year study funded by Texas Waterfowl Stamp and Nongame Stamp funds, hunting license revenue, and the Southwestern Public Service Company.

Distribution, Abundance, Subspecific Composition and Recruitment of the Gulf Coast Subpopulation of Mid-continent Sandhill Cranes

Bart Ballard, Jonathan Thompson and Thomas C. Tacha - Caesar Kleberg Wildlife Research Institute and M. Todd Merendino, James D. Ray and Jay Roberson - Texas Parks and Wildlife Department

Little information exists on the demographics of the Gulf Coast subpopulation, which includes over 95% of the mid-continent greater sandhill cranes (*Grus canadensis tabida*), a subspecies of special concern. We determined distribution, abundance, subspecific composition, and winter age ratios of the Gulf Coast subpopulation of mid-continent sandhill cranes during Dec-Jan 1995-96 and 1996-97. Aerial surveys were conducted on 72 line transects along the Texas Coast during peak population in late December. Transects were allocated among coastal counties in proportion to average historical crane densities. Subpopulation size was estimated at 36,130



Photo by Tom Tacha

(SD=12,348) during 1995-96, and at 120,072 (SD=32,264) during 1996-97. Sex by gonadal examination and measurements (mm) of culmen post-nares, tarsus, and wing chord were obtained from 172 (1995-96) and 246 (1996-97) adult sandhill cranes collected in the southern Gulf Coast, Rolling Plains, and South Texas Plains regions. Subspecific composition of cranes was determined using discriminant function models developed from morphometric measurements on breeding birds of known origin. Cranes sampled from the Texas Coast consisted of 31% greater sandhill cranes, 58% Canadian sandhill cranes (*G. c. rowani*), and 11% lesser sandhill cranes (*G. c. canadensis*). Subspecific composition in the Rolling Plains included 8% greater, 38% Canadians, and 54% lessers, and in the South Texas Plains included 2% greater, 21% Canadians, and 77% lessers. Ground surveys of crane flocks along the Texas Coast indicated that 10.6% ($n=224$) and 9.5% ($n=307$) of wintering birds were juveniles during 1995-96 and 1996-97, respectively.

This study was funded jointly by the Texas Parks and Wildlife Department, the Webless Migratory Game Bird Research Program (USFWS), and Caesar Kleberg Wildlife Research Institute.

Sublethal Effects of Organophosphorus Pesticides on White-winged Doves

Michael F. Small and David G. Hewitt - Caesar Kleberg Wildlife Research Institute and Gary Waggenerman - Texas Parks and Wildlife Department

Declining populations of white-winged doves in the Lower Rio Grande Valley (LRGV) of Texas have been a concern to biologists since the 1920s, especially because the

LRGV historically represents the primary breeding ground of the species in the U.S. Recent research has shown that white-winged doves in the LRGV have been exposed to compounds, presumably agricultural pesticides, that inhibit acetylcholinesterase (AChE), an enzyme critical to nervous system function.

In January 1995, we initiated a study to document the effects of methyl parathion (MP), a common AChE inhibiting pesticide, on productivity of white-winged doves. Our first experiment used captive birds to determine the relationship between blood and brain AChE inhibition and MP dose. These results allowed us to calculate the required MP dose necessary to accurately replicate pesticide exposure of wild white-winged doves. A second trial was conducted to determine if length of exposure is a factor in the level of AChE. We determine that length of exposure is not a significant factor affecting levels of AChE inhibition in white-winged doves.

Data from these initial experiments were used to design a study on the impacts of organophosphorus (OP) pesticide exposure on white-winged dove productivity. We randomly assigned 60 pairs of white-winged doves to three treatment groups (control, 1.0 ppm, and 4.5 ppm MP in drinking water) and measured reproductive output from June through August 1996.

White-winged productivity was not significantly affected by 1.0 ppm MP ingestion but was adversely affected by 4.5 ppm MP exposure. Doves on the 4.5 ppm MP treatment showed a decrease in the number of eggs laid, number of fertile eggs, number of eggs hatched, and number of young surviving to fledging.

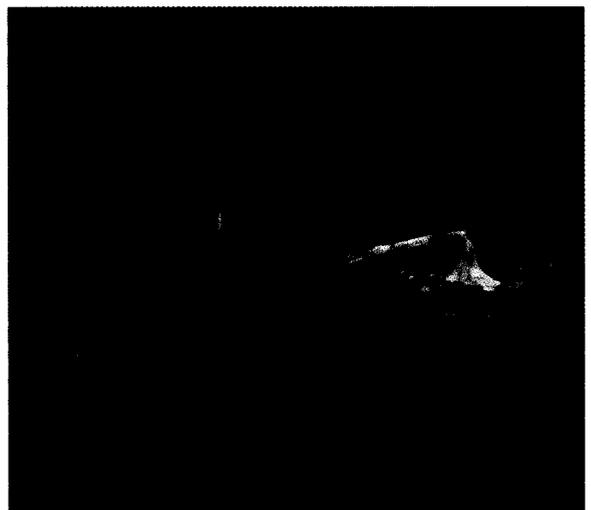


Photo by Bill Reaves

Second year observations will include a similar design except that the 1.0 ppm group will be replaced with a group receiving biweekly MP spike. This will mimic periodic exposure that wild birds are probably experiencing. We will measure the same parameters as the first year, as well as behavioral measures, weight of eggs, weight of young, eggshell thickness, and food and water intake. We will also be determining OP pesticide levels and persistence in irrigation water in LRGV cotton fields.

This study is unique because it is the first: 1) instance of successful captive breeding of white-winged doves in which pairs were pre-determined, 2) study in which cloacal and surgical sexing techniques were successfully used on a large number of individuals of a sexually monomorphic species, and 3) avian study to evaluate orally ingested irrigation water as the route of exposure of OPs with taste aversion tested as a consideration in concentration and amount consumed.

This study, funded with Texas Parks and Wildlife Department White-winged Dove Stamp revenue, will add greatly to our understanding of white-winged dove population dynamics in the LRGV and changes in geographic distribution occurring throughout the state.

NONGAME WILDLIFE

Ecology of the Mountain Lion on Big Bend Ranch State Park in Trans-Pecos Texas

Michael T. Pittman, Billy Pat McKinney, and Gilbert Guzman - Texas Parks and Wildlife Department

In January 1993, a 5-year mountain lion research study was initiated by the TPWD on Big Bend Ranch State Park (BBRSP). This study is the first attempt by TPWD to supplement current mountain lion status information with field research. BBRSP, owned and managed by the TPWD, is located within the Chihuahuan Desert in southern Brewster and Presidio counties and contains approximately 414 square miles. The objectives of the study are to determine home ranges, investigate population dynamics, evaluate genetic variability, identify diets, and improve the Department's knowledge of the technical requirements needed to conduct mountain lion research.

Male and female resident mountain lions within the study site were captured using trained lion hounds or leg-hold

snares, immobilized, and fitted with radio collars operating on specific frequencies. Kittens were captured by hand and fitted with expandable collars. Age, sex, and a series of body measurements were recorded for each captured lion. Blood and tissue samples were collected for DNA and disease analysis. All collared lions were monitored weekly by ground and aerial telemetry to collect data on movements, home range characteristics, habitat utilization, location of den sites, and survival and dispersal of kittens after they become independent. All fecal samples encountered were collected for diet analysis. Lion kills were verified and recorded on base maps. Mule deer, hare, rabbit, and furbearer census data from fall spotlight surveys were used to estimate prey population trends.



Photo by Billy Pat McKinney

Twenty-one mountain lions were captured on BBRSP from January 1993 through March 28, 1996. Sixteen lions (5 adult females, 2 juvenile females, 7 adult males, 2 juvenile males) were captured and fitted with radio transmitters. Six collared lions were recaptured for attachment of new radio transmitters or collar adjustment. Ground and aerial tracking of collared lions was conducted March 1993 through August 1996. A total of 681 relocations was recorded for 16 lions (7 females, 9 males). Twelve lions (6 females, 6 males) had a sufficient number of relocations to estimate home ranges. Mean home range estimates for the females were 138 square miles and 215 square miles for the males. One hundred-two fecal samples were collected and analyzed. Analysis of the samples indicated 4 prey components; collared peccary, mule deer, lagomorphs, and unidentified material. Peccary were the most important prey with a frequency of occurrence of 49 percent. Deer and lagomorphs were the second and third most important prey with frequencies of 41 and 13 percent, respectively.

Future activities will include capturing and collaring new resident lions, capturing and collaring juvenile lions born to collared resident females, continuation of telemetry activities of all collared lions, submission of samples for analysis, and the continued inclusion of TPWD personnel to familiarize them with the basics of mountain lion ecology.

This study is funded by the Texas Parks and Wildlife Department.

Ecology of Mountain Lions in South Texas

Louis A. Harveson and Michael E. Tewes - Caesar Kleberg Wildlife Research Institute, Jimmy Rutledge, Jim Hillje, John Huff, Leif Henderson and Rick Taylor - Texas Parks and Wildlife Department, Nova J. Silvy - Texas A&M University and James H. Everitt - USDA Agricultural Research Station - Remote Sensing Research Unit



Photo by Ron George

The goal of the South Texas Mountain Lion Project is to gather baseline data on the ecology of a South Texas mountain lion population that will aid the Texas Parks and Wildlife Department in developing a state-wide comprehensive management plan.

Data on mountain lion ecology was collected from March 1994-March 1997 from a 1,182 square mile study area of privately owned lands within La Salle, McMullen, Webb, and Duval counties.

Over 45 landowners within the study area participated in this project by allowing the research team access to their ranches. Trapping effort focused on 15 of those ranches where mountain lion sign was identified. We set 187 leg-hold snares and recorded 4,591 trap-nights. Snare-trapping efforts resulted in the capture of 8 males (14 times) and 3 females. Initial snare capture success was 1 capture/459 trap nights and total capture success (including recaptures) was

1 capture/270 trap nights. Trained hounds were used to compliment snare captures and for recapturing subadult mountain lions for collar adjustment. Trained hounds were used 37 times during the course of the study and resulted in 12 mountain lions being "treed" 21 times. Thirteen of the 21 times the target animal was successfully "treed." Two litters of radio-collared mountain lions were also captured by hand. During the course of the study, a total of 19 mountain lions (9 females, 10 males) were captured and radio-collared.

Radio-collared mountain lions were located using standard radio-telemetry techniques from the ground and air. The 19 radio-collared mountain lions were located >1,400 times (range = 7 - 227 locations/mountain lion) to determine habitat preferences, home ranges, and social interactions of radio-collared mountain lions. Home ranges for adult males (range= 97 - 649 square miles) were greater than adult females (range = 31 - 160 square miles).

We evaluated the efficiency of remote sensing technology to delineate vegetation communities used by mountain lions in South Texas. Remote sensing methods (satellite imagery, color infrared photographs, and color infrared videography) and ground-verification techniques were used to identify 6-12 vegetation communities within the study area. Using a geographic information system, mountain lion locations will be overlaid onto the vegetation community maps and preference-avoidance analyses will be performed.

To determine food habits of mountain lions in South Texas, we assessed mountain lion involvement at 85 different carcasses representing 9 species of mammals. Nineteen percent were attributed to dying of other causes (primarily coyote predation and crippling loss by hunters), 42% of the carcasses were considered possible mountain lion kills, and the other 39% were classified as certain mountain lion kills. Using the 69 possible or certain mountain lion kills, food habits of mountain lions consisted of 51% white-tailed deer (26% male and 25% doe and fawn), 22% javelina, 9% feral hogs, and 11% other species. Other species included skunk, bobcat, mountain lion, and livestock.

Possible causes of mortality for mountain lions in South Texas have been identified as rifle and bow hunters, private and federal predator control practices, vehicle collision, intraspecific, and other. During the 3-year study, 29 mountain lions (10 collared, 19 uncollared) died from sport-hunting, predator control practices, and other causes within the study area.

Cooperative funding is provided by the Texas Parks and Wildlife Department, the Boone and Crockett Club, the Welder Wildlife Foundation, and the USDA-Agricultural Research Station-Remote Sensing Research Unit in Weslaco.

Assessment of Burning and Juniper Control on Black-capped Vireo Habitat

John T. Baccus and Jane Nelka - Southwest Texas State University and Bill Armstrong and Donnie Harmel - Texas Parks and Wildlife Department

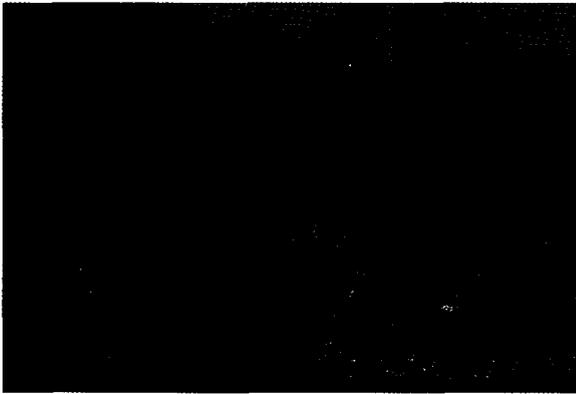


Photo by Matt Wagner

The black-capped vireo (*Vireo atricapillus*) is listed as an endangered species by the U.S. Fish and Wildlife Service. The species nests in scrub brush habitats throughout the Edwards Plateau ecological region of Texas. A number of factors may be contributing to the decline of the vireo. Habitat is being lost because of natural plant succession, encroachment and dominance of regrowth Ashe juniper (*Juniperus ashei*), or poor range management practices associated with livestock grazing and overpopulation of white-tailed deer and exotic big game animals.

Research conducted at the Kerr Wildlife Management Area (KWMA) has demonstrated that prescribed burning is an effective and economical range management tool for controlling regrowth Ashe juniper. A combination of juniper control, proper grazing with cattle, and deer population control resulted in a resurgence of low-growing brushy vegetation. The development of dense liveoak and shinoak mottes may thereby provide excellent nesting habitat for the vireo on the KWMA.

The objective of the study is to determine the effect of prescribed burning as a range management tool to control

regrowth Ashe juniper on black-capped vireo nesting habitat, distribution and production.

In 1996, 91 territories were located and studied. This was an increase of 10 territories from the previous year. The number of black-capped vireo territories increased in all pastures except North Doe and South Doe, which remained the same as in the previous year at 11 and 16, respectively. North Rock pasture had the largest increase in territories from 15 in 1995 to 22 in 1996. There has been a significant increase in the number of black-capped territories in Rock and Doe pastures from 64 in 1993 to 91 in 1996 ($P[t=13.5] < 0.001$). At three years post burn, a trend seems to be emerging. The number of territories in pastures burned under a "cool" fire environment (South Rock and North Doe) have changed the least and are similar to that of the control. The greatest change in the number of territories has occurred in the pasture (North Rock) burned under a "hot" fire environment. Nesting activity and production in 1996 was similar in burned and nonburned pastures. There were 3.2 young per active nest ($n=5$). The parasitism rate by brown-headed cowbirds was 17% (nests observed=12). These data indicate that prescribed burning does not limit black-capped vireo use of habitat when done in conjunction with standard range and wildlife management practices.

In 1997, Rock and Doe pastures will be surveyed for territories. Territories will be delineated on a map, and during nesting, attempts will be made to locate nest and count the number of eggs, nestlings, fledglings and percent parasitism by cowbirds.

This study should be continued until the number of territories stabilizes and declines to determine the long-term effects of prescribed burning on black-capped vireos, to evaluate changes in the size and location of BCV territories, and to determine if no management of habitat such as in control pastures results in a less viable vireo population.

This study is funded by the Nongame and Urban Wildlife Program.

Effects of Grazing by Cattle on the Demography and Ecology of the Texas Tortoise

Richard T. Kazmaier and Eric Hellgren - Oklahoma State University, Donald C. Ruthven III, Jimmy Rutledge, and Matt Wagner - Texas Parks and Wildlife Department



Photo by Rich Kazmaier

The Texas tortoise (*Gopherus berlandieri*) is listed as threatened by the State of Texas as a result of its limited range, its apparent low reproductive and recruitment rates, and its decline in recent years. Knowledge of how land use practices affect a species is imperative to the successful management of that species. Currently, little information is available on how land use practices impact the Texas tortoise. This study is testing the hypothesis that moderate, controlled grazing does not adversely affect the Texas tortoise. The study area is the Chaparral Wildlife Management Area (CWMA) in the western Rio Grande Plains.

Demographic characteristics (density, adult survival, sex ratio, size structure, and age structure) and spatial, temporal, and dietary dimensions of the realized niche of Texas tortoises are being compared between grazed and ungrazed areas. Field work was initiated in April 1994 and will be

completed in August 1997. To assess demographic characteristics, data on sex, size, and age is being collected from all tortoises during fortuitous encounters. Population estimates will be made utilizing mark-recapture methods. In addition, 10 (6F:4M) adult tortoises will be monitored by radiotelemetry in each of 4 pastures (2 grazed, 2 ungrazed) to determine home range, resource utilization, survivability, and movements. Time budgets are being calculated by intensive monitoring of radio equipped individuals. Fecal samples are being collected for dietary analysis. Comparisons of vegetative characteristics between treatments are being conducted utilizing the line intercept and Daubenmire frame methods.

Through 1996, 688 captures of 571 individual tortoises have been made, and 46 transmitter outfitted tortoises have been monitored for 22,575 transmitter days with 1,615 relocations. Population size, utilizing mark-recapture methods, is estimated to be approximately 3,000 individuals on the 15,200 acre CWMA. The CWMA population appears to be comprised of smaller individuals than other populations studied. Age estimates and growth rates derived from recaptures suggest unusually rapid attainment of sexual maturity for a tortoise. Annual survival rates for adult tortoises derived from telemetry data are 77.5% for the grazed treatment and 85.2% for the ungrazed treatment. These survival estimates are similar to a 77.1% annual survival rate determined from life table analysis for CWMA tortoises estimated to be older than 4 years of age. Tortoises are traditionally thought to be extremely long lived, with annual adult survival exceeding 90%; however, our preliminary survival rates indicate an unusually high adult mortality rate for the entire CWMA population. Fecal samples from cattle and tortoises are currently being analyzed for dietary overlap.

This study is funded by the Rob and Bessie Welder Wildlife Foundation and the Nongame and Urban Wildlife Program.

Black Bear Habitat Suitability in East Texas

Nathan P. Garner and Sean Willis - Texas Parks and Wildlife Department

Habitat suitability index (HSI) values were used to evaluate the quality of habitat for black bears on 4 study areas

in East Texas and included food, cover, and human impact factors. The HSI value of 1.0 indicated most suitable while the HSI value of 0.0 indicated no suitability. An HSI value of greater than 0.50 was considered favorable for bears and less than 0.50 unfavorable for bears. The four food variables (v1-v4) were combined to calculate the total HSI value for the food component portion of the model. The protection cover (v5) and tree den sites (v6) variables were combined to calculate the total HSI value for the cover component of the model. The total HSI value for the human impact component was calculated by combining the open road density (v7) and human-bear conflict (v8) variables. The overall suitability of a study area was calculated after combining the food, cover, and human impact components of the model.

The HSI values for the Big Thicket National Preserve (72,812 acres) for the eight variables tested ranged between 0.0 and 1.0 and the food, cover, and human impact components were 0.84, 0.82, and 0.42 respectively. The overall HSI value was 0.73.

The HSI values for the Sulphur River Bottom (51,000 acres) for the eight variables tested ranged between 0.0 and 1.0 and the food, cover, and human impact components were



Photo by Ron George

0.87, 0.76, and 0.52 respectively. The overall HSI value was 0.76.

The eight variables tested for the Middle Neches River Corridor (246,695 acres) ranged in value from 0.0 and 1.0 and the food, cover, and human impact components were 0.88, 1.0, and 0.80 respectively. The overall HSI value was 0.89.

The Lower Neches River Corridor (31,609 acres) had HSI values ranging from 0.0 to 1.0 for the eight variables tested and the food, cover, and human impact components were 0.83, 1.0, and 0.51 respectively. The overall HSI value was 0.79.

For all four areas sampled, the total food component values ranged from 0.83 to 0.88 which indicated a strong favorable rating for the availability of summer food and the availability, productivity, and diversity of fall food.

Total cover component values for all areas sampled ranged from 0.76 to 1.0 which indicated a strong favorable rating for the availability of protection and concealment cover. None of the areas had any measurable large and older trees that could adequately serve as tree den sites. However, since dense understory cover for bears in areas with mild winters can serve as adequate ground den sites, the lack of tree den sites is not considered necessary for successful bear denning activities in this HSI model, and the HSI values reflect that in the cover calculations.

Total human impact component values for all areas sampled ranged from 0.42 to 0.80 which indicated a less than favorable rating for the Big Thicket National Preserve and a moderately to strong favorable rating for the other three areas. Open road densities were greatest on the Middle and Lower Neches River Corridors while human/bear conflict zones were more prevalent on the Big Thicket National Preserve and Sulphur River Bottom study areas.

Overall HSI values indicated that the most suitable area for bears in this study was the Middle Neches River Corridor (0.89) followed by the Lower Neches River Corridor (0.79), Sulphur River Bottom (0.76), and the Big Thicket National Preserve (0.73). The Middle Neches River Corridor not only provided suitable food and cover for bears but also was an area where bear/human conflicts had the greatest likelihood to be minimized in East Texas according to the model.

This study was funded by the Texas Parks and Wildlife Department, AAZK Chapter of the Tyler Caldwell Zoo, and Federal Aid in Wildlife Restoration Grant W-125-R.

Texas Horned Lizard Population Structure, Abundance, and Growth Rates

Donald C. Ruthven III and Bradley D. Simpson - Texas Parks and Wildlife Department



Photo by Chip Ruthven

Collection of horned lizard data began on the Chaparral Wildlife Management Area (CWMA) in the South Texas Plains in 1991 and is continuing. To investigate differences between separate populations, as well as to add to the data base, collections were initiated on the Matador Wildlife Management Area (MWMA) in the Rolling Plains in 1995. Individuals were measured by snout/vent length (SVL) and total length, sexed, and marked by either a series of toe clippings or the implantation of passive integrated transponder (PIT) tags.

Through 1996, 1,036 individuals have been captured and marked on the CWMA. Horned lizards have been captured during every month of the year except January; however, most lizards (84%) were captured from April through July with the most active month (34% of all captures) being May. Observed adult sex ratios are 65% females and 35% males. Typical reptilian sexual dimorphism was evident with females being larger (SVL, $x = 91.8\text{mm}$) than males (SVL, $x = 86.3\text{mm}$). Juvenile representatives of the population averaged 32%, 13% in 1992 to 45% in 1994.

One hundred-twelve horned lizards have been recaptured on the CWMA since 1991. Preliminary analysis of 1991-94 data utilizing the Schnable method estimates yearly population densities ranging from 1 horned lizard per 9.4 acres in 1991 to 1 horned lizard per 4.3 acres in 1994. This increase in density could be a result of more intensive sampling during the latter years of this study. During an

individual year, 10 juveniles showed an average growth of 3.55mm (SVL) per week, while 14 adults illustrated growth rates of an average of 1.77mm per week. Of individual horned lizards which were recaptured during a different year than their original capture, juveniles produced an average growth of 32.9mm per year and 9 adults grew an average of 5.13mm per year. The longest interval between captures of an individual was 4 years and 3 days for an adult female which was estimated to be at least three years of age when first captured.

Since 1995, 82 individual horned lizards have been captured and marked on the MWMA with 7 recaptures. Juveniles comprised 8% of the sample in 1995 and 57% in 1996. Observed adult sex ratios are 59% females and 41% males. Horned lizards are active during a shorter time period than those on the CWMA with captures occurring from April through August. Ninety one percent of captures were within the months of June, July, and August. Horned lizards on the CWMA were somewhat larger (SVL, $x=89.9\text{mm}$) than those on the MWMA (SVL, $x = 81.8\text{mm}$).

Monitoring of these two populations will continue with the possible expansion of data collection on other wildlife management areas. Additional research will include diet of juvenile horned lizards and radio telemetry studies to determine habitat use, hibernaculum site characteristics, juvenile dispersal, and the accuracy of mark/recapture data in estimating population size. Funding is provided by the Texas Parks and Wildlife Department and the Horned Lizard Conservation Society.

Visitor Impact on Bat Emergence Behavior at the Old Tunnel WMA

John T. Baccus, Marian Bailey, Max Sears, Kelly Harper - Southwest Texas State University and Tim A. Lawyer - Texas Parks and Wildlife Department

Texas has 32 bat species, more than any other state, and some exceptionally large colonies which are characteristic of the Southwest. The majority of bats in Texas are insectivorous, and some colonies consume large quantities of insects nightly. Bats are the major predators of night-flying insects and are helpful to farmers and ranchers by controlling certain species of destructive insects.

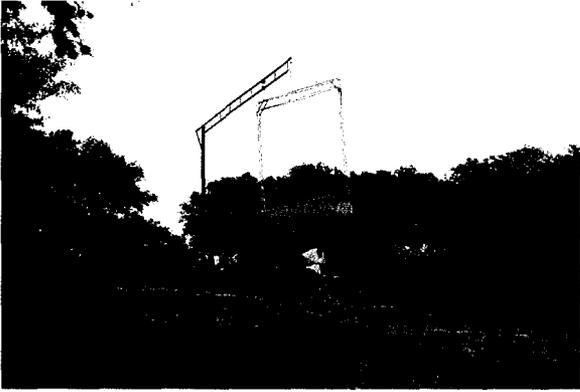


Photo by Tim Lawyer

The Old Tunnel Wildlife Management Area (WMA) is a 10.5-acre tract of land owned and operated by the Texas Parks and Wildlife Department. The WMA, located in northern Kendall County about 14 miles north of Comfort, Texas, contains an abandoned railroad tunnel which serves as an annual roosting site for 2-3 million Mexican free-tailed bats (*Tadarida brasiliensis*). The WMA was purchased for the specific purpose of preserving and protecting this important bat colony. With the dramatic increase in public interest about bats, bat biology and life history, the Old Tunnel WMA has become an extremely popular and important site in terms of public education and public bat-viewing opportunities. In 1996, approximately 11,000 visitors participated in public tours at the Old Tunnel WMA. As public awareness of the tunnel continues to increase, the potential of detrimental human disturbances to the colony also could increase. Little is known about the effects of human disturbance on Mexican free-tailed bat colonies, but at some point, harassment and roost disturbance causes roost abandonment and a general decline in bat populations. Concern over the effect of visitors watching the emergence of bats has been and will continue to be addressed as part of this research project.

The objectives of this study are to: (1) determine effects of visitors on bat emergence and behavior, (2) evaluate the tunnel as a natal site, (3) determine the temporal changes in the composition of the bat population regarding sex and age ratios, (4) estimate bat populations in the tunnel, (5) delineate migratory periodicity, (6) determine crepuscular night patterns, (7) identify species composition, and (8) evaluate continuous site-use by free-tailed bats.

The nature of the colony composition with respect to age and sex will be studied. This will require bimonthly (March to October) collections of bats using a "Harp-Type" bat trap.

Bats collected will be aged and sexed, marked, and reproductive information will be recorded. Surveys of the tunnel during late June and early July will verify the presence or absence of pups. Data collected will be used to develop a population profile for the resident bat colony. Use of the tunnel by migrating bats will be assessed during February to May and August to November by trapping and surveys of the tunnel.

The results of this on-going research will be used to properly manage the extensive public-use on the WMA without impinging upon the integrity of the resource. A major benefit of this research will be the development of a long-term operational policy for the area. These policy guidelines are necessary for site-specific management of public lands containing important bat colonies.

This is the sixth year of the study funded by the Texas Parks and Wildlife Department and Southwest Texas State University.

The Use of Artificial Nest Sites by Elf Owls in Western Texas

Bonnie R. McKinney - Texas Parks and Wildlife Department



Photo by Bonnie R. McKinney

The elf owl (*Micrathene whitneyi*) is the smallest owl in North America and a neotropical migrant. Wintering in Central Mexico, they return to western Texas as well as other regions of the Southwest, to nest and raise their young. In the lower Chihuahuan Desert, elf owls are dependent on ladder-backed woodpecker (*Picoides scalaris*) cavities for their nest sites. Trees are scarce in this region, and woodpeckers use fence posts, yucca stalks, dead tree limbs, and power poles as nest sites. As overhead electric lines are replaced with

underground utilities, the removal of power poles may impact the breeding population of elf owls as well as other cavity nesters in the lower regions of the Chihuahuan Desert.

A 4-year study was initiated to determine if elf owls would use nest boxes. In addition, other aspects of the ecology of this little-known species are being studied. Both adult and young elf owls are color banded for identification purposes, weighed, measured and photographed. Nesting success, pair and site fidelity, longevity, diet, and return of young to natal areas as breeding adults are major objectives of the research. In 1994, 80 nest boxes were constructed and placed in various habitats on the Black Gap Wildlife Management Area in southeastern Brewster County.

Occupancy rates were 22%, 34%, and 21% in 1994, 1995 and 1996 respectively. Successful nesting attempts and total eggs laid averaged 60% and 47% for 1994 and 1995. Sixty percent of the eggs hatched, while about 97% of the hatchlings fledged in both years. In 1996, successful nesting attempts fell to 30%. A total of 37 eggs were laid of which only 38% hatched. Seventy-nine percent of the hatchlings actually fledged. Lower occupancy, fewer successful nesting attempts, lower number of eggs produced and young fledged in 1996 could be attributed to lower insect availability due to drought conditions.

Rainfall was measured from January through June (breeding season) each year with a total of 4.5 cm in 1994, 4.0 cm in 1995 and 2.3 cm in 1996.

A total of 55 adult females and 59 nestlings have been banded. Return rates on adult females to the study area were 9.5% in 1995 and 17.2% in 1996.

Twenty-one prey items have been identified, with insects making up the largest portion of the diet.

Funding for this project is provided by the Nongame and Urban Program.

The American Peregrine Falcon in Western Texas and Adjacent Northern Mexico

Bonnie R. McKinney - Texas Parks and Wildlife Department



TPWD photo

The U.S. Fish and Wildlife Service has proposed delisting the American peregrine falcon (*Falco peregrinus anatum*). Although recovery criteria are being met in some areas of the Southwest, the peregrine falcon population in Texas has the poorest production and numbers in the United States. The Texas population is found in the rugged canyon country in the western region of the state, mainly along the Rio Grande, which forms a boundary with the states of Coahuila and Chihuahua, Mexico. Nearly half the total population (15 known pairs) are located on the Mexico side of the Rio Grande. The population is geographically isolated and has not been manipulated through cross-fostering or hacking captive raised peregrines.

Over a 22 year period, from 2 to 15 breeding areas have been closely monitored. In only 7 of 22 years has production reached, or exceeded the 1.25 young fledged per site considered necessary for population stabilization. A total of 135 young have been produced during the 22 year period (young actually observed) with 129 total young actually fledged.

Nest failure in the incubation stage is a common occurrence. Contaminants are a possible factor responsible for poor reproductive success. In addition, recruitment rate is very low, sometimes taking several years for a lone adult to attract a mate. Opportunistic collections of peregrine feathers and egg shell fragments, as well as selected prey species have been analyzed for possible DDE, mercury, and other contaminant effects. These results will be combined

with future sample analyses to understand possible factors of low reproduction.

Current and future research needs will continue to focus on contaminants, reproductive success and more extensive surveys in the nearby mountains of Coahuila, Mexico.

Funding for this research is provided by the Nongame and Urban Program, private donations from organizations and individuals, and from the sale of peregrine T-shirts.

A Roadside Raptor Census in Chihuahuan Desert Grasslands of Western Texas

Bonnie R. McKinney - Texas Parks and Wildlife Department



Photo by Bonnie R. McKinney

The Marathon Basin contains a mixture of Chihuahuan Desert habitats comprised mainly of open grasslands interspersed with rolling hills, valleys and mountain foothills. Vegetation consists of mixed grasses, cholla cactus (*Opuntia imbricata*), Spanish dagger (*Yucca torreyi*), mesquite (*Prosopis spp.*) and prickly pear (*Opuntia spp.*). More than 50% of the annual precipitation for the area falls May through August.

This area provides excellent habitat for wintering, migrating and resident raptor species. Due to the scarcity of trees, raptors are easily detected on fence posts, power poles and perched in low vegetation. Nests are highly visible, and often constructed on power poles and in the tops of Spanish dagger plants. Roadside surveys are a convenient method of estimating relative numbers of these conspicuous birds, and have the potential to provide long-term population trend data.

Four, 10-mile survey routes were set up to sample each of four habitats within the high grassland basin. Each route is surveyed once weekly. The route is driven at 25 miles per

hour, and each raptor within binocular range is recorded. Raptor activity at the time of observation, and location on the route is noted. Raptor mortalities are also noted, and carcasses checked for cause of death.

Census routes for 1 1/2 years have documented 5 permanent resident species, 10 transient species, 5 winter resident species and 9 breeding summer residents. Unusual species recorded on the route are the osprey (*Pandion haliaetus*) and Mississippi kite (*Ictinia mississippiensis*). Three mortalities have been documented, 2 great horned owls (*Bubo virginianus*) and 1 red-tailed hawk (*Buteo jamaicensis*). All three were hit by vehicles.

In addition, Sherman traps are set in January of each year along each survey route to estimate diversity and abundance of small mammals. This information will be used to assess trends in seasonal prey availability.

At the conclusion of the study, raptor and small mammal data will be charted to track changes in unmodified grassland habitats. Funding for this project is provided by the Nongame and Urban Program.

Colonial Waterbird Survey and Management

Brent Ortego - Texas Parks and Wildlife Department



Photo by Brent Ortego

The Colonial Waterbird Survey is an on-going cooperative effort between TPWD, the U.S. Fish & Wildlife Service, Texas General Land Office, Texas Colonial Waterbird Society, and other interested organizations and volunteers. The TPWD has participated with this survey since 1968. Department activities have been funded by the Federal Aid in Wildlife Restoration Program and has included conducting bird banding research, serving as the primary manager of the

data from cooperative surveys and maps of colony locations, conducting aerial and ground surveys of colonial waterbird sites both inland and along the coast, providing information to the public about colonial waterbirds in the form of pamphlets and signs at colonies and public boat ramps near colonies, and assisting in managing selected colonies along the coast. Today, TPWD participates by conducting aerial surveys of remote colony sites along the Gulf Coast during even numbered years between May 15 and June 1. Data generated are pooled into a common data base that is frequently used by participants, consultants and developers to avoid damaging colonial waterbird nesting sites. Data are also used to monitor coastal population trends of 25 species of colonial waterbirds whose populations are very good biological indicators of the health of the coastal wetlands and estuaries. This Texas survey is viewed as one of the best of its kind in the Nation and is the longest running one.

TPWD conducted an aerial survey of 44 historic and recently active colonies from San Antonio Bay northeastward along the coast to Sabine Lake during 1996. A total of 40,699 nests were estimated to occur at 21 active colonies. This was less than half of the number of nests estimated during the 1994 survey at the same sites. This major drop in nesting was attributed to the 1996 drought and the associated drying of natural wetlands in the Guadalupe and Trinity River bottoms.

The TPWD Geographic Information System (GIS) staff have developed computer-generated county maps of the colonial waterbird nesting sites along the entire coast. These maps and associated data points contain nesting information for 25 species of colonial waterbirds dating back to 1972. Data will be shared with the Texas General Land Office and other interested agencies and organizations.

Bald Eagle Nesting and Wintering Surveys

Mark Mitchell, Kevin Herriman and Annice Story - Texas Parks and Wildlife Department

Surveys are conducted annually to monitor breeding and wintering populations of bald eagles in Texas. Surveys of nesting bald eagles are conducted beginning in December and continuing through March. A mid-winter survey is conducted during January to monitor the population of non-nesting eagles.

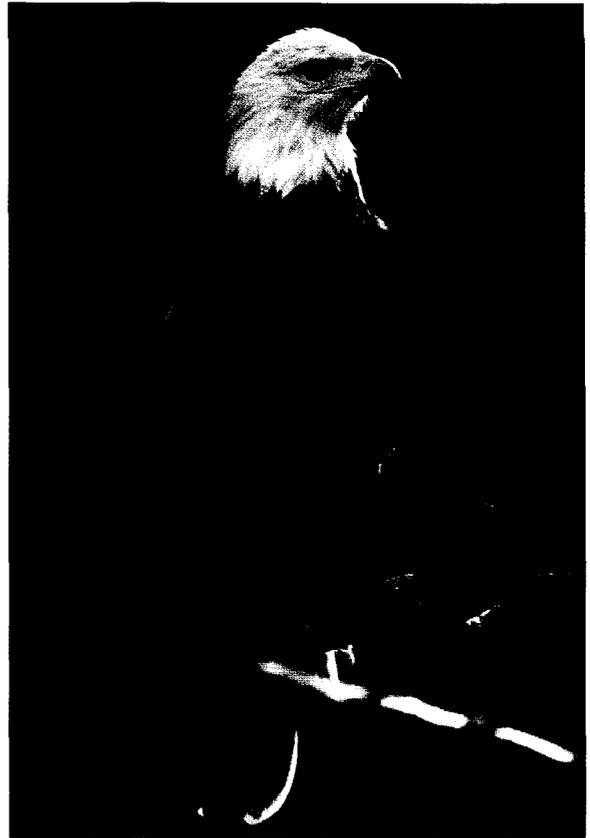


Photo by Leroy Williamson

Nesting bald eagles have been monitored in Texas since the 1960s, at which time less than 5 active nests were known. In the early 1970s efforts were increased to find and document nests. From 1975 to 1996 the number of known active nests increased from 7 to 49, respectively. This increase in known nests was due to a combination of an increasing bald eagle population, an increase in agency effort, and an increase in public awareness and reporting of nests.

Aerial surveys are conducted January through March of known and newly-reported bald eagle nests. Data collected included nest location, status, productivity, and hatching date. Ground surveys are also conducted by local Texas Parks and Wildlife Department biologists in assessing the nesting population in Texas. These data are used extensively to aid in the preparation of environmental impact assessments for development projects in areas of known nesting activity.

Surveys of 22 standardized locations are monitored during mid-January to estimate the non-nesting winter bald eagle population. Nineteen of the 22 sites are reservoirs in central and East Texas. These surveys are coordinated by Texas Parks and Wildlife Department personnel but utilize volunteer labor. Volunteers conducted surveys on the 22 sites

in 1996 and 1997 and reported 248 and 305 bald eagles, respectively. During January 1997, the highest numbers were found on Lake Fork and Lake Palestine with 56 and 46 eagles, respectively.

These are ongoing annual surveys funded by the Texas Parks and Wildlife Department through Federal Aid in Wildlife Restoration Grant W-125-R.

Population Dynamics of the Monarch Butterfly in Texas

William H. Calvert and Matt Wagner - Texas Parks and Wildlife Department



Photo by Chip Ruthven

Preliminary investigations revealed that monarchs were found breeding in East and West central Texas during September and part of October 1996. Monarchs were found in higher densities on *Asclepias latifolia* than on the other native milkweeds. The highest egg and larval densities were found along survey routes east of Livingston followed by survey routes west of Junction.

The lowest densities of eggs and larvae were found in the Central Prairies and the Pineywoods west of Livingston. These areas also contained high concentrations of the imported fire ant (*Solenopsis invicta*), but the correlation between the presence of fire ants and the lack of monarch eggs and larvae was not strong.

There are two possible explanations for the bimodal distribution of immature monarch and queen butterflies across Texas: 1) Predators such as fire ants are more common in the Central Prairies and in the western portion of the Pineywoods. These predators may suppress the fall population of monarchs and queens. 2) Oviposition is not uniform across Texas. In the fall, monarchs infiltrate far eastern and western Texas to lay eggs on flourishing

milkweeds. They tend to avoid the Central Prairies and western portion of the Pineywoods.

All native milkweeds declined in vigor between October and December, 1996. Only the non-native *A. curassauica* was present during the winter as an actively growing plant in locations where it was cultivated and protected from frost. This species is not frost tolerant, is limited in distribution, and therefore is not a reliable host plant at these latitudes for monarchs.

In mild winters, monarchs could breed continuously on *A. curassauica* as they sometimes do along the Texas Coast. In contrast, native hosts are not available to monarchs through the winter. Because the population of *A. curassauica* is likely to be very limited in extent, the breeding population of monarchs along the coast using this plant during the winter is likely to be very small.

This study will continue at least through 1997 in order to complete general population characteristics for monarchs in the state. This project is funded by the Texas Parks and Wildlife Department.

Food Habits, Reproduction, Disease and Condition of Feral Hogs in the Central Rolling Plains

Calvin Richardson and Brad - Texas Parks and Wildlife Department



Photo by Glen Mills

Feral hog numbers have increased dramatically over the past decade throughout much of Texas, especially in the central and northern portions of the Rolling Plains ecological region. Numerous studies have been conducted on feral hogs in other ecological regions of Texas and in other states; however, documentation of feral hog food habits, reproduction, and disease is lacking for the Rolling Plains. It

is important to gather some general biological information as soon as possible on this colonizing population, and to assess feral hog impacts on native wildlife in the Rolling Plains. This study was initiated in September 1996 and will continue for at least two years. A minimum of 25 hogs are being collected each season for a total sample size of 100+ hogs/year.

The objectives of this study are to: (1) determine seasonal food habits of feral hogs in the central Rolling Plains, (2) assess direct impacts of feral hog depredation on vertebrate wildlife species including potential impacts on deer, quail, and turkey production, (3) assess the potential for competition between feral hogs and native wildlife for hard and soft mast, (4) evaluate breeding chronology and reproductive potential relative to site, season, nutrition, and age, (5) compare commonly used physical condition indices and evaluate the effect of season, site, gender, and age on physical condition, (6) determine the role of feral hogs in the Rolling Plains as vectors for human, livestock, and wildlife diseases, and (7) establish management recommendations for feral hogs in the Rolling Plains.

A major portion of the study is being conducted on the 28,000-acre Matador Wildlife Management Area, owned by the Texas Parks & Wildlife Department and located in Cottle County. Other study sites in Motley, Kent, King, and Dickens counties are being included opportunistically with the cooperation of the Texas Animal Damage Control Service (TADCS). TADCS conducts predator management programs for landowner associations through aerial gunning, ground-shooting, and trapping; and landowners frequently ask TADCS to control feral hog populations along with other target species.

The majority of hogs are taken by aerial shooting although a few specimens are taken by ground shooting. General physical data are recorded for each specimen including live weight, dressed weight, chest girth, age, sex, physical condition, and numerous mammalogical measurements. A blood sample is collected from each specimen and analyzed for brucellosis, pseudorabies, trichinellosis, toxoplasmosis, plague, and Lyme disease (in cooperation with Texas A&M University, U.S. Dept. of Agriculture, and Texas Dept. of Health). Stomach contents are categorized into 10 food classes: grasses, forbs, woody plants, roots/tubers, cactus pads, cactus fruit, hard mast, soft mast, vertebrates, and invertebrates. Reproductive glands of male and female specimens are collected to compare the

chronology of gametogenesis with chronology of actual breeding. Adrenal glands are being analyzed for changes in hormone production (Texas A&M University), the results of which will be compared to the chronology of puberty as indicated by examination of reproductive glands. Fetal crown-rump measurements are taken to determine the presence or absence of peak breeding and farrowing dates. Feral hog collections have been completed for the fall and winter seasons. Although not a primary objective of the study, any findings concerning effects of feral hogs on native wildlife should highlight potential problem areas on which to focus future research.

This project is funded by Wildlife Division Region 1 funds.

ENDANGERED RESOURCES

Effects of Recreation on Texas Wild-Rice

Shannon Breslin - Texas Parks and Wildlife Department



The purpose of this research was to determine the amount and intensity of recreational impact on Texas wild-rice (*Zizania texana*). In 1978, Texas wild-rice was the first plant in Texas to be listed as endangered by the U.S. Fish and Wildlife Service. It is a perennial, emergent, aquatic grass presently known only from the upper 2.5 km of the San Marcos River. Recreation poses an unknown degree of threat to Texas wild-rice. Due to its extremely limited distribution and location in a heavily used river, many popular activities such as tubing, swimming, boating, and fishing could impact the rice. During 1996, volunteers contributed 446 observation hours to help TPWD record data at six transects

located between Spring Lake and the IH-35 bridge. The final report will provide a summary of recreational contact with wild-rice and describe management strategies towards alleviating existing or potential stresses. The USFWS provided funding for this one year study.

Effects of Prescribed Burning on Houston Toad Habitat

Andrew H. Price - Texas Parks and Wildlife Department



TPWD photo

The Houston toad (*Bufo houstonensis*), endemic to Texas, was known from only a single locality prior to 1990. As the result of a 3-year comprehensive survey conducted by Jim Yantis assisted by several other TPWD personnel during the breeding season, it is now known from 9 counties in Central Texas. The species is restricted to deep sandy soils supporting ephemeral wetlands within native post oak/loblolly pine woodlands and savannas which have been subjected to minimal landscape-scale disturbance. Except for 2 sites, nothing is known about the newly-discovered populations. A total of 1700 (1288 males, 412 females) adult Houston toads have been marked with PIT tags in one watershed within Bastrop State Park from 1990-1996. Breeding choruses of up to 200 individuals form under specific climatic conditions over 1-4 nights during February and early March, separated by intervals of several days to several weeks. Individual females are rarely recaptured during the same breeding season, whereas males have been recaptured as frequently as 22 times. Maximum longevity appears to be 5 years for males and 4 years for females. Individual toads have been recorded traveling distances of up to 1.3 km during the breeding season. Regional climatic regimes have a profound effect upon Houston toad recruitment and survivorship,

compounded by the current fragmented status of the species' populations. A study to determine the effects of prescribed burning on the Houston toad began during the 1996 season in Bastrop State Park. Total toad numbers utilizing 2 ponds within the proposed burn area will be censused for 2 years prior to burning, and compared with control ponds following treatment.

Funding for this work is being provided by the Texas Parks and Wildlife Department

Aerial Videography of Black-capped Vireo (BCV) Habitat on Public Land

Gareth Rowell and John Maresh - Texas Parks and Wildlife Department and Doughs Wunneburger - Texas A&M University

The purpose of this project was to characterize and map vegetation associated with black-capped vireo (*Vireo atricapillus*) occurrence on public lands at the landscape scale. BCV sightings and associated locality data at eight State Parks and Natural Areas were compiled from previous studies into a Geographic Information System (GIS). Color video, linked to global position systems (GPS), was flown over the study areas to identify narrow strips (ca. 1000 ft width) of vegetation structure associated with vireo habitat. 1:40,000 scale aerial photographs were obtained from U.S. Geological Survey for each study area to provide continuous image coverage of vegetation on each property. Aerial photos were georeferenced by gathering differentially-corrected field GPS data at park boundaries. BCV sightings data, aerial videography, and aerial photography are currently being combined to develop maps of potential BCV habitat on TPWD properties. Funding for this work was provided by Section 6 of the U.S. Endangered Species Act.



Southern Pine Beetle Infestation of Red-cockaded Woodpecker Cavity Trees

Richard N. Conner and D. Craig Rudolph - Southern Research Station, Ricky M. Maxey and M. Melissa Parker - Texas Parks and Wildlife Department and Robert N. Coulson - Texas A&M University



Photo by D. C. Rudolph

The objective of this study was to characterize southern pine beetle (*Dendroctonus frontalis*) (SPB) infestation of pines used by endangered red-cockaded woodpeckers (*Picoides borealis*) (RCW) for cavity roosts. All active and inactive RCW cavity trees on the Angelina National Forest were checked during late fall 1995 and spring 1996. During the field work approximately 121 loblolly pine, 52 shortleaf pine, 17 slash pine, 360 longleaf pine, and 18 pines of undetermined species (a total of 568 pines each season) were examined for status and possible SPB activity. Six cavity trees were infested and killed by SPB (2 loblolly pines, 3 shortleaf pines and 1 longleaf pine) on the Angelina National Forest during FY 1996. One additional cavity tree was killed by wind-snap.

During January 1996, data on SPB activity for FY 1995 in the forest compartments on the north end of the Angelina National Forest (compartments 1-20 plus the Turkey Hill Wilderness Area) were obtained from the Forest Pest Management section of the U. S. Forest Service in Pineville, Louisiana. SPB data for FY 1996 will be compiled when it becomes available from Forest Pest Management personnel. During FY 1995, 66 SPB spots were detected and 1620 pines were infested by SPB according to the Southern Pine Beetle Information System (SPBIS) data set. These data along with the FY 1995 data on SPB-caused mortality of RCW cavity trees were added to the database. During FY 1995 a total of 8 cavity trees were infested and killed by SPB on the northern portion of the Angelina National Forest. Funding for this work was provided by Section 6 of the U.S. Endangered Species Act.

Effects of Disturbance on Rare Wintering Shorebirds

Lee F. Elliott - Texas Parks and Wildlife Department and Tamara Teas - Texas A&M University, Corpus Christi

The goal of this study was to evaluate the effects of human disturbance on piping plovers (*Charadrius melodus*) or snowy plovers (*Charadrius alexandrinus*) in their wintering habitat in Texas. Beach habitats have been determined to be important for each of these species and beaches are also heavily used for recreational activities. Both of these species were examined to determine whether recreational activities might affect shorebird behavior on Texas beaches. Three sites were used to monitor plover behavior as it relates to human disturbance (Matagorda Island, Padre Island and Mustang Island). It was determined that plovers that encountered pedestrians differed significantly

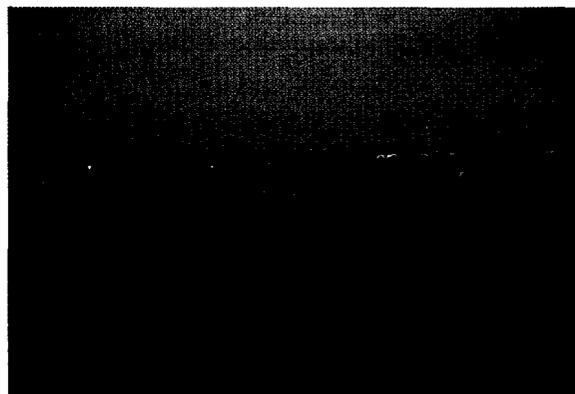


Photo by Phil Glass

in the amount of time spent foraging and in the amount of time in active non-foraging movements, with undisturbed birds foraging more and actively moving less. No such effect was identified for birds encountering vehicular traffic. Migratory and wintering birds may have marginal energy budgets due to the stresses of migration and the metabolic stresses associated with colder winter weather. Reductions in foraging time and increases in non-foraging activity may have implications for the energy budgets of these birds. Funding for this work was provided by Section 6 of the U.S. Endangered Species Act.

Survey and Roost Characterization of Two East Texas Rare Bats

Peggy Horner - Texas Parks and Wildlife Department
and Katy Mirowsky - Texas A&M University, Kingsville



Photo by Peggy Horner

The southeastern bat (*Myotis austroriparius*) and eastern big-eared bat (*Corynorhinus rafinesquii*) are rare bats of the southeastern U.S. which occur as far west as the bottomland hardwood forests of East Texas. Although these bats are often considered cave dwellers, East Texas is mostly devoid of caves and little is known about factors governing roost tree selection for either species. Declines in populations throughout other parts of their range due to disturbance and habitat loss make it imperative that habitat be identified and protected in Texas. This study began in 1994 and continues to document the presence and distribution of the two target species as well as locate and characterize tree roosts and their associated habitats. Since 1994, the southeastern bat has been documented in 13 counties and the eastern big-eared bat in 9 counties, expanding their known range in East Texas. Several maternity and winter tree roosts

have been discovered and continue to be monitored. It appears that these species prefer tree roosts in very large live bottomland hardwood trees where the base has been hollowed out by floodwaters. Future efforts will focus on monitoring the roosts to determine the stability of the population. This project was funded by Texas Parks and Wildlife Department, U.S. Forest Service, Wray Trust, Bat Conservation International, The Nature Conservancy, and Naegeli Transportation Company.

Assessment of Habitat Features at Potential Reintroduction Sites for Attwater's Prairie Chickens

Lee Ann Linam - Texas Parks and Wildlife Department

This project will examine three potential reintroduction sites in Brazoria, Matagorda, and Aransas Counties for the purpose of assessing habitat requirements associated with the Attwater's prairie chicken (*Tympanuchus cupido attwateri*). Currently, the Attwater's prairie chicken is the most endangered animal in the state of Texas. In particular, this study will assess habitat characteristics including total native grassland area, degree of habitat fragmentation near the potential release sites, composition of grass and forb communities, insect abundance, predator abundance, evidence of disease (based on local galliformes, especially bobwhite quail), and topography with regards to flooding. In addition, this study will assess local land-use trends, concerns and support of local landowners and the local community, and the success of the reintroduction effort in addressing those concerns at the three potential reintroduction sites. Funding for this work is being provided by Section 6 of the U.S. Endangered Species Act.



Photo by Ron George

Population Monitoring of the Black-capped Vireo and Two Rare Orchid Species at Camp Barkeley, Texas Army National Guard

David W. Wolfe, Wesley Bailey, Phi A. Nguyen, and Paul Turner - The Nature Conservancy and C. Craig Farquhar and John Maresh - Texas Parks and Wildlife Department



Photo by Jim O'Donnell

Biological inventories performed at Camp Barkeley (Taylor County) during the 1993 and 1994 field seasons revealed the presence of one federally endangered neotropical migrant; the black-capped vireo (*Vireo atricapillus*), and two rare orchids; Glass Mountain coral root (*Hexalectris nitida*) and Warnock's coral root (*H. Warnockii*). A project was initiated in 1995 and continued through 1996 to delineate and map black-capped vireo territories, quantitatively characterize the habitat features that are critical in the protection and maintenance of the existing BCV population, obtain baseline data on the distribution and reproductive status of the two rare coral root species, quantify the composition and extent of the habitat of these two rare plant species, and develop site-specific management plan alternatives to protect and maintain the habitat of the species of concern. Results of the project indicate that the current black-capped vireo habitat on Camp Barkeley is limited in extent and marginal in quality. The vegetation height, density and Ashe juniper composition exceeds that of quality vireo habitat. Past disturbances (e.g., fire, bulldozing) appear to have created and maintained the habitat, but no disturbances of this type have occurred for many years. In order to begin the process of habitat restoration and maintenance, a mechanical manipulation is scheduled for early 1997. Glass Mountain coral root is thriving at Camp Barkeley (approximately, 73 individuals were located in 1995). This species was found throughout the Ashe juniper - oak

woodlands which cover approximately two-thirds of the training site. It has also been found throughout this type of habitat in Central Texas. Warnock's coral root was less abundant (18 individuals were located in 1995) and had a more restricted range than its sibling species, however the population appears to be stable over the past three years of surveys. A concentration of both coral roots was found on the north slope of the Callahan Divide which dissects the central portion of the training site. This study recommended coral root protection from intensive disturbances. Funds for this work were provided by the Adjutant General's Department of the Texas Army National Guard.

Site Characteristics and Management of Johnston's Frankenia

Gena K. Janssen - Texas Parks and Wildlife Department and Paula S. Williamson - Southwest Texas State University



TPWD photo

Johnston's frankenia (*Frankenia johnstonii*) is a low growing perennial shrub known from Starr and Zapata counties of South Texas, and from Nuevo Leon, Mexico. Johnston's frankenia was listed as endangered by the U.S. Fish and Wildlife Service on August 7, 1984 and was listed as endangered by the state of Texas soon afterward. The purpose of this research has been to survey Johnston's frankenia populations and examine their association with soils, geology and other plant and animal species collected at each site. In addition, the floral morphology, phenology, and pollination biology of Johnston's frankenia is being studied. This work has led to the discovery of several new Johnston's frankenia populations and has addressed landowner and community outreach including: participation at the Zapata County Fair, a Conservation Summer Camp for Kids, and

landowner meetings in order to work towards conservation agreements. Each conservation agreement is a voluntary undertaking between an individual landowner with Johnston's frankenia and the Texas Parks and Wildlife Department. Approximately 90% of landowners contacted have agreed to participate in conservation agreements. Surveying for new populations and developing new landowner contacts are continuing efforts. Funding for this work is being provided by Section 6 of the U.S. Endangered Species Act.

A Natural Community-Based Approach to Evaluate Habitats for Rare Species

Guy Cameron - University of Houston and Gary L. Graham - Texas Parks and Wildlife Department

The Endangered Resources Branch (IPWD) has contracted with the University of Houston to analyze the association of rare plants and animals with plant communities. The rare-species by plant-community matrix has been completed and contains 91 communities and about 300 species. The goals of analysis are to determine which habitats harbor the most rare species, to determine habitats which are rare themselves, and how those habitats are situated on the landscape. These data will be integrated with our Biological and Conservation Database (BCD) to form an easy-to-access, habitat-based natural resource information system for use by conservation planners and land managers at the local level.

Funding for this work is being provided by the Texas Parks and Wildlife Department.

Status Update on the Tobusch Fishhook Cactus

Jackie M. Poole and Gena K. Janssen - Texas Parks and Wildlife Department

The purpose of this research is to determine the current status of the federally-listed Tobusch fishhook cactus (*Ancistrocactus tobuschii*). Currently, nine populations of the species are being monitored twice a year to check the health of individual plants. Efforts are also underway to contact private landowners for written permission to survey for additional populations. If the data from status research reflect healthy populations and ample numbers are found, recovery and delisting of this species may be well on the way.

Funding for this work is being provided by Section 6 of the U.S. Endangered Species Act.

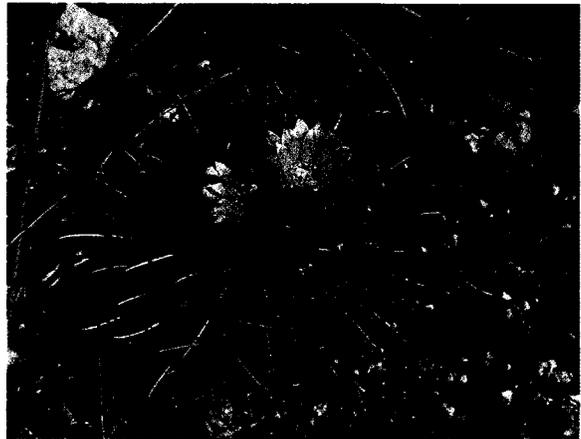


Photo by Max Traweck

Monitoring and Management of Rare Plants on Highway Right-Of-Ways

Jackie M. Poole and Gena K. Janssen - Texas Parks and Wildlife Department

This on-going Section 6 project has now achieved 26 management agreements for monitoring 33 populations of 26 species including 11 listed plants and 15 candidates for listing. Most populations have been monitored four or more years and have increased in size. One of the reasons for this success is the close working relationship with Texas Department of Transportation (TxDOT) staff. Site meetings with local, regional and statewide personnel review management practices and effects on rare plants. Usually few modifications are required. TxDOT has been extremely cooperative in adjusting mowing schedules, restricting herbicide use, and placing signs. Increased awareness and inter-agency cooperation have resulted in the success of this project.



Photo by Jackie Poole

ECOSYSTEMS

Classification of Land Cover and Assessment of Forested Wetlands in the Cypress Creek Watershed

Changxiung Liu, Jim A. Neal, Craig Scofield, Jane Chang, A. Kim Ludeke and Carl Frentress - Texas Parks and Wildlife Department



Photo by Jim Neal

Bottomland hardwood forests are considered important habitats for wildlife and are of value for the conservation of biological diversity. In preparing for a statewide wetland conservation plan, Texas Parks and Wildlife Department, using funding provided by the United States Environmental Protection Agency, initiated this study on the status of forested wetlands (including bottomland hardwood forests) in East Texas and western Louisiana. Classification and analysis were made for the forested wetlands and other land cover types in the Cypress Creek watershed using Landsat Thematic Mapper (TM) imagery and Geographical Information System (GIS) technology. Color infrared (CIR) aerial photography and information on soils, geology, and topography were also utilized in the process.

The area of Caddo Lake and the remainder of the Cypress Creek watershed is highly diverse in terms of numbers of plant communities and aquatic species, and importance for wildlife. Fourteen land cover types were identified. Of these fourteen types, 11 are vegetated or forested. Forested wetlands consist of river birch (*Betula nigra* L.) - black willow (*Salix nigra* Marsh.), swamp/baldcypress (*Taxodium distichum* (L.) Rich.) swamp, mixed cypress-hardwood, and water oak (*Quercus nigra* L.) - overcup oak (*Q. lyrata* Walt.) - blackgum (*Nyssa sylvatica* Marsh.). These four types occupy only small areas

(3.3%) of the floodplains which were formerly covered principally by bottomland hardwood trees, shrubs, and vines, and by aquatic herbaceous species. The single most significant factor in contributing to the decline of bottomland hardwood forests has been reservoir construction. Other factors include agricultural and silvicultural practices, and urban development.

Demonstration of Bottomland Hardwood Forest Restoration for Wildlife Habitat and Timber Production

Hayden Haucke, Carl Frentress, and Dale Prochaska - Texas Parks and Wildlife Department

Bottomland hardwood forests are among the most ecologically important habitats in Texas. These forests provide the hub, or nucleus from which many resident and migrant wildlife species radiate out to adjoining upland sites. Nationally, the 70-80% original presettlement floodplain forest acreage has been lost due to human land use changes. In Texas, about 60% of the original floodplain forest has been



Photo by Dale Prochaska

lost. Recently, new national and international markets have increased demand for hardwood saw timber and pulp. In Texas, this market is predominately supplied from bottomland hardwood forests.

The objectives of the study are to improve the species composition of trees on approximately 200 acres of existing high-graded forests using an improvement cut method of timber harvest followed by tree seedling plantings using native oaks and pecan and to develop information products and conduct outreach events to private landowners concerning options for bottomland timber management.

The timber harvest/replanting treatment site has been selected within the Trinity River floodplain on the South Unit of the Richland Creek WMA. This site was chosen as representative of the 10,000 acre high-graded elm-hackberry-green ash forest on this management area. The Texas Forest Service conducted a complete timber inventory of the treatment site and marked all trees to be harvested. The first inventory was analyzed using the Inventory Processor computer program for two interest variables, sawtimber and pulpwood. Analyzed data indicated 36.7 trees per acre or 1,419.4 board-feet (Doyle Scale) available for sawtimber. Analyzed data also indicated 54.1 trees per acre or 7.6 cords of pulpwood per acre. The timber sale and harvest occurred during August and September, 1995. All marked trees were removed from the replanting areas and stacked within adjoining rights-of-way. The timber harvest, known as "thinning from above," resulted in a total of 1,587 tons of sawtimber and pulpwood removed from the study area. The study site was replanted in February 1996 using 150 native oak and pecan and other hard-mast producing seedlings per acre.

In September 1996, five 1-acre test plots, planted in February 1996, were surveyed for seedling survival. Seedlings persisting through this time frame were considered to have survived the first growing season. A total of 449 trees were surveyed. Survivability by species is as follows: 1) Shumard Oak - 22.4%, 2) Bur Oak - 11.5%, 3) Overcup Oak - 6.8%, 4) Pecan - 2.2%, and 5) Water Oak - 2.0%.

The low survivability was attributed primarily to severe drought conditions experienced throughout the first growing season. Additional losses were contributed to feral hogs, whitetailed deer and swamp rabbits. The overall survivability on the 200 acre project site was estimated to be 3,217 seedlings, approximately 16 trees/acre. Surveys will be

conducted again in September 1997 to estimate survival over a two year period. There is a one year extension added to this study to further develop outreach literature.

This study is funded primarily through a grant from the United States Environmental Protection Agency. Assistance in timber harvest and replanting procedures was obtained through an interagency agreement with the Texas Forest Service.

Wildlife Value Orientations and Information Needs of Non-Industrial Private Forest Landowners in East Texas

Carter P. Smith and Stephen R. Kellert - Yale University and Kirby Brown - Texas Parks and Wildlife Department



Photo by Carter Smith

One of the most formidable challenges facing natural resource management practitioners is the ability to engender a heightened awareness, knowledge, and interest among private landowners regarding the benefits of wildlife stewardship. To assist wildlife managers in East Texas with this endeavor, we conducted an attitudinal survey of Non-Industrial Private Forest (NIPF) landowners to elucidate the following items of interest: 1) wildlife information needs and preferred sources for receiving information; 2) incentives/disincentives for engaging in wildlife management; 3) relative interest in various Texas Parks and Wildlife Department (TPWD) landowner extension programs; and 4) attitudes towards property rights and endangered species conservation on private lands.

A multi-stage cluster sampling scheme was employed to randomly select 2700 NIPF landowners from 18 counties within the northern, southern, and central portions of the Pineywoods and Post Oak Prairie Ecological Regions. Following extensive pre-testing, a self-administered mail

survey questionnaire was developed and mailed to NIPF participants in November 1995. A 68% total response rate was achieved through the initial survey dissemination and one follow up mailing to non-respondents.

A high percentage of NIPF owners expressed interest in acquiring information about wildlife, although relatively few indicated they had consulted TPWD for past assistance with their wildlife management needs. Younger, well educated, affluent, and larger landowners expressed the greatest interest in actively managing for wildlife on their lands. "Maintaining a healthy environment" and "conserving wildlife for my children and grandchildren to enjoy" were the two motivations most frequently cited by NIPF owners as being important reasons for engaging in wildlife management activities. Future extension initiatives must recognize the divergent interests of small and large landowners, the non-consumptive motivations for participating in wildlife management, the time and monetary constraints of most NIPF owners, and the independence of landowners in carrying out management practices if they are to be successful in fostering broader interest in TPWD sponsored programs.

Project funding for this 1 year study has been provided through the Private Lands Enhancement and Migratory Wildlife Programs of the Texas Parks and Wildlife Department.

Inventory and Monitoring Habitat and Wildlife Diversity on Wildlife Management Areas

Matt Wagner and Brad Simpson - Texas Parks and Wildlife Department

The Texas Parks and Wildlife Department administers nearly 1.5 million acres of public land on over 200 sites, including Wildlife Management Areas, State Parks and State Natural Areas. These areas represent a diversity of habitats from 10 ecological regions of the state. In order to insure proper stewardship and management of these resources, baseline inventory and long-term monitoring procedures for vegetation and wildlife have been initiated. Soil and vegetation cover maps are being developed using Geographic Information System (GIS) technology. Systematic sampling procedures are used to estimate the distribution and relative abundance of plants and vertebrates. Line and point transects, in conjunction with the Daubenmire frame method are used

for sampling vegetation cover, composition and density. Live trapping for small mammals and drift fence arrays for reptiles and amphibians are used to record occurrence and estimate relative abundance. Point counts, belt transects and mist netting for nongame birds are used to develop checklists and monitor long term trends in bird populations. Mist nets are also used to sample bat populations. All data collection is conducted seasonally. A procedures manual has been produced, and field training of various survey techniques is ongoing. Data collected from these procedures will be used to assess long-term trends in habitat and nongame species, evaluate the effectiveness of various habitat management techniques, and incorporate data for nongame species into a statewide Terrestrial Wildlife Database.



Photo by Chip Ruthven

The Salt Bayou Marsh Restoration Project

Terry Turney - Texas Parks and Wildlife Department

The Salt Bayou Marsh Restoration Project encompasses over 60,000 acres of intermediate to brackish coastal marsh in Jefferson County, Texas. A water control structure was placed on Salt Bayou at the Gulf Intracoastal Waterway in October 1995. The structure's purpose is to decrease wetland degradation by reducing drastic water and salinity level fluctuations, thus promoting desired emergent and submergent vegetation. Monitoring of water salinities, climatic influences, vegetation, and wildlife populations was initiated in 1993 by TPWD personnel to acquire baseline data documenting habitat responses to direct management strategies before and after structure completion. Monitoring efforts have keyed on vegetation, salinities, and the utilization of annual wildlife surveys of the area. Vegetation monitoring

is conducted to document species composition, frequency of occurrence, distribution and density along 21, 1-km transects. To achieve this, line and point intercept methods are utilized with Robel pole readings taken along each transect line. Preliminary data analyses indicate increases in marshy cordgrass (*Spartina patens*) coverage and decreases in open water. Bi-weekly salinity readings are taken at 13 locations throughout the area. Climatic factors have had dramatic effects on salinity readings. Annual TPWD alligator nest count and waterfowl survey results are incorporated in the analyses. Preliminary data indicate a reduction in the number of alligator nests and an increase in waterfowl numbers. Final results will be used to evaluate the effectiveness of the Salt Bayou structure for salinity and water level regulation across the entire marsh system.



Photo by Jim Sutherland

Funding and support for this project has been provided by the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, Ducks Unlimited, and the Texas Parks and Wildlife Department.

An Ecological Investigation of Robbins Slough Drainage: Ecosystem Response to Management Strategies

M. Todd Merendino, D.W. Mabie, J. Brent Ortego, and Dennis L. Brown - Texas Parks and Wildlife Department

Saltwater intrusion, as a result of natural subsidence, river channelization, reduction of freshwater inflows, and canal dredging is a major cause of coastal wetland deterioration. Natural drainage patterns along many areas of the Gulf Coast have been altered by construction of the Gulf Intracoastal Waterway (GIWW) and other channelization projects. Specifically, a comparison of 1930, 1973, and 1991

aerial photography indicates that natural drainage patterns and vegetative dynamics in Robbins Slough drainage at Mad Island Wildlife Management Area in Matagorda county, Texas, have been altered by the GIWW and Culver Cut Ditch (CCD). Concomitant with changes in freshwater and saltwater flow patterns has been a change in vegetation species composition from that which is more characteristic of fresh, intermediate, and brackish marshes to that more characteristic of brackish and saline marshes, and also, an increase in unvegetated open water areas. Erosion of shorelines and organic matter has occurred due to barge traffic in the GIWW.

We are proposing to restore freshwater inflow and regulate saltwater intrusion into Rattlesnake Island Marsh and Savage Marsh at Mad Island Wildlife Management Area by constructing several structures, levees, and small channels. These activities will replenish sediments and soil nutrients in the Rattlesnake Island and Savage Marshes. Numerous plant and animal species will be monitored over a 3-4 week period during each phase of management activity.

One year of baseline monitoring has been completed. To date, 47 fish species have been recorded. Further analysis will be conducted to determine species composition and relative abundance. We have tagged 100 red drum. This tagging will provide information on fish movements within the Robbins Slough estuary and the adjacent bay systems. We have tagged 115 alligators from 18" to 6' in length. Future recapture efforts will provide information on movements, growths, and survival in response to marsh management strategies. Phase II monitoring is nearly complete, at which time staff will begin a large scale data analysis project.

This project is funded by the Texas Parks and Wildlife Department, Wildlife Division, Region 4.

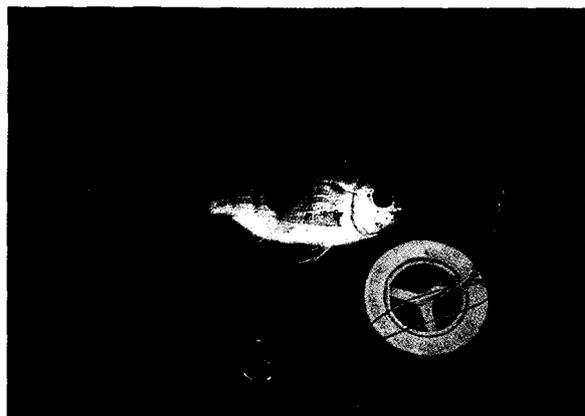


Photo by Ron George

Control of Regrowth Chinese Tallow after Herbicide Application

Terry Turney - Texas Parks and Wildlife Department
and Ron K. Jones - U.S. Fish and Wildlife Service



Photo by Matt Wagner

The genus *Sapium* consists of approximately 100 species. A native of China, it has been historically cultivated as a seed-oil crop for soap production, as well as other tallow products. Significant numbers of Chinese tallow (*Sapium sebiferum*) trees were established in the early 1900s along the Upper Texas Gulf Coast. Range expansion has dramatically increased in recent years because of the tree's ornamental value in yards in the American sunbelt. The tree is a rapid invader of moist soils and will out-compete native species. Chinese tallow is expanding its range in low-lying areas along the Gulf Coast, where it can dominate and radiate along roadside ditches and into former rice fields and other areas where the soil stays wet. The rapid forestation of Chinese tallow has contributed significantly to the degradation of wetlands along the Gulf Coast. The plant also produces tannins which inhibit the feeding of isopod and amphipod invertebrates of aquatic systems (Cameron and LaPoint 1978). Wildlife utilization of these areas is greatly reduced from a historical perspective since the lands originally were predominantly seasonal wetlands and Coastal Prairies.

Research, began in 1996, is underway on the Upper Coast Wetland Ecosystems Project to determine the most practical and cost-effective measures to be taken to control regrowth of Chinese tallow trees. Mechanical removal and the use of herbicides are proven methods of removing established mature trees yet very little documentation of effective second growth treatment has occurred. The 212 acre (86 ha) study site on the J.D. Murphree Wildlife

Management Area has been documented as having one of the highest mottled duck nesting densities on the Texas Coast in the past. However, recent invasions of tallow and willow baccharis (*Baccharis halimifolia*) have reduced the utilization of this site for nesting.

The study area was sprayed with the herbicide Grazon P+D in August of 1996 at a rate of 1 gallon per acre to insure total coverage. Prior to herbicide application, a 1200 m² grid was delineated on site by the use of mowing and markers. Each 100 m² sample plot will be individually subjected to different treatments to determine the most effective and cost efficient means of regrowth control. Treatment methods to be used are mechanical shredding by tractor, mechanical hand removal, prescribed burning and treatment with various herbicides and methods of application. Grazing by goats or cattle and flooding are potential treatments depending on cost and logistics.

Results of this study will be used to determine the most effective and cost efficient means of re-treatment of tallow and baccharis. Impacts on non-target species of vegetation will be assessed in each of the treatments. Peripheral studies associated with this project will investigate the effects of re-treatment on nesting birds with emphasis on mottled ducks and the impacts on fire ants from intensive vegetation control.

This project is funded by the Texas Parks and Wildlife Department, and the U.S. Fish and Wildlife Service.

Evaluation of Earthen Plugs in Restoring Coastal Marsh on the Lower Neches Wildlife Management Area

Zen Polasek, Jerry M. Mambretti - Texas Parks and Wildlife Department, Richard W Griffin - Prairie View A&M University, and William A. White and Robert A. Morton - Bureau of Economic Geology

The most extensive, contiguous loss of wetlands along the entire Texas Coast has occurred along the Lower Neches River (White et al. 1987). From 1956-78, 3,811 hectares (160 ha/yr) of vegetated open marshes were converted to open water. Loss of these wetlands is attributed to: (1) an aggradation deficit relative to sea level rise and sediment deposition; (2) subsidence associated with active faulting or induced by extraction of groundwater, oil, and gas; and (3)

the direct and indirect effects of dredged canals (Morton and Paine 1990, White 1993).

Pipeline canals, navigation channels, and borrow ditches change the natural hydrology of coastal marshes by: (1) facilitating rapid drainage of interior marshes during low tides or low precipitation, (2) reducing or interrupting freshwater inflow and associated littoral sediments, and (3) allowing salt water to move further inland during periods of high tide. Saltwater intrusion into fresh marsh in turn causes loss of salt intolerant emergent and submergent aquatic plants (Chabreck 1981, Pezeshki et al. 1987) and erosion and net loss of soil organic matter (Craig et al. 1979).

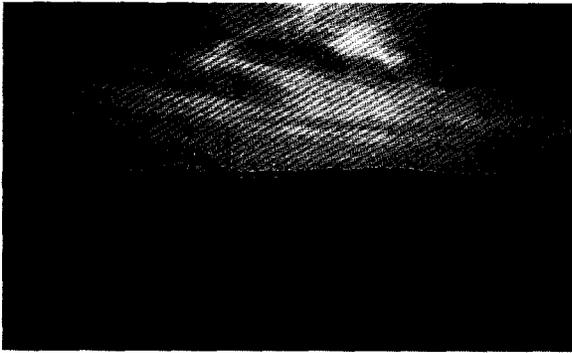


Photo by Terry Turney

To examine the potential role of saltwater intrusion in marsh degradation, Texas Parks and Wildlife Department will plug two borrow ditches connecting the Gulf States Utilities Intake Canal with the Lower Neches Wildlife Management Area. Placed at marsh level, the earthen plugs will prevent daily tides from entering the marsh at this location, but will allow extreme high tides and storm tides to overtop the plug. Four 5-foot by 5-foot box culverts under State Highway 87 will allow tidal waters and the ingress/egress of marine organisms to enter the 600 ha marsh. Specific objectives of this research are to examine: (1) water conductivity, salinity, temperature and dissolved oxygen using continuous recording instruments; (2) morphology, distribution, and vegetative association of wetland sediments; (3) distribution, density and cover of emergent and submergent vegetation; and (4) diversity, density, and size of aquatic macro invertebrates and fishes during spring, summer, and fall. Field data will be collected 1 year prior to plug construction and 2 years post-construction. Data will also be collected from a control marsh to compare habitat changes due to earthen plug effects versus habitat changes caused by natural events (storm tides, low or high annual rainfall, etc.) To

examine if subsidence is continuing at a rate sufficient to produce marsh loss, the extent of emergent marsh will be compared between the periods of 1956-78 and 1978-1990s. Field work began Summer 1996 and will continue through Summer 1998.

This project is being funded as a mitigation project by the Port of Beaumont.

Assessment of Wetland Habitat Alterations Resulting from Pipeline Construction Through Coastal Marshes in Orange County, Texas

Len Polasek - Texas Parks and Wildlife Department

Impacts of pipeline construction on vegetation and soil were investigated along a newly constructed pipeline in Orange County, Texas. Approximately 3.73 km (6 miles) of marsh were monitored within Texas Parks and Wildlife Department's Lower Neches Wildlife Management Area and adjacent properties to determine potential habitat degradations from construction activities. Vegetation and soils were sampled just prior to and 1 year after, pipeline construction, which was completed in September 1995. Both



Photo by Bill Hartje

submerged aquatic (SAV) and emergent vegetation (EV) were sampled to detect changes in taxa frequencies and percent cover within 3 pipeline corridor treatments (soil deposit/borrow, pipeline ditch, and construction equipment) and a control.

No analyses were performed on SAV data because these plants were present during 1995 sampling, but were not detected in 1996. SAV losses were likely due to low rainfall in 1996 which increased salinities within the marshes.

Taxon richness was not significantly altered by pipeline construction within EV plots. However, pipeline construction significantly decreased total vegetative coverage of EV plots within the 3 pipeline corridor treatments. A 33% (2.7 ha) decrease in EV coverage was calculated within a 30.4 m buffer along the pipeline ditch using pre- and post-construction aerial photographs and Geographic Information System (GIS) technology. Similarly, data from EV plots indicated a 49% (2.6 ha) loss within the 19.8 m wide pipeline construction corridor. Post-construction criteria specified that any vegetation quadrat that did not revegetate to at least 85% coverage with former plant species by 1 year after construction would be considered a failed plot. Using this criteria, 67% of EV plots did not successfully revegetate. Thus, approximately 3 ha of vegetated emergent marsh were lost within the pipeline construction corridor.

In addition, soil horizons were affected by pipeline construction. Vertical soil profiles were significantly decreased within the pipeline ditch and control. Soil losses within the pipeline ditch may have resulted from erosion and/or decomposition of emergent vegetation. Decreased soil elevations within the control were also detected. This most likely resulted from compaction by equipment traveling outside the construction corridor because 88% of the EV plots remained 100% vegetated. Vegetation loss and reduced soil elevation within pipeline construction corridors should be expected with the continued use of current double-ditching techniques. Ultimately, present surface-trenching techniques used for pipeline construction, including double-ditching, will alter marsh hydrology and function in Coastal Texas.

This study was funded by TI Energy Services Inc., Houston, Texas.

The Effects of Three Range Management Practices (Livestock Grazing, Prescribed Burning and Juniper Cutting) on the Population Ecology of Tobusch Fishhook Cactus at the Walter Buck Wildlife Management Area

John T. Baccus and Kari Sutton - Southwest Texas State University and Mary Humphrey and Max Traweek - Texas Parks and Wildlife Department



Photo by Mario Gonzalez

The Tobusch fishhook cactus (*Ancistrocactus tobuschii*) was federally listed as an endangered species on 7 November 1979 with confirmation action by the State of Texas on 29 April 1983. This cactus was originally described by W. T. Marshall (1952) from a single plant collected on a private ranch east of Vanderpool, Bandera county, Texas.

Actual and presumed threats to Tobusch fishhook cactus include livestock grazing and trampling, insect parasitism, real estate development, flooding and erosion of habitat, and collection by cactus fanciers. Most sites inhabited by the species are on private lands with various intensities of land use that alter the plant community. Keeney (1987) suggested limited vegetative disturbances benefitted the species by controlling competing grasses.

The control of regrowth Ashe juniper and manipulation of community succession can be accomplished by a combination of livestock grazing, prescribed burning, and juniper cutting. These range management techniques are practiced on thousands of acres of private lands and are in the operational plans of the Edwards Plateau wildlife management areas of the Texas Parks and Wildlife Department. The objective of this study is to determine the measurable effects (none, detrimental, or beneficial) of common range management practices on the Tobusch fishhook cactus.

Field work began on this study in September 1995 and will continue for five years through August 2001. Eight study sites were selected with seven of the sites to receive one of seven possible treatment scenarios and the eighth site to serve as a control.

A cattle herd was stocked in the grazing plots in early February 1997. A prescribed burn was conducted on the burn plots in January-February 1997. Juniper was cut in the appropriate study sites during the period 1994-1996.

As of October 1996, a total of 488 Tobusch fishhook cacti has been located and marked on the Walter Buck WMA. Cacti located within each study site were monitored using 1-m² quadrats. Over 40 other species of vegetation occurred within the quadrats. Average percent vegetative ground cover was calculated at 33 percent for the quadrats. Flowering and fruiting success was monitored for 103 plants during the 1996 late winter period, with 53 percent of the plants producing fruits. The mean number of flowers per cactus was approximately 1.7. The diameter of each cactus was measured using a hand-held caliper just prior to the February 1997 controlled burns.

This project is funded by the Texas Parks and Wildlife Department.

Land Use/Cover Classification and Trend Analysis of Old Sabine Bottom Wildlife Management Area

Jason R. Singhurst and Kay M. Fleming - Texas Parks and Wildlife Department and Susanne M. Alden - University of Texas at Tyler

Bottomland cover types are difficult to recognize and classify by name. Composition varies widely along the Sabine River and includes second terrace, first terrace, and levee or natural alluvial terraces adjacent to the river. This Forested Palustrine Wetland has complex interactions of hydroperiod, climate, soils, and physiography/topography which produce a mosaic of existing vegetation types and associations. Southern hardwood bottoms occur primarily in alluvial river valleys and, to a lesser extent, on stream sides. The flows and sediments of a river are primarily responsible for the origin, character, and maintenance of flood plains and their vegetational aspects. Old Sabine Bottom Wildlife Management Area in Smith County is primarily an oxbow with a web of

sloughs between the Old Sabine River channel and the current Sabine River channel.

The study in progress has identified 17 existing vegetation types and 505 plant species from 107 families. The area's vegetation is currently being classified using a combination of historical and current photo interpretation, forest plot sampling, Global Positioning plot points, and image processing software. Features such as soils, geology, hydrology, and topography are being converted to digital format and topologically superimposed over color infra-red aerial photography. Edaphic and anthropogenic factors will be combined on the area to infer series level or historical vegetation units, fragmentation, and unidentifiable anomalies.

A monitoring and trend analysis program has been initiated by establishing permanent forest plots in each existing vegetation type. This program will allow managers to track woody plant and herbaceous species composition changes over time and their influence on resident and migratory fauna. Dominant bottomland hardwoods will also be estimated for monetary value.

This vegetation analysis of Old Sabine Bottom Wildlife Management Area will act as a guide in decision making and setting resource priorities. The analysis and associated plant list should help stimulate public interest, outdoor education, outdoor recreation, and future research opportunities on the area.

This project is being funded by the Texas Parks and Wildlife Department.



Photo by Kay Fleming

Restoration of a Native Coastal Tallgrass Prairie through Tallow Tree Control

M. Todd Merendino - Texas Parks and Wildlife Department

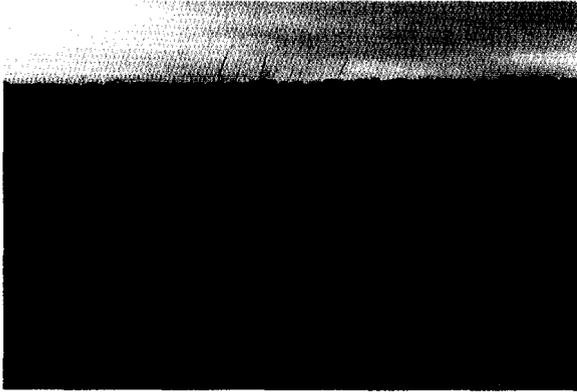


Photo by Matt Wagner

Chinese tallow (*Sapium sebiferum*) is a noxious, non-native tree which has invaded the Mid and Upper Texas Coast, extending into southwest Louisiana. Chinese tallow invades disturbed sites and abandoned agricultural fields, as well as other poorly managed sites. Tallow is an aggressive invader that out-competes native vegetation and quickly overtakes native grassland areas. Herbicidal control is perhaps the best method for quickly and efficiently reducing invading Chinese tallow. At Peach Point WMA (Brazoria County), a native coastal tallgrass prairie is being invaded with Chinese tallow. This prairie is dominated by eastern gamagrass, switchgrass, Indian grass, and big bluestem. Management intervention is needed to prevent the loss of this important habitat. Staff propose to aeri ally apply Grazon PC or Grazon P+D during late summer/early fall, following seed set. This timing will ensure that optimum amounts of herbicide are translocated to the root system of the tree. Vegetation changes will be monitored along a permanent transect that bisects the tallgrass prairie site. Pre-treatment data from the transect will be used to document vegetational changes. Two one-acre exclosures will not be herbicidally treated and will serve as "control sites." Rotational cattle grazing and controlled burning will be additional management activities used to provide for tallow tree control and tallgrass rejuvenation. Vegetation will be compared between the exclosures and treated areas.

Funding is currently being provided by the Texas Parks and Wildlife Department.

Inventory and Analysis of Vegetational Communities on Richland Creek Wildlife Management Area - North Unit

Jason R. Singhurst and Dale F. Prochaska - Texas Parks and Wildlife Department

The 4803.5 acre North Unit of Richland Creek Wildlife Management Area (RCWMA) is located in northeast Freestone and southwest Navarro counties. RCWMA is situated in the ecotone separating the Post Oak Savannah and the Blackland Prairie ecological regions. A large portion of the management area lies within the Trinity River floodplain and is characterized by periodically flooded Trinity and Kaufman clays with occasional lenses of Lamar Clay Loam and Silawa Fine Sandy Loam. Virtually all of the woodland sites on the WMA are bottomland forests with a diverse understory, while non-forested areas are typified by large expanses of wetland-associated herbaceous communities. Systematic flora inventories have not been conducted on RCWMA and inventories for bottomland vegetational communities are severely lacking in Freestone county and nearly void in Navarro county.

The project objectives include developing a baseline vegetation inventory for RCWMA to enhance public interest, outdoor education and future research opportunities on the management area. The permanent survey plots and vegetational analysis will serve as a monitoring and trend analysis program, allowing managers to observe vegetational community changes over time. The program will assist managers in evaluating management strategies and projects and their influence on resident and migratory wildlife species.



Photo by Jason Singhurst

Permanent survey transects and plots will be established, utilizing Global Positioning System (GPS) points, in all series

level plant communities. Seasonal plant inventories will be conducted for one growing season with plant accessions of significant flora deposited in regional herbaria. Geographical Information System (GIS) coverage will be developed in ArcView for existing vegetation, series level vegetation, geology and soils utilizing current and historical aerial photographs. The collection and importation of data will follow National Biological Survey Field Methods for Vegetational Mapping.

Initial data collection for this project started in September 1996 and is scheduled for completion in August 1997. The project is funded by the Texas Parks and Wildlife Department.

Baseline Survey and Monitoring on Texas State Parklands

*David H. Riskind, Keith Blair, Wm. Lynn Pace, Duane Lucia, Kelly Bryan, Ted Hollingsworth, Murk Lockwood, Jason Singhurst, Linda Hedges, Joe Liggio, Michelle Valek and Laura Watkins - Texas Parks and Wildlife Department and Collaborators**

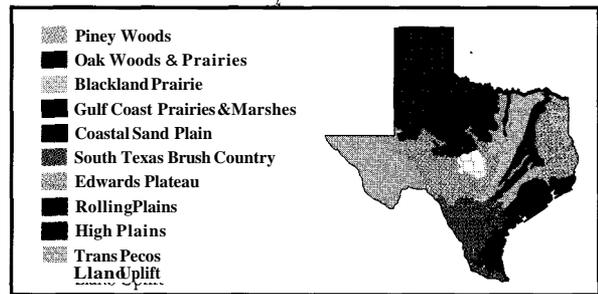
One hundred twenty five state parks with approximately 700,000 acres distributed across Texas represent significant examples of the state's habitat diversity. Ongoing floral, faunal and natural community surveys are the basis for resource planning documents that detail resource management and stewardship strategies for each site. Geological, hydrological and soils data as well as land use history also are integral components of such plans. Resource inventories and baseline data gathering follow uniform standards system-wide with all data sets being fully integrated into a GIS using ArcInfo/ArcView software. Protocols have been established for long-term ecological monitoring on selected sites. All specimens taken as vouchers are accessioned to accredited institutions; a database of collections is maintained at TPWD for use in the Department's Texas Biological Conservation System and/or Terrestrial Wildlife Database as appropriate. This project is funded by the Texas Parks and Wildlife Department.

*

Collaborators: TxDOT, Texas Tech University, Sul Ross State University, Cesar Kleberg Institute, Texas A & M Kingsville, University of Texas at Austin, Texas Christian University, Baylor University, University of Texas El Paso, Lamar University, University of Houston, Texas A & M University at Canyon, Southwest Texas State University, Chihuahuan Desert Research Institute, Abilene Christian University.

Inventory and Characterization of Department Lands

Mike Herring, Jack Bauer, and David Riskind - Texas Parks and Wildlife Department



In response to a Parks and Wildlife Commission charge, Department staff initiated an inventory of publicly held lands in conservation status in December, 1995. A questionnaire was sent to all Department and other public land managers requesting the following information for each area managed: major plant community occurrence, vegetation class description, vegetation condition, acreage represented by each plant community, and percent of facility represented by each plant community and map delineation of plant communities. The Plant Communities of Texas (series level) was chosen as a common data base to allow information exchange with other state and federal agencies and across administrative boundaries within Texas.

The inventory of Department lands represented 1,211,443 acres, and 89 plant communities. A subsequent update added 1,501,115 acres of non-TPWD lands. Plant community conservation priorities were listed for each ecoregion based on Conservation Need Index; an index derived from ratings for acreage, threat, distribution, occurrence, conservation rank, and condition. An attempt was also made to rank conservation priorities at an ecoregion level based on percent plant community representation. Management implications derived from the initial analysis include 1) riparian areas support our most valuable habitats, and many are in a degraded condition, 2) native grasslands are the most poorly represented irrespective of ecological region, 3) nearly one-fourth of all lands in conservation are in poor condition indicating a need for habitat improvement, and 4) nearly one-half of lands in conservation status are in good condition, and can be improved inexpensively with appropriate stewardship and habitat management. This project was funded by the Texas Parks and Wildlife Department.

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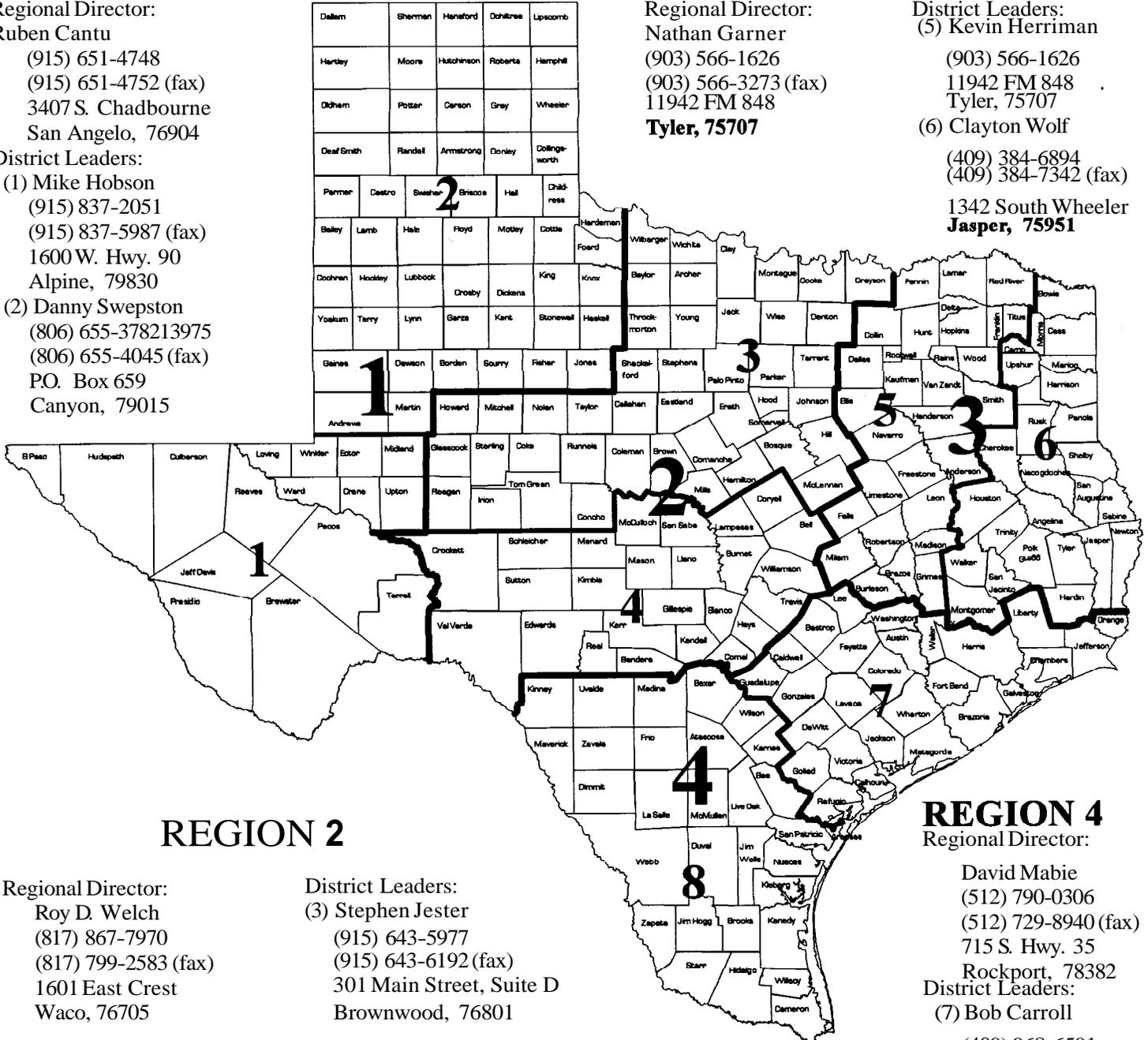
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