

Volume 3



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WILDLIFE RESEARCH HIGHLIGHTS

Edited by Mike Berger, PhD



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Austin, Texas*

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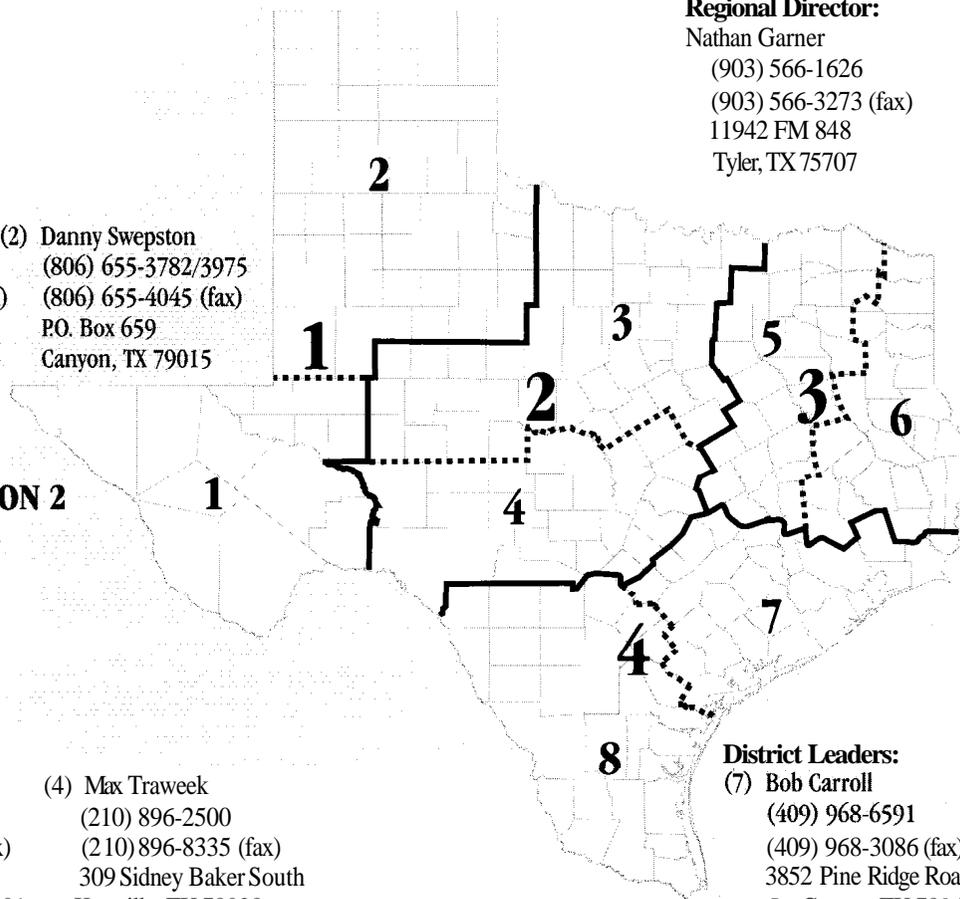
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We express our appreciation to those persons who designed these research studies, analyzed data, drafted abstracts, and provided photographs for this publication. We are indebted to Chris Hunt for designing the manuscript and to Mike Diver for coordinating the printing. Thanks to Rob Fleming and Clemente Guzman III for their illustrations. We appreciate the assistance of all of those individuals, universities, and agencies who cooperated in these studies. We especially thank those persons who donated funds for wildlife research and those private landowners who permitted access to their property for research purposes. This publication is a contribution of the Federal Aid in Wildlife Restoration Act.

COVER PHOTOS

Front: Wildlife biologists investigate bald eagle nests to determine reproductive success – photo by David Mabie.

Back: Wildlife biologist places identification band on white-winged dove so its life-span and migration pattern may be determined – photo by Ed Dutch.

*In Memorial***DONNIE E. HARMEL**

Donnie Harmel died on 19 October 1997 after a hard fight with cancer. For 21 years Donnie was my boss. You learn a lot about a man in 21 years. Donnie had five loves. They were God, family, friends, hunting, and work. He found God in all he did. He worked at being a husband, dad and grandfather. He worked at being a friend. He worked at hunting. And he worked at working. He approached issues and tasks in a black and white manner. It was either right or wrong, and wrongs should be made right. Donnie did not live in a gray world.



If you knew Donnie, you know he was not hesitant about making a decision and you know he didn't spend a great deal of time second guessing himself on the decisions he made. That was probably one of his greatest strengths as a boss. He was definitely a "take charge" person. You knew what was expected from you and you knew that it better be done right. What you didn't always know was "What will Donnie think is right?" He had a great deal of pride in a job well done, and you knew that if he didn't like it, you would have to do it over.

If you knew Donnie, you know he had a great love of the land and activities associated with it. Donnie always acknowledged that what God created was right and he was a dedicated steward of those natural creations. He taught that to his children. He shared that with his

friends. He would have liked to share that with all who would listen, especially the kids. Donnie always saw that a lot of little things make up the Big Picture and he observed many things that most people overlooked. He was a firm believer that "you have to get out of the truck to see what's happening in the pasture."

One of his greatest pleasures was to sit around a campfire with friends and reminisce about hunting trips and things past and talk about deer. If the truth be known,

some of the best ideas about research and management of deer herds in Texas were the product of those campfire discussions.

The Kerr Wildlife Management Area was an extension of his personality and his love for the land. He put a lot of himself into it. Through his leadership and insight, the Kerr WMA became a recognized leader in the conservation world. His office wall was mantled with plaques to his achievements and successes. At his memorial, the pastor read a passage from a journal that Donnie kept. I don't remember the exact words, but part of the passage went something like this, "I wonder where I fit into God's plan." That kind of surprised me. Donnie was part of God's plan for almost 30 years. I'm sure the Kerr Area will go on. Donnie will be missed but his contributions, his caring, and his stories will be remembered around a lot of campfires.

Bill Armstrong

Wildlife Research Highlights

May 1998

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. Our primary objectives for conducting research are to seek answers for important management questions, train our staff, expand scientific knowledge, publish results, and inform the public.

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 \$1,859,000 for 64 wildlife research projects during Fiscal Year 98. 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.

FUNDING SOURCES

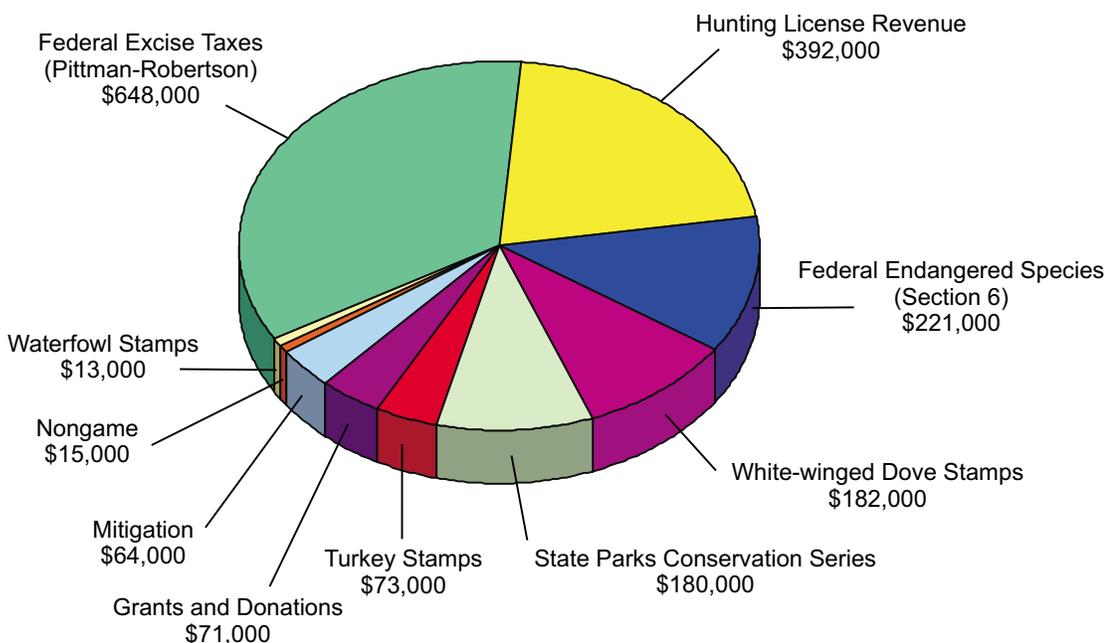


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UPLAND WILDLIFE ECOLOGY

GENETICS AND ENVIRONMENTAL INTERACTION IN WHITE-TAILED DEER

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

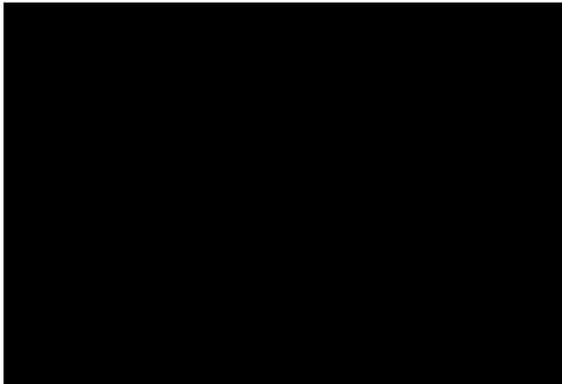


Photo by Eugene Fuchs

Research studies conducted on the Kerr Wildlife Management Area have demonstrated that genetics affect 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, and E. L. Young and Donnie Harmel - Texas Parks and Wildlife Department

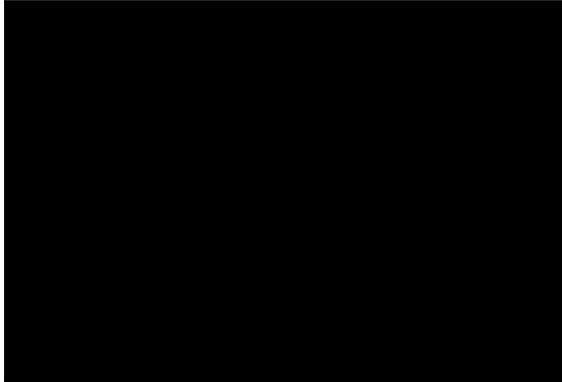


Photo by Media Resources, College of Veterinary Medicine, Texas A&M University

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 35 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 6 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 2 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 genetics program of the International Society for Animal Genetics

(ISAG). As the Coordinating Laboratory for the ISAG, Texas A&M University is helping to develop an internationally accepted panel of genetic markers for use in *Cervidae*.

This study is funded by the Bass Foundation in cooperation with the Texas Parks and Wildlife Foundation and the Texas Parks and Wildlife Department.

WHITE-TAILED DEER SUBSPECIES IDENTIFICATION USING GENETIC ANALYSIS

Timothy L. Bone - Texas Parks and Wildlife Department

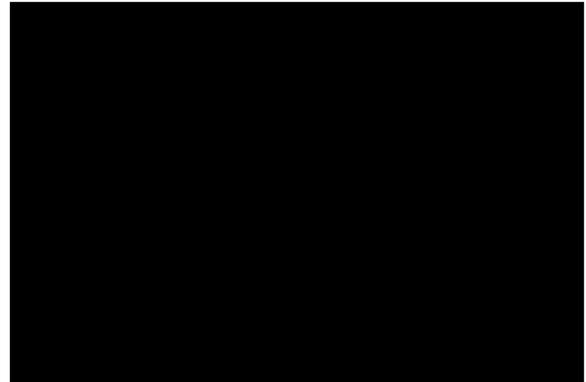


Photo by Tim Bone

The Carmen Mountains white-tailed deer subspecies *Odocoileus virginianus carminis* was first described in 1940 and was named for the center of its distribution, the Sierra del Carmen range located in Mexico. External dimensions, cranial details, pelage color, and antler tine-size and spread were used to describe the subspecies. Carmen Mountains white-tailed deer are the smallest of the 4 white-tailed deer subspecies found in Texas.

Initial descriptions of Carmen Mountains white-tailed deer in the United States limited their distribution to mountain ranges within the present boundaries of Big Bend National Park (BBNP). Most of the Carmen Mountains white-tailed deer in BBNP are located in the Chisos Mountains.

Small, isolated populations of deer located in mountain ranges outside of BBNP in Presidio, Jeff Davis, and Brewster Counties resemble Carmen Mountains white-tailed deer but have not been studied. The need for a better understanding of the classification of isolated white-tailed deer populations in the Trans-Pecos has become apparent. The Texas Parks and Wildlife Department has received requests from private

individuals for authorization to transplant white-tailed deer from outside the Trans-Pecos to locations close to possible isolated populations of Carmen Mountains white-tailed deer. The acceptability of such transplants may depend on the taxonomic status of endemic white-tailed deer which may be exposed to released white-tailed deer.

DNA analysis may be an important tool in classifying Carmen Mountains white-tailed deer, Texas white-tailed deer (*O. v. texanus*), and the possible intergradation between the 2 subspecies. This study will address: 1) the development of DNA analysis to identify Carmen Mountains white-tailed deer, Texas white-tailed deer, and intergrades thereof and; 2) the sampling of isolated white-tailed deer populations in Presidio, Jeff Davis, and Brewster Counties to locate Carmen Mountains white-tailed deer or Carmen - Texas intergrade populations outside of BBNP. In addition, Texas white-tailed deer populations from other areas in the Trans-Pecos as well as desert mule deer (*O. hemionus crooki*) will be sampled. Samples will be obtained from Carmen Mountains white-tailed deer in Mexico if possible.

Samples were collected from hunter harvested deer during the 1997-98 hunting season. Incidental samples from road kills and illegal deer confiscated by game wardens will also be collected through the winter to meet sample size goals, especially regarding both white-tailed deer and mule deer does. A variety of material such as flesh, hide, hoof, bone, and antler may be collected for testing. Samples will be sent to a university or other research entity for DNA analysis.

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

SEASONAL FOOD HABITS/PREFERENCES 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

Deer numbers and physical condition can be limited by the available food supply. A 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,

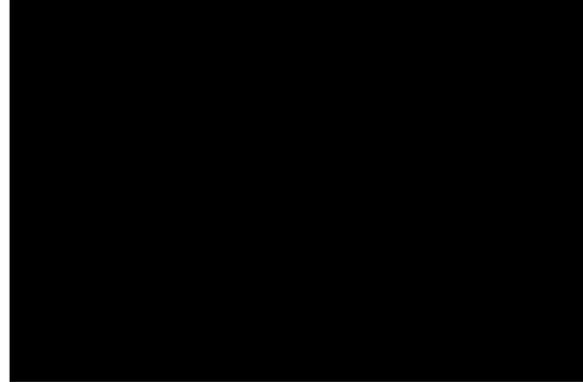


Photo by Lin Poor

deer food habits on 2 major soil types supporting different plant regimes are being compared by site and seasonality of use.

Rumen samples were collected from 5 white-tailed deer during May, August, and November 1997 and February 1998 on each of the 6 study sites located in Bosque, Brown, Jack, Erath, Parker, and Wise Counties. Data were 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 is the second year of a 3-year study funded by Texas Parks and Wildlife Department through Federal Aid in Wildlife Restoration Grant W-127-R.

MORTALITY AND REPRODUCTION OF EASTERN WILD TURKEYS RELOCATED INTO THE POST OAK SAVANNAH OF TEXAS

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

During 1994-97, 183 eastern wild turkeys (*Meleagris gallopavo silvestris*) were released into 7 study areas in the Post Oak Savannah of Texas. Prior to release, all birds were

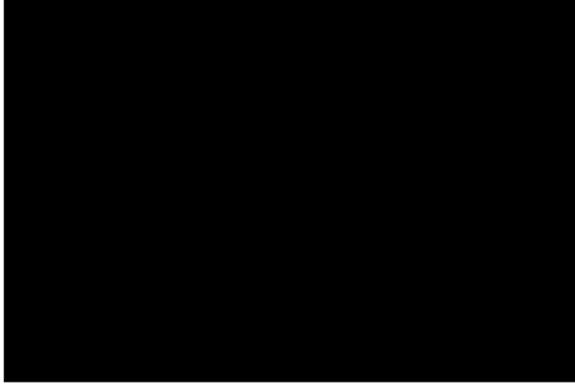


Photo by John K. Thorne

fitted with a battery-powered radio transmitter, and mortality, reproduction and movements were monitored. High mortality and zero reproduction has kept these populations from expanding during the study. The effectiveness of supplemental releases of birds was evaluated and survival was compared to non-supplemental birds. The hypothesis that survivorship of supplemental and non-supplemental birds was equal was rejected ($P < 0.05$), suggesting that supplemental releases increased bird survivorship. The hypothesis that southeastern brood stock has higher survivorship and reproductive potential in restoration efforts also was evaluated. Initial findings indicated there is no difference ($P > 0.05$) in survivorship or reproduction of southeastern and midwest brood stocks.

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***

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 eastern broodstock from several midwestern and southeastern states. 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 compared survival, reproduction, and movements among Iowa, Georgia, and Texas broodstock. Also, the habitat composition of spring-summer home ranges of radio-tagged turkeys was developed.

In February 1994, groups of 12 hens and 3 gobblers were released at each of 4 sites in Tyler County, Texas. Approximately equal numbers of Georgia and Iowa broodstock were released at each site. All birds were fitted with backpack transmitters and were radio-located at least twice a week. In February 1995, 8 Texas resident hens were captured, radio-tagged, and released at the point of capture 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 were monitored on a schedule similar to that of the Tyler County birds.

Between 1 March 1994 and 30 June 1996, 38 mortalities were recorded and contact was lost with 8 other turkeys. As of 30 June 1996, 37 birds were being radio located. These consisted of 12 Georgia birds (9 hens and 3 gobblers) and 9 Iowa hens in Tyler County and 4 Texas hens and 12 Iowa hens on Boggy Slough. During the 28-month period following release, Kaplan-Meier survival probabilities for Georgia and Iowa birds in Tyler County were 0.595 ± 0.096 and 0.322 ± 0.088 , respectively ($\underline{n} = 59$, $X^2 = 4.13$, $\underline{P} = 0.042$). For Georgia and Iowa gobblers, these values were 0.833 ± 0.152 and zero, respectively ($\underline{n} = 12$, $X^2 = 8.86$, $\underline{P} = 0.003$); survival probabilities of Georgia and Iowa hens were 0.533 ± 0.110 and 0.391 ± 0.102 , respectively ($\underline{n} = 47$, $X^2 = 0.67$, $\underline{P} = 0.415$). 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,

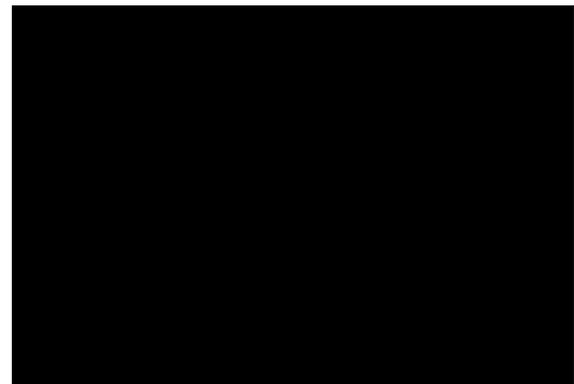


Photo by James George

disease, and other causes were 3, 7, 4, and 6 turkeys, respectively. Proportionally, mammals preyed on Iowa broodstock more heavily than on broodstock from other sources.

During 3 nesting seasons, only 4 hens had reproductive success, hatching 7 broods and fledging only 11 poult. Twenty-five established nests were destroyed during the 3 nesting seasons and an additional 52 nests were suspected of being established and then destroyed. The 25 unsuccessful nests were lost to mammals (10), snakes (11), unknown (2), and abandonment (2). Our results suggest that high nest predation is the factor limiting successful restocking of wild turkeys in the Pineywoods of East Texas.

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

Phase II of this project will involve supplementally stocking 80 midwestern and southeastern wild turkeys at the 4 Tyler County release sites.

EASTERN TURKEY RESTORATION IN THE PINEYWOODS OF EAST TEXAS: PHASE II - SUPPLEMENTAL STOCKING

R. Montague Whiting, Jr. and Jimmie D. Kelly - Stephen F. Austin State University, and John D. Burk - Texas Parks and Wildlife Department

Research in the early 1980s indicated that wild-trapped eastern wild turkeys (*Meleagris gallopavo silvestris*) could be used to successfully rehabilitate wild turkey populations in eastern Texas. Therefore, in 1987, Texas Parks and Wildlife Department (TPWD) began an intensive program to restock the Pineywoods and Post Oak Regions of eastern Texas using wild-trapped eastern turkeys. In 1994, research was initiated to evaluate the success of the restocking programs. In February of that year, 60 wild-trapped turkeys, 30 from Georgia and 30 from Iowa, were radio tagged and released at 4 sites in Tyler County in the Pineywoods; each site received 12 hens and 3 gobblers. Those birds were radio tracked for 28 months and survival, reproduction, and movements were compared between broodstock. Survival of the Georgia birds was somewhat better than that of the Iowa birds; for gobblers, the difference was significant. Reproductive success was poor during the 3 springs, however, with only 11 poult fledged.



Photo by Bill Reaves

In some areas of eastern Texas, restocked populations did become established and flourished; spring hunting was allowed in 10 Pineywoods counties in 1997. However, efforts to restock other sites, including the Tyler County study areas, could not be classified as successful. Therefore, TPWD began supplementally stocking some release sites in 1997. Five gobblers and 15 hens are to be released at each site. The general objective of this research project is to evaluate the supplemental stocking program. Specifically, we hope to determine if the supplementally stocked birds are associating with those released in 1994, and to determine if such associations impact survival, reproduction, etc.

In February 1997, 83 radio tagged eastern wild turkeys were supplementally stocked in Tyler County with each of the 4 original release sites receiving 5 gobblers and 14-18 hens. At each site, approximately half the birds were from southeastern states (including Georgia) and half from midwestern states (including Iowa). At that time, 21 of the original 1994 birds were being radio tracked; these were 3 gobblers and 9 hens from Georgia and 9 Iowa hens. Therefore, when the supplemental stocking was completed in Tyler County, we were tracking 104 turkeys, 13 gobblers and 40 hens from the

southeast and 10 gobblers and 41 hens from the midwest. Additionally, in Trinity County on the Boggy Slough study area, we were tracking 2 resident hens radio tagged in March 1995 and 11 Iowa hens released in February 1996, thus as of 1 March 1997, we were tracking 117 turkeys.

At the beginning of the 1997 breeding season, we were tracking about 85 hens in the 2 counties; only 1 may have successfully reared poults. That was an Iowa hen released in 1994; she had successfully fledged poults the previous 3 springs. Unfortunately, she was poached when the poults were 5 weeks old; their fate is unknown.

During 1997, we lost 21 turkeys to bobcats; 20 of these were at the Tyler County release sites (4 southeastern hens and 5 gobblers, 8 midwestern hens and 3 gobblers). Canine and avian predators took 2 turkeys each, 6 were probably poached, 1 died of disease, and 6 were lost to unknown causes. Additionally 8 birds are missing, 2 of which were likely poached.

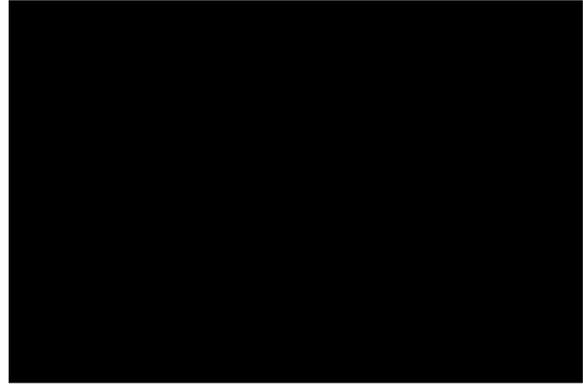
As of 1 January 1998, we were radio tracking 10 gobblers and 61 hens. Seven of the gobblers are southeastern birds, 3 from the 1994 release. Twelve gobblers have been killed, 6 from each subpopulation, and 1 midwestern gobbler is missing. In Tyler County, 24 hens have died, including 11 southeastern and 13 midwestern birds. Three southeastern and 4 midwestern hens are also missing. On the Boggy Slough study area 2 Iowa hens were killed, thus we still have 9 Iowa hens and the 2 resident hens.

In Tyler County, the birds stocked in 1997 are definitely associating with those released in 1994. Although no statistics have been applied to the data, it does not appear that the association is improving either survival or reproduction. Although the study is to continue through the 1999 breeding season, radios on the 1994 birds are expected to fade out in the near future.

A STUDY OF TEXAS TURKEY HUNTERS

Clark E. Adams and John K. Thomas - Texas A&M University, Denise Harmel-Garza - Texas Agricultural Extension Service, and Markus J. Peterson - Texas Parks and Wildlife Department

This study was the first investigation of Texas turkey hunters, who represent a unique subset of the state's hunting population. The goal of this study will be to determine the characteristics of Texas turkey-hunter-permit buyers and their attitudes and preferences towards turkeys and turkey hunting and management.



TPWD photo

Turkey hunting is a popular option among the Texas hunting public and stamp revenues are being used to increase turkey hunting opportunities. The success of turkey management efforts will, in part, be measured by how these efforts compare with the attitudes, activities, and expectations of user groups. Since the overall goal of game management is to provide hunting opportunities for the financial support group, there needs to be a mechanism of critical analysis of how well agency efforts satisfy (now and in the future) constituency needs.

The names of a random sample ($n = 3,500$) of turkey stamp purchasers was drawn from the 1994-1995 season list ($N = 154,306$). All members ($n = 2,345$) of the Texas Chapter of the National Wild Turkey Federation were added to the respondent pool. Turkey hunters were sent a self-administered mark sense questionnaire that asked them to respond to questions addressing their hunting methods, locations, access, and travel distance; opinions and attitudes on selected turkey management regulations or programs; factors that promote or prevent their participation in turkey hunting; factors that limit turkey populations in Texas and selected demographic characteristics.

Questionnaires were returned by 1,350 (38%) turkey stamp purchasers and 729 (31%) of the Wild Turkey Federation members. About 2% of the respondents from both groups were not turkey hunters. The responses from the 2,014 turkey hunters in this study are generalizable to the Texas turkey hunter population at $\pm 3\%$ ($\alpha = 0.05$).

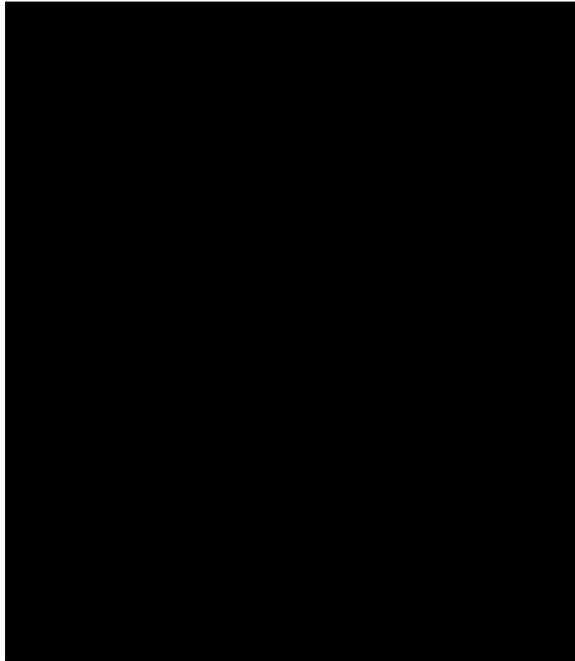
On average, respondents began hunting turkeys when they were 30 years old and have hunted for 17.5 years. The average age of respondents was 47 years and the majority were white males. Over one-third (38%) hunted turkeys in the Fall and Spring while 33% and 13%, respectively, reported hunting during the Fall and Spring only. However, most (95%) of the Fall turkey hunters are also hunting whitetails and would not be hunting for turkey exclusively (55%).

Factors that most prevented respondents from going turkey hunting more often were not enough time due to work, family commitments, low turkey numbers where they hunted and high lease costs.

Most respondents selected 2 out of 6 management strategies to increase Rio Grande turkey production in Texas. These were to allow gobbler only harvest for Fall and Spring seasons and implement a 1 bird bag limit. Hunters (> 65%) believed that predators, loss of habitat, change in habitat and adverse weather conditions were the factors that most limited turkey populations in Texas.

ASSESSMENT OF SCALED QUAIL POPULATION DYNAMICS IN TEXAS

Raquel Leyva - Texas Tech University, Nick C. Parker - U.S. Geological Survey, Texas Cooperative Fish and Wildlife Research Unit, and Markus Peterson - Texas Parks and Wildlife Department



100-year average precipitation for Texas

Scaled quail (*Callipepla squamata*) populations have declined in most areas of Texas in the past decades. Changes in habitat characteristics may have caused changes in population dynamics of the species throughout its historical

range. Research is currently underway to test the hypothesis that long-term habitat changes are not correlated with scaled quail population declines in Texas.

Remotely sensed data and other databases are being used to describe changes in the biotic and abiotic habitat composition in areas of scaled quail distribution in Texas. A Geographical Information System (GIS) is being used to assemble all the databases for habitat description. Databases include soil description, scaled quail population surveys, historical climate data, and vegetation description.

Arc/Info was used to create a referenced frame using counties as the sampling unit for this study. This frame will be used to overlay the coverages produced with each database. A soil map for the state of Texas has been created as one of the several data layers that will integrate into a spatial model. This model will aid in the description of changes in scaled quail populations in Texas. A second coverage is being created using historical climate data from the late 1800s. This coverage will be created using Geostatistics (i.e., Kriging) and incorporated in the spatial model. A total of 3860 point locations for the state of Texas have been used to create a climatic map for the entire state. These locations represent areas where climate stations are located.

Population surveys derived from the U.S. Fish and Wildlife Service's Breeding Bird Survey for scaled quail will be incorporated into the GIS and will be spatially correlated with roads from which these surveys were conducted.

Completion of this project is expected to provide a tool for the management of scaled quail populations in Texas. Remote sensing techniques employed in the project may prove to be important tools in the management of not only scaled quail but also other wildlife populations in the future.

Funding for this research was provided by the Texas Parks and Wildlife Department.

LANDSCAPE CHANGES RELATED TO SCALED QUAIL HABITAT IN TEXAS

X. Ben Wu, Nova J. Silvy and Fred E. Smeins - Texas A&M University, and Markus J. Peterson - Texas Parks and Wildlife Department

Abundance of scaled quail (*Callipepla squamata*) and northern bobwhite (*Colinus virginianus*) in Texas are volatile and their populations tend to have simultaneous peaks and valleys statewide. Recent studies conducted by the Texas Parks

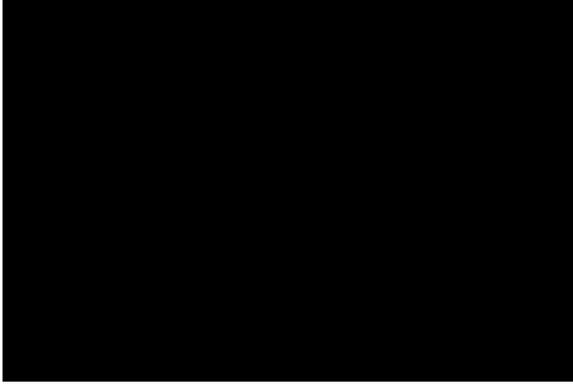


Photo by Jim Whitcomb

and Wildlife Department have shown that the abundance of scaled quail has declined over the last decade in the Edwards Plateau, Trans-Pecos, and especially the Rolling Plains, whereas no long-term trend is exhibited in the South Texas Plains. Landscape-scale habitat changes, which are changes in the composition, abundance, and spatial arrangement of land-cover types, are likely causes for the large-scale decline in quail abundance. Determination of landscape changes and their relationship to the trends in scaled quail abundance, as well as the land use and management practices that contribute significantly to the landscape changes, can provide useful information for the Texas Parks and Wildlife Department and private landowners. Such information can be used to design and implement management plans to reverse the decline in scaled quail abundance.

The objective of this study is to determine whether scaled quail abundance has declined across much of its range in Texas as a consequence of landscape changes that have occurred over the last two decades. We will focus the analysis on the Rolling Plains, where the decline of scaled quail has been most apparent, and the South Texas Plains, where there is no apparent decline.

Remote sensing, GIS, and landscape analysis approaches will be used to determine whether and how the composition and spatial pattern of landscapes have changed in the Rolling Plains and the South Texas Plains from the early 1980s to the mid 1990s; assess how the changes differ in the two ecological regions; determine which components of the landscape change are closely related to trends in abundance of scaled quail and northern bobwhite; and evaluate what land use or management practices contributed significantly to the landscape changes.

A spatially explicit habitat suitability modeling approach at multiple scales will be taken to explore how changes in components of the landscape and their spatial pattern affect

habitat quality, and how they differentially affect the habitat of scaled quail and northern bobwhite; to examine how the amount and spatial pattern of land management practices such as brush control, cropping, and the Conservation Reserve Program (CRP) affect landscape pattern and habitat quality; and to determine the distribution and connectivity of potential quail habitats.

Field vegetation/landcover surveys along census transects will be conducted and compared to a historical (1976) survey to determine whether and how scaled quail and northern bobwhite habitat selection have changed in response to landscape changes.

Funding for his study is provided by the Texas Parks and Wildlife Department, the Rob and Bessie Welder Wildlife Foundation and the Texas A&M University.

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

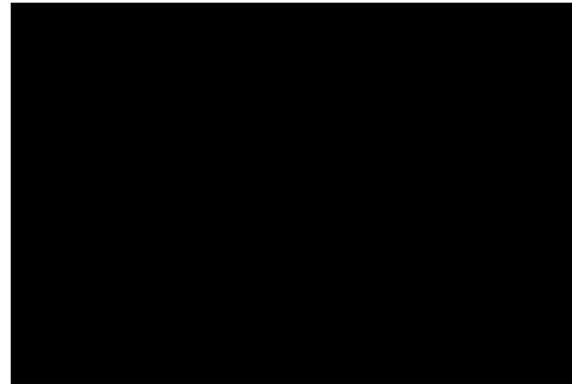


Photo by Martin T. Fulfer

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.

LANDSCAPE CHANGES IN LESSER PRAIRIE CHICKEN HABITAT IN THE TEXAS PANHANDLE

X. Ben Wu, Nova J. Silvy, Fred E. Smeins and Robert C. Maggio - Texas A&M University, and Markus J. Peterson - Texas Parks and Wildlife Department

Grassland birds have shown the most consistent decline of all groups of birds monitored by the nationwide Breeding Bird Survey. The once common lesser prairie chicken (*Tympanuchus pallidicinctus*, LPC), which occurs within the plains region of Colorado, Kansas, New Mexico, Oklahoma, and Texas, is one of these species at risk. The historical range of the lesser prairie chicken in Texas has been estimated to extend over most of the grasslands of northwestern Texas, and they tend to be associated with areas of mixed mid- to tallgrass grassland and shrub lands (e.g. sand sagebrush, shinnery oak) most often on sandy soils. Records indicated there may have been as many as 2 million LPC in Texas prior to 1900. Today,

in Texas, approximately 5-10,000 LPC are found in only 2 separate metapopulations: one in the eastern and northeast Panhandle along the Texas-Oklahoma border (~293,800 ha) and the other along the Texas-New Mexico border (~279,400 ha). Habitat loss is suspected as the major factor causing the decline of LPC.

This study will investigate landscape changes in LPC habitat and the relationship of these changes to the reduction of LPC ranges in the Texas Panhandle at both regional and landscape scales. The regional-scale study involves the development of a GIS database for the 60-county area (~15,000,000 ha) in the Texas Panhandle containing coarse-scale data layers of environmental attributes and general vegetation type and land use, as well as LPC ranges for 1940 and 1989. Analyses are being conducted to characterize the landscape attributes of LPC habitat, determine their relationship to the change in LPC habitat range, and assess potential LPC habitat areas in the Texas panhandle. The landscape-scale study will be conducted in several intensive study areas (300,000-500,000 ha total) in the Texas Panhandle using GIS and aerial photo-based landscape analysis to assess temporal

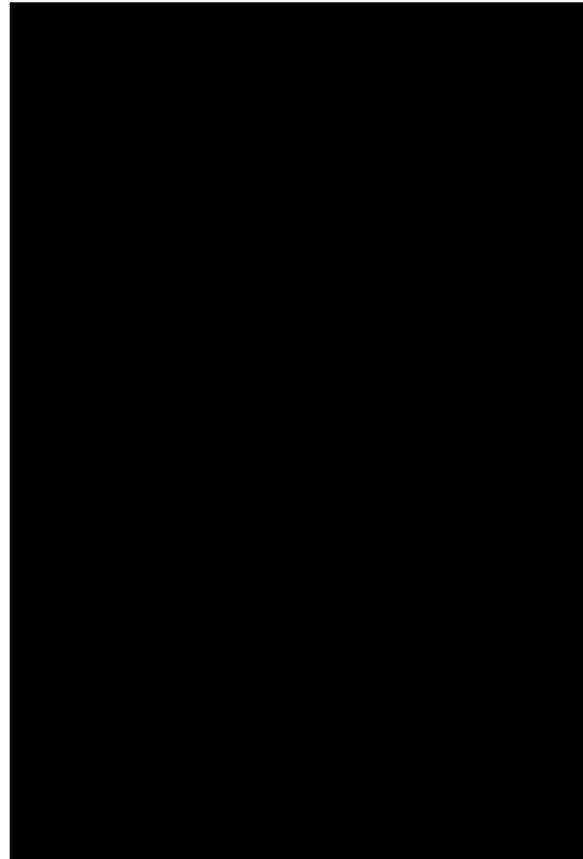


Photo by Wyman P. Meinzer

change in land-use/habitat characteristics of the LPC habitat over the past 5 decades and their possible relationship to the contraction of areas occupied by the LPC.

The development of the GIS database for the 60-county Texas Panhandle study area has been completed. Preliminary results of regional-scale analyses indicate that LPC habitat in the Rolling Plains portion of the Texas Panhandle has considerably different landscape characteristics than those in the High Plains portion of the Panhandle. Landscape characteristics of the apparently suitable but unoccupied habitat differ from currently occupied habitat. A paper based on these preliminary results was presented at the Prairie Grouse Technical Council 22nd International Meeting, College Station, Texas on 4-7 February 1998.

Funding for his study is provided by the Texas Parks and Wildlife Department and the Texas A&M University.

TIME DIFFERENCE OF ARRIVAL: A NEW METHOD OF WILDLIFE RADIO LOCATION

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

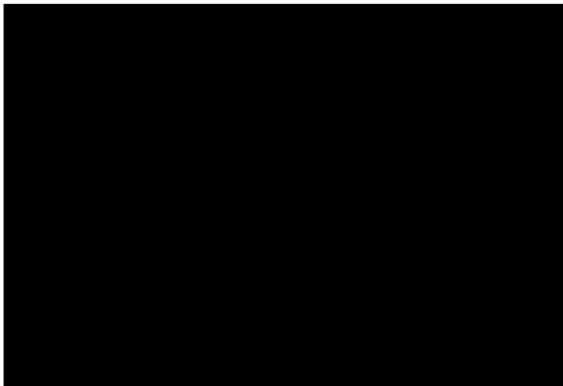


Photo by Duane Kurtin

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.

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, (10s 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.

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 has 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.

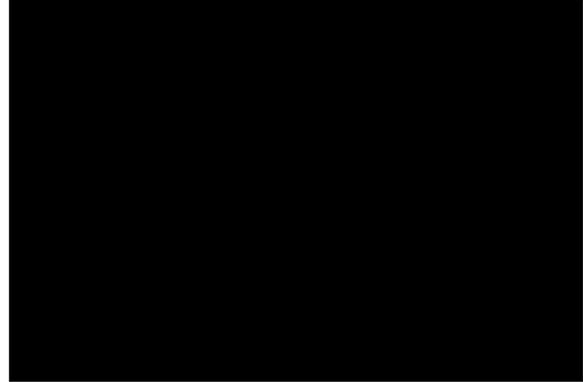


Photo by Ron George

MIGRATORY GAME BIRDS

HABITAT SELECTION BY WOOD DUCKS AND NONGAME CAVITY-NESTING 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

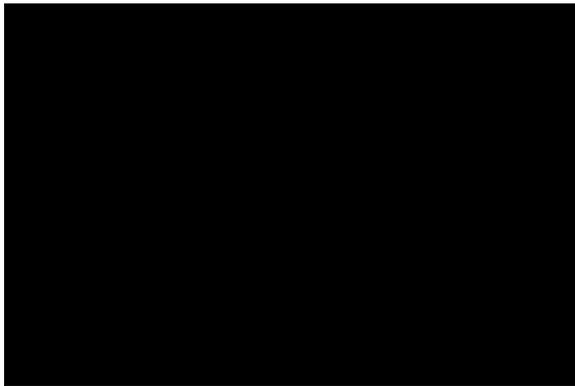


Photo by James D. Ray

There is little information available pertaining to the nesting requirements and biology of cavity-nesting nongame birds and wood ducks in the riparian zones of the northern Rolling Plains. Woodlands of cottonwoods, black willows, and other tree species, and wetland habitat of streams, beaver ponds, and man-made impoundments characterize these riparian zones. The areas provide nesting habitat to an expanding population of wood ducks as well as to populations of nongame cavity-nesting birds. The objectives of the study were to: (1) characterize wood duck and nongame cavity-nesting bird habitat in the northern Rolling Plains; (2) evaluate habitat characteristics affecting occupancy rates and nest success of box-nesting birds; and (3) compare habitat characteristics between occupied nest boxes and both occupied and unoccupied natural cavities.

Potential nest cavities were located on randomly selected plots during winter months, and were then revisited during the middle and end of the nesting season to determine use and nest success. Habitat was characterized according to cavity orientation, tree species, diameter at breast height, stand basal area, distance to water, distance to brood cover (wood ducks only), and distance to forest clearings as well as the associated compass bearings. Eighty wood duck nest boxes, equipped

with a smaller cavity for small nongame species, were placed along the same drainages that were searched for cavities.

During the study, wood ducks occupied 4.0% of the available natural cavities suitable for wood ducks ($n=74$). Nongame birds occupied 6.9% of the cavities available for nesting ($n=351$). Wood ducks, European starlings, red-headed and downy woodpeckers, northern flickers and Bewick's and house wrens occupied natural cavities. Of the 160 nest boxes available (80 nest boxes, each in place for two years), 10 were occupied by wood ducks. Nest success for wood ducks was 80%. Wood duck occupancy rates and nest success were similar for boxes with and without predator guards. Of the 320 nest-box cavities available to nongame cavity-nesting birds, 35% were occupied. Eighty-three (74%) of these nests successfully hatched one or more eggs. There was no difference in nongame bird occupancy or nest success between nest boxes with and without predator guards.

Preliminary results suggest that wood ducks, and, similarly, nongame cavity-nesting birds, select for nest sites in high stand basal area that are adjacent to clearings and water. The most abundant nesting species were house wrens, Bewick's wrens, wood ducks, and American kestrels. Less common species were eastern screech owls and bluebirds, great-crested flycatchers, and northern flickers. Abundance was determined by raw numbers of nest boxes occupied. By determining the habitat preferences of cavity-nesting birds, managers can tailor their decisions to meet the requirements of these species. This was a two-year study funded by Texas Waterfowl Stamp and Nongame Stamp funds, hunting license revenue, and the Southwestern Public Service Company.

GENETIC DETERMINATION OF SUB-SPECIFIC COMPOSITION IN THE GULF COAST SUBPOPULATION OF SANDHILL CRANES

Jonathan E. Thompson and Bart M. Ballard - Caesar Kleberg Wildlife Research Institute, Travis C. Glenn - University of South Carolina, and Jay A. Roberson - Texas Parks and Wildlife Department

Effective management to maintain genetic diversity in wintering sandhill crane (*Grus canadensis*) populations



Photo by Tom Tacha

requires accurate delineation of subspecific composition. Based on phenotypic variation, the Gulf Coast subpopulation of mid-continent sandhill cranes contains 3 subspecies including the lesser (*G. c. canadensis*), Canadian (*G. c. rowani*), and greater sandhill cranes (*G. c. tabida*). Of these 3 subspecies, the greater sandhill crane is the least abundant and has the most restricted distribution in the mid-continent region. Previous research to determine subspecific composition of wintering sandhill crane populations has relied primarily on discriminant function models developed from morphological measurements on birds of known sex and subspecies. Unfortunately, morphological discrimination of crane subspecies is subject to several potential biases that could affect their reliability.

To combat these problems, a variety of genetic techniques has been developed to construct more accurate avian phylogenies. Analysis of mitochondrial DNA (mtDNA) is probably the best approach for genetic discrimination of avian subspecies because it is maternally inherited, has a more rapid rate of evolution than nuclear DNA, and is selectively neutral despite morphological variation. Furthermore, there is close correspondence between mtDNA and morphological divergence in several other species of birds, despite the fact that most genes influencing morphology are located in the cell nucleus. This study is using comparative analysis of mtDNA samples to obtain the most reliable estimates of subspecific composition in the Gulf Coast subpopulation of mid-continent sandhill cranes. Additionally, we plan to compare subspecific discrimination of cranes using genetic and morphological techniques to assess the reliability of using the latter procedure to monitor subspecific harvest of sandhill cranes in Texas. We have obtained genetic samples from 220 sandhill cranes that were collected during a previous study. Individual samples of heart tissue were taken from the same specimens used in morphological analyses.

The results of this genetic study will allow state wildlife agencies to evaluate the validity of using morphological models to determine subspecific composition of wintering sandhill cranes. Cooperative funding for this study is being provided by the Texas Parks and Wildlife Department, the Webless Migratory Game Bird Research Program (U.S. Fish and Wildlife Service and the U.S. Geological Survey-Biological Resources Division), and the Caesar Kleberg Wildlife Research Institute at Texas A&M University - Kingsville.

SUB-LETHAL EFFECTS OF ORGANO-PHOSPHORUS PESTICIDES ON PRODUCTIVITY AND REPRODUCTIVE BEHAVIOR OF CAPTIVE WHITE-WINGED DOVES

Nathan A. Burkepile and David G. Hewitt - Caesar Kleberg Wildlife Research Institute, and Gary Waggerman - Texas Parks and Wildlife Department

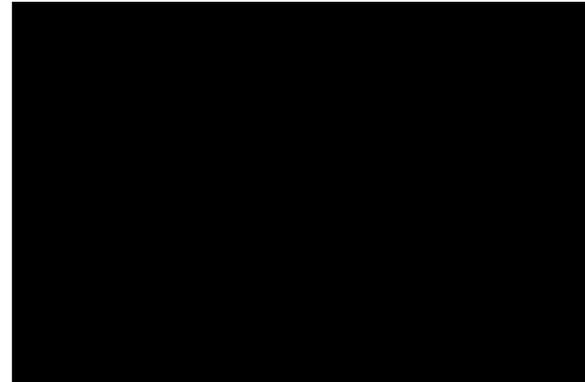


Photo by Michael Small

White-winged dove populations in the Lower Rio Grande Valley (LRGV) of Texas have declined since the 1920s. One factor contributing to this decline may be the widespread use of organophosphorus (OP) pesticides on agricultural lands. These pesticides inhibit cholinesterase (ChE) enzymes resulting in behavioral or physiological changes or death. Past studies found doves in the LRGV had significantly inhibited ChE levels. This study is designed to determine if decreased ChE levels due to OP pesticides affect productivity and reproductive behavior of white-winged doves.

Sixty pairs of white-winged doves were randomly placed in individual breeding pens and assigned to 1 of 3 drinking water treatments: (1) distilled water; (2) water with 5.4 ppm methyl parathion (MP) once every 6 days; and (3) water with 5.4 ppm MP. Each pen was monitored daily to record the number of

eggs laid, egg dimensions, number of eggs hatched, number of chicks fledged, and number of broods reared. In addition, reproductive behavior was monitored in 12 pens (4 from each treatment) to determine if behavioral changes could explain changes in productivity.

Both treatment groups showed decreased productivity with the 5.4 ppm group not going beyond the egg laying stage of reproduction. The group that received a 5.4 ppm dose once every 6 days showed high rates of nest abandonment. This study, funded with Texas Parks and Wildlife Department White-winged Dove Stamp revenue and the Caesar Kleberg Wildlife Research Institute at Texas A&M University, Kingsville, will help wildlife managers determine where to concentrate their effort in helping restore white-winged dove populations in the LRGV.

ENDOPARASITES AND PARASITIC DISEASES IN WHITE-WINGED DOVES

Jason W. Glass and Alan M. Fedynich - Caesar Kleberg Wildlife Research Institute, Michael F. Small - Sul Ross University, and Steve Benn - Texas Parks and



Wildlife Department

TPWD photo

The primary breeding area for white-winged doves in the U.S. has been the Lower Rio Grande Valley (LRGV) of Texas. However, over the last several decades there has been a significant northward range expansion coupled with a changing density distribution pattern. The impact of these changing patterns is not fully understood, particularly in relation to how parasitic diseases may impact these patterns. Such relationships between white-winged doves and disease-producing parasites may ultimately influence how this species is managed. The purpose of this study is to identify parasites and parasitic diseases in the Eastern population of white-

winged doves occurring in Texas and evaluate if parasites may, in part, influence range expansion and account for the observed white-winged dove density distribution in Texas.

During summer 1997, we collected 171 birds from 3 geographic regions: the LRGV (57 birds), San Antonio and surrounding area (60 birds), and north-central to southeast Texas from San Angelo to Galveston (54 birds). These 3 regions represent the historic breeding area in Texas, an intermediate area, and the breeding area periphery for the expanding population of white-winged doves in Texas.

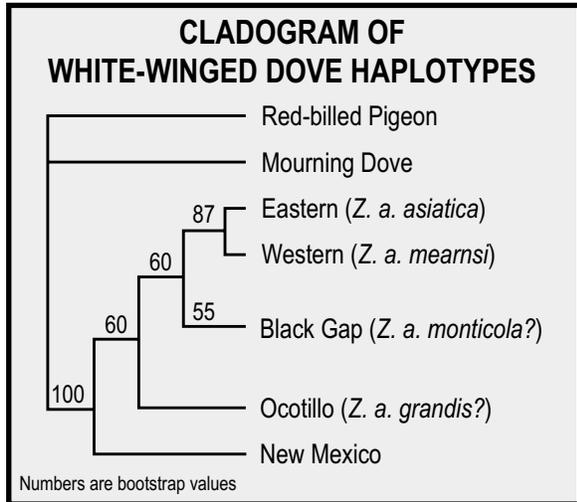
All the white-winged doves except 1 tested positive for *Trichomonas* (99% prevalence). This potentially pathogenic parasite appears to be common in the Eastern population of white-winged doves and this parasite extends from the LRGV to the breeding area periphery in north and east Texas. However, we did not find evidence of disease caused by this parasite. In the second phase of this study, we will examine white-winged doves for blood parasite and helminth parasite infections and look for signs of bacterial and viral diseases.

This study, funded with Texas Parks and Wildlife Department White-winged Dove Stamp revenue and the Caesar Kleberg Wildlife Research Institute at Texas A&M University-Kingsville, will provide baseline data necessary to determine the presence and extent of pathogenic parasites that may negatively impact white-winged doves. This will provide important information that can be used to manage more effectively the Eastern population of white-winged doves in Texas.

DNA ANALYSIS OF THE SUBSPECIES OF WHITE-WINGED DOVES IN TEXAS

Christin L. Pruett and Scott E. Henke - Caesar Kleberg Wildlife Research Institute, Kelly M. Hogan - Texas A&M University-Kingsville, Michael F. Small - Sul Ross University, and Jay A. Roberson - Texas Parks and Wildlife Department

White-winged doves in Texas inhabit several diverse ecosystems ranging from semitropical in the southeast to the Chihuahuan desert in the west. However, a recent northward range expansion led to questions about which subspecies are found in Texas and whether they have separate breeding ranges. Historically, four subspecies of white-winged doves were thought to occur in Texas, with each subspecies having a limited range along the Rio Grande. The subspecies were recognized by differences in size and coloration, but significant overlap in measurements made it difficult to accurately identify



birds from the expansion area. Currently scientists do not agree as to which subspecies occur in Texas. Knowledge of the systematic status and geographic range of the various subspecies of white-winged doves is needed to assess genetic diversity and overall fitness. Therefore, the objectives of this study were to re-evaluate the systematic status of the subspecies of white-winged doves, to determine which subspecies are involved in the recent range expansion, and to determine whether the subspecies have overlapping ranges.

We collected 244 white-winged doves from 33 locations in Texas, New Mexico, Arizona, and Mexico and used mitochondrial DNA sequencing and morphological measurements to differentiate subspecies. Our preliminary results indicate that the eastern and western subspecies are primarily involved in the range expansion. Also, it appears that their breeding areas overlap in central Texas. Continued genetic analysis will determine whether all the subspecies are found in Texas and whether morphology is a reliable indicator of subspecies.

This study, funded with Texas Parks and Wildlife Department White-winged Dove Stamp revenue and the Caesar Kleberg Wildlife Research Institute at Texas A&M University - Kingsville, should aid in the future management of white-winged doves in Texas.

TECHNIQUE DEVELOPMENT, EVALUATION, AND IMPLEMENTATION RECOMMENDATIONS FOR IMPLANTED RADIO TRANSMITTERS ON WHITE-WINGED DOVES

Michael F. Small and James F. Scudday - Sul Ross University, and Jay A. Roberson - Texas Parks and

Wildlife Department

White-winged doves (*Zenaida asiatica*) have historically used the lower Rio Grande Valley (LRGV) of Texas as their primary breeding range in the U.S. However, because the range of white-winged doves in this country is peripheral, much of this species' life history and biological/management needs are yet to be determined. Although reproduction and productivity have been extensively studied, factors regarding home range, urban breeding and breeding season length, food preference, in vivo water requirements, call count survey accuracy, and many other aspects are yet to be fully understood.

As a research tool, radio-tagging allows biologists to monitor wildlife species both in space and time. Recent studies conducted with mourning doves (*Zenaida macroura*) have compared the efficiency of radio-tagging, leg banding, and mark/recapture techniques for evaluating various population parameters. These studies strongly indicate that radio-tagging not only provides the greatest amount of information regarding estimation of period survival rates, annual survival rates, and recruitment but it is also the most cost effective (data/unit cost) method of populational parameter studies.

These studies provide a basis for testing the possibility of establishing a low-impact radio-tagging implantation technique for white-winged dove as a feasible alternative to more traditional external attachment methods. We suggest that physiological and pathological parameters will not be significantly affected by the implantation technique and that reproductive physiology and productivity will not differ significantly from the controls. This study, funded with Texas Parks and Wildlife Department White-winged Dove Stamp

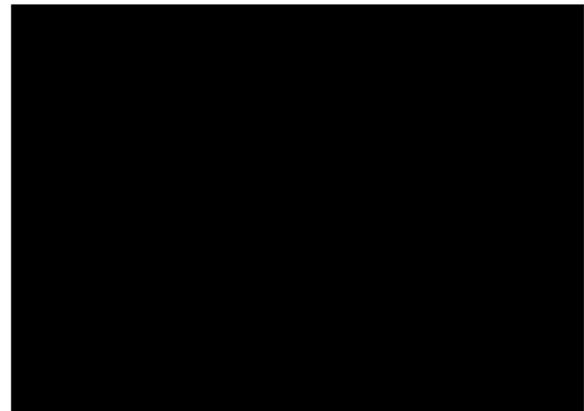


Photo by Michael Small

revenue and Sul Ross University, will be conducted over a 24-month period followed by field experiments.

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



Photo by Billy Pat McKinney

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.

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

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 were collected from March 1994-March 1997 from a 1,182 square mile study area of privately owned lands within La Salle, McMullen, Webb, and

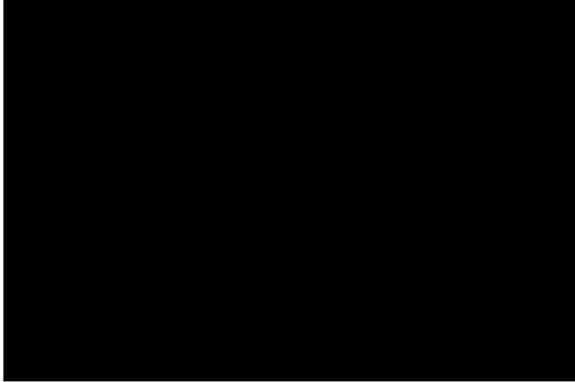


Photo by Barbara George

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 for 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 photography, 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 UDSA-Agricultural Research Station-Remote Sensing Research Unit in Weslaco.

GENETIC RESEARCH ON THE STATE BISON HERD

James Derr, Joe Templeton, and Todd Ward - Texas A&M University College of Veterinary Medicine, and Matt Wagner, Brad Simpson and Roy Welch - Texas Parks and Wildlife Department

Less than 200 years ago, millions of bison (*Bison bison*) roamed over the North American continent. However, in the 1800s, habitat loss, hunting, and introduced diseases resulted in one of the most dramatic and well documented population reductions in history. By the late 1800s, fewer than 1000 bison remained in the United States. In the Panhandle, legendary Texas cattleman Charles Goodnight captured a few remaining

animals that were once part of the vast Southern Plains Bison Herd. His interest in bison was twofold. First, he was a conservationist who was interested in preventing the extinction of this magnificent species. He also produced hybrids by crossing cattle and bison in an attempt to strengthen his cattle herds.

Recently, the J A Ranch donated Mr. Goodnight's bison to the Department to develop a Texas State Bison Herd. However, due to the history of these animals, it was possible that some were the offspring of Mr. Goodnight's hybridization experiments. Researchers at Texas A&M University recently discovered cattle-bison hybrids in some northern bison herds, and they developed a genetic test that can identify cattle mitochondrial DNA (a genetic marker) in bison. Using their genetic test, these researchers determined that 6 of the 38 remaining Goodnight bison have cattle mitochondrial genes. Only the animals that proved to have true bison mitochondrial DNA will be used to establish a new herd in Caprock Canyons State Park. Genetic tests will also be used in planning selective breeding to ensure maximum genetic variability is maintained in the bison herd.

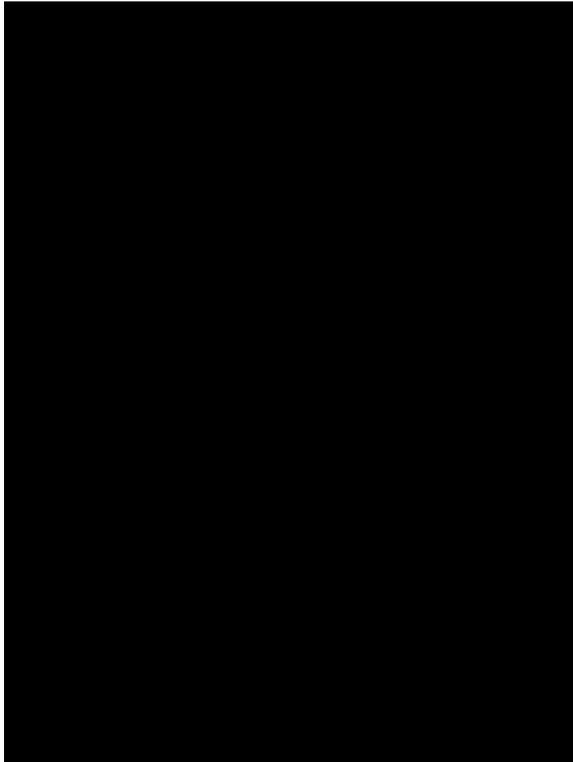


Photo by Earl Nottingham

VISITOR IMPACT ON BAT EMERGENCE BEHAVIOR AT THE OLD TUNNEL WILDLIFE MANAGEMENT AREA

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

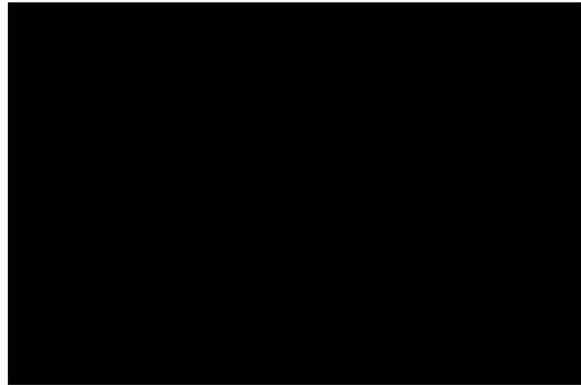


Photo by Tim Lawyer

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.

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 1997, approximately 10,000 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 flight 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 seventh year of the study funded by the Texas Parks and Wildlife Department and Southwest Texas State University.

FOOD HABITS, REPRODUCTION, DISEASE AND CONDITION OF FERAL HOGS IN THE CENTRAL ROLLING PLAINS

Brad Simpson, Calvin Richardson and Duane Lucia - Texas Parks and Wildlife Department

Feral hogs have increased dramatically in the past decade in the central and northern portions of the Rolling Plains ecological area. Therefore, this study was initiated in September 1996 to gather biological information and to assess impacts on native wildlife of the colonizing population of feral hogs in the central Rolling Plains.

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) determine the role of feral hogs in the Rolling Plains as vectors for human, livestock, and wildlife diseases, and (6) 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, located in Cottle County. Other study sites are included opportunistically, primarily in 5 surrounding counties, Motley, King, Foard, Childress, and Dickens. Sampling is conducted seasonally, with a minimum of 25 hogs collected each season for a total sample size of 100+ hogs/year. Hogs are collected by ground shooting, aerial gunning in cooperation with the Texas Animal

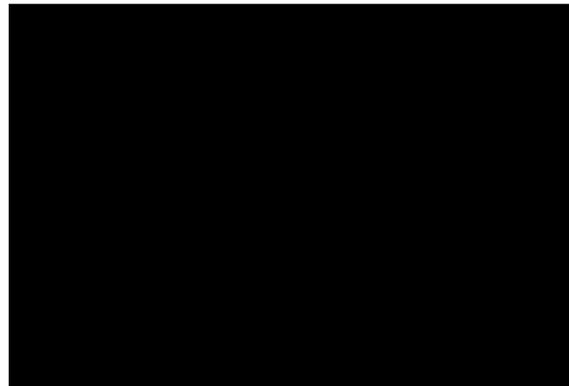


Photo by Glen Mills

Damage Control Service, and by trapping.

Seventy-six hogs were collected during the first year of the study, 24, 11, 33, 8 were collected in the fall, winter, spring and summer, respectively. Seventy-four percent of all hogs collected were < 3 years of age, 63% < 26 months of age, and 5% were in the 5 to 6 year age class, the highest age class collected. Twenty-three percent of feral hog sows (n = 44) collected contained fetuses. Average number of fetuses was 3.9/sow, ranging from 1 to 10 fetuses/sow, with a male to female sex ratio of 1:1. Farrowing dates were highest in the winter (74%), followed by spring (26%). Conception rates were 64%, 26%, and 10% in the fall, winter, and summer, respectively. Age of sows carrying fetuses ranged from 10 to < 72 months, 40% were 18-22 months of age.

Stomach contents for food habits analysis are being categorized into 10 food classes: grasses, forbs, woody plants, roots/tubers, cactus pads, cactus fruits, hard mast, soft mast,

vertebrates, and invertebrates. Preliminary analysis of food habits indicates seasonal use of food resources. Acorns, roots/tubers, and grass/forb combination were predominant in the fall, winter and spring, respectively. Mean field dressed body weight to live body weight percentage for both males and females was 74%, with a range of 0.57 to 0.84 for females and 0.58 to 0.90 for males. The only positive result for disease tests, was Rickettsia (Rocky Mountain Spotted Fever) which occurred in 4 of 11 ticks collected from one feral hog in Motley County.

Funding for this project is provided by the Texas Parks and Wildlife Department and Central and South West Environmental Services, West Texas Utilities Division. This project is scheduled to be completed in FY 99.

BALD EAGLE NESTING AND WINTERING SURVEYS

Mark Mitchell, Kevin Herriman and Annice Storey -



*Photo by David Mabie
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.

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.

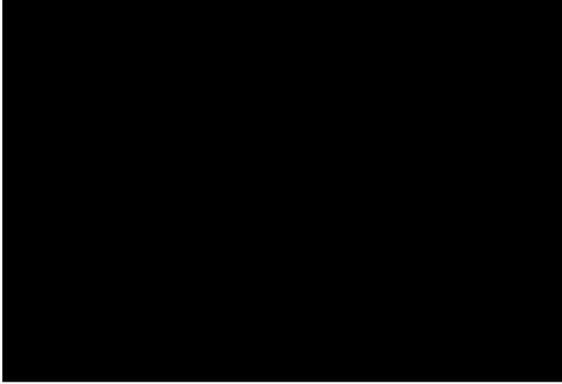
These are ongoing annual surveys funded by the Texas Parks and Wildlife Department through Federal Aid in Wildlife Restoration Grant W-125-R.

THE AMERICAN PEREGRINE FALCON IN WESTERN TEXAS AND ADJACENT NORTHERN MEXICO

Bonnie R. McKinney - Texas Parks and Wildlife Department

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) is 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 23-year period, from 2 to 15 breeding areas have been closely monitored. In only 8 of 23 years has production reached, or exceeded the 1.25 young fledged per site considered necessary for population stabilization. A total of 152 young have been produced during the 23-year period (young actually observed) with 146 total young actually fledging.



TPWD photo

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 private donations from organizations and individuals, and from the sale of peregrine T-shirts.

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

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.

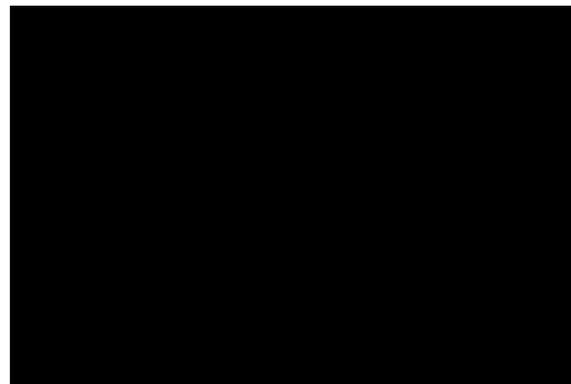


Photo by Matt Wagner

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.

SUMMER DIETS OF GREATER ROAD-RUNNERS IN SOUTH TEXAS

Donald C. Ruthven III and David R. Synatzske - Texas Parks and Wildlife Department, and Lori Moore and Richard T. Kazmaier - Oklahoma State University



Photo by Donald Ruthven III

Greater roadrunners are locally common throughout the western two-thirds of Texas. Little information is available on the diet of the greater roadrunner; however, anecdotal information suggests that reptiles are important prey items. Of potential concern are the impacts of greater roadrunners on threatened reptiles such as the Texas horned lizard. Our objective is to investigate the diets of roadrunners during the summer months when reptiles are generally most active and Texas horned lizard hatchlings first begin to emerge.

The study area is the Chaparral Wildlife Management Area (CWMA) which is a site of relatively high greater roadrunner and Texas horned lizard abundance. Fifty-one greater roadrunners were collected by shooting during July

through September 1997. Stomachs were analyzed for proportion of occurrence of prey items based on families.

Stomachs contained remains representing 27 families of insect, 5 families of spider, 1 family each of scorpion, wind scorpion, and centipede, 2 families of terrestrial snail, 3 families of reptile, 2 families of amphibian, and 3 families of mammal, as well as various fruits. Grasshoppers were the most common prey item being found in 100% of the stomachs studied. Other commonly occurring insects were leaf-footed bugs, darkling beetles, and dung beetles. Jumping spiders were encountered in 29% of stomachs and terrestrial snails in 35%. Reptiles occurred in 33% of the stomachs examined. Because of the rapid rate of digestion, many reptile remains could not be identified to species. Identified reptiles include Texas spotted whiptail, Texas horned lizard, southern prairie lizard, Texas spiny lizard, ground snake, Schott's whipsnake, and Texas patchnose snake. Four Texas horned lizards were found in 3 stomachs. Mammals detected in the diet include desert cottontail rabbit, cotton rat, and pocket mouse which were found in 1 stomach each. Prickly pear cactus fruit was found in 26% of the stomachs examined.

Greater roadrunners appear to be very opportunistic foragers. Insect production appeared high during the wet spring and summer of 1997 resulting in high utilization by greater roadrunners. However, predation on vertebrates was also common. During years of normal to below normal precipitation, predation on vertebrates may increase. In areas of high greater roadrunner density and low to moderate Texas horned lizard density, predation by greater roadrunners may adversely affect Texas horned lizard populations or hamper reintroduction efforts. On the CWMA, Texas horned lizard numbers appear to remain stable despite high greater roadrunner numbers.

COLONIAL WATERBIRD SURVEY AND MANAGEMENT

Brent Ortego - Texas Parks and Wildlife Department

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 have included conducting bird banding research,

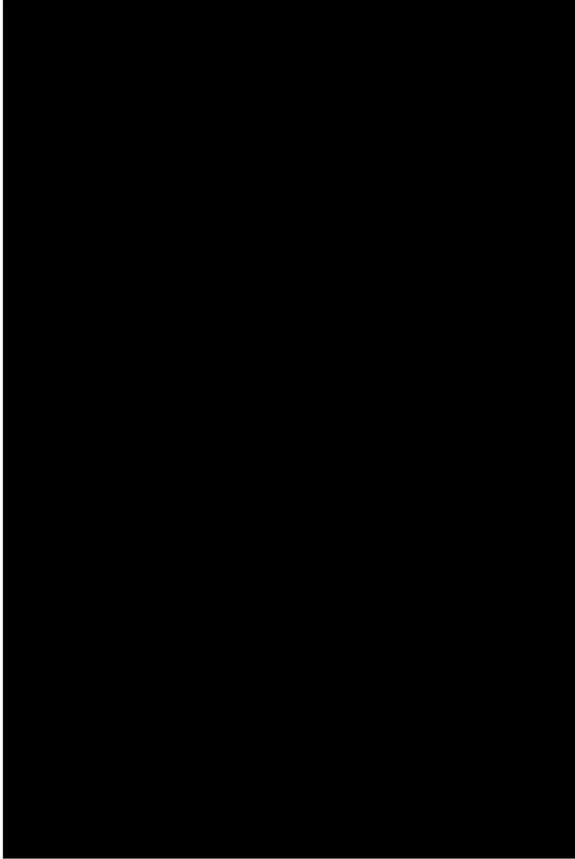


Photo by Leroy Williamson

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 frequently is 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.

Addresses for landowners with colonial waterbird nest sites on their property were obtained for future use in contacting them for permission to release colonial waterbird survey data obtained from aerial surveys along the coast.

Colonial waterbirds nesting on 2 islands in Cedar Creek Islands Wildlife Management Area in Henderson County were surveyed from the ground on 2 June. A total of 143 neotropical cormorant (*Phalacrocorax brasilianus*) pairs, 798 great egret (*Casmerodius albus*), 62 snowy egret (*Egretta thula*), 10 little blue heron (*Egretta caerulea*), 4 tricolored heron (*Egretta tricolor*), and 4,766 cattle egret (*Bubulcus ibis*) were observed. Most neotropical cormorant and great egret eggs had already hatched, and less than 20% of the cattle egret eggs had hatched by this date. A team of scientists and volunteers on 14 June banded and color-marked 317 neotropical cormorants, 64 snowy egrets, 6 tricolored herons, and 879 cattle egrets as part of a long-term banding/color-marking program. During the survey, 4 banded/color-marked birds from previous years were observed.

Geographic Information System staff continued to develop computer generated maps of the colonial waterbird nesting sites along the coast. A meeting with colonial waterbird survey cooperators was held in Corpus Christi to coordinate upcoming survey efforts and plan for data storage and management.

BREEDING SHOREBIRD DISTRIBUTION AND HABITAT USE IN THE PLAYA LAKES REGION

Warren C. Conway and Loren M. Smith - Texas Tech University, and James D. Ray - Texas Parks and Wildlife Department

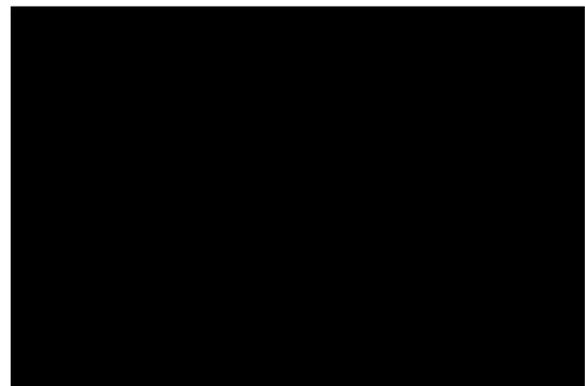


Photo by James D. Ray

North American shorebirds consist of an array of species, with many breeding systems, habitat preferences, and migration strategies. Shorebirds use a variety of habitats, from coastal wetlands to temporary freshwater and saline wetlands throughout the interior United States. However, many

shorebirds use variable/fluctuating wetland habitats, which makes such wetlands unsuitable for continuous use during migratory and reproductive periods. Depending on temporary wetland habitats, shorebirds rely upon specific sequences of suitable sites to complete their annual cycle.

Many shorebird species have experienced sharp population declines (>70%) since 1970. Such declines have been attributed to a variety of factors, mostly due to wetland habitat losses from urbanization, industrialization, and agriculture. Over 46% of the wetlands present in the U. S. prior to European settlement have been lost. Despite various conservation and management efforts, it has become increasingly important to identify wetland habitat preferences of shorebirds and understand their annual life cycle requirements, after which, appropriate habitat management schemes may be implemented for each stage of their annual cycle.

The Playa Lakes Region of Texas is located in the interior U. S. and supports a unique landscape of varying habitats, highlighted by the presence of playa wetlands, and this region supports a wide variety of waterfowl and waterbirds. However, no information is available from this region on the composition, distribution, preferred wetland types, habitat selection within wetlands, and nesting success of breeding shorebirds. This study was undertaken to determine the habitat requirements of breeding shorebirds and to propose plans for the management and protection of wetlands for these species.

The importance of the Playa Lakes Region to breeding shorebirds is presently unknown. Recent studies completed on the ecology of migrant shorebirds in the Playa Lakes Region indicate that a number of shorebirds remain during the breeding season. Such observations were made throughout the breeding season in a variety of wetland types including riparian areas, saline wetlands, and playas. We plan to examine the ecology of breeding shorebirds throughout the Playa Lakes Region during 1998 and 1999. Specifically, we will (1) determine species composition and distribution of breeding shorebirds, (2) examine shorebird macro- and microhabitat selection among and within wetland types during the breeding season, (3) quantify nesting parameters (i.e., nesting success, habitat choice, nest-site selection, etc.) of dominant shorebirds, and (4) develop sound conservation and management plans for breeding shorebirds in the Playa Lakes Region. This is a two-year study funded by the Texas Parks and Wildlife Department, Playa Lakes Joint Venture, U.S. Fish and Wildlife Service, and Texas Panhandle Audubon Society.

CONSERVATION ECOLOGY OF THE TEXAS HORNED LIZARD: THE INFLUENCE OF LAND USE PRACTICES

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

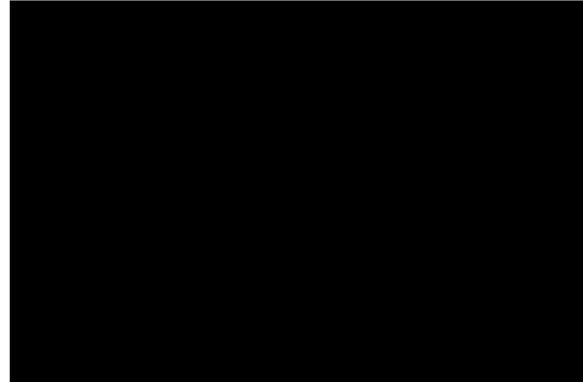


Photo by Donald Ruthven III

Little information is available to evaluate ecological effects of land uses such as grazing, burning, and disking on herpetofauna in general and the Texas horned lizard in particular. Protected by Texas legislative mandate in 1967, the horned lizard has experienced apparent declines throughout its range, but particularly in Texas. Causative factors for this decline may include direct and indirect effects of the red imported fire ant, habitat alteration for other land uses (e.g., agriculture, development), highway mortality, and commercial exploitation.

We will seek to explore aspects of the ecology and demographics of the Texas horned lizard on a site of relatively high lizard abundance in southern Texas. The 2 primary objectives of this study are: (1) to examine the effects of livestock stocking rate on ecological characteristics of horned lizards (range size, habitat preferences, and population parameters) on the Chaparral Wildlife Management Area; and (2) to expand a long-term ecological monitoring of horned lizards to include temporal responses of the horned lizard population to anthropogenic (e.g., increased public use, road-building, prescribed burning, disking, fire ant invasion) impacts.

The study area will be the 15,200-acre Chaparral Wildlife Management Area (CWMA) in Dimmit and La Salle Counties, Texas. Vegetation on the area is dominated by mesquite/mixed-

brush communities characteristic of the South Texas Plains. Horned lizards will be captured by hand during fortuitous encounters on roads and in the brush beginning in the spring of 1998. Drift fence arrays already existing on the Chaparral will be used to supplement captures. Horned lizards will be sexed and implanted with a PIT (passive integrated transponder) tag. Body mass, snout-vent length, and total length will be determined. Females will be scanned by ultrasound for condition (gravid vs. nongravid) and to estimate clutch size.

Selected individuals (primarily adult females) will be fitted with radio transmitters. Transmitters will be placed on 10 individuals in each of 3 sites: ungrazed, grazed at moderate stocking rates, and grazed at heavy stocking rates. Radio-transmitted individuals will be relocated at least twice-weekly. Microhabitat characteristics (e.g., grass, forb, or shrub cover, bare ground, understory height, etc.) for each location will be determined. Range size, habitat selection, reproductive characteristics (% gravid, clutch size), and survival rates of radioed individuals will be compared among treatments.

We also propose surveys of nest/mound density of harvester ants within lizard home ranges. We will examine the relationship of harvester ant distribution to habitat characteristics and livestock stocking rate.

We will also attempt to infer potential impacts of winter burning and disking on horned lizards. Winter trips will be made to the study area to study hibernation behavior of transmitters horned lizards. Data from these observations can be utilized to assess the impact of management activities in relation to depth of hibernacula.

Funding for this project is provided by Texas Parks and Wildlife Department, the Nongame and Urban Wildlife Program, and the South Texas Research Fund.

DEMOGRAPHY AND ECOLOGY OF AN INLAND POPULATION OF THE TEXAS TORTOISE

Richard T. Kazmaier and Eric C. Hellgren - Oklahoma State University, and Donald C. Ruthven III and David R. Synatzske - Texas Parks and Wildlife Department

The Texas tortoise is the smallest and least well known of the 3 species of tortoise found within the United States. Since its original protection by the State of Texas in 1967 because of concerns over declining populations, several ecological studies

have greatly added to our understanding of this poorly known organism. Historically, however, research on the Texas tortoise has concentrated on coastal populations in Cameron County and little is known about the variability of life history traits across its range. Such variability could have implications for conservation and management of this threatened species.

A marking and monitoring program for the Texas tortoise was initiated by Texas Parks and Wildlife Department personnel on the Chaparral Wildlife Management Area (CWMA) in Dimmit and La Salle Counties in 1990. Tortoises are captured during fortuitous encounters and data pertaining to sex, size, date, time, and location are recorded. Tortoises are released after receiving a unique identification code made by notching the marginal scutes with a triangular file. Thus far, 2,374 captures of 1,760 individuals have been made. A more intensive study of the tortoises on the CWMA, initiated in 1994, incorporated aging by scute annuli, assessment of reproduction with x-ray and ultrasound techniques, determination of diet through direct observations and fecal analysis, and assessment of activity, habitat selection, and movements by monitoring individuals with radiotelemetry. This effort resulted in 838 individuals being captured and aged, 110 females were either x-rayed or scanned with ultrasound, and 47 radio-transmitted tortoises were monitored for 30,541 radio-days. Our demographic analyses have focused on the subset of the entire CWMA tortoise database in which age is available for the tortoises.

Annuli data from 194 recaptures over 4 years suggests that tortoises in this population do accumulate 1 annuli per year. Thus, we believe our aging technique is valid. Few individuals over 13 years of age were encountered and 40% of captured individuals were juveniles. Kaplan-Meier survival rates from radiotelemetry data produced annual survivals of 79% for females and 83% for males. The adult sex ratio of 1:1.07 (F-M) was not significantly different from 1:1 ($n = 504$,

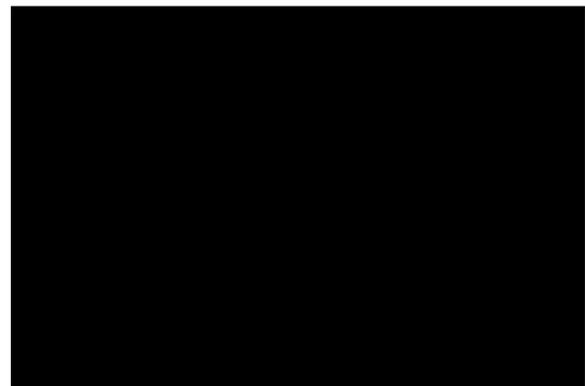


Photo by Rich Kazmaier

X² = 0.6429). Mean carapace lengths were 139 mm for females (n = 243) and 150 mm for males (n = 261). Females produced eggs at carapace lengths as small as 131 mm, which can be reached by most females in 5-6 years. A paired t-test of 14 individuals for which both x-ray and ultrasound data are available indicated no difference in detecting clutch size between the 2 methods (P > 0.05). Mean clutch size was 2 eggs (n = 40 clutches). Further analysis, including development of a life table, assessment of movements and home range, and quantification of diet are forthcoming. Continued monitoring of the CWMA tortoises is planned and should be highly enlightening regarding the long-term dynamics of this inland population. These preliminary analyses suggest that the CWMA population differs substantially from the previously studied populations in Cameron County.

Funding for this project is provided by the Rob and Bessie Welder Wildlife Foundation, the Nongame and Urban Wildlife Program, and the Texas Chapter of the Nature Conservancy.

EFFECTS OF GRAZING BY CATTLE ON THE DEMOGRAPHY AND ECOLOGY OF THE TEXAS TORTOISE

Richard T. Kazmaier and Eric Hellgren - Oklahoma State University, and Donald C. Ruthven III, Jimmy

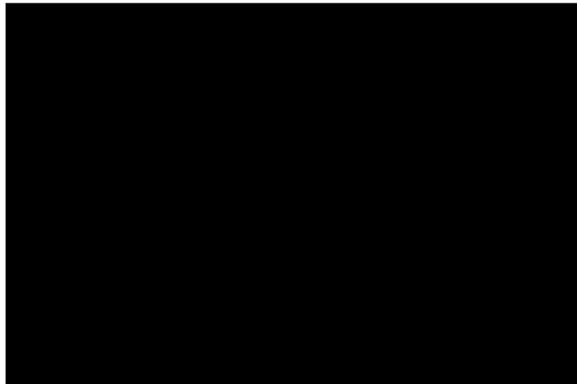


Photo by Rich Kazmaier Rutledge, and Matt Wagner - Texas Parks and Wildlife Department

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 was completed in August 1997. To assess demographic characteristics, data on sex, size, and age was collected from all tortoises during fortuitous encounters. Population estimates were made utilizing mark-recapture methods. In addition, 10 (6F:4M) adult tortoises were monitored by radiotelemetry in each of 4 pastures (2 grazed, 2 ungrazed) to determine home range, resource utilization, survivability, and movements. Time budgets were calculated by intensive monitoring of radio equipped individuals. Fecal samples were 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 were made, and 46 transmitter outfitted tortoises were 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.

POPULATION DYNAMICS OF THE MONARCH BUTTERFLY IN TEXAS

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

Investigations conducted during the spring of 1997 revealed that in contrast to the fall pattern, monarchs bred primarily in the eastern one-third of the state. Spring breeding activity was more than 5 times greater east of the Balcones Fault than west. In Central Texas, breeding commenced in later March and extended through May. Spring breeding activity represented about 58% of the total for both spring and fall, indicating that fall breeding in Texas is more important than previously thought. Most breeding activity occurred in the Blackland Prairie and Oak Woods and Prairie areas. Breeding was also heavy along certain highway corridors in the Pineywoods of East Texas.

In the spring, the most favored milkweed host species were *Asclepias viridis* and *A. oenotheroides*, while *A. asperula* was used mostly in the fall. *A. latifolia*, a West Texas species, was the most heavily used plant in the fall, because it did not mature early enough in the spring to serve as a host. This one species partially explained the elevated fall breeding pattern. Shifts in host plant use between spring and fall may also be explained by different migratory patterns. Fall migrants stay primarily west of the Balcones Fault, while spring migrants use a more eastern corridor. Thirdly, fall predators, such as imported fire ants, may be more effective at foraging in the fall when conditions are warmer and drier than the spring.

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

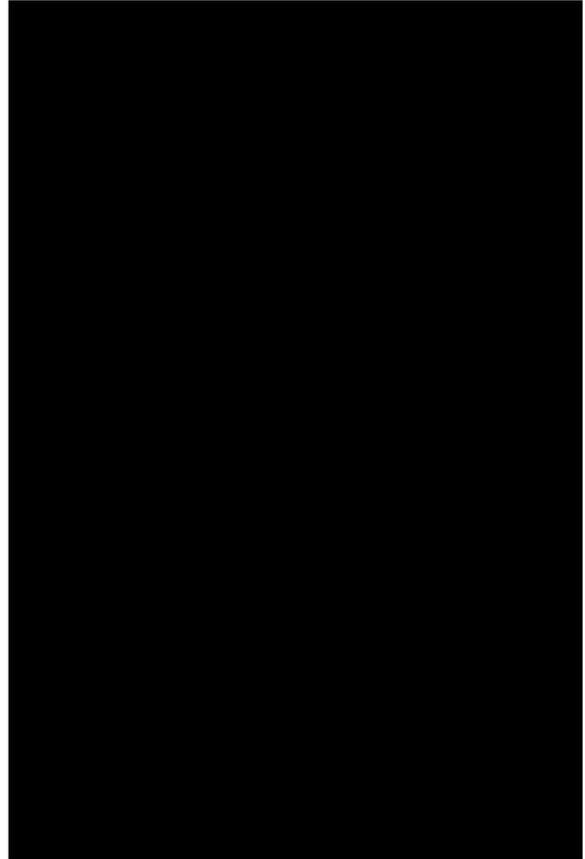


Photo by Bill Calvert

ENDANGERED RESOURCES

ASSESSMENT OF HABITAT FEATURES AT POTENTIAL REINTRODUCTION SITES FOR ATTWATER'S PRAIRIE CHICKENS

Lee Ann Linam - Texas Parks and Wildlife Department



Photo by Ron George

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.

SOUTHERN PINE BEETLE INFESTATION OF RED-COCKADED WOODPECKER CAVITY TREES

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

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 summer 1996, winter 1996-97, and spring 1997. 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



Photo by D. C. Rudolph

season) were examined for status and possible SPB activity. Nine 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 1997. Five were killed by bark beetles, 2 killed by lightning, 1 killed by wind-snap, and 1 death from unknown causes.

During January 1997, data on SPB activity for FY 1996 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 1997 will be compiled when it becomes available from Forest Pest Management personnel. During FY 1996, 27 SPB spots were detected and 263 pines were infested by SPB according to the Southern Pine Beetle Information System (SPBIS) data set. These data along with the FY 1996 data on SPB-caused mortality of RCW cavity trees were added to the database. During FY 1996 a total of 5 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

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

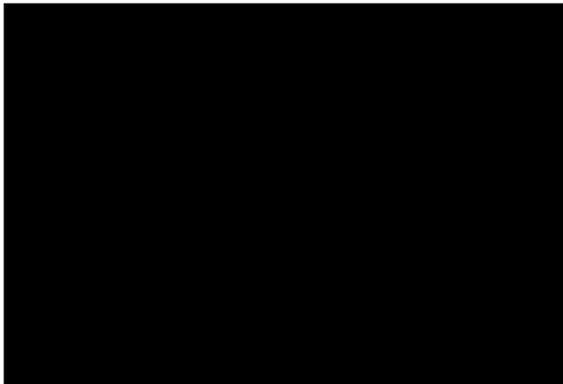


Photo by Phil Glass

The goal of this study was to evaluate the effects of human disturbance on piping plovers (*Charadrius melodus*) or snowy plovers (*C. 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 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

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

The southeastern bat (*Myotis austroriparius*) and Rafinesque's 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 in order 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, a total of 22 roosts have been discovered: 13 roosts with southeastern bats in 8 counties, and 11 roosts with Rafinesque's big-eared bats in 7 counties. Two roosts contain both species. One-half of the roosts are live, hollow, old-growth bottomland hardwood trees, and the remainder are man-made structures such as abandoned buildings and culverts. The results of monitoring these roosts

indicate that some roosts are more important than others. One roost on private property is occupied year-round so it serves as both a maternity and winter roost, while others are temporary or seasonal roosts. Future efforts will continue to focus on roost surveys and monitoring as well as determining roosting patterns among populations.

This project has been funded by Texas Parks and Wildlife Department, U.S. Forest Service, Wray Trust, Bat Conservation International, The Nature Conservancy, and Naegeli Transportation Company.

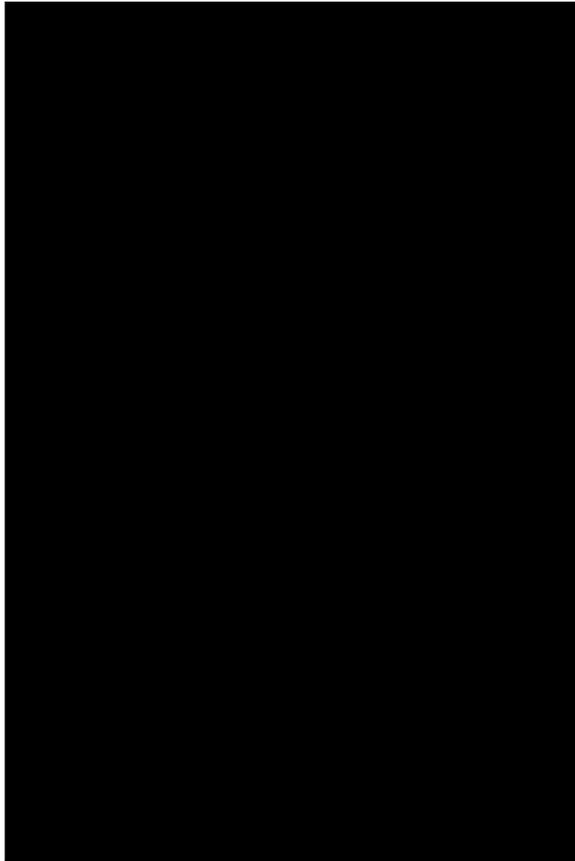
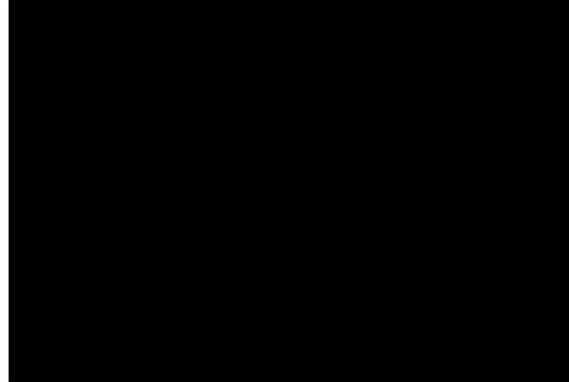


Photo by Peggy Horner

EFFECTS OF PRESCRIBED BURNING ON HOUSTON TOAD HABITAT

**Andrew H. Price - Texas Parks and Wildlife
Department**

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



TPWD photo

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 (passive integrated transponder) 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.

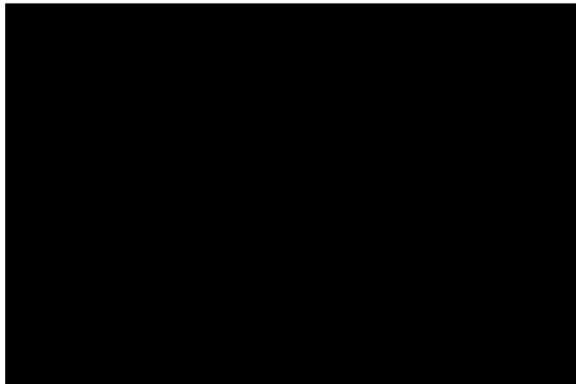
Funding for this work is being provided by the Texas Parks and Wildlife Department.

HABITAT ASSESSMENT AND RESTORATION PLAN FOR SUNKEN GARDEN SPRINGS AND ELIZA SPRINGS POOL, ZILKER PARK, AUSTIN, TEXAS, FOR THE CONSERVATION OF BARTON SPRINGS SALAMANDER

David E. Bowles and Andy Price - Texas Parks and Wildlife Department

The Barton Springs salamander (*Eurycea sosorum*) is among the most endangered vertebrate populations in North America. The species occurs only in the Barton Springs system, including Barton Pool, Eliza Springs Pool, and Sunken Garden Springs Pool. The habitat conditions at Eliza Springs Pool and Sunken Garden Springs are poor. Improvement of these systems, including restoring them to as near natural condition as possible, would greatly benefit the salamanders and would represent a significant step in their conservation. The objectives of this study are to accomplish detailed habitat assessments for Eliza Springs Pool and Sunken Garden Pool, develop a detailed restoration and management plan to return them to as near natural conditions as possible, and to initiate baseline restoration of these systems towards the conservation of the Barton Springs salamander.

Funding for this project was provided by Section 6 of the U.S. Endangered Species Act.



USFWS photo

STATUS UPDATE ON THE TOBUSCH FISHHOOK CACTUS

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



Photo by Max Traweek

The purpose of this research is to determine the current status of the federally-listed Tobusch fishhook cactus (*Ancistrocactus tobuschii*). Currently, 10 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.

SURVEY OF LLOYD'S MARIPOSA CACTUS IN THE LOWER BIG BEND REGION OF WESTERN TEXAS

Bonnie McKinney - Texas Parks and Wildlife Department

Lloyd's mariposa cactus (*Neolloydia mariposensis*), is a federally and state listed threatened species that occurs in patches on hills and ridges in the lower Big Bend Region of Western Texas. This species has the largest concentration on slopes and canyon rims between 2,000 and 4,000 feet in elevation, in soils of limestone origin and in rocky condition. The objective of this survey is to document known occurrences

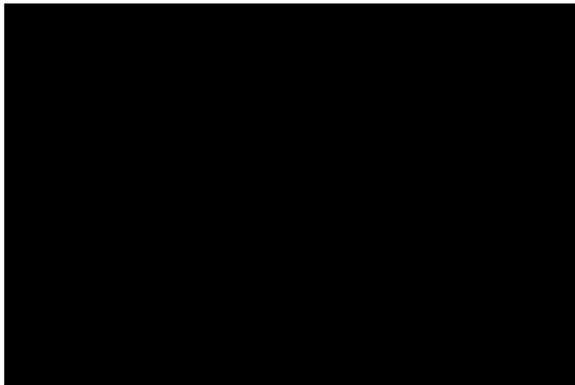


Photo by Bonnie McKinney

of Lloyd's mariposa cactus and to explore new found populations on state and private lands. This survey will concentrate on documenting seed dispersal, true population size, and in some areas, restoration of the species.

Funding for this project was provide by the U.S. Fish and Wildlife Service.

EFFECTS OF RECREATION ON TEXAS WILD-RICE

Shannon Breslin - Texas Parks and Wildlife Department

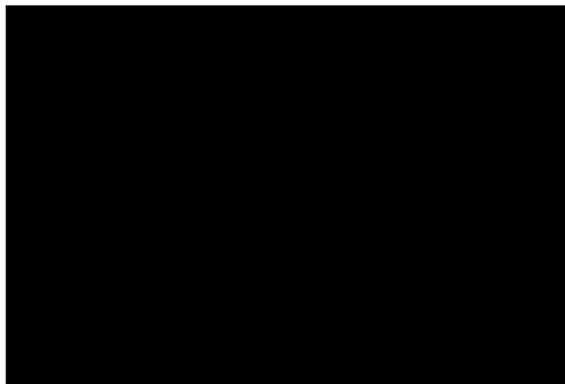


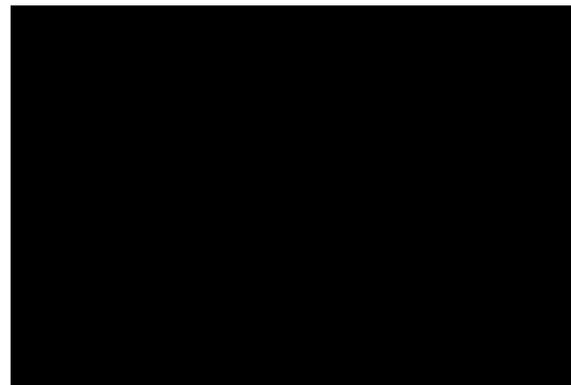
Photo by Kristin Terpening

Funded by the U.S. Fish and Wildlife Service (FWS), 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 FWS. 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 6 transects located between Spring Lake and the IH-35 bridge. Completed in December 1997, the final report provides a summary of recreational contact with wild-rice and offers management strategies towards alleviating existing or potential stresses.

SITE CHARACTERISTICS AND MANAGEMENT OF JOHNSTON'S FRANKENIA

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



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. When the species was listed, there were only 4 known populations in Texas. The purpose of this research has been to survey Johnston's frankenia populations and examine their association with soils, geology and other plant 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 45 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. This project is ongoing, and may eventually lead to the delisting of this species as endangered.

MONITORING AND MANAGEMENT OF RARE PLANTS ON HIGHWAY RIGHTS-OF-WAY

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

This on-going project, originally funded by Section 6, is now funded by the Department. The study continues to monitor 19 populations of 8 listed and 5 candidate plants at sites throughout the state. The Texas Department of Transportation has initiated a new program which will install "Restricted Right-Of-Way Area" activity signs at these endangered plant populations. It is hoped that the signs will foster better communication between contractors and TxDOT staff so that inadvertent destruction of rare plants will no longer occur. The first signs will be installed in April 1998. All signed plant populations will continue to be monitored to determine if the signs are making a difference.

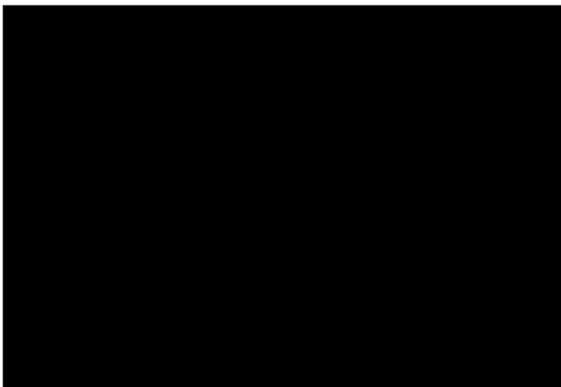
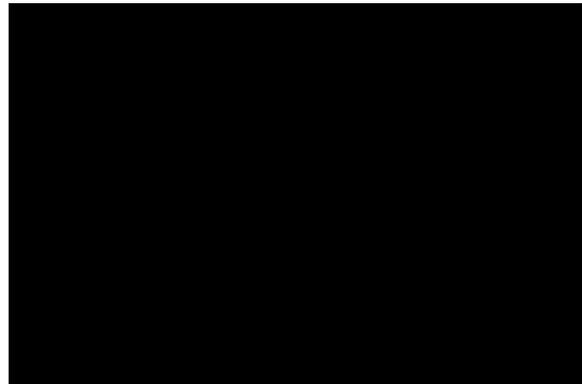


Photo by Jackie Poole

SURVEY OF ABUNDANCE, DISTRIBUTION, AND GENERAL BIOLOGY OF TEXAS HORNSHELL AND OTHER UNIONIDS IN THE RIO GRANDE, TEXAS

Robert G. Howells - Texas Parks and Wildlife Department



TPWD photo

Texas hornshell (*Popenaias popei*) is one of several rare unionid species believed endemic to the Rio Grande. Until recently, several species had not been documented since the 1970s and another may not have been found alive in this century. Since initiation of this work in 1997, TPWD has developed a unionid data base including records from the Rio Grande through the present, scheduled field work to start in March 1998, and documented a previously unknown specimen of Texas hornshell from the upper Concho River drainage (perhaps suggesting a disjunct Central Texas population). Corresponding work in New Mexico has confirmed Texas hornshell surviving there and has provided the first insight into habitat and substrates where it occurs (allowing subsequent work in Texas to be more efficient). These data have already been included in a chapter on Texas hornshell in a national mussel atlas being prepared, a range-extension note covering the Concho River collection, and another manuscript being drafted by New Mexico Department of Game and Fish.

ECOSYSTEMS

DEMONSTRATION OF BOTTOMLAND HARDWOOD FOREST RESTORATION FOR WILDLIFE HABITAT AND TIMBER PRODUCTION

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

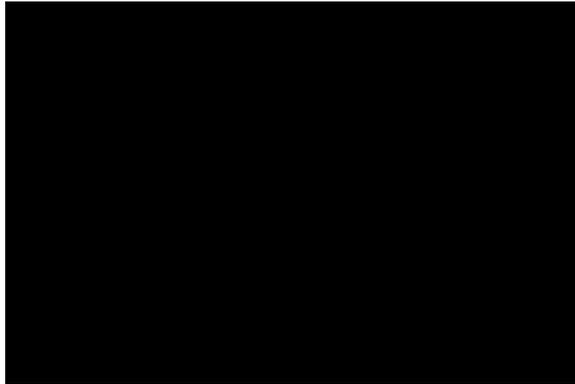


Photo by C. Frentress

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 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 Wildlife Management Area. 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 2 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, pecan and other hard-mast producing seedlings per acre.

In September 1996, 5 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, white-tailed deer and swamp rabbits. The overall survivability on the 200-acre project site was estimated to be 3,217 seedlings, approximately 16 trees/acre.

In conjunction with this project, a video entitled "Forests of the River Bottom" was developed and will serve as an educational tool for teachers, resource managers and conservationists to transfer information to the public on the ecological functions and importance of bottomland hardwoods. The demonstration area has already been used as the site for several presentations on bottomland hardwood ecosystems and timber management and will be a valuable site for extension work in the future. The video, demonstration area and knowledge gained from this project will continue to be used to provide the public and particularly the private landowner with information and timber management options as the hardwood timber market continues to expand.

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

INVENTORY AND MONITORING HABITAT AND WILDLIFE DIVERSITY ON WILDLIFE MANAGEMENT AREAS

Matt Wagner and Brad Simpson - Texas Parks and Wildlife Department

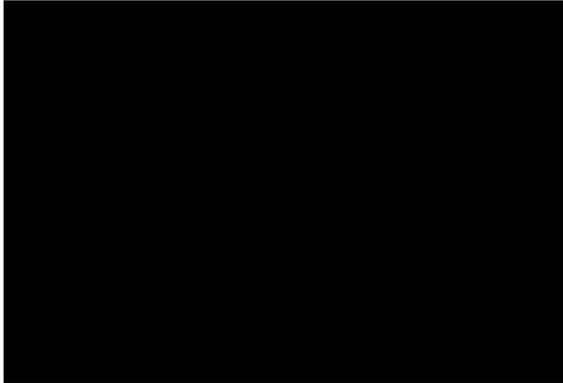


Photo by Donald Ruthven III

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.

THE SALT BAYOU MARSH RESTORATION PROJECT

Amos Cooper - 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 marshhay 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 results are incorporated in the analyses. Final results will be used to evaluate the effectiveness of the Salt Bayou structure for restoring wetland diversity, functions, and dynamics throughout the marsh system.

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.

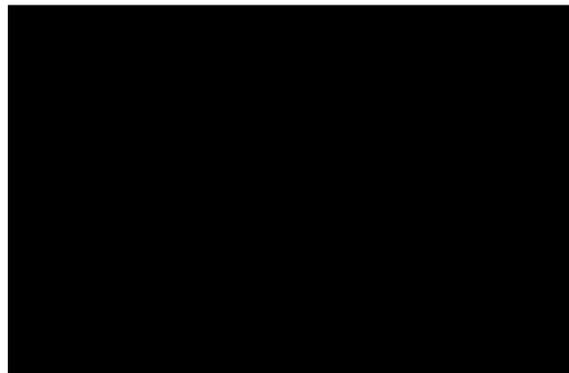


Photo by Jim Sutherland

AN ECOLOGICAL INVESTIGATION OF ROBBINS SLOUGH DRAINAGE: ECOSYSTEM RESPONSE TO MANAGEMENT STRATEGIES

M. Todd Merendino, Matt Nelson, J. Brent Ortego and Justin Hurst - Texas Parks and Wildlife Department

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 188 red drum. This tagging will provide information on fish movements within the Robbins Slough estuary and the adjacent bay systems. To date, 11 red drum have been recaptured. Preliminary results suggest that red drum remain within the same marsh area and exhibit little movement within the system. We have tagged 144 alligators from 18 inches to 6 feet in length. Future recapture efforts will provide information on movements, growths, and survival in response to marsh management strategies. Preliminary results indicate that growth of small alligators is about 2 centimeters per month, and that the distribution of small alligators is correlated with water salinity. 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.

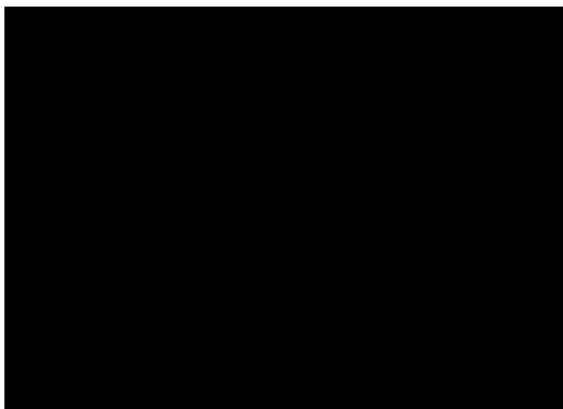


Photo by Ron George

EVALUATION OF EARTHEN PLUGS IN RESTORING COASTAL MARSH ON THE LOWER NECHES WILDLIFE MANAGEMENT AREA

Len Polasek and 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

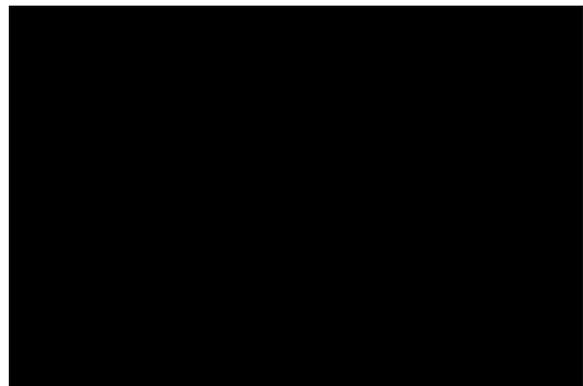


Photo by Len Polasek

The most extensive, contiguous loss of wetlands along the entire Texas Coast has occurred along the Lower Neches River. 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.

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 farther inland during periods of high tide. Saltwater intrusion into fresh marsh in turn causes loss of salt intolerant emergent and submergent aquatic plants and erosion and net loss of soil organic matter.

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 the

ingress/egress of marine organisms and tidal waters 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 Spring 1999.

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

EFFECTIVENESS OF GEOTUBES AND HAY BALE FENCES IN REDUCING WETLAND VEGETATION AND SOIL LOSSES ALONG A NEWLY CONSTRUCTED PIPELINE

Len Polasek - Texas Parks and Wildlife Department, and Richard W. Griffin - Prairie View A&M University

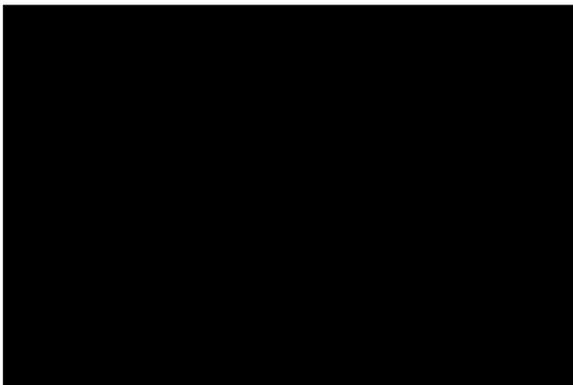


Photo by Len Polasek

Air Liquide America Corporation constructed a 30 cm (12 inch), gaseous oxygen pipeline, within Texas Parks and Wildlife Department's (TPWD) Lower Neches Wildlife Management Area during Fall 1997. Air Liquide utilized a double-ditching

technique in its construction. Double ditching is a technique in which an amphibious trackhoe excavates the pipeline ditch and stacks the soil in piles adjacent to the trench. After laying the pipe in the trench, the operator replaces the excavated soil and attempts to maintain topsoil on the surface. TI Energy Services, Inc. also utilized double ditching to construct a pipeline in the same marsh in 1995. Research on TI Energy's line revealed significant soil and emergent vegetation (2.6 ha) losses 1 year after the pipeline was constructed. Therefore, TPWD proposed the use of geotubes and hay bale fences to minimize soil and vegetation losses along the newly constructed pipeline.

Geotubes, constructed from polyester fabric, were fitted to the size of the pipeline trench, filled to marsh elevation with excavated soil, and covered with topsoil. Geotubes were placed at the intersections of the pipeline trench and bayous and major ditches to serve as rigid plugs to minimize tidal scouring along the pipeline trench. In addition, hay bale fences, wrapped with 100% coconut fiber matting, were placed over the geotubes and at all locations where emergent vegetation intersected open water.

Vegetation and soil sampling occurred just prior to construction within 2 pipeline corridor treatments (pipeline ditch and construction equipment/soil deposit) and a control corridor where no construction occurred. Vegetation sampling consisted of both field quadrats and Geographic Information System (GIS) analysis of aerial photography. Soil plugs were collected to determine changes in profile thickness. Sampling will be repeated annually to determine changes in vegetation (submergent and emergent) composition and coverage and soil thickness. Results will be compared to the TI Energy pipeline study and a control section of the pipeline where only unwrapped hay bales were used.

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

EFFECTS OF FIRE ON FORB DIVERSITY AND PRODUCTIVITY IN THE WESTERN SOUTH TEXAS PLAINS

Donald C. Ruthven III, James F. Gallagher and David R. Synatzske - Texas Parks and Wildlife Department

Prescribed burning is a common management technique utilized to enhance rangeland productivity and improve wildlife habitat. However, the effects of fire on plant communities in

the western south Texas plains are not clearly understood. Our objective was to compare forb productivity and diversity on prescribe burned rangelands and untreated rangelands under controlled conditions.

Four rangeland sites that were prescribe burned during winter 1997, and 4 sites of untreated rangeland were selected on the Chaparral Wildlife Management Area, Dimmit County, Texas. To investigate the influence of livestock grazing, the most common land use practice in south Texas, 2 burned and 2 untreated sites were subjected to grazing by cattle. Herbaceous canopy cover and forb density were estimated with 20-x 50-cm quadrats (250 per site) during late spring (May-June) 1997.

Forb coverage was greater on burned than unburned sites. Species diversity and richness were similar between treatments. Important seed producing annuals such as prairie sunflower and croton were more prevalent on burned sites. Day flower, an important forage plant for white-tailed deer and the Texas tortoise, was also more common on burned sites. Grazing did not appear to influence the presence of forbs on burned sites; however, grazing did reduce productivity of desirable species such as prairie sunflower.

Prescribed burning is a cost effective management tool which can be utilized to control woody plants and enhance wildlife habitat by promoting forb production in south Texas. However, effects of winter burning on hibernating non-game species such as the Texas tortoise and Texas horned lizard need further investigation.

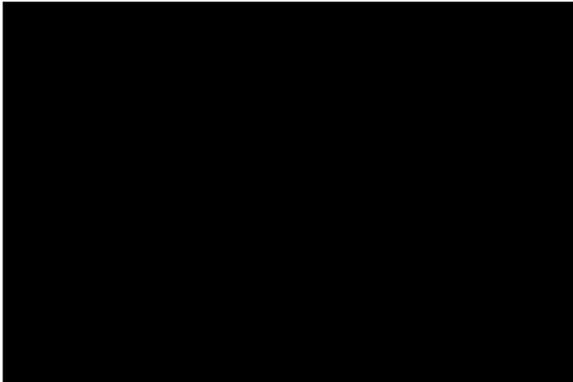


Photo by Donald Ruthven III

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

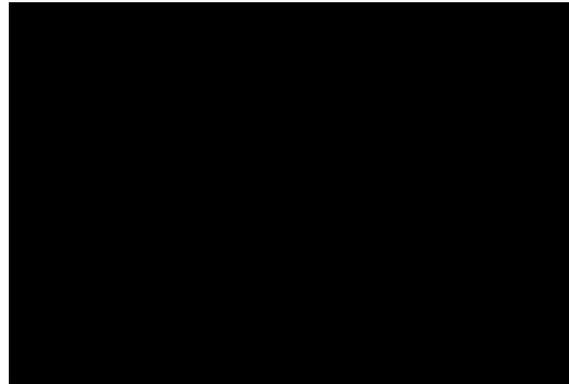


Photo by Mario Gonzalez

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. The cactus was originally described by W. T. Marshall in 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 developments, 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. It has been suggested that 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 (WMA) 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 7 of the sites to receive 1 of the 7 possible treatment scenarios (cut, graze, burn, cut-graze, burn-graze, burn-cut and cut-burn-graze) and the eighth site to serve as a control.

A cattle herd was rotated through the grazing plots during Winter, Spring and Summer 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.

By the end of this report period, a total of 635 Tobusch fishhook cacti had been located and marked on the Walter Buck WMA. Cacti located within each study site were monitored using 1-m² quadrats. Forty-one other species of vegetation were identified occurring within the quadrats. The median number of plant associates per quadrat was 5. Average percent vegetative ground cover was calculated at 33% for the quadrats. The primary vegetative type found in the quadrats was grass, with species of *Bouteloua* having the highest composite percent cover. Limestone bedrock and coarse rock fragments were the major physical features identified in the immediate area of Tobusch fishhook cacti habitat.

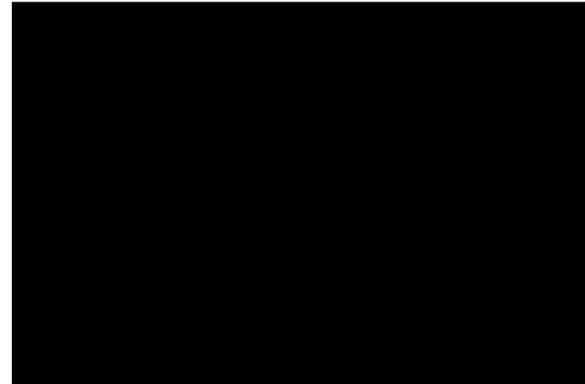
Overall mortality during the study period September 1995 to May 1997 was 26.6%, with observed mortality decreasing from 20.7% before treatment (September 1995 through December 1996) to 14.6% after treatments were applied (December 1996 to May 1997), including the control site. The before and after treatment periods yielded significant differences in overall mortality between the control site and the graze, cut-graze and cut-burn-graze sites and no significant differences between the control site and the burn, cut, burn-cut and burn-graze sites.

The mean flowers/cacti was 1.74 before treatments were applied. There was no significant difference in flower production by cacti based on treatment. Comparison of the mean diameter of cacti, measured using a hand-held caliper, at the control site and the treatment sites showed confounding results. Cacti at treatment sites and control sites both increased and decreased in size.

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

EFFECTS OF GRAZING ON HERPETOFAUNA DIVERSITY AND ABUNDANCE IN THE SOUTH TEXAS PLAINS

Donald C. Ruthven III, James F. Gallagher and David R. Synatzske - Texas Parks and Wildlife Department, and Richard T. Kazmaier - Oklahoma State Univer-



sity

Photo by Donald Ruthven III

There has been much debate on whether grazing by domestic livestock adversely affects wildlife populations. Of particular concern, is how grazing may affect threatened and endangered species. To address these issues, we investigated the effects of grazing by cattle on reptile and amphibian populations on the Chaparral Wildlife Management Area (CWMA), located in the south Texas plains. The CWMA not only has a diverse herpetofauna population but lies within the range of 4 state threatened species, the Texas horned lizard, Texas tortoise, Texas indigo snake, and reticulate collared lizard.

Historically, the CWMA has been continuously grazed by cattle since the late 19th century. Upon purchase by the State of Texas in 1969, rotational grazing programs were initiated. The CWMA was deferred from grazing during the period 1984-89. Cattle grazing resumed in 1990 at low to moderate stocking rates under a high intensity low frequency rotational system.

To monitor the effects of grazing, 4 drift fence/pitfall arrays were installed in each of 2 ungrazed pastures and four drift fences installed in each of 2 management units subjected to grazing by cattle. One ungrazed pasture had been deferred from grazing since 1976, the other since 1984. Four drift fences (2 per treatment) were monitored during summer and fall 1996. All 16 drift fences were monitored during late Spring and early Summer 1997. Through 1997, each array was

monitored for an average of 788 hours. Pitfalls were checked twice daily. Upon capture, specimens were identified, measurements (total and snout-vent lengths) taken, lizards marked by toe clipping, then released.

Fourteen species of reptiles and 5 species of amphibians were encountered in pitfall traps. There was no difference between treatments for species richness. Species diversity was greater on grazed sites and total numbers captured was greater on ungrazed areas. The only 2 species which showed differences between treatments were Great Plains narrowmouth toads and Texas toads, with the former being more abundant on ungrazed sites, the latter on grazed areas. The Texas horned lizard was the only threatened reptile which can be effectively captured in pitfall traps. There was no treatment effect for horned lizard abundance, although total horned lizard captures (19) was relatively low.

A large number of Great Plains narrowmouth toads encountered in one of the ungrazed pastures accounted for the lower species diversity on ungrazed treatments. This increase in narrowmouth toads may be a result of habitat differences rather than grazing effects. It appears that rotational grazing at low to moderate stocking rates had no effect on herpetofauna populations. In late 1997, stocking densities were increased and are anticipated to remain relatively high through 2000. Monitoring of drift fence arrays will continue to determine the effects of higher stocking rates on herpetofauna.

HABITAT ANALYSIS, VEGETATION SURVEY, AND GIS MAPPING OF BIG LAKE BOTTOM WILDLIFE MANAGEMENT AREA

Kay M. Fleming and Jason R. Singhurst - Texas Parks and Wildlife Department

The degradation and loss of bottomland hardwood cover types have reached critical proportions in Texas. At the turn of the century these hardwoods occupied an estimated 16 million acres throughout the State. Recent estimates place this number at less than 6 million with most being scattered into small disjunct tracts within the eastern third of the State. The 3,182-acre Big Lake Bottom Wildlife Management Area (BLBWMA) lies adjacent to the Trinity River and is one of the largest remaining bottomland hardwood tracts of its type in the central Trinity River basin. This alluvial bottomland has originated from the periodic flows and sediments of the river as it cut through the blackland prairies and post oak savannah

ecosystems of northeastern Texas. The poorly drained clay soils and uniform topography have produced a forest dominated by hydrophytes and includes overcup oak, water oak, willow oak, and water hickory.

Since BLBWMA was purchased to preserve the unique and rapidly disappearing bottomland habitat along the Trinity River, a systematic inventory of the habitat is imperative for proper management. Information from this study will influence the area manager's ability to function effectively when dealing with land trades, undivided interests, mineral exploration, and rights-of-way that will impact area plant communities and ecosystems.

The project objectives include developing a baseline vegetation inventory and analysis of Globally Positioned (GPS) permanent survey plots for documenting change of plant communities over time. The program will assist in defining age, land use, and land cover classes of bottomland hardwoods. The research also provides data for future restoration and characterizing historical plant communities by defining natural successional stages with the use of historical black and white, and current color infra-red aerial photography. Geographic Information System vector modules are used to delineate habitat polygons of existing vegetation conditions. Land cover vegetation classification (following National Vegetation Classification System) of landscape level bottomland hardwood conditions was also processed utilizing Thematic Mapper imagery and image processing software unsupervised and supervised classification techniques. A digital elevation model was created and spatial analysis software established regional slope and aspect influences on the area.

Inceptive data aggregation for this project started in September 1997 and is scheduled for completion in August 1998. This project is funded by Texas Parks and Wildlife

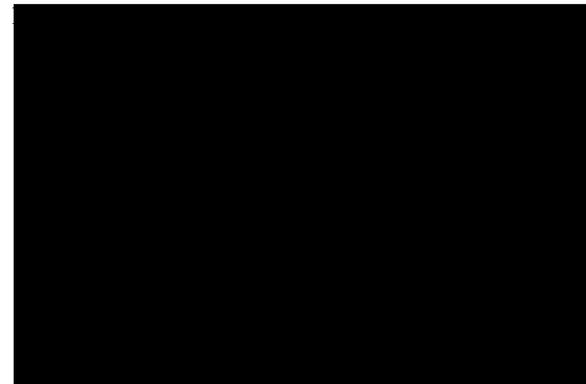


Photo by M. D. Marks

INVENTORY AND ANALYSIS OF VEGETATIONAL COMMUNITIES ON RICHLAND CREEK WILDLIFE MANAGE- MENT AREA - NORTH UNIT

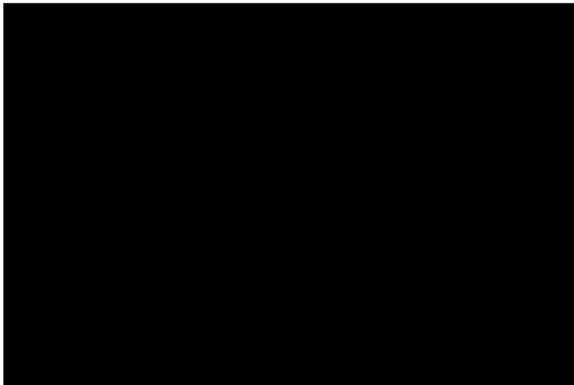


Photo by Dale Prochaska
**Jason R. Singhurst and Dale F. Prochaska - Texas
Parks and Wildlife Department**

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 included 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.

Permanent survey transects and plots were established, utilizing Global Positioning System (GPS) points, in all series level plant communities. All plant accessions of significant flora were deposited in regional herbaria. Geographical Information System (GIS) coverage was developed in Arc View for existing vegetation, series level vegetation, geology and soils utilizing current and historical aerial photographs.

The field work was completed in June 1997 and data were analyzed the fall and winter of 1997-98. The result of inventory and analysis of the RCWMA North Unit included a rich assemblage of flora. A total of 434 species representing 303 genera from 99 families was documented. The largest number of species are from the Angiospermae in the Asteraceae family (41 species). Approximately 96% of the vascular plants on the RCWMA North Unit are native to Texas. *Loeflingia squarrosa* (loeflingia), an under-reported native plant taxon, and *Bellardia trixago* (sticky bellardia), an exotic from the Mediterranean and recently reported as new to the Texas flora, were the only uncommon plant species documented on the area. A total of 31 permanent vegetation plots/transects were sampled and indicated 16 (5 forest, 7 brush and 4 herbaceous) different vegetation types on the area. From these 16 vegetation types, 7 distinct series level plant communities (= alliance level, National Vegetation Classification System) were recognized. Photo-points and monitoring plot data sets were hot-linked to the GPS vegetation plot points for change detection and database queries in GIS. A 1995 Thematic Mapper scene for the area was analyzed using unsupervised classification techniques and consummation of 12 distinct land cover vegetation types. Additional GIS progress included a Digital Elevation Model which was utilized to construct a spatial analysis of slope, aspect and hillshade for the area.

The project was funded by the Texas Parks and Wildlife Department.

EFFECTS OF SHORT-TERM DROUGHT ON HERPETOFAUNA DIVERSITY AND ABUNDANCE IN SOUTH TEXAS

**Donald C. Ruthven III - Texas Parks and Wildlife
Department, and Joe K. Moody - Simpson College,
Iowa**

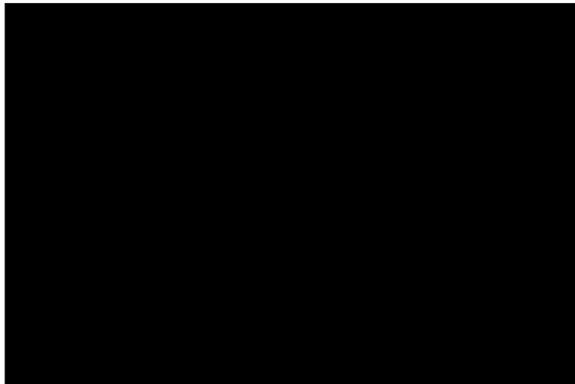
Drought affects most wildlife populations by reducing available surface water and food supplies. The effects of

drought on herpetofauna, amphibians in particular, are not well documented. The Rio Grande Plains of south Texas are normally subjected to periodic drought and serves as an ideal location to investigate the effects of drought on wildlife populations.

During the period January through mid-May 1996 the Chaparral Wildlife Management Area (CWMA) in Dimmit and La Salle Counties, Texas received 0.38 inches of precipitation resulting in one of the most severe short-term droughts in recorded history. Conversely, during the same time period in 1997 the CWMA received 13.48 inches of rainfall, well above the average of 7.54 inches. To monitor drought effects, 10 drift fence arrays on the CWMA were monitored during early May 1996 and 1997. Drift fences were checked twice daily. Captured animals were identified, total and snout/vent length measurements taken, and then released.

A total of 19 species of reptiles and amphibians were captured during the collection periods. Species diversity and richness were greater during the drought year. Total numbers of animals captured were greater during the wet year of 1997. Texas spotted whiptails and Great Plains narrowmouth toads were the most commonly encountered species comprising 60% of all captures in 1996 and 83% in 1997. Texas spotted whiptails were more abundant during the wet year of 1997. Great Plains narrowmouth toads were as active during the drought year as in the wet year.

Drought conditions appeared to have little effect on herpetofauna diversity and abundance. High nighttime relative humidity may account for amphibians such as Great Plains narrowmouth toads remaining active during periods absent of rainfall. Increases in diversity during drought may have resulted from increased activity by certain species in



search of limited food resources. *Photo by Donald Ruthven III* This increased activity may result in higher predation rates.

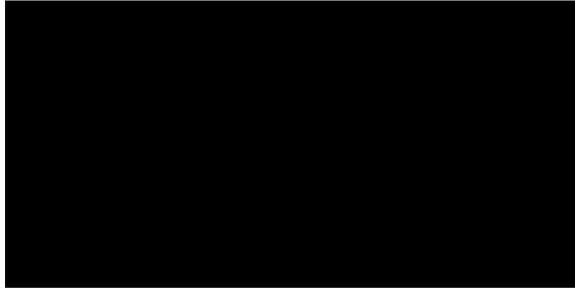
BASELINE SURVEY AND MONITORING ON TEXAS STATE PARKLANDS

David H. Riskind, Keith Blair, Wm. Lynn Pace, Kelly Bryan, Ted Hollingsworth, Mark Lockwood, Jason Singhurst, Linda Hedges and Michelle Valek - 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 Texas Wildlife Information System as appropriate. The more significant completed reports include *The Mammals of Big Bend Ranch State Park*, *Geology of the Solitario Dome*, *TransPecos Texas*, and *Baseline Herpetofauna of Brazos Bend State Park*. 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, Texas A&M University - College Station, 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.

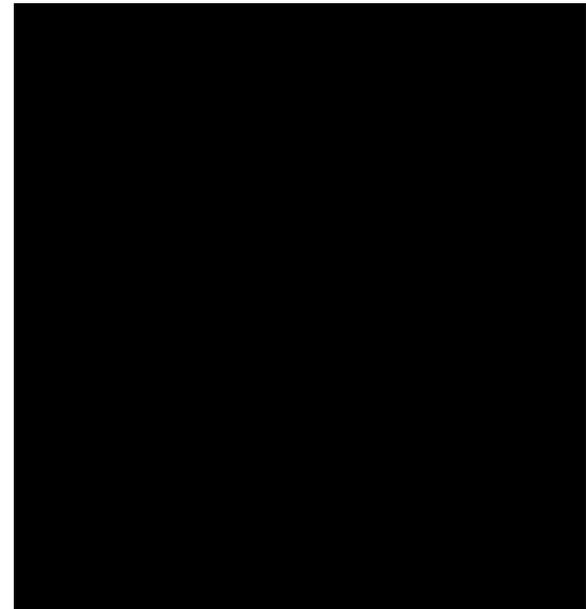
This project was funded by the Texas Parks and Wildlife

Department.

FAUNAL SURVEYS OF STATE-OWNED PROPERTIES

Robert D. Bradley, Robert J. Baker, Clyde Jones, Nick C. Parker and David J. Schmidly - Texas Tech University, and Vivian Ackerson, David H. Riskind and Ronnie R. George - Texas Parks and Wildlife Department

Over the past 2.5 years, researchers at Texas Tech University have collaborated with the Texas Parks and Wildlife Department (TPWD) in conducting faunal surveys on state-owned properties. The focus of these endeavors was to: (1) assist TPWD with its ongoing base-line inventories; (2) archive voucher specimens (skins and skeletal material) for historical documentation of existing biodiversity and for future reference; (3) archive tissue samples for future studies pertaining to systematics, genetics, ecotoxicology, and emerging viruses (e.g. rabies, hantavirus, and arenavirus); (4) provide Geographic Information System localities of traplines for use in habitat



preference studies or future base-line studies; and (5) provide data and information to the TPWD and the scientific community.

As of February 1998, we have conducted surveys on 22 state-owned properties, with a majority of our efforts being focused on Wildlife Management Areas. These surveys generally have focused on small mammal species with the major

emphasis being on rodents and bats. The results of these surveys have ranged from producing the first base-line data for poorly studied properties to supplementing and updating existing data for those properties which have been studied in more detail. To date, we have discovered at least 27 county records and several property specific records as a result of these inventories.

We hope that this collaboration will enhance our knowledge of the biodiversity of state-owned properties, as well as serve as an indicator of the biological status of wildlife species across the state of Texas. It has been 100 years since the Biological Survey of Texas was conducted by Vernon Bailey and his colleagues. Not only has a significant amount of time passed, but the land use practices and human activities of Texans have changed significantly since the initial survey. Data such as those being generated through the interactions of TPWD and Texas Tech University will be instrumental in addressing the current and future issues concerning the biodiversity of Texas.

THE NATURAL SCIENCE DATABASE AND THE WORLD WIDE WEB

Robert J. Baker - Texas Tech University, Nick C. Parker - U.S. Geological Survey-Texas Cooperative Fish and Wildlife Research Unit, and Don McCarty,



John Herron and Ronnie R. George - Texas Parks and

Wildlife Department

The Natural Science Research Laboratory (NSRL) of the Museum of Texas Tech University and the Texas Cooperative Fish and Wildlife Research Unit are constructing the Natural Science Database (NSD) as a reference tool for wildlife biologists and academicians, but also as a reservoir of biological data to address public health issues. Database management software linked to Geographic Information Systems (GIS) will provide interactive queries and map production through a World Wide Web (WWW) interface. Wildlife data will include currently archived, but inaccessible, historical records for distribution of species and quality and quantity of habitat from a variety of sources. The NSRL currently has 50,000 cryopreserved tissue samples and a total holding of over 100,000 cataloged natural history specimens which will be included in NSD. Additional data will be included from, or linked to, Texas Parks and Wildlife Department, other museums in Texas, and the Texas Department of Health (TDH) which collect specimens with the potential of possessing rabies or other human pathogens. The Natural Science Database will provide dynamic analysis and evaluation of factors influencing resource management and public health in a user friendly environment to anyone with Internet access.

Products currently available through the WWW include *The Mammals of Texas* by W.B. Davis and D.J. Schmidly, the 1897 *Manual of Fish Culture* with many photographs and line drawings, and information on current projects. The field notes, photographs, and records from the 1895 to 1905 *Biological Survey of Texas* by Vernon Bailey are currently being prepared by D. J. Schmidly for publication on the WWW.

CULTURAL RESOURCES

PREHISTORIC BISON HUNTER CAMP DISCOVERED NEAR STATE BISON HERD ENCLOSURE

*Margaret Howard, Logan McNatt and Amy Ringstaff -
Texas Parks and Wildlife Department*



TPWD Archeology Lab photo

In 1997, Texas Parks and Wildlife Department archeologists studied a prehistoric bison hunters' camp near the modern bison enclosure at Caprock Canyons State Park in Briscoe County. This enclosure houses descendants of the original Southern Plains bison herd protected by Charles Goodnight in the late nineteenth century. The prehistoric site and enclosure are on the edge of a plain cut by a tributary of the Little Red River.

August 1997 investigations assessed the extent, age, integrity, and significance of site 41BI206. Three concentrations of artifacts were discovered that represent prehistoric camps or task areas. The 108 artifacts recovered include an arrow point, a hammerstone, knife fragments, scraping tools, engraving tools, and chipping debris. The arrow point is made of obsidian from the Jemez Mountains of northern New Mexico. The tools were used for hide and meat processing. Although no bones were found, bison probably was the main animal that was processed, based on a comparison with similar sites in the region. Many burned rocks in one artifact concentration probably represent displaced campfires. Although sites of late Ceramic and/or early Historic age often contain pottery, none was found at this site. The site was occupied at some time between A.D. 1100 and 1700, and has

shallow, diffuse cultural deposits that represent a brief occupation. Its research potential is moderately high, and the site is a designated State Archeological Landmark.

The Parks and Wildlife Department has taken several measures to protect and preserve the site. Long term protection will be ensured by monitoring its condition. The mid-grass prairie vegetation that covers the site will be managed to promote species diversity, increase ground cover, and retard the effects of erosion. Brush species will be removed by hand-clearing, herbicide, and/or fire, without disturbing the ground surface.

In addition to the Parks and Wildlife Department Archeology Survey Team, this site investigation was assisted by a crew made available by the Texas Department of Criminal Justice.

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