

*Caesar
Kleberg
Wildlife Research Institute*



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Current Research 2011–2012

This year's cover features a photograph of an ocelot taken by Larry Ditto. The endangered ocelot is a beautifully spotted feline that historically occupied much of central and east Texas. Currently, less than 80 ocelots occur in Texas and live in 2 populations in southern Texas.

Editor Alan M. Fedynich, Ph.D.

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December 2012

Report of *Current Research*

September 1, 2011 to August 31, 2012

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FOREWORD



In the past 16 years, I have used this spot in our Annual Report to talk about issues like drought, Eagle Ford Shale, the "querencia" (see the 2007–2008 issue), how the recession affected our financial health, invasive grasses, our endowment needs, a prospective U.S. Navy Bombing Range, among other topics. Hopefully, I never failed to end my letter without thanking you for your support and encouragement. But this time, I just want to talk about Grady.

Grady Cage passed away in May at the young age of 33. He battled cancer for 12 years, but you would never see anything but a smile on his face and warmth in his heart. The outpouring of genuine compassion for Grady and his family was truly inspiring. It is an experience that requires re-telling about Grady, his family, and those who gave in his memory and honor.

I was aware of Grady's condition and knew he passed away on May 9. Because I am notified immediately via e-mail when the Institute receives an online donation or gift, something began happening on May 10, 2012 that caught me by surprise. I began to see e-mail after e-mail of online donations coming across my computer screen. Ten or so came by 9:00 am. My curiosity aroused, I decided to stop working on a detailed report that was due, and began to read the notices. What I realized was that they were all online gifts in honor of Grady. What I didn't know at the time was that his wife Caroline, with support from his parents Presnall and Stephanie, had recommended

memorial gifts be made directly to the Institute for quail research. And, memorial gifts were still being received as of last week.

Another heartwarming part of this story is that I was beginning to see that we possibly could approach the \$25,000 level that is necessary to create an endowment in Grady's name. Such an endowment would carry his name forever as the *Grady Cage Memorial Fund for Quail Research*. When I approached Caroline, and later, Presnall and Stephanie with this idea about an endowment, they were so supportive and grateful to those who made this happen.

With memorial gifts and pledges we have received to date, the total so far is more than \$60,000 and, more than double the amount required by the Texas A&M University-Kingsville Foundation for establishing a named endowment.

But, this is what struck me most about this remarkable experience.

As we lose cherished loved ones, we all think about supporting hospitals, cancer research, hospice and other very important entities that strive to help those who helped our loved ones through their final days. The Cage Family decided to ask their friends and family to support what Grady lived for—if you have ever hunted wild bobwhites in South Texas on a foggy morning in January, you and Grady would have had a blast. God bless Grady. He is in a place where there is no more pain and suffering. And, God Bless his precious family for this remarkable gift.

Sincerely,

A handwritten signature in black ink that reads "Fred C. Bryant". The signature is written in a cursive, flowing style.

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Every graduate student in our program financially
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 Spanish Doors – given by *Ruth E. Sullivan*

In Memory and Honor...

Many people choose to send unsolicited gifts in honor of cherished friends or family.

We have received memorials and gifts to honor...

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Our spirits are lifted by these gifts. Please accept our thanks to all of you who support and encourage us.

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Ocelot Survey on the East El Sauz Ranch in South Texas

Arturo Caso, Alfonso Ortega-Sanchez, Jr., Daniel Kunz, William C. Stasey, Michael E. Tewes, Jimmy Rutledge, Lon I. Grassman, and Alan Cain

The ocelot in Texas is considered an endangered species by Texas Parks and Wildlife Department and the U.S. Fish and Wildlife Service. We initiated this study to learn more about the ocelot in South Texas.

We captured and radio-collared 7 ocelots (4 males, 3 females) and monitored their movements by radio telemetry. Computer programs were used to calculate home range size. To determine population density, 15 camera stations separated by 2,000–3,300 feet were deployed for 7 months. Individual ocelots were identified by their unique coat pattern, and population density was estimated using capture-recapture models. To calculate the effective sampling area, we established a buffer for each camera location using the half mean maximum distance moved of individuals photographed at 2 or more stations.

Results included 55 ocelot photos of 11 individuals (5 males, 6 females) after 2,700 camera trap-nights of surveys. Initial analysis indicates a mean home range size of 1.6 mi² for males and 0.8 mi² for females. Population density is estimated at 117 ocelots per 100 mi².

Continued monitoring is vital in developing an in-depth understanding about the status and demographics of this important ocelot population. This project will contribute to the knowledge of previous research on ocelot populations in Texas.

Cooperative funding provided by the East Wildlife Foundation and Wild Cat Conservation, Inc.

Monitoring Ocelots and Bobcats within a Fragmented Landscape

Jennifer M. Korn, Michael E. Tewes, Arturo Caso, Lon I. Grassman, William C. Stasey, and John H. Young

The ocelot is a federally endangered felid found in isolated populations in South Texas. Previous research of ocelot and bobcat interactions revealed that ocelots primarily use thornshrub habitat. As part of a long-term project, we are monitoring ocelot and bobcat populations within 2 federal conservation easements consisting of about 450 acres of Tamaulipan thornshrub habitat.

We placed remotely triggered cameras around the easements beginning in 2003. In addition, we trapped an ocelot and 3 bobcats in 2010, 4 ocelots in 2011, and 5 ocelots and 3 bobcats in 2012. We collared 4 bobcats with very high frequency (VHF) transmitters and one with a Global Positioning Systems (GPS) unit. Two male ocelots were given GPS collars and 5 were given VHF collars.

An adult male ocelot had the largest home range (550 acres) and used both easements. Two adult female ocelots resided in one easement, but in unequal proportions (170 acres and 214 acres), and shared it with 2 sub-adult ocelots. One adult female ocelot was not live-trapped, but its home range (202 acres) was calculated from camera data. The offspring of this adult was collared in 2012 and the young ocelot resided within its natal range (224 acres) until dispersing and dropping the collar. Bobcats had larger ranges (3 adult males averaged 1,130 acres; one adult female averaged 721 acres; 2 sub-adult males averaged 484 acres) than ocelots, preferring mixed brush habitats around the easements.

Findings from this study provide spatial information about these wild cats. In addition, it demonstrates the need for remote camera surveys in conjunction with live-trapping and radio telemetry to effectively monitor ocelots and other wild felids.

Cooperative funding provided by the Tim and Karen Hixon Foundation, TAMUK Title V Promoting Post-Baccalaureate Opportunities for Hispanic Americans Program, Gary Wag-german Memorial Scholarship, Hispanic Leaders in Agriculture and the Environment, Houston Safari Club, Michael and Charles Corbett Scholarship, Texas Academy of Science/Texas Organization for Endangered Species, and Wild Cat Conservation, Inc.

Chemical Immobilization Strategies for the Wild Jaguarundi

Arturo Caso, Michael E. Tewes, and Lon I. Grassman

Information on the chemical immobilization of wild felids is sparse, and for some species is absent. Although the jaguarundi is the most common Neotropical cat in the wild, there have been few field studies because of the difficulty involved in capturing this species. Furthermore, chemical immobilization is an important aspect of wild cat studies since most studies require live-capture and sedation for obtaining biological samples, physical measurements, or attaching radio collars for monitoring movements of the cats. Thus,

it is important to know the best drug type and dosage level for each species to increase the efficacy of chemical immobilization and decrease the potential adverse effects of sedation to the cat.

From 1991 to 2007, we studied the jaguarundi population at Los Ebanos Ranch, Tamaulipas, Mexico. Twenty-one jaguarundis were captured using box traps baited with live chickens and coturnix quail. For chemical immobilization, we used ketamine hydrochloride (Ketaset®) combined with xylazine (Rompun®) on 18 jaguarundis. Three individuals were sedated with tiletamine-zolazepam (Zoletil 50®).

Sedated jaguarundis did not exhibit any physiological problems during and after the sedation procedure. Based on the data gathered for wild-captured jaguarundis, it seems that the mixture of ketamine-xylazine or tiletamine-zolazepam can be effectively used for chemical immobilization. However, additional testing on a larger sample of jaguarundis may provide further insight into the safety and efficacy of chemical immobilization on wild jaguarundis.

Cooperative funding provided by the Dallas Zoo, Los Ebanos Ranch, and Gladys Porter Zoo.

Assessment of Rodent Populations Needed as a Prey Base for Ocelots

M. Eric Mehlenbacher, Scott E. Henke, and Alfonso Ortega-Sanchez, Jr.

The ocelot is a federally listed endangered species that occurs in southern Texas. Recently, a new subpopulation consisting of 14 individual cats was discovered in northeastern Willacy County, Texas. Because of the newness of this discovery, little information about this subpopulation exists. The ocelots appear to limit their use to oak habitat in Willacy County.

The primary diet of ocelots is rodents. As such, rodents need to be prolific to maintain their populations to offset the effects of predation. However, rodent species richness and abundance can fluctuate depending on habitat type, human habitat use, and precipitation. Our objective is to monitor rodent populations in the oak habitat and surrounding habitat types to determine the rodent species present and their relative abundance.

Sherman traps will be used to live capture rodents in habitats of oak, mesquite, grassland, sand dune, and coastal beach. Rodents will be identified to species and relative abundance determined for each habitat type. This information will be used to determine the

adequacy of rodent abundance within the oak habitat needed to sustain the known ocelot population, or if ocelots must venture into the neighboring habitat types to fulfill their dietary needs.

Cooperative funding provided by the East Wildlife Foundation.

Variety in Coat Patterns of Bobcats and Potential Adaptive Value

Paeton M. Phaup, Taylor O. Garrison, Arturo Caso, Sasha Carvajal-Villarreal, Jennifer M. Korn, William C. Stasey, and Michael E. Tewes

Wild cats have acquired numerous adaptations to function as a hypercarnivore. Cryptic fur patterns are important for most feline species, enabling cats to ambush prey and hide from enemies. Bobcats exhibit considerable variation in coat patterns and color throughout their range. Considerable variation can occur within the same population. Our objective is to quantify the type and amount of variation in bobcat coats within a localized geographic area.

We examined bobcat coat variation using photographs obtained during a study on the Escondido Ranch in McMullen County, Texas. The photographic survey covered several months in 2010 and 2011, with additional sampling in 2012. Currently, we have 238 bobcat photographs from over 3,980 camera-nights of surveys.

Coat patterns of bobcats varied from brown and rufous fur void of spots to coats with considerable number, clarity, and variation of spots and rosettes. This variation in coat patterns may contribute to the ability of bobcats to exploit a variety of habitats, including



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Bobcats have a range of coat patterns, which are likely an adaptation to the wide range of habitats they occupy.

grasslands, thornshrub, and forests. Further research is needed to measure how bobcat fur coloration and patterns differ in varying environments.

Cooperative funding provided by the Feline Research Center of the Caesar Kleberg Wildlife Research Institute and Wild Cat Conservation, Inc.

Mapping Vegetation Cover for Ocelots in the Northern Sierra Tamaulipas

William C. Stasey, Arturo Caso, Sasha Carvajal-Villarreal, and Michael E. Tewes

Information about the vegetation types in the Sierra Tamaulipas of Mexico is necessary in the evaluation of a possible source population for ocelot translocation efforts here in Texas. Accurate maps classifying preferred habitat types are needed to estimate the distribution of ocelots in the Sierra Tamaulipas.

Vegetation type and extent were estimated by classifying 2 Landsat 7 images taken on 9 November 2009 that covered parts of the Sierra Tamaulipas. Reference areas for each vegetation type were visually confirmed along public roads and private properties when access was granted. We produced a detailed vegetation map of the Sierra Tamaulipas that has various applications for ocelot conservation. Thornshrub (540 mi²) and low spiny forest (1,215 mi²) vegetation types were identified and mapped, which are important to estimating the size of the potential source population of ocelots.

This vegetation mapping project will serve as a model for future projects that need to estimate the location and size of potential ocelot populations. Such information is critical for ocelot conservation efforts.

Cooperative funding provided by the Tim and Karen Hixon Foundation and the Feline Research Center of the Caesar Kleberg Wildlife Research Institute.

Activity Patterns of Four Sympatric Wild Cats in the Sierra Tamaulipas, Mexico

Sasha Carvajal-Villarreal, Arturo Caso, and Michael E. Tewes

The Sierra Tamaulipas in northeast Mexico is one of the few areas that jaguar, puma, ocelot, and jaguarundi occur together. However, there is little information about the ecology of these species and how they interact with each other. Previous reports suggest that varying



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We are learning how wild cat species partition their activity patterns to minimize competitive effects.

activity patterns and spatial use may allow the coexistence of sympatric species; however, this supposition needs to be tested for the above 4 wild felids.

We will determine the activity patterns of jaguar, puma, ocelot, and jaguarundi on the Caracol and Camotal ranches in the Sierra Tamaulipas using remote-sensing cameras with the time stamp printed on each photo. The photos will be grouped, based on a 24-hour period using 1-hour intervals. We will calculate the percentage of cat species photographed during each hour. Statistical analyses will be used to determine when most activity occurs for each species and which species have similar activity patterns.

The information collected in this study will lead to a better understanding of the ecology of these sympatric felids. Findings can be used to aid those developing conservation and management strategies.

Cooperative funding provided by the Tim and Karen Hixon Foundation, Caracol and Camotal ranches, Barry Putegnat, Dean Putegnat, the Feline Research Center of the Caesar Kleberg Wildlife Research Institute, and Wild Cat Conservation, Inc.

Bobcat Point Occurrence Related to Coyote Presence and Abundance

Taylor O. Garrison, Paeton M. Phaup, William C. Stasey, Arturo Caso, Sasha Carvajal-Villarreal, Jennifer M. Korn, and Michael E. Tewes

It has been hypothesized that bobcats are negatively influenced by coyotes. The mechanisms of this relation-

ship are not clearly understood, although antagonistic and competitive factors may be important.

We are conducting the study on Escondido Ranch located in southeastern McMullen County, Texas. We are using remote-sensing cameras to determine potential interactions between sympatric bobcats and coyotes. Surveys were conducted in 2010 and 2011, with additional sampling in 2012. Currently, we have 187 bobcat photographs collected over 2,840 camera trap-nights. From these images, we identified 33 bobcats (18 females, 15 males).

Analyses of the location and timing of bobcats and coyotes are ongoing. Findings may provide insight into the co-occurrence strategies used by these species.

Cooperative funding provided by the Feline Research Center of the Caesar Kleberg Wildlife Research Institute and Wild Cat Conservation, Inc.

Jaguar and Ocelot Population Estimation using Non-invasive Techniques in Mexico

Sasha Carvajal-Villarreal, Arturo Caso, and Michael E. Tewes

The jaguar and ocelot are considered federally endangered species in the United States and Mexico, and they are classified by the Convention on International Trade in Endangered Species (CITES) as Appendix I species. The present study contributes to the knowledge of jaguar and ocelot population densities in Tamaulipas, northeast Mexico.

We used a grid of camera traps deployed for 6 months to estimate local jaguar and ocelot populations in the Sierra Tamaulipas. This grid covered 35 mi² and



© Arturo Caso

CKWRI graduate student Sasha Carvajal-Villarreal is setting up a remotely triggered camera to survey wild cats.

contained 30 camera stations separated at least 0.6 miles apart. Individual jaguars and ocelots were identified by their unique pelage pattern. Population density was estimated using capture-recapture models with the aid of the computer program CAPTURE. To calculate the effective sampling area, we established a buffer for each camera location using the half mean maximum distance moved of individuals photographed at 2 or more camera stations, thus obtaining an effective study area of 54 mi² for jaguars and 48 mi² for ocelots.

After 6,335 camera-nights of surveys, we obtained photographs of 9 jaguars (4 males, 4 females, and 1 of unknown sex) and 38 ocelots (17 males, 21 females). We estimated a population density of 17 jaguars per 100 mi² and 79 ocelots per 100 mi².

We consider the Tamaulipan ocelot population robust enough to provide ocelot translocations to Texas. Additional monitoring in the Sierra Tamaulipas is recommended to determine the response, if any, that ocelot removals for translocation to other areas would have on this population in the Sierra Tamaulipas.

Cooperative funding provided by the Tim and Karen Hixon Foundation, Caracol and Camotal ranches, Barry Putegnat, Dean Putegnat, the Feline Research Center of the Caesar Kleberg Wildlife Research Institute, and Wild Cat Conservation, Inc.

Size of the Ocelot Tamaulipan Population Needed to Sustain Translocation

William C. Stasey, Arturo Caso, Sasha Carvajal-Villarreal, and Michael E. Tewes

Ocelot populations in the United States are not large enough to provide several surplus individuals for one-way translocations over long periods. Therefore, it is necessary to identify and evaluate an external ocelot source population that is sufficiently robust to supply the needed individuals to prevent extirpation of ocelots in the United States.

Ocelots in northeast Mexico (Tamaulipas) are most ecologically and genetically similar to the ocelots in Texas and would be the most likely choice. Before translocations can begin, we need to evaluate the source population to determine whether there is any jeopardy by removing individuals from that population for translocation to the United States.

We predict that ocelots occupy approximately 50% of the 1,756 mi² of thornshrub habitat and low spiny forest habitat that were previously mapped in the Sierra Tamaulipas. Based on previous research, conservative

estimates suggest there are about 269 ocelots in the Sierra Tamaulipas.

Population Viability Analysis (PVA) indicated that removing 16 ocelots every 3 years could reduce the source population from 269 to 252 individuals with zero chance of extirpation. Modeling results indicated that translocation of 16 ocelots every 3 years from a source population over 110 individuals would have a zero chance of causing extirpation of the source population.

It must be emphasized that these projections are conservative. There are no plans to actually translocate 16 ocelots every 3 years from Mexico. In addition, the size of the Sierra Tamaulipas population is likely larger than the 269 individuals estimated because additional ocelots probably occupy nearby locations and are not accounted for in the population estimate. We conclude the ocelot population in the Sierra Tamaulipas of Mexico could provide source individuals needed for translocation at the level explored in this study without the source population being harmed.

Cooperative funding provided by the Tim and Karen Hixon Foundation and the Feline Research Center of the Caesar Kleberg Wildlife Research Institute.

Rodent Monitoring for the Willacy and Cameron Ocelot Populations

Jennifer M. Korn, Michael E. Tewes, Lon I. Grassman, John H. Young, and Andrea R. Litt

The ocelot is an endangered felid in South Texas that preys primarily on small mammals such as rodents and rabbits. Information on prey population trends is



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Ph.D. student Jennifer Korn is monitoring the food resources of ocelots.

important to better understand the conservation needs of ocelots.

Prey populations have been monitored on the Yturria Ranch in Willacy County and Laguna Atascosa National Wildlife Refuge in Cameron County. On the Yturria Ranch, 5 transects of 60 Sherman live traps each (n = 300) were set along fence lines and corridors of 2 conservation easements. In Cameron County, 4 transects of 50 traps each (n = 200) were placed in areas that have been identified as primary release sites for ocelot translocation and 3 transects of 50 traps each (n = 150) were placed at secondary release sites. Traps were set for 4 consecutive nights and captured rodents were marked using numbered metal ear tags.

Trap success on the Yturria Ranch declined from January to July 2011 as much of South Texas was in extreme drought. Whereas, hispid cotton rats were the most common rodents captured in fall 2011 (12%), none were captured in April 2012. Heteromyid species (e.g., pocket mice) and deer mice comprised the majority of captures in April 2012. Trap success decreased dramatically from summer 2010 to summer 2011. The Palmer Modified Drought Index changed from 3.4 in summer 2010 to 3.9 in summer 2011, reflecting the drought conditions.

Monitoring prey populations may provide an index for population health of ocelots. Findings will aid in guiding future translocations of ocelots in Texas.

Cooperative funding provided by Friends of Laguna Atascosa National Wildlife Refuge, Tim and Karen Hixon Foundation, the Feline Research Center of the Caesar Kleberg Wildlife Research Institute, Wild Cat Conservation, Inc., TAMUK Title V Promoting Post-Baccalaureate Opportunities for Hispanic Americans Program, Gary Waggerman Memorial Scholarship, Hispanic Leaders in Agriculture and the Environment, Houston Safari Club, Michael and Charles Corbett Scholarship, and Texas Academy of Science/Texas Organization for Endangered Species.

Leopard Population Study in Tanzania, East Africa

Arturo Caso, Michael E. Tewes, and Lon I. Grassman

The African leopard is one of the most important trophy animals in East Africa; however, there is concern about the degree of sustainable hunting this species can tolerate in some game reserves located in Tanzania. Although leopards appear to be abundant in most places, no comprehensive population studies or censuses have occurred within the hunting areas of Tanzania.

In 2011, we started a field survey at the Luganzo Game Controlled Area using remote-sensing cameras to monitor the local leopard population. We used 25 remote-sensing camera stations that were superimposed on a grid and separated at least 1.5 miles apart. We calculated the camera station buffer using the half maximum mean distance moved by leopards and obtained an effective survey area of 116 mi².

From the camera surveys, we obtained 22 leopard photographs from which 16 individual leopards (9 males, 7 females) were identified by spot patterns and other body marks. With the computer program CAPTURE, we estimated a population density of 29 leopards per 100 mi². We will continue field surveys to increase the amount of data collected. Future management decisions should benefit from the findings of this study.

Cooperative funding provided by the Robin Hurt Wildlife Foundation, Lubbock Safari Club International, Safari Club International Houston Chapter, Felipe Reveilhac, and Wild Cat Conservation, Inc.

Spatial and Ecological Response of Bobcats to Habitat Management

Jennifer M. Korn, Michael E. Tewes, Marc Bartoskewitz, and Matthew J. Schnupp

Bobcats are a common and important predator in Texas, playing a valuable ecological role. Brush management likely alters bobcat use of the landscape as well as the prey species upon which bobcats depend. Our objectives were to analyze bobcat spatial ecology and movements in pastures actively managed for brush compared to those that had not received brush treatment (control pastures).

Our study site comprises 3 pastures (2 manipulated, 1 control) on the Santa Gertrudis Division of the King Ranch in Kleberg County, Texas. We trapped 9 bobcats (3 females, 6 males) from June 2011 to January 2012 and deployed Global Positioning Systems (GPS) collars on 2 females and 6 males. The collars took geographic locations every 2 hours for 6 months before a timed drop-off of the collars occurred. We used a model-based approach in program ANIMAL SPACE USE to determine home range estimates of bobcats.

Home ranges of 4 male bobcats averaged 1.7 mi² and were roughly 2 times larger than females, which averaged 0.8 mi². One sub-adult male had a home range of 0.9 mi² and another male covered an area greater than 15 mi². Home range sizes did not differ between



© Charlie Spiekerman

Researchers at CKWRI are learning how bobcats use the habitats found in South Texas.

pastures with brush management for either gender. Bobcat movements along brush strips typically occurred during dawn, dusk, and nocturnal hours. Bobcat activity was greater during evening and nighttime periods than other periods.

Our results do not indicate a strong relationship between bobcat movements or use among brush manipulated pastures and the control pasture. Information from this study will provide a better understanding of how predators react within shifting environments and will aid biologists seeking to manage lands for wildlife.

Cooperative funding provided by TAMUK Title V Promoting Post-Baccalaureate Opportunities for Hispanic Americans Program, Gary Waggener Memorial Scholarship, Hispanic Leaders in Agriculture and the Environment, Houston Safari Club, Michael and Charles Corbett Scholarship, and Texas Academy of Science/Texas Organization for Endangered Species.

Lion Population Survey in Two Hunting Areas in Tanzania, East Africa

Arturo Caso, Michael E. Tewes, and Lon I. Grassman

The African lion is one of the most charismatic and economically important game species in East Africa. Knowledge of accurate lion demographic information is important for effective game management; however, the status of lions within game reserves is not well known. Consequently, much debate exists over the sustainability of lion populations by pro-hunting and anti-hunting organizations. Therefore, there is an urgent need to assess the population status of lions in these areas.



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The density of African lions is being estimated to evaluate the effect of hunting on these wild cats.

We began the first phase of this field project in August, 2011 in the Rungwa Game Reserve and the Luganzo Game Controlled Area in Tanzania. We incorporated call-in stations and digital remote-sensing cameras to identify individual lions. We established 62 call-in stations and 25 remote-sensing cameras and ran the surveys for 1,050 camera trap-nights. Currently, our density estimation for Rungwa Game Reserve is 17–34 lions per 100 mi² and 12–25 lions per 100 mi² for the Luganzo Game Controlled Area.

These preliminary results indicate that lion densities are somewhat greater than expected given the demographic turnover that is thought to occur in areas open to hunting. However, we caution that more data must be collected and analyzed before a more accurate assessment can be given. These results represent the first year of a 4-year study.

Cooperative funding provided by the Robin Hurt Wildlife Foundation, Lubbock Safari Club International, Safari Club International Houston Chapter, Felipe Reveilhac, and Wild Cat Conservation, Inc.

Translocation Strategies to Augment Texas Ocelot Populations using PVAs

William C. Stasey, Arturo Caso, Sasha Carvajal-Villarreal, and Michael E. Tewes

The 2 small ocelot populations in Texas have a high likelihood of disappearing in the near future because of environmental and demographic factors. Our research has found low genetic variation in these isolated popu-

lations. Expansion of the ocelot populations in Texas is limited by insufficient habitat. The current efforts to restore ocelot habitat will likely take decades. Consequently, translocation is needed as an interim conservation strategy to augment the demographic and genetic makeup of the Texas ocelot populations.

We developed a Population Viability Analysis (PVA) model that used habitat and population information to predict the presence of 2 separate populations. The Willacy population was located in Willacy and southern Kenedy counties, whereas the Cameron population was delineated in and around Laguna Atascosa Refuge in eastern Cameron County.

The most efficient number of ocelots required for translocation was 4 individuals every 3 years. This assumed all 4 individuals will be successfully incorporated into the population as evidenced by active reproduction. This rate of translocation would require 24 individuals over 20 years. There was a negative growth rate with many of the scenarios because of the initial small population size and high levels of mortality along roadways.

Until additional habitat can be restored and mortality along roadways reduced, translocation will only serve as a temporary delay in the ultimate extirpation of the ocelot in Texas. Some genetic benefit can be achieved by exchanging ocelots between the 2 isolated populations in Texas. This strategy may slow the time to extirpation, thereby permitting other remedial actions to be achieved.

Cooperative funding provided by the Tim and Karen Hixon Foundation and the Feline Research Center of the Caesar Kleberg Wildlife Research Institute.

Genetic Pedigree Analysis of Ocelots from Texas

Jennifer M. Korn, Jan Janečka, Randy W. DeYoung, and Michael E. Tewes

In Texas, ocelots occur mainly within 2 isolated populations and are vulnerable to the negative effects of inbreeding. Genetic monitoring is critical for the management of this endangered species. Creating a genetic pedigree of all individuals will allow researchers to have baseline information for continued genetic monitoring, which is critical for translocation efforts. This information will allow researchers to track the genetic contribution of introduced ocelots in the population, provide information on movements between

populations, measure relatedness of individuals across the entire South Texas range, estimate population sizes, determine population origin of ocelots killed along roadways, and create a baseline for continued genetic monitoring (e.g., genetic diversity and connectivity among populations).

Ocelots that were live-captured in the Willacy County and Cameron County populations and vehicle-killed specimens within and around these areas prior to 2008 were genotyped in a previous study. Estimates of relatedness between ocelot pairs and those within the populations will be performed, and will include gender and estimated ages. Demographic data from camera surveys and live-trapping will be used to better explain these findings.

Previous research has shown that genetic and demographic augmentation of the remaining Texas ocelot populations is necessary to prevent extirpation. Accurate baseline genetic information of ocelots in Texas is vital to a successful translocation program.

Cooperative funding provided by Friends of Laguna Atascosa National Wildlife Refuge, Tim and Karen Hixon Foundation, TAMUK Title V Promoting Post-Baccalaureate Opportunities for Hispanic Americans Program, Gary Waggerman Memorial Scholarship, Hispanic Leaders in Agriculture and the Environment, Houston Safari Club, Michael and Charles Corbett Scholarship, Texas Academy of Science/Texas Organization for Endangered Species, and Wild Cat Conservation, Inc.



Courtesy Texas Parks and Wildlife Department

WHITE-TAILED DEER

The Comanche-Faith Project

Named after the 2 ranches on which the study is replicated, the Comanche-Faith Project began in 2004 with the goal to determine the best combination of supplemental feed and white-tailed deer density for intensive deer management. Six high-fenced enclosures of 200 acres each were constructed on both the Comanche and Faith ranches in Dimmit County, Texas. Two enclosures on each ranch have a target deer population of 10 deer (low density; 1 deer per 20 acres), 2 have a target population of 25 deer (medium density; 1 deer per 8 acres), and 2 are managed for 40 deer (high density; 1 deer per 5 acres). These are real deer densities, not observed densities from helicopter surveys, which are commonly used in South Texas. One enclosure of each deer density on each ranch contains pelleted supplemental feed and the other enclosure does not. All enclosures have a central water trough. Coyotes, feral pigs, and javelinas have largely been excluded from the enclosures.

Within this overall experimental design, many projects are being conducted to understand the response of deer and vegetation to different deer densities and to improved nutrition through provision of supplemental feed. Some projects use all 12 enclosures, whereas others use a subset. The following 15 abstracts describe research currently on-going as part of the Comanche-Faith Project.

Primary cooperative funding provided by T. Dan Friedkin, the Comanche Ranch, the Stedman West Foundation, and the Faith Ranch. Secondary cooperative funding provided for individual students and projects by Caesar Kleberg Partners, the various named endowments and scholarships, and the Hispanic Leaders in Agriculture and the Environment.

Effect of Deer Density and Supplemental Feed on Deer Population Dynamics

Nathan S. Cook, Charles A. DeYoung, David G. Hewitt, Timothy E. Fulbright, Randy W. DeYoung, Kim N. Echols, and Don A. Draeger

Population dynamics of white-tailed deer are impacted by many factors, including supplemental nutrition, deer density, and drought. There is a clear need for long-term research to examine the effects of supplemental nutrition on carrying capacity of South Texas ranches. Supplemental feed should allow managers to support higher deer densities, but the density at which density dependent effects appear is not evident. These density dependent effects should manifest themselves in measurable decreases in body size, antler size, and fawn production. Our objective is to determine the optimum density with supplemental feeding at which the potential for producing trophy deer is greatest.

Population estimates of white-tailed deer in all 12 enclosures are generated twice a year using camera surveys after which adjustments to maintain target densities (10, 25, or 40 deer) in each enclosure are completed. Body measurements are taken on all captured deer and include weight, body condition score, and Boone and Crockett antler score, which allows for analysis of density dependent effects. At first capture, each deer receives a colored and numbered cattle ear tag for individual identification during

camera surveys. The results of this long-term research will help landowners and land managers make decisions about effective and sustainable white-tailed deer densities for their herds, given the effects of pelleted rations on carrying capacity.

Effects of Deer Density and Supplemental Feed on Forage Abundance and Quality

Brandi L. Crider, Timothy E. Fulbright, David G. Hewitt, Charles A. DeYoung, Kim N. Echols, and Don A. Draeger

Evaluating wildlife habitat quality is necessary in making informed management decisions. Available forage quality and quantity determine the maximum number of animals an area can sustain. Managers attempt to improve the habitat, but the weather patterns of South Texas often cause wide variations in forage standing crop.

Providing supplemental feed is a common management practice in Texas and may alleviate natural variation and forage availability constraints. Our objective is to determine the effects of deer density and supplemental feed on the standing crop of browse, forbs, grasses, cacti, and mast.

Twenty 164-foot transects were randomly placed within each of the 12 enclosures. Biomass was estimated in 40 plots per enclosure biannually and was harvested in 20 randomly selected plots per enclosure to verify and correct estimates of dry biomass.

Variation in annual rainfall had pronounced effects on standing crop of all forage classes. Providing supplemental feed did not appear to result in a forage decline caused by more selective deer foraging nor an increase in forage due to reductions in forage pressure because standing crop was similar between feed treatments. Forage standing crop varied in response to annual rainfall more than to feed or increasing deer density. The highly variable rainfall likely ameliorated treatment effects. During drought years, such as 2011, forbs were virtually absent; whereas, in the wettest years, spring forb standing crop might not have been limiting to deer even at high densities.

This study will provide a better understanding of the relationships regarding feed and deer density on nutritional and forage-based carrying capacities of a given rangeland. Such information will help those wishing improve their deer management strategies.

Patterns of Antler Growth in Male White-tailed Deer

Dawson W. Lilly, David G. Hewitt, Timothy E. Fulbright, Charles A. DeYoung, Kim N. Echols, and Don A. Draeger

Supplemental feed is often used to increase nutrient availability for white-tailed deer in Texas with a common goal being to improve antler growth. However, supplemental feed may also allow deer density to increase, which in turn, may influence the effect of supplemental feed on antler size. Our objective is to evaluate the effects of supplemental feed and deer density on antler growth.

Antler growth will be examined using measurements taken from white-tailed deer in all 12 enclosures. Antler characteristics and gross Boone and Crockett score will be measured for captured deer or estimated using the BuckScore program from photographs of deer not captured. When possible, antler scores will be obtained throughout successive years from the same buck to evaluate growth patterns over time. Comparisons among scores will be made to determine the effect of supplemental feed and deer density on antler growth.

Preliminary data suggest that antler growth is greater in those enclosures provided with supplemental feed than in enclosures without supplemental feed. Understanding the interaction between supplemental feed and deer density and their effects on antler growth can help landowners modify deer management techniques on their property to improve antler quality and size.

Nutritional Response of Forage to White-tailed Deer Herbivory

Brandi L. Crider, Timothy E. Fulbright, David G. Hewitt, Charles A. DeYoung, Kim N. Echols, and Don A. Draeger

Highly proactive white-tailed deer management and habitat enhancement activities are common in southern Texas. In much of North America, deer herbivory is a key factor shaping the dynamics of plant populations and communities. A prediction based on foraging theory is that herbivores should feed more selectively in response to high-quality foods. The decision by a deer to consume forage is determined by the forage nutritional value relative to other available forages. It has been well documented that forage manipulation, including ungulate herbivory, can alter physical and chemical plant responses. Our objective is to determine if increasing deer density and providing supplemental feed alters the chemical composition of browse, forbs, grasses, and cacti.

Twenty 164-foot transects were randomly placed within each of the 12 enclosures. Plant standing crop was harvested biannually in 20 randomly selected plots per enclosure and dried at 104°F to a constant weight. Forage class samples by enclosure were analyzed to determine dry matter, neutral detergent fiber, acid detergent fiber, and crude protein. Sampling was conducted during March 2005 through March 2012, and August 2004 through August 2012. Chemical analyses were completed during summer 2012.

Understanding feed and density effects on nutritional quality of deer forages is imperative for making informed decisions. Results from this study will aid in making deer management strategies more successful.



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Long-term studies are being used to determine the effects of forage availability, supplemental feed, and deer density.

Patterns of Supplemental Feed Use by White-tailed Deer

Dawson W. Lilly, David G. Hewitt, Timothy E. Fulbright, Charles A. DeYoung, Kim N. Echols, and Don A. Draeger

The provision of supplemental feed for white-tailed deer is common in many wildlife management programs in Texas. Many factors affect the use of supplemental feed. Feed consumption may be influenced by season and weather patterns, and it may vary among individual deer. The objective of this research is to evaluate use of supplemental feed by white-tailed deer and determine factors that influence feed consumption and their relative effects.

Research will be conducted on both ranches using 6 enclosures in which supplemental feed is provided. Supplemental feed use will be measured weekly and expressed on a per capita basis. We will evaluate the effect of number and sex ratio of deer, season, drought, and forage quality on supplemental feed use.

Preliminary results indicate that season influenced the effect of deer density and year on per capita feed consumption. Per capita feed consumption tended to be greater at low deer densities than at medium and high densities during winter, spring, and autumn, but was similar across densities during summer. Knowledge of factors influencing supplemental feed use can help land managers make informed decisions about and enhance their supplemental feeding program to improve deer on their property.

Supplemental Feed and Deer Density Effects on White-tailed Deer Habitat Selection

Kim N. Echols, Timothy E. Fulbright, David G. Hewitt, Charles A. DeYoung, and Don A. Draeger

Throughout much of Texas, deer managers have implemented supplemental feeding programs, which have the potential to increase deer density. Higher deer density may affect natural food availability and affect social hierarchies, thereby influencing deer habitat selection. This study will determine factors that influence deer habitat selection throughout the year.

In December 2009, we equipped 2 male and 2 female deer with Global Positioning Systems (GPS) radio collars in enclosures with high and low densities of deer, both with and without *ad libitum* pelleted feed. Radio collars recorded locations every 30 minutes and activity levels every 15 minutes and remained on the deer until December 2010. We will use computer



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Supplemental feeding is a common practice in South Texas to increase deer herds or increase size of trophy bucks.

software to plot deer locations and determine habitat cover types. Cover types used by our GPS-collared deer will be compared to those cover types available within each enclosure to examine the effects of density and supplemental feed on habitat choice.

As land managers continue their use of supplemental feed to alter deer densities, development of a more effective and comprehensive management strategy may arise only after a clearer understanding of their effects on deer habitat choices. This study should provide that needed information.

Effects of Population Density on Supplemental Feed Use by Deer

Kory R. Gann, David G. Hewitt, Timothy E. Fulbright, Charles A. DeYoung, Kim N. Echols, and Don A. Draeger

The provision of supplemental feed is a popular deer management technique across Texas. High quality forage may be limited at high deer densities, forcing individuals to consume more supplemental feed than deer at low densities. Conversely, dominance hierarchies may be present at high deer densities, which may inhibit access of subdominant individuals to the supplemental feed. The objective of this study is to determine the effects of deer density, gender, and age class on the proportion of supplemental feed in white-tailed deer diets.

The percentage of supplemental feed in deer diets will be measured using non-radioactive forms of isotopes known as stable isotopes. Tissue will be collected from deer in supplemented enclosures. Tissue

will also be collected from deer without access to supplemental feed to determine the isotope ratio of the natural vegetation in diets. Stable isotope ratios found in deer tissues when compared to that of vegetation and supplemental feed will be used to determine their proportion in each deer's diet.

Findings will allow us to determine if deer density, gender, and age class affect supplemental feed consumption. Understanding the relationship between population density and supplemental feed consumption will help deer managers increase the effectiveness of their supplemental feeding program, thereby providing for better management of deer herds.

Response of Two Browse Species to Deer Density and Nutrition Enhancement

Whitney J. Priesmeyer, Eric D. Grahmann, Timothy E. Fulbright, David G. Hewitt, Charles A. DeYoung, David B. Wester, Kim N. Echols, and Don A. Draeger

The provision of supplemental feed may alter the effects of increasing deer densities on vegetation. When native forages are supplemented with a high-quality pelleted ration, deer may respond by moving more while foraging and by feeding more selectively on highly nutritious and rare plants. For this study, we considered granjeno and kidneywood to be both nutritious and relatively rare within our study site.

Pelleted feed was provided *ad libitum* in one of each pair of enclosures containing similar deer densities on each ranch. The height, width, and internode length (segment of a stem between 2 leaves) of non-lignified growth were determined for kidneywood and granjeno plants. Plants were protected from browsing



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Enclosures allow for comparisons of plants inside and outside the cages to assess intensity of deer foraging.

with fenced enclosures (cages) in 2005 and a similar sized corresponding unprotected plant was selected for monitoring for each caged plant. Data were collected from July 2007 to July 2012.

Preliminary analysis indicates that higher deer densities and supplemental feed corresponded to an increase in the number of internodes per twig. Averaged across deer densities and feeding treatments, protected kidneywood plants were taller and wider than uncaged kidneywoods. The number of internodes per non-lignified growth segment also appeared to increase with increasing deer density. In 2009, the ratio of internodes per non-lignified growth segment of uncaged plants was greater at lower deer densities.

Based on our findings, granjeno appears to be highly resistant to browsing by white-tailed deer and capable of utilizing compensatory growth to mask browsing effects (as evidenced by comparisons between caged and uncaged plants). However, kidneywood is negatively affected by browsing even at low deer densities.

Deer Density and Supplemental Feed on Fawn Survival and Bed-Site Selection

Asa S. Wilson, Charles A. DeYoung, Timothy E. Fulbright, David G. Hewitt, Kim N. Echols, and Don A. Draeger

Little is known about the effects of deer density and supplemental feed on white-tailed deer fawn survival and bed-site characteristics in South Texas environments. The objective of this project is to examine fawn survival and bed-site selection as they relate to deer densities and access to supplemental feed.

In April 2011 and 2012, vaginal implant transmitters (VITs) were placed in 50 and 70 does, respectively, in enclosures that varied in deer density and provision of supplemental feed. Implanted does were monitored 3 times daily from June 15 through August 15. Newborn fawns will be measured and fitted with radio collars. Each fawn birth site will be paired with a randomly selected control site and both will be evaluated for plant cover. Radio-collared fawns will be checked daily for survival. When fawns are 7- and 14-days of age, characteristics of their bed-sites will be measured along with a randomly paired site using the same initial birth-site sampling procedures. Bed-site characteristics of fawns at different ages will be compared to determine whether there is a difference in site selection by age of fawn.

This study will help wildlife managers better understand white-tailed deer fawn survival and bed-site characteristics. This will enable them to produce

quality habitat for fawns, which can help conceal fawns from predators and harsh summer temperatures.

Effects of Deer Density and Supplemental Feeding on Density of Palatable Plants

Whitney J. Priesmeyer, Eric D. Grahmann, Timothy E. Fulbright, David G. Hewitt, Charles A. DeYoung, David B. Wester, Kim N. Echols, and Don A. Draeger

Availability of nutritious feeds may alter selection of natural forages by white-tailed deer; however, it is unclear how supplemental feeding and increasing deer densities affect highly palatable plant species. Kidneywood, granjeno, guayacan, orange zexmenia, and bush sunflower are important in white-tailed deer diets, and they are considered preferred forage.

Plant density was estimated on both ranches by height class (small: less than 1.6 ft, medium: 1.6–5 ft, and large: over 5 ft) along belt transects in each enclosure annually beginning in 2004. Density of bush sunflower and orange zexmenia initially increased in the enclosures with low deer density and deer access to supplemental feed; however, density of bush sunflower and orange zexmenia remained constant between 2009 and 2012 following an extended period of drought. In average-to-wet years, medium sized guayacan plants increased in enclosures that did not have supplemental feed, but not in enclosures with supplemental feed.

Density of other plant species appears to be unaffected by deer density and supplemental feeding. Supplemental feeding may alter deer patterns of dispersion throughout the landscape. However, preliminary results indicate that rainfall may affect plant density more than treatments.



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Bush sunflower is one of the species being studied because it is a highly preferred forage of white-tailed deer.

Performance of Vaginal Transmitters used to Locate Newborn Fawns

Nicholas Kolbe, Asa S. Wilson, Charles A. DeYoung, Timothy E. Fulbright, David G. Hewitt, Kim N. Echols, and Don A. Draeger

Researchers rely on vaginal implant transmitters (VITs) to locate newborn fawns when studying fawn birth dates, habitat selection, morphology, and survival. The technology is relatively new and a better understanding of its performance is necessary. The goal of this study is to determine if VITs can be used to locate newborn fawns.

This project is being conducted in research enclosures on the Comanche and Faith ranches. Thirty-five adult female white-tailed deer were captured on each ranch during April 2012, verified to be pregnant using ultrasound, and fitted with a VIT. The VITs transmit a slow pulse rate when in the reproductive tract and a quicker pulse rate about 3 hours after being expelled during the birth process.

Finding a fawn represents success when using VITs. Failure may occur because of transmitter malfunction, premature expulsion, or inability of personnel to find fawns. The proportion of VIT failures to each of these 3 causes will be calculated. In addition, when a fawn is located, we will measure the distance between the VIT location and the fawn.

Knowing failure rates will ensure that researchers have reasonable expectations when using VITs and will allow for realistic sample size calculations. The distance at which fawns are found will help researchers plan their searches when using expelled VITs to locate fawns.

Influence of White-tailed Deer Density and Supplementation on Plant Cover

Whitney J. Priesmeyer, Eric D. Grahmann, Timothy E. Fulbright, David G. Hewitt, Charles A. DeYoung, David B. Wester, Kim N. Echols, and Don A. Draeger

Supplemental feeding is a practice that is widely used in Texas to meet a variety of management objectives for white-tailed deer. However, there is some concern that access to supplemental feed may alter the selection of natural forages by deer and lead to disproportionate consumption of palatable forage species. Such alterations in the diet of deer can cause impacts that have long-lasting negative effects on plant communities.

Canopy cover of forage was assessed annually on the study area during summer 2004 through 2012 using 2.75 ft² (0.25 m²) plots along 20 randomly placed transects in each enclosure. We grouped forages into classes of subshrubs, grasses, and forbs. Forage categories were then divided into functional groups consisting of unpalatable forbs, daisies, and palatable subshrubs including orange zexmenia and awnless bush sunflower.

We found that cover of unpalatable species appears to be greater at lower deer densities. This trend reversed in 2007 and unpalatable forbs appeared to increase at high deer densities regardless of feed treatment. Cover of palatable subshrubs appeared to decrease slightly at high deer densities relative to low deer densities, but increased with the addition of supplemental feed. Findings from this study will be used to determine if supplementation and differing deer densities lead to changes in the pattern of use of important forage plant species.

White-tailed Deer Fawn Bed-Sites in Relation to Water Resources

Shannon M. Hall, Asa S. Wilson, Charles A. DeYoung, Timothy E. Fulbright, David G. Hewitt, Kim N. Echols, and Don A. Draeger

Water is a key resource for white-tailed deer, but it may be scarce during summer when does are raising fawns. There are greater water requirements during lactation, consequently, the location of drinking water may influence where does have their fawns. Alternatively, does often seek to have their fawns in isolation until fawns are greater than 3 to 4 weeks of age and, therefore, may keep their fawns far from water. The objective of this research is to determine if there is a relationship between fawn bed-sites and location of drinking water.

Newborn fawns in enclosures on the Comanche and Faith ranches will be fitted with an expandable radio collar and located in a daytime bed-site when 1, 7, and 14 days old. The distance between the fawn's bed-site and the water trough in each enclosure will be calculated. These distances will be compared to distances between the water source and random points in each enclosure to determine if fawns are closer to or further from the water source than expected at random. The distance between fawn bed-sites and the water source will also be compared between fawn ages to determine if fawns bed closer to or further from the water source as they grow older.



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By knowing how fawns choose bed-sites, management strategies can better focus on this important age class.

Results of this research will increase our understanding of factors affecting fawn habitat selection. This information will be useful in providing insight that can help those wanting to better manage water resources for deer on their property.

Effects of Deer Density and Supplemental Feeding on Density of Browse Species

Whitney J. Priesmeyer, Eric D. Grahmann, Timothy E. Fulbright, David G. Hewitt, Charles A. DeYoung, David B. Wester, Kim N. Echols, and Don A. Draeger

Supplemental feeding has been used to assist white-tailed deer populations by improving the nutritional quality of deer diets and reducing impacts on vegetation communities. However, access to supplemental feed may result in disproportionate consumption of palatable versus unpalatable browse species. Because they forage selectively, deer strongly affect competitive relationships among plant species. These shifts, in turn, may either increase or decrease overall cover and diversity of browse species.

Canopy cover of browse species was estimated on both ranches each summer during 2004–2012 using the line-intercept survey technique on 20 transects within each enclosure. Canopy cover was compared from the beginning of the study in enclosures with and without supplemental feed and across the 3 deer densities to determine if providing supplemental feed results in reduced canopy cover of shrubs.

Based on our preliminary results, supplemental feeding and deer density have not affected canopy

cover of shrubs. Additionally, rainfall may affect canopy cover of browse species to a greater extent than treatments.

Spatial Distribution of White-tailed Deer at High and Low Densities

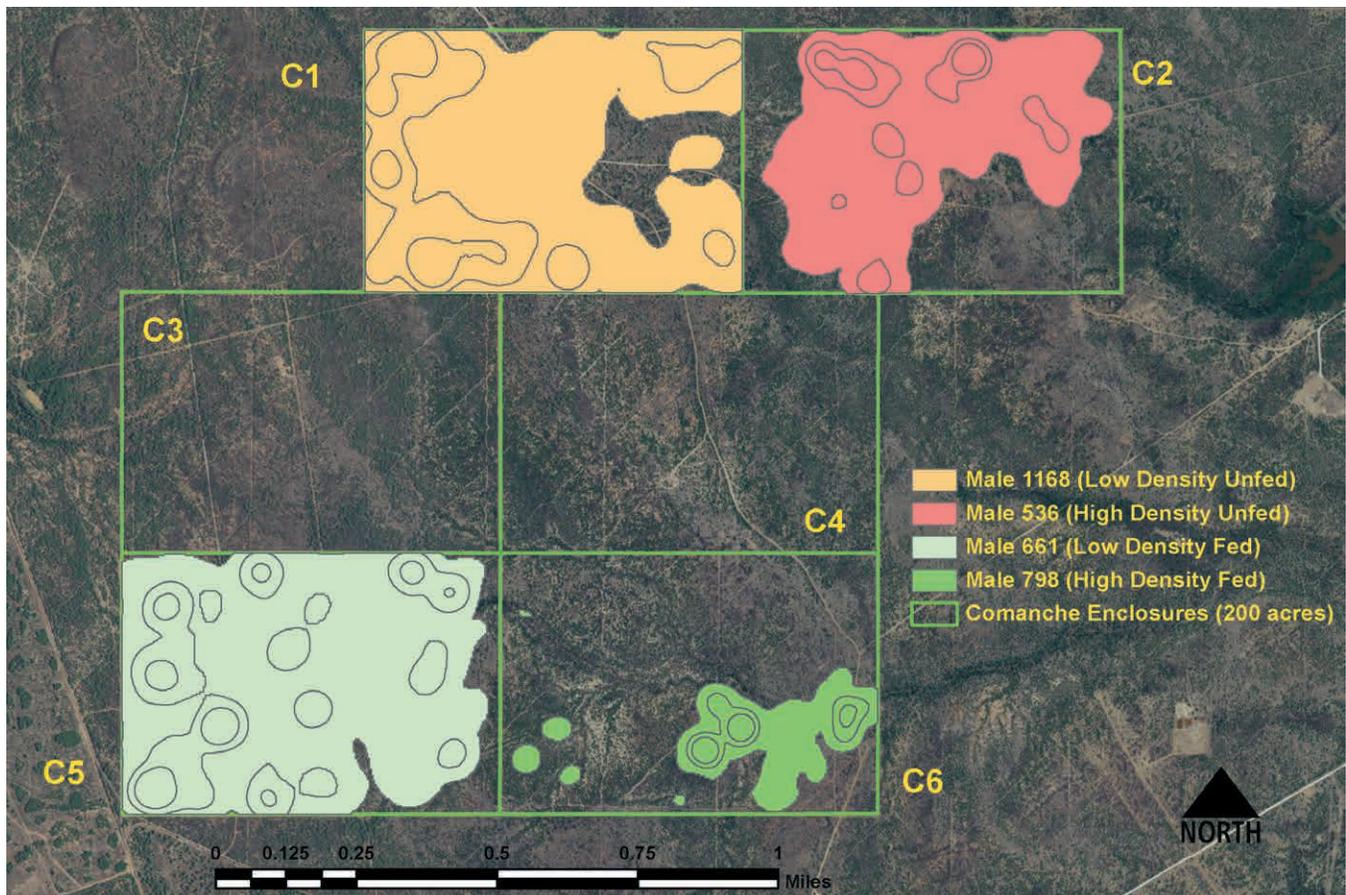
Kim N. Echols, David G. Hewitt, Timothy E. Fulbright, Charles A. DeYoung, and Don A. Draeger

The use of supplemental feed in South Texas is a common practice that may result in the elevation of white-tailed deer densities. Elevated deer densities affect social relationships and can influence natural spacing of individuals within the habitat. Social constraints of higher white-tailed deer densities may limit usage of available areas by reducing sizes of core areas as well as the size of the overall area frequented. The purpose of this study is to examine how density impacts the spacing of individuals within the habitat that is available to them.

Two high density deer (40 deer per 200 acres) and 2 low density deer (10 deer per 200 acres) enclosures on each ranch were used in this study. We equipped 4 white-tailed deer (2 males, 2 females) per enclosure with Global Positioning Systems (GPS) radio collars from December 2009 through December 2010. One enclosure for each deer density per ranch has pelleted supplemental feed provided *ad libitum*. The GPS collars collected coordinate locations of each deer at 30-minute intervals.

Location data will be analyzed using ArcView software; estimates of spatial use will be generated on a seasonal basis using the Animal Movements extension for ArcMap software. These estimates will be compared across deer densities.

The use of supplemental feed influences many aspects of white-tailed deer biology, from nutritional to social factors. Understanding deer social responses to increasing density can help the deer manager make decisions about how best to implement supplemental feeding programs.



Distribution estimates for 4 male white-tailed deer generated from GPS locations obtained during the period of 1 July 2010 to 30 September 2010 on the Comanche Ranch in Dimmit County, Texas.

End of In-Progress Comanche-Faith Project Abstracts

Water Intake of White-tailed Deer Does during Lactation

Matthew Nuernberg, Kory R. Gann, and David G. Hewitt

Water may be a limiting factor for white-tailed deer during summer in southern Texas and especially for females nursing fawns. However, the extent to which lactation increases water consumption is not known, making it difficult to assess the extent to which water is limiting. Our objective is to measure water consumption weekly during late gestation and throughout lactation in 6 white-tailed deer raising fawns.

The study will be conducted at the Alkek Ungulate Research Facility at Texas A&M University-Kingsville during summer and early autumn. Daily water consumption will be related to the age and number of fawns, temperature, and food intake by the does. Our findings will help deer managers understand the importance of drinking water during fawn-rearing.

Cooperative funding provided by the ExxonMobil Summer Intern Program.

Effects of Release Area Deer Density on Antler Size of Offspring from DMP Pens

Stuart W. Stedman, Matthew T. Moore, and Charles A. DeYoung

Deer Management Permits (DMPs) issued by Texas Parks and Wildlife to qualified ranches are used to control breeding in white-tailed deer. Many ranches utilize the DMP program to try to maximize antler growth in their whitetail herd. We are evaluating how antler size of DMP offspring is affected when the offspring are released into 2 different deer density populations.

The study is being conducted on the Faith Ranch in Dimmit County, Texas. Adjacent study areas under the same intensive supplemental feeding program and surrounded by high fence were chosen in 2010. Most resident deer were removed from each area via helicopter capture; the study areas will be restocked with releases from DMP pens. One area will have a target density of 1 deer per 5 acres and the other 1 deer per 15 acres. DMP pens contain native Faith Ranch whitetails. In 2011, the first fawns were marked in DMP pens with ear tags specific to year-of-birth and released into the 2 study areas.

Tagged bucks of DMP origin will be captured via helicopter and net gun in the fall of 2012 and



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We are monitoring how controlled breeding of deer influences growth and antler development.

subsequent years to collect antler data for comparisons within age classes between treatments. This project will continue for several years.

Cooperative funding provided by the Faith Ranch.

Foraging Ecology of Unmanaged Deer Populations in Southern Texas

Kory R. Gann, David G. Hewitt, Timothy E. Fulbright, J. Alfonso Ortega-Santos, and Alfonso Ortega-Sanchez, Jr.

White-tailed deer have become an important resource to owners of private lands in southern Texas. This has resulted in an increased number of properties under management programs for deer, making populations not under some form of harvest or supplemental feed management uncommon. Unmanaged white-tailed deer populations are useful in providing baseline data on diet, body weight, body condition, and population parameters that will allow us to determine the effects of various deer management practices.

We will study the foraging ecology of unmanaged deer populations by using non-radioactive forms of isotopes known as stable isotopes. The stable isotopes of carbon in deer tissues and vegetation will be used to determine the proportion of C3 (shrubs and forbs) versus C4 plants (warm season grasses) and cacti consumed by individual deer.

Tissue samples will be collected from deer in 4 unmanaged white-tailed deer herds across southern Texas during autumn of each year. Samples of warm



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Plants collected for analysis of stable isotope ratios aid in determining which forages are consumed by deer.

season grasses, pads and fruits of prickly pear cactus, and up to 10 important deer forages (forbs, browse, and mast) will also be collected at each property during autumn of each year. We will then use the stable isotope ratios of deer tissue and vegetation to determine the proportion of C3 versus C4 plants and cacti in an individual deer’s diet as it relates to deer age and sex, precipitation, and vegetation community. Understanding the foraging ecology of unmanaged white-tailed deer populations will enable us to better comprehend the interactions between deer and their environment on rangelands in southern Texas.

Cooperative funding provided by the East Wildlife Foundation.

Census, Movements, and Modeling of Deer in Fair Oaks Ranch, Texas

Kara B. Campbell, Charles A. DeYoung, Randy W. DeYoung, David G. Hewitt, Richard Heilbrun, and Ryan Schoeneberg

Fair Oaks Ranch, Texas is located 27 miles north of San Antonio and has an overabundant deer population. We are conducting a 2-year study to determine deer population estimates and deer movements throughout the city and adjacent landholdings. The study will also model different management practices with particular interest in focusing on contraceptives as a way to maintain a desired population size of deer.

White-tailed deer were captured from January to April 2012 using drop-nets placed throughout the city. Captured deer were sexed, aged, and given unique

ear-tag combinations for future identification. Deer were aged using tooth wear and replacement methods and then placed into 1 of 4 categories: fawn, yearling (1.5 years old), middle (greater than 1.5 but less than 6.5 years), or old (greater than 6.5 years). Twenty females were collared with very high frequency (VHF) transmitters and 18 males were tagged with a VHF ear transmitter. We captured 332 deer by the end of trapping during 2012. Of the deer tagged, 208 were females and 124 were males. During trapping, 26 deer were recaptured.

Deer with transmitters are being located weekly using a receiver and portable antenna. City residents submit sightings of tagged deer on a Citizen Science website. Mark re-sight surveys are conducted monthly to produce a scientifically sound population estimate. This study is still at the preliminary stages and data will continue to be collected for 2 years.

Cooperative funding provided by City of Fair Oaks Ranch.

How are Deer Influenced by the Impacts of Cattle Grazing?

Stacy L. Hines, Timothy E. Fulbright, J. Alfonso Ortega-Santos, David G. Hewitt, Thomas W. Boutton, and Alfonso Ortega-Sanchez, Jr.

The debate regarding cattle grazing impacts on deer is decades old. Many studies have been completed on cattle and white-tailed deer interactions, but ambiguity in the literature exists, therefore, the debate persists. There have been few studies on the effects of cattle grazing on preferred forbs for white-tailed deer and dietary niche overlap. The objective of this project is to (1) complete a literature review of cattle and deer interactions in North America, (2) determine impacts of cattle grazing on preferred deer forbs, and (3) estimate seasonal dietary niche overlap between cattle and deer.

An extensive literature review will be completed on cattle grazing impacts on deer behavior and dietary overlap of cattle and deer in North America. To determine cattle grazing effects on preferred deer forbs, 50 5-ft² vegetation enclosures were randomly allocated for installation at each of 6 6,000-acre study sites. Every autumn and spring, plant species inside each enclosure will be compared to a paired outside plot. In addition, autumn vegetation biomass will be determined in the following categories (1) grasses, (2) preferred forbs, and (3) non-preferred forbs. Deer fecal

samples on the study sites will be collected during spring, autumn, and winter for stable isotope analysis to determine dietary overlap.

This project will synthesize pertinent literature and reveal possible trends, determine if grazing by cattle promotes or hinders growth of preferred deer forbs, and surmise competition between species based upon dietary niche overlap. This information will provide valuable insight regarding the effects of cattle on deer.

Cooperative funding provided by the East Wildlife Foundation.

Evaluation of DMP Pens for Increasing Antler Size on Texas Ranches

Stuart W. Stedman, Matthew T. Moore, and Charles A. DeYoung

Deer Management Permits (DMPs) are issued to qualified ranches by Texas Parks and Wildlife. DMPs allow a buck and up to 20 does to be temporarily enclosed for breeding. We are evaluating how antler size of a population is affected by this permit.

The study is being conducted in Dimmit County, Texas on the Faith Ranch. Adjacent 1,100-acre treatment and control pastures surrounded by high fence were established in 2007. Both pastures are under an intensive supplemental feeding program. Most resident deer were removed from the treatment pasture, and it is being replenished with DMP sired offspring. The control pasture has resident deer that were enclosed when the high fence was constructed. DMP pens are stocked with native Faith Ranch deer. Fawns are marked in DMP pens and the control area each year with ear tags specific to year-of-birth. Each fall, marked bucks that are DMP offspring and marked bucks in the control area are captured via helicopter and measurements taken. Antler size is compared within age classes.

In 2008, 2009, 2010, and 2011, antlers of treatment yearlings (1.5 years) averaged +9, -2, 0, and -12 Boone and Crockett (B&C) inches different from control yearlings. In 2009, 2010, and 2011, treatment 2.5-year-olds averaged +6, +5, and +7 B&C inches different from the control deer. In 2010 and 2011, 3.5-year-olds averaged +7 and +12 B&C inches different from the control deer. In 2011, 4.5-year-olds averaged +7 B&C inches different from the control deer. This study will continue for several years.

Cooperative funding provided by the Faith Ranch.

Phylogeographic Structure of White-tailed Deer Subspecies in Mexico

Karla G. Logan-López, Randy W. DeYoung, J. Alfonso Ortega-Santos, David G. Hewitt, Damon L. Williford, and James R. Heffelfinger

White-tailed deer are distributed throughout much of the Americas, ranging from southern Canada to Peru. Thirty-eight subspecies are recognized; 14 are present in Mexico. Subspecies have been based upon minor morphology and geographic distribution. Although remarkable differences in body and antler size and timing of rut are evident among some subspecies, their genetic distinctiveness remains unclear.

There is no current way to distinguish among subspecies or even to determine the validity of the subspecies designations. This lack of information has led to a big-game management system that mainly encourages the conservation of large-antlered deer.

To learn more about the various subspecies, we analyzed DNA from 248 hunter-harvested or captured whitetails. We collected samples in 73 locations within the range of 9 subspecies. We obtained 480 base pairs of sequence data from the mitochondrial DNA control region.

Phylogenetic analyses did not reflect clear separations among subspecies genealogy. Analysis indicated greater genetic variation within subspecies than among subspecies. We observed a deep phylogenetic discontinuity between the white-tailed deer from southeastern Mexico and those from the rest of the country.

The geographic distribution of major clades and subdivision within clades suggests a complex evolutionary history of lineages in the sampled populations.



© Steve Bentsen

Trophy hunting has altered how ranchers view white-tailed deer subspecies that don't have large antlers.

Our findings indicate possible fragmentation during the Last Glacial Maximum and subsequent secondary contact. Currently designated subspecies might not represent historically independent groups. Ongoing analyses will attempt to untangle the complex biogeographic history of whitetail lineages in Mexico.

Cooperative funding provided by Consejo Nacional de Ciencia y Tecnologia, Fundacion Produce Tamaulipas, A.C., and the Boone and Crockett Club.

White-tailed Deer Management in the Cattle Fever Tick Quarantine Area

Hank C. Birdsall, David G. Hewitt, Greta L. Schuster, Timothy E. Fulbright, and Daniel Baca

The cattle fever tick (CFT) is the only known vector for the protozoan that causes cattle fever, an important livestock disease. The USDA has a program to eradicate the CFT from the United States. The program has been remarkably successful except along the Rio Grande River in southern Texas where the tick is maintained by animals crossing from Mexico. Furthermore, white-tailed deer are a viable host for CFTs and high deer densities in many areas along the river are complicating tick eradication efforts. The objective of our project will be to better understand deer management in the area so we can help landowners meet their deer management goals, in part, by managing deer density.

We will conduct deer management workshops in Zapata County, Texas to improve landowner knowledge of deer management and ecology. We will also conduct programs for 4H and Future Farmers of



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There is concern that deer and other wildlife can maintain the cattle fever tick, which could impact the cattle industry.

America (FFA) to reach the next generation of landowners about effective deer management. To track our initiative's effectiveness, we will survey workshop participants before workshops and after each hunting season. We will also track the number of does harvested in the county.

In February, we conducted a helicopter deer survey adjacent to Falcon Lake, which is a reservoir on the Rio Grande River southeast of Laredo, Texas. The survey revealed a sex ratio of 1 buck per 6 does, suggesting heavy harvest of bucks. Our project will improve the effectiveness of the CFT eradication program in southern Texas and aid in deer management.

Cooperative funding provided by the USDA Animal and Plant Health Inspection Service Veterinary Services.

Can Culling Bucks Lead to Genetic Change in Deer Populations on Large Acreages?

Don A. Draeger, T. Dan Friedkin, Charles A. DeYoung, Mitch A. Lockwood, Donnie Frels, and Jimmy Rutledge

Managers commonly believe that culling bucks leads to genetic improvement in antler size of white-tailed deer populations. Whereas genetic improvement is common with selective breeding in confined deer, data are limited for ranch-sized deer populations. We are conducting a 10-year buck culling study on large acreages in South Texas to help clarify results of various buck-culling practices.

Bucks are captured on 3 areas of the Comanche Ranch in Maverick County, Texas by helicopter and net gun, aged, and antlers measured for Boone and Crockett (B&C) score. Bucks meeting culling criteria are sacrificed, and the meat donated to worthy users. Bucks not meeting culling criteria are released after a microchip is implanted. On one area, we cull yearlings with less than 6 points, 2-year-olds with less than 8 points, 3- and 4-year-olds with less than 9 points, and 5-year-olds and older with a gross B&C score of less than 145. On another area, all yearlings and 2-year-olds are released, and older deer culled by the same criteria as above. A third area serves as a control and all bucks captured are measured and released.

After 6 years, 3,260 individual bucks have been caught, of which 1,180 have been culled and 2,080 released. Thus far, there have been 1,048 bucks recaptured. The study will continue for 4 more years.

Cooperative funding provided by the Friedkin Conservation Fund.

Landowner Attitudes toward Conservation of White-tailed Deer Subspecies in Mexico

Karla G. Logan-López, Randy W. DeYoung, J. Alfonso Ortega-Santos, and David G. Hewitt

Fourteen subspecies of white-tailed deer occur in Mexico. The subspecies display obvious divergences in body and antler size. For instance, dressed body weight of the diminutive Coues (*Odocoileus virginianus couesi*) males rarely exceeds 90 pounds, whereas Texas whitetail (*O. v. texanus*) males regularly exceed 130 pounds. The prospect of economic opportunities associated with hunting large-antlered deer has led to the translocation of Texas whitetails into the historical range of smaller-bodied subspecies.

We surveyed 149 landowners from Mexico to determine attitudes toward subspecies of white-tailed deer. Results revealed clear economic advantages for hunting revenue in ranches within the range of Texas deer over ranches with other subspecies.

More than 90% of landowners with ranches outside of the Texas deer distribution thought big game production was limited by lack of additional trophy categories, while 80% within the Texas deer range disagreed. Eighty percent agreed the establishment of additional trophy categories for small-bodied subspecies is desirable. Forty percent believed that additional categories would reduce translocations across subspecies boundaries. Despite the fact that most landowners disagreed with introductions of exotic subspecies, translocations were widespread. The main reasons to justify these translocations were to increase the antler size of the native deer and to provide more trophies to meet hunting demand.

Results from this study suggest that the integrity of small-bodied white-tailed deer subspecies may be preserved by the implementation of additional trophy categories to recognize the unique nature of native subspecies. Ongoing analyses will aid in the conservation of the diverse lineages of whitetails in Mexico.

Cooperative funding provided by Consejo Nacional de Ciencia y Tecnología and Fundación Produce Tamaulipas, A.C.

BOBWHITES AND OTHER QUAIL

The Santa Gertrudis Quail Research Project

Richard H. Sinclair, II, Fidel Hernández, Leonard A. Brennan, Fred C. Bryant, Matthew J. Schnupp, and Verl Cash

The Santa Gertrudis Quail Research Project was initiated in March 2011 to continue long-term data collection on northern bobwhites in South Texas. The primary goal of the project is to document bobwhite response (i.e., survival, nest success, productivity, spatial distribution, and density) to certain brush management practices. The project also will provide year-round information about the general status of bobwhites in South Texas.

The study is being conducted on 3 pastures (Paisano, Canelo, and Laguna Larga) of the Santa Gertrudis Division of the King Ranch. Each pasture contains a 1,000-acre block on which a brush management treatment will be applied. Three treatments (grubbing, prescribed fire, and control) will each be applied to a corresponding pasture during the summer of 2012. Radio-marked bobwhites (20 bobwhites per pasture) will be monitored 3 years post-treatment. Survival and nest success will be estimated using radio telemetry data. Productivity will be calculated using age ratios from fall trapping; density will be determined using helicopter surveys (distance sampling) during November. This study will provide important data for the management of bobwhite habitat in South Texas.

Cooperative funding provided by the South Texas Chapter of the Quail Coalition and King Ranch, Inc.

Evaluation of the Quailerator for Bobwhite Habitat Management in South Texas

Kristan E. Jenschke, Leonard A. Brennan, Fidel Hernández, and Timothy E. Fulbright

During breeding, extensive brooding and foraging areas are crucial for northern bobwhite production. Having adequate overhead screening cover along with available bare ground for easier mobility is an essential component of foraging areas. Prescribed fire, cattle grazing, disking, and aeration are common management disturbances used to create or maintain northern bobwhite brooding and foraging areas.

The recent development of a new type of aerator (the "quailerator") that creates soil disturbance with-

out crushing bunchgrasses provides an opportunity to test how this technique works in comparison with other management disturbance methods. Our objective is to evaluate the effectiveness of the quailerator in comparison with prescribed fire and disking as management disturbance tools for maintaining bobwhite brooding and foraging areas.

We found that the vegetation structure following quailerator disturbance contained a mix of bunchgrasses and forbs, whereas the vegetation structure following prescribed fire contained mainly grasses. In contrast, the vegetation structure following disking contained mainly forbs.

We are analyzing how the 3 disturbance techniques (fire, disking, and the quailerator) influence the abundance and diversity of arthropods needed by bobwhite chicks and hens for food. Results will provide insight regarding better quail management practices.

Cooperative funding provided by Laborcitas Creek Ranch, Lawrence Family Foundation, Richard M. Kleberg, Jr. Center for Quail Research, and South Texas Chapter of the Quail Coalition.

Influence of Rainfall on Northern Bobwhite Reproduction

Ian C. Trewella, Fidel Hernández, Bart M. Ballard, David B. Wester, and David G. Hewitt

The abundance of northern bobwhites is highly correlated with the amount and timing of rainfall in semi-arid regions. This strong influence of rainfall results in dramatic population fluctuations called a "boom-and-bust" phenomenon. In unpredictable environments such as the Rio Grande Plains, bobwhites may rely more on local stimuli such as rainfall to time breeding instead of relying solely on photoperiod. Our research hypothesis is that bobwhites may use rainfall as a reproductive stimulus. The objective of this research is to quantify the reproductive responses (i.e., percentage of hens laying, laying date, nesting rate, nesting season length, and clutch size) of northern bobwhites to variation in rainfall and temperature.

We will use data from a long-term radio telemetry study on northern bobwhites from the South Texas Quail Research Project, which was conducted on the Encino Division of the King Ranch during 2000–2008. Approximately 60 radio-marked bobwhites were monitored year-round, thereby providing basic demo-

graphic data. Rainfall varied greatly during the study period. We will be using this information to investigate how the nesting parameters mentioned above are affected by the amount and timing of rainfall. This study will provide information on how changes in rainfall patterns influence reproduction in this economically important species.

Cooperative funding provided by the TAMUK University Research Award and South Texas Chapter of the Quail Coalition.

Phylogeography of the Bobwhite Quails in North and South America

Damon L. Williford, Randy W. DeYoung, Leonard A. Brennan, Fidel Hernández, and Rodney L. Honeycutt

Bobwhites are widely distributed New World quails that consist of 3 allopatric species: northern bobwhite (United States and Mexico), Yucatán bobwhite (Yucatán Peninsula and Nicaragua), and the crested bobwhite (Central and South America). Approximately 56 subspecies are currently recognized among the bobwhites on the basis of geographic distribution and male plumage coloration; however, relationships within and among species have not yet been studied in detail.

The DNA from toepads of museum specimens of 241 northern, 16 Yucatán, and 48 crested bobwhites was extracted. Intraspecific geographic patterns of genetic variation were examined using the maternally-inherited mitochondrial DNA control region. Species-level relationships were examined using the control region and a protein-coding mitochondrial gene (ND2) that was sequenced for a small subset of each species.

Phylogenetic analysis showed that northern and Yucatán bobwhites were more closely related to each other than either was to the crested bobwhite. Northern and Yucatán bobwhites exhibited shallow genetic structure and poorly differentiated subspecies. In contrast, genetically distinct groups of haplotypes occurred in the crested bobwhite in (1) Central America, (2) Venezuela and Brazil, and (3) Colombia and Panama. The crested bobwhite also exhibited greater differentiation among its subspecies.

The shallow phylogeography of the northern and Yucatán bobwhites was probably caused by recent expansions into suitable habitats and the lack of long-term isolation of populations. In contrast, the highly structured crested bobwhite was probably due to the

climate-induced fragmentation of savannas by the expansion of rainforests and long-term geographic barriers such as the Andes.

Cooperative funding provided by the Quail Associates Program, Richard M. Kleberg, Jr. Center for Quail Research, and South Texas Chapter of the Quail Coalition.

Influence of Abiotic and Biotic Factors on Northern Bobwhite Abundance

Chad J. Parent, Fidel Hernández, Leonard A. Brennan, Fred C. Bryant, David B. Wester, and Matthew J. Schnupp

The timing and amount of precipitation appears to be the most influential factor driving northern bobwhite populations in South Texas. Precipitation between April and August is highly correlated with fall relative abundance of bobwhites. Other factors influencing bobwhite populations include land management practices such as habitat management, cattle stocking rate, harvest, and supplemental feeding of quail. Precisely how these practices interact synergistically with precipitation at the pasture and landscape levels to influence bobwhite populations is the impetus for this work. Our objective is to quantify relationships between these variables and refine how management and harvest are applied at pasture and landscape scales.

We are analyzing a 12-year dataset (2000–2011) of bobwhite relative abundance and abiotic and biotic variables from the King Ranch (825,000 acres). Abiotic variables include precipitation, precipitation-based index (Palmer Drought Severity Index), and



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By using a holistic approach, we will gain a better understanding of what influences bobwhite productivity.

maximum temperature. Biotic variables include cattle grazing, habitat management, quail harvest, and supplemental feeding. Precipitation on the King Ranch is monitored intensely and this permits analysis at the pasture level through interpolation techniques in a Geographic Information System (GIS). We will use GIS and various statistical software packages to identify relationships between land management and precipitation and build a model to simulate bobwhite population dynamics. Our study will provide new information about how habitat management and weather influence bobwhite population dynamics in South Texas.

Cooperative funding provided by the South Texas Chapter of the Quail Coalition and King Ranch, Inc.

Phylogeography of the Scaled Quail in the American Southwest

Damon L. Williford, Randy W. DeYoung, Leonard A. Brennan, Fidel Hernández, and Rodney L. Honeycutt

The scaled quail inhabits grasslands and scrublands of the Chihuahuan Desert and adjacent regions in the United States and central Mexico. Four subspecies have been described based on slight variations in coloration and body size; however, no genetic analysis has been conducted to determine how distinct these subspecies are from one another. Knowledge of the genetic distinctiveness of its subspecies will aid in establishing conservation and management priorities for the scaled quail. The objectives of this study are to (1) examine the overall genetic diversity and population structure of the scaled quail and (2) determine the genetic distinctiveness of its 4 subspecies.

The DNA from muscle tissue of hunter-harvested birds, feathers of trapped birds, and toepads of historical museum specimens was extracted. A segment of the maternally-inherited mitochondrial DNA control region was sequenced from 189 contemporary and 38 historical specimens.

The scaled quail exhibited low genetic diversity, little geographic structuring among its 16 haplotypes, and poorly differentiated subspecies. The lack of genetic structuring suggests that the subspecies do not represent historically independent lineages. Overall low genetic diversity indicates that the scaled quail passed through a severe population bottleneck during the Pleistocene epoch when the climate of the American Southwest was cooler and wetter than



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The scaled quail is a sought after game bird found in more arid regions of Texas.

today. The greatest genetic diversity occurred in South Texas, which may indicate that this area served as a refugium from which the scaled quail expanded as the American Southwest became more arid at the end of the Pleistocene epoch.

Cooperative funding provided by the Quail Associates Program, Richard M. Kleberg, Jr. Center for Quail Research, and South Texas Chapter of the Quail Coalition.

Simulating Northern Bobwhite Response to Management and Weather

Chad J. Parent, Fidel Hernández, Leonard A. Brennan, Fred C. Bryant, David B. Wester, and Matthew J. Schnupp

Much is known about the population ecology of the northern bobwhite. In southern Texas, bobwhite population dynamics are influenced by ecologically complex relationships involving the timing and amount of precipitation and anthropogenic activity (e.g., harvest, habitat management, and supplemental feeding). Of all the anthropogenic activities, habitat management has the greatest capacity to influence bobwhite populations because it alters the structure of vegetation across the landscape.

There is empirical evidence that indicates habitat management positively influences bobwhite populations, but there is a lack of studies that attempt to quantify the relationships between precipitation and the many mechanisms that wildlife managers possess to manage habitat. Additionally, the delayed effect of

various habitat management techniques on bobwhite populations is unknown.

Systems modeling offers a way to evaluate complex relationships while incorporating stochasticity (randomness) into the models. It has been used extensively at the Caesar Kleberg Wildlife Research Institute to model northern bobwhite population dynamics, and we view our work as an extension of prior knowledge. Our objectives are to simulate bobwhite population dynamics as a function of weather and habitat management.

We will pose hypothetical management scenarios that wildlife managers frequently face, simulate the results, and identify which management practices are most applicable for a given scenario. An ecosystem-centric understanding of the bobwhite's population dynamics in response to management will improve how we manage quail on landscapes in South Texas.

Cooperative funding provided by the South Texas Chapter of the Quail Coalition and King Ranch, Inc.

Phylogeography of the Gambel's Quail in the Southwestern United States

Damon L. Williford, Randy W. DeYoung, Leonard A. Brennan, Fidel Hernández, and Rodney L. Honeycutt

The Gambel's quail is found throughout the Sonoran Desert and adjacent areas in the United States and Mexico. It is divided into 7 subspecies based on slight differences in plumage variation, body size, and geography; however, little is known about the genetic distinctiveness of the subspecies. The objectives of



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The genetic composition of the Gambel's quail is being studied to learn how closely it is related to other quails.

this study are to (1) examine the overall population structure and genetic diversity of the Gambel's quail, (2) determine the genetic distinctiveness of its subspecies, and (3) explore its relationship to the California, scaled, and elegant quails.

The DNA from feathers and muscle tissues of hunter-harvested quail was extracted. In addition, toe-pads of museum study skins were used. Portions of the control region and the protein-coding ND2 genes of the maternally inherited mitochondrial genome were sequenced and linked together for 169 Gambel's and 51 California quail.

Preliminary analysis revealed 48 haplotypes within the Gambel's-California quail complex, which clustered into 3 distinct groups. One group consisted of haplotypes only found in the California quail, while the Gambel's quail was composed of 2 genetically distinct groups. Two aberrant Gambel's quail haplotypes were also observed, neither of which was closely related to the 2 haplogroups in this species.

Large genetic gaps between the 3 haplogroups and 2 aberrant haplotypes indicate previous periods of isolation. Future analysis will examine the genetic distinctiveness of the subspecies and explore the relationships among Gambel's quail and its close relatives and their biogeographic histories.

Cooperative funding provided by the Quail Associates Program, Richard M. Kleberg, Jr. Center for Quail Research, and South Texas Chapter of the Quail Coalition.

Northern Bobwhite Population Structure and Diversity in Texas and the Great Plains

Katherine S. Miller, Leonard A. Brennan, Randy W. DeYoung, Fidel Hernández, and X. Ben Wu

The northern bobwhite has been experiencing severe population declines throughout its range. Fragmented habitats may impact northern bobwhite genetic structure. Our goal is to assess whether landscape affects the population structure and diversity for northern bobwhites in Texas and the Great Plains.

We extracted DNA from hunter-harvested northern bobwhites for 19 sites in South Texas from 2004–2010, and analyzed 7 microsatellites. To compare the genetic structure of bobwhite populations to landscape characteristics, we used geographic distances, barriers (large water bodies and highways), and the Biologist Ranking Information from the National Bobwhite Conservation Initiative. These landscape character-



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Hunters can contribute to our understanding of quail by participating in CKWRI's Quail Associates Program.

istics were compared to the genetic structure of bobwhite populations in South Texas.

Low levels of genetic population differentiation were observed; most variation was within individuals. However, landscape barriers also appeared to be an important factor that influenced the observed genetic patterns. This research will be expanded throughout Texas and into the Great Plains to determine the effect that the landscape has on northern bobwhite populations, and how we manage for the species.

Cooperative funding provided by the Quail Associates Program, Richard M. Kleberg, Jr. Center for Quail Research, and South Texas Chapter of the Quail Coalition.

Landscape Correlates of Spatial Distribution of Bobwhite Abundance

Chad J. Parent, Fidel Hernández, Leonard A. Brennan, Fred C. Bryant, David B. Wester, and Matthew J. Schnupp

Abundance estimates of northern bobwhites are important for making informative decisions about bobwhite management. By understanding bobwhite abundance in relation to spatial variables that reflect weather and habitat management, wildlife managers could prioritize their allocation of time and effort. Interpolating abundance across a landscape provides a means of evaluating spatial relationships. Our objectives are to relate the spatial distribution of bobwhite relative abundance to weather and habitat management using a Geographic Information System (GIS).

Our study area occurs on the King Ranch (825,000 acres), a private ranch comprising 6 counties in Texas (Brooks, Jim Wells, Kenedy, Kleberg, Nueces, and Willacy). The King Ranch conducts aerial surveys of bobwhites from helicopters along established transects during September and October. These transects provide an estimate of relative abundance that can be interpolated using a geospatial technique. Our dataset will include pasture-scale information on weather and management variables collected from 2000 to 2011. Findings from this study will provide a basis for "micromanaging" habitat to maximize wildlife manager time and effort.

Cooperative funding provided by the South Texas Chapter of the Quail Coalition and King Ranch, Inc.

Contemporary Genetic Structure of the Bobwhite West of the Mississippi River

Damon L. Williford, Erin M. Wehland, Randy W. DeYoung, Leonard A. Brennan, Fidel Hernández, and Rodney L. Honeycutt

Taxonomists have identified more than 20 subspecies across the geographic range of the northern bobwhite. Whether there is a genetic justification for these subspecies remains an important question. Additionally, there are insufficient genetic data to determine whether these subspecies should be managed separately. The objectives of this study were to (1) assess the genetic structure of the northern bobwhite west of the Mississippi River and (2) determine the genetic distinctiveness of 4 subspecies (eastern, plains, Texas, and masked bobwhites) in the western portion of the northern bobwhite's range.

The DNA from muscle tissue of hunter-harvested bobwhites and the feathers or blood of trapped bobwhites was extracted. A portion of the maternally-inherited mitochondrial DNA control region was sequenced for 478 bobwhites from Sonora, Texas, Kansas, Missouri, and Oklahoma.

Of the 69 haplotypes found, 3 were unique to the eastern bobwhite, 13 to the plains bobwhite, and 28 were unique to the Texas bobwhite. Only 2 haplotypes occurred in the masked bobwhite, neither of which was shared with any of the other subspecies.

Evolutionary distances among all 4 subspecies of bobwhites were low, however, the masked bobwhite was the most divergent. Although the northern bobwhite lacked large genetic gaps, some latitudinal vari-

ation in haplotype distribution was apparent. Future analysis will use statistical methods that will help correlate geographic distances with genetic differentiation among populations.

Cooperative funding provided by the Quail Associates Program, Richard M. Kleberg, Jr. Center for Quail Research, and South Texas Chapter of the Quail Coalition.

Trichomonas gallinae and Helminths of Bobwhites from the Rolling Plains

Andrea Bruno, Alan M. Fedynich, and Dale Rollins

The role parasites and diseases play in the ecology of the northern bobwhite is often overlooked or disregarded as inconsequential. However, parasites have been known to serve as population regulators in various avian species.

The objectives of this study are to (1) conduct a survey for *Trichomonas gallinae* (a protozoan pathogen), (2) assess helminth prevalence, intensity, and abundance, and (3) identify pathological responses attributable to parasite infection in bobwhites from the Rolling Plains Ecological Region in Texas and western Oklahoma. Parasitological findings will be related to host age, host sex, year of collection, rainfall events, host body weights, and estimates of bobwhite population density.

Bobwhites were collected in August and October 2011. Samples were taken from 194 live bobwhites for *T. gallinae* analysis and 43 bobwhites were euthanized

for the helminth survey. All 194 samples tested negative for *T. gallinae*. Seven species of helminths were found in 43 bobwhites, representing 6,233 individual worms. The most commonly occurring (prevalent) species was the cecal worm *Aulonocephalus pennula* followed by the eyeworm *Oxyspirura petrowi*, proventricular worm *Tetrameres* sp., cystacanth (acanthocephalan of unknown species), *Physaloptera* sp. (encysted in muscle tissues), proventricular/gizzard worm *Dispharynx nasuta*, and gizzard worm *Cheliospirura spinosa*.

Preliminary results show that prevalence of *A. pennula* increases with host age, whereas no age related differences in prevalence occurred for *O. petrowi* or *Tetrameres* sp. Prevalence of infection was similar between host sexes. Additional sampling periods are scheduled for August and October 2012 and 2013.

The present study will advance our understanding about helminth parasites that occur in northern bobwhites across the Rolling Plains of Texas and western Oklahoma. In addition, our findings will provide insight regarding the role parasites play in negatively impacting bobwhites.

Cooperative funding provided by the Rolling Plains Quail Research Foundation.

Descriptive statistics of helminths from 43 northern bobwhites collected during August and October 2011 in the Rolling Plains of Texas and western Oklahoma.

Helminth Species	Prevalence	Intensity of Infection		Helminth Abundance	
	n (%)	mean ± SD ¹	Range	mean ± SD	Total
<i>Aulonocephalus pennula</i> (C, S, L) ²	37 (86)	161.5 ± 134.0	1–579	139.0 ± 136.0	5,976
<i>Cheliospirura spinosa</i> (G)	1 (2)	2.0 ± <0.1	1–2	<0.1 ± <0.1	2
<i>Dispharynx nasuta</i> (G)	2 (5)	1.0 ± 0.0	1	<0.1 ± 0.2	2
<i>Oxyspirura petrowi</i> (E)	21 (49)	9.0 ± 13.1	1–46	4.4 ± 10.1	190
<i>Physaloptera</i> sp. (BM)	4 (9)	4.8 ± 4.9	1–12	0.4 ± 1.9	19
<i>Tetrameres</i> sp. (P)	12 (28)	2.2 ± 1.1	1–5	0.6 ± 1.1	26
Acanthocephalan larva (N, CR)	6 (14)	3.0 ± 1.5	1–9	0.4 ± 1.5	18

¹ SD = Standard Deviation

² BM = breast muscle, C = ceca, CR = crop, G = gizzard, E = eye and nictitating membrane, L = large intestine, N = neck muscle, P = proventriculus, S = small intestine

Control of Buffelgrass and Kleberg Bluestem to Promote Native Vegetation

Eric D. Grahmann, Blake A. Martin, Michael W. Hehman, Forrest S. Smith, and Timothy E. Fulbright

Buffelgrass and Kleberg bluestem are grasses that were introduced from Africa and Asia in the early 1900s to provide forage for cattle and to prevent soil erosion. Today, these aggressive grasses have spread over millions of acres of rangeland, threatening the biological integrity of remaining wild lands. To date, little research has been focused on restoring native plants in areas dominated by these plants.

In 2008, we began a study on the Hixon Ranch in La Salle County, Texas to test and replicate 6 treatments on a relatively large area (164 ft² plots) and temporal scale. Treatments include combinations of soil disturbance, fire, mowing, herbicide application, and planting native species.

Preliminary results suggest that prolonged soil disturbance (repeated disking or plowing when exotic grasses return), repeated herbicide application, and reintroducing native species can be viable methods for managing and diversifying areas previously dominated by exotic grass monocultures. Areas consisting of 99% buffelgrass canopy cover have been replaced with over 80% native plant cover.

Determining treatment longevity and economic viability are important goals. Our project will continue until viable treatment options are identified.

Cooperative funding provided by the College of Graduate Studies at Texas A&M University-Kingsville, Hixon Ranch, Houston Livestock Show and Rodeo, Arthur A. Seeligson, Jr., Conservation Fund, Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust), Native Plant Society of Texas, Reñe Barrientos, Jack R. and Loris J. Welhausen Experimental Station, ExxonMobil Community Jobs Program, and South Texas Charity Quail Hunts, Inc.

Long-term Study of Burn Effects on Exotic Grasses

Sandra Rideout-Hanzak and David B. Wester

We have begun a long-term study to evaluate the effects of burning on exotic grasses of the South Texas region. This region has been dramatically affected by exotic grasses, and little is known about effective control methods. Perennial grasses are most affected

by disturbance (e.g., fire, grazing, and mowing) during the post-flower, pre-dormancy period. For warm-season perennials, this stage follows the growing season near the end of summer. However, most prescribed burning in South Texas is conducted during the dormant season. Often, this dormant-season burning is not effective for controlling exotic grasses.

Our study will compare the effects of differing seasons of prescribed burning over a long period of time. An added value of the long-term component of this study is that it will allow us to place fire effects within the context of climate, i.e., to separate fire effects from drought or high rainfall amounts.

We have begun establishing permanent plots on rangeland near Kingsville, Texas. To evaluate the effects of burning, we will collect pre-treatment data on species composition, cover, production, and density. This information is critical because it provides the baseline against which we can compare the effects of burning. We will recollect data following burning from these rangeland plots; these data will be collected at the beginning and end of each growing season following burning.

Using long-term plots to study changes in the populations of grasses in response to prescribed burning is unique. This will allow us to document both fire effects and effects of environmental (e.g., climatic) change within the South Texas landscape.

Cooperative funding provided by the Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust).

Long-term Effects of Roller Chopping and Fire on Invasion of Exotic Grasses

Johanna M. Prukop, J. Alfonso Ortega-Santos, Felix Ayala-Alvarez, and Timothy E. Fulbright

The invasion of exotic grasses into South Texas native rangelands is affecting the ecology of the region, leading to decreased biodiversity. Practices such as roller chopping used to reduce brush vegetation and encourage herbaceous cover may also favor the invasion of exotic grasses.

Prescribed burning may be used to prolong the effects of roller chopping as a management tool, however, it may also encourage the establishment of invasive plant species. The hypothesis that prescribed fire can prolong the effects of roller chopping and reseeding is being tested.

The study is being conducted at the Welder Wildlife Refuge near Sinton, Texas. The study area consists of 9 plots. Beginning in fall 2007, roller chopping, roller chopping plus seeding a native plant mix, and a control (no vegetation manipulation) are being evaluated. With the addition of prescribed fire in 2011, we are now evaluating the effects of roller chopping, roller chopping and prescribed fire, roller chopping plus seeding, roller chopping plus seeding and prescribed fire, and the control.

Since 2011, data have been collected for percentage of canopy cover of exotic grasses, native grasses, litter, and forbs. Woody plant cover data are being collected using the line intercept method. It is likely that prescribed fire after roller chopping will prolong the life of the initial treatment, however, it may also favor the increase of invasive species.

Cooperative funding provided by the USDA Natural Resources Conservation Service and the Rob and Bessie Welder Wildlife Foundation.

Burning and Grazing Exotic Monocultures to Manage Bobwhite Habitat

Eric D. Grahmann, Blake A. Martin, Michael W. Hehman, Timothy E. Fulbright, Fidel Hernández, David B. Wester, and J. Alfonso Ortega-Santos

Invasive exotic grasses such as buffelgrass, Kleberg bluestem, and Lehman lovegrass pose a major threat to native plant and animal species throughout the southwestern United States. In southern Texas, bobwhite densities have been shown to be about 50% lower in areas dominated by exotic grass compared to native-plant communities. Exotic grasses possibly impede travel, reduce food availability, and promote intense fires that reduce important woody cover for bobwhites. Bobwhite populations have decreased over the past century from habitat loss. Native shrub and grasslands in southern Texas are disappearing because of the encroachment of exotic grasses.

We initiated this study to evaluate the hypotheses that a mosaic of small prescribed burns followed by intense grazing by cattle in exotic grass monocultures would (1) increase usable space, (2) improve nest success, and (3) lead to population growth of bobwhites. Our research is being conducted in La Salle County, Texas. Two 500-acre pastures dominated with buffelgrass were chosen to receive a patch burn-graze treatment and 2 pastures were selected as controls (no treatment). Burning and

grazing were conducted in January 2010–2011. Forty-eight radio-marked bobwhite hens are being tracked to estimate their use of exotic grasslands and nest success.

Compared to pretreatment locations, our preliminary findings suggest that bobwhites are using exotic grass patches more in manipulated areas; however, this has been limited to a few burns where annual forbs or woody plants are abundant. Bobwhites continue to avoid areas, including burns, that lack native vegetation growth. This study will conclude in 2013.

Cooperative funding provided by the College of Graduate Studies at Texas A&M University-Kingsville, Hixon Ranch, Houston Livestock Show and Rodeo, Houston Safari Club, Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust), Arthur Seeligson Conservation Fund, South Texas Charity Quail Hunts, Inc., South Texas Chapter of the Quail Coalition, Reñe Barrientos, ExxonMobil Community Jobs Program, and the Jack R. and Loris J. Welhausen Experimental Station.

Persistence of Tanglehead Seeds in South Texas Soil

Aaron D. Tjelmeland, John Lloyd-Reilley, and Shelly D. Maher

Tanglehead has recently increased in abundance in South Texas to the point that it is considered by many to be an invasive species. To aid future native plant restoration and tanglehead control efforts, it is important to understand tanglehead's seed persistence in the soil.

Tanglehead seeds were collected in fall of 2010. In December 2010, seeds were placed in aluminum mesh bags and buried at 2 sites in South Texas where tanglehead is considered to be invasive. Twenty bags



© Forrest Smith

Recently emerged tanglehead seedlings demonstrate the magnitude of colonization from the existing seed bank.

containing approximately 30 seeds each were buried in December 2010 along a transect. Four transects were placed at each site. Along 2 transects, tanglehead seeds were buried 1 to 2 inches beneath the soil surface and along the other 2 transects, seeds were buried 3 to 4 inches. One transect of seeds at each depth was recovered from each site about 7 months after the seeds were buried. A second retrieval of the seeds was accomplished in January 2012, 13 months after the seeds were buried.

Tanglehead seeds were germinated within one month of retrieval. A few seeds germinated from the first retrieval period; most of the seeds remained viable, but ungerminated. From the second retrieval period, 19% of the seeds germinated and 21% of the remaining seeds were viable.

Preliminary results from this study indicate that tanglehead seeds can remain viable for over a year with the potential to germinate 13 months after seed dispersal. Thus, control efforts will need to focus on multi-year instead of single-season methods.

Cooperative funding provided by the USDA Natural Resources Conservation Service and the numerous donors to South Texas Natives.

Seedling Competition between Tanglehead and Slender Grama

Jeremy W. Edwardson and Sandra Rideout-Hanzak

Tanglehead is a native warm season perennial bunchgrass found in sandy soils throughout South Texas and the Trans-Pecos region. Within the last 15 years,



© Sandra Rideout-Hanzak

Tanglehead seedling trials will help determine factors affecting the establishment of this invasive grass.

tanglehead has shown invasive characteristics, creating monotypic stands throughout areas of the South Texas Sand Sheet. We are currently investigating and comparing the early growth stages of tanglehead and slender grama in greenhouse trials. Slender grama is found in areas with tanglehead and is a desirable species.

We have completed studies to determine seedling densities at which tanglehead may suppress slender grama. We are also exploring their competitive abilities with different watering regimes to better understand the effects of drought years and wet years on seedling establishment. Results from these trials will aid in decision-making regarding habitat management, grazing management, and tanglehead control practices during drought or wet years.

In addition, we conducted a trial comparing tanglehead seedling establishment in pots with bare soil to seedling establishment in pots where soil was covered with 2 inches of grass litter. Preliminary findings indicated that pots without litter cover had 3.5 times higher seedling success rate than pots with grass litter. Findings from this trial have implications for field treatments that leave soil bare in the presence of mature tanglehead plants, such as prescribed burning, and for restoration efforts after wildfire.

Our trials take place in a greenhouse. However, they have important implications regarding establishment of tanglehead from seed under varying conditions, and will aid in determining factors affecting the success of tanglehead control practices.

Cooperative funding provided by the San Antonio Livestock Exposition, Inc.

Soil Modification as a Restoration Tool to Reduce Old World Bluestems

Adam B. Mitchell, Andrea R. Litt, Anthony D. Falk, and Forrest S. Smith

Increased dominance by non-native Old World bluestem (OWB) grasses can alter the structure of the native plant community as well as change soil chemistry. As a result, modifying preexisting soil conditions may favor native plants and serve as a restoration tool for grasslands invaded by OWBs.

We selected 10 soil modification treatments to assess as restoration tools (pH increase, pH reduction, carbon addition, addition of soil mycorrhizae, soil disturbance alone, and each of the previous combined with seeding of native vegetation). We are comparing treated areas

to undisturbed areas dominated by OWBs and areas dominated by native plants.

In June 2011, we established 60 research plots (20 ft x 30 ft, 5 replicates of each treatment) at the Welder Wildlife Refuge located in San Patricio County, Texas and applied the various soil treatments. We sampled soil chemistry, vegetation density, cover, and height as well as presence and abundance of soil, terrestrial, and flying arthropods 4 and 8 weeks after the treatments were applied.

Plots dominated by native plants contained more than 2 times as many plant species and 3 times higher arthropod abundance compared to the undisturbed OWB plots. Because of extreme drought in 2011, no vegetation grew on treatment plots. Despite lack of vegetation, arthropod abundance on treatment plots was similar to undisturbed OWB plots.

Sampling will be continued for the next 2 years. We hope this study will help find an effective tool to restore native grasslands that have been invaded by OWB grasses.

Cooperative funding provided by the Rob and Bessie Welder Wildlife Foundation, TAMUK University Research Award, Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust), Montana State University, and South Texas Natives.

Habitat Use and Dispersal of Scaled Quail in Landscapes Dominated by Exotic Grass

Blake A. Martin, Eric D. Grahmann, Michael W. Hehman, Timothy E. Fulbright, Fidel Hernández, and David B. Wester

Chestnut-bellied scaled quail have been declining throughout their range in southern Texas. Several hypotheses have been posed about this decline, including displacement by northern bobwhites and habitat loss. However, habitat loss seems to be the most plausible cause because millions of acres in southern Texas have been mechanically manipulated, converted to exotic grass, or both. Additionally, little is known about scaled quail in southern Texas. To our knowledge, only 4 scaled quail ecology studies have been conducted to date, all of which occurred more than 20 years ago without use of radio telemetry.

Our objectives in this study are to document (1) the general life ecology of chestnut-bellied scaled quail and (2) patterns of habitat use and dispersal in landscapes dominated by exotic grass. Two 1,000-acre pastures were selected on 2 ranches in La Salle County, Texas that contain a matrix of exotic grass and native brush.



© Timothy Fulbright

Patches invaded by buffelgrass such as in the above picture are avoided by scaled quail.

Forty radio-marked scaled quail are being monitored twice per week.

Preliminary data suggest that scaled quail mostly avoid areas dominated by exotic grass and small, isolated patches of suitable habitat. Additionally, we have documented scaled quail dispersing up to 6 miles with further distances likely.

Practices such as root plowing and seeding exotic grass may not be compatible with this species in southern Texas as scaled quail seem to require large contiguous areas of diverse brushlands. This study will conclude in 2015.

Cooperative funding provided by the South Texas Chapter of the Quail Coalition, the Hixon and Maltsberger families, Houston Livestock Show and Rodeo, Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust), South Texas Charity Quail Hunts, Inc., Reñe Barrientos, ExxonMobil Community Jobs Program, and the Jack R. and Loris J. Welhausen Experimental Station.

Vegetation and Arthropod Response to Grubbing on the King Ranch

Carter G. Crouch, J. Alfonso Ortega-Santos, Leonard A. Brennan, Greta L. Schuster, and Fidel Hernández

Brush management is used to improve wildlife habitat throughout much of Texas. However, little is known about the influence of brush management on insect populations and communities. The objective of this study is to evaluate the effect of the grubbing brush management technique on insect diversity and availability, thereby focusing on its effect on food resources of northern bobwhites.

Two hundred yard strips will be cleared using a grubber to create hunting lanes for bobwhites. The grubber work will be conducted on a 1,585-acre section of the Santa Gertrudis Division of the King Ranch, while a control site will be established on a 1,607-acre section. We will monitor vegetation and arthropod numbers. Vegetation and arthropods will be sampled before the treatment is applied and 3, 6, 9, and 12 months post-treatment. Canopy coverage of grasses, forbs, bare ground, and litter will be estimated using the quadrat sampling technique. Density estimates of suitable nesting clumps and food plants that are key components of the bobwhite diet will also be obtained. Arthropods will be sampled using a modified ES-230 Shred "N" Vac (Echo Inc., Lake Zurich, IL).

We anticipate a temporary increase in forbs and arthropods after grubbing, which may benefit bobwhites. Because of the disturbance associated with this mechanical treatment, unwanted invasive species, such as Kleberg bluestem, may also increase. As these invasive species often negatively affect wildlife, including bobwhites, landowners may need to start considering the pros and cons of grubbing and other brush management techniques.

Cooperative funding provided by King Ranch, Inc.

Seed Collection of Native Plants for Future Seed Release

Anthony D. Falk, Colin S. Shackelford, Mia A. McCraw, and Forrest S. Smith

Despite continued drought throughout most of the state, Texas Native Seeds (TNS) staff have been moving forward in making new seed collections. This

year, 305 native plant seed collections were obtained from 61 counties across south, central, and west Texas. In addition, landowner and manager outreach across the state has resulted in many new partnerships. TNS staff met with 67 landowners and managers to gain permission to make seed collections.

The abundant winter precipitation resulted in a large number of the cool season species collections. We obtained 89 and 35 collections of Texas wintergrass and little barley in spring 2012. TNS will begin evaluations of these species in fall 2012. The collections from this year help to build on the growing seed bank TNS has assembled, totaling 668 new collections since September 2010.

In coming years, we hope to obtain as many as 100 collections per region of 50 or more native plant species. These collections will be of great value in the development of new restoration seed sources of native plants for Texas.

Cooperative funding provided by the Texas Department of Transportation, Lee and Ramona Bass Foundation, Faye L. and William L. Cowden Foundation, Caesar Kleberg Partners, and Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust).

Comparison of Aerial and Drill Seeding of Native Plants after Brush Management

Forrest S. Smith, Anthony D. Falk, Keith A. Pawelek, Marc Bartoskewitz, Verl Cash, and Robert Obregon

Mechanical drill seeding is a successful planting technique for native seeds. However, on large acreages, drill seeding can be cost-prohibitive. Rough seedbeds, such as those following brush management can also make drill seeding impractical. Aerial seeding in the western United States is used to reduce planting costs on large acreages and to facilitate seeding of rough terrain.

To compare aerial and drill seeding using *South Texas Natives* released seeds, we began a study in autumn 2010 on the Laureles Division of the King Ranch. Replicated plots were seeded using a Truax native seed drill and fixed-wing aircraft following brush management that included chaining, root plowing, raking, and double disking. We also delineated control plots that were not treated and plots subjected to brush management only. Plant species composition and forage production in each treatment are being monitored twice annually.

Drought conditions have prevailed on the study area for the duration of the project. As a result, little to no native grass emergence (either seeded or volunteer) has been observed. However, the annual weed lambsquarter has established a monoculture in the treatment plots and has dominated for the past year. Before the establishment of lambsquarter, bare ground was prevalent on the treated plots for most of 2011.

Our plans are to monitor native grass seed establishment in each of the seeding sites for several more years. Presently, our results underscore the risk associated with rangeland improvement practices and native plant restoration within arid regions of South Texas as well as the need for long-term evaluation of such efforts.

Cooperative funding provided by King Ranch, Inc. and the numerous donors to South Texas Natives.

Selection for Crown Node Placement to Improve Seedling Establishment

John Lloyd-Reilley and Shelly D. Maher

The crown node is where the base of the plant's shoot separates from the plant's root system. Below the crown node is where the adventitious roots develop and become the primary root system of the mature grass plant.

Excessive crown node elevation in warm-season grass seedlings has been implicated as a major limitation to successful field establishment. It is known that crown node placement at or above the soil surface hinders development of adventitious roots at the crown node. The E. "Kika" de la Garza Plant Materials Center (PMC) is screening warm-season grass species to select for low crown node placement and thereby improve their field establishment.

The PMC evaluated a collection of switchgrass that was received from the King Ranch. Subsequently, a population of seedlings with low crown node placement was observed, selected, and planted in a breeder field for further monitoring. The PMC harvested seed from this breeder field and tested the seed to determine whether the low crown node trait was retained within the subsequent progeny. We had 73% low crown seedlings based on evaluating 518 seedlings of this switchgrass seed, while seedlings of Alamo switchgrass had only 1% with low crowns.

We are planning to establish a second cycle of breeding trials to see whether we can further improve

the percentage of low crown node in this population. We also plan to start field plantings to see whether this trait significantly improves switchgrass establishment in the field.

Cooperative funding provided by King Ranch, Inc. and the USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center.

TxDOT Highway Right-Of-Way Seeding Specification Modifications

Forrest S. Smith, Dennis K. Markwardt, Anthony D. Falk, and Keith A. Pawelek

Since 2001, *South Texas Natives* (STN) has worked with the Texas Department of Transportation (TxDOT) to develop native plant seed sources for South Texas. Beginning in 2010, Texas Native Seeds began work to improve right-of-way seeding using native plants in central and west Texas. We continue to assist TxDOT in implementing the findings of our research. In 2011, because of commercial seed availability and research findings, seeding specifications for the Pharr and Corpus Christi TxDOT districts were modified. These modifications replaced all non-native grasses for use in permanent seed mixtures in these regions with native seed mixtures that include 10 STN and partner-developed seed sources.

Using results obtained in trial plantings and evaluation studies, we are working to identify commercially available native seed sources that can be added to current mixes being used in central and west Texas to improve native seeding success. Seeding



© Anthony Falk

Roadsides represent extreme environments in which suitable native plants are needed for vegetative cover.

specifications for the Laredo and San Antonio TxDOT districts are also being rewritten to include only the use of native plants.

In summer 2012, we developed recommendations for changes and submitted them to the TxDOT Specification Committee for review. If the proposed modifications are accepted, all permanent roadside seed mixtures used by TxDOT in South Texas would be wholly comprised of adapted native plants by 2014.

Cooperative funding provided by Texas Department of Transportation and the numerous donors to South Texas Natives and Texas Native Seeds.

Trial Plantings of Native Seed Releases on South Texas Rangelands

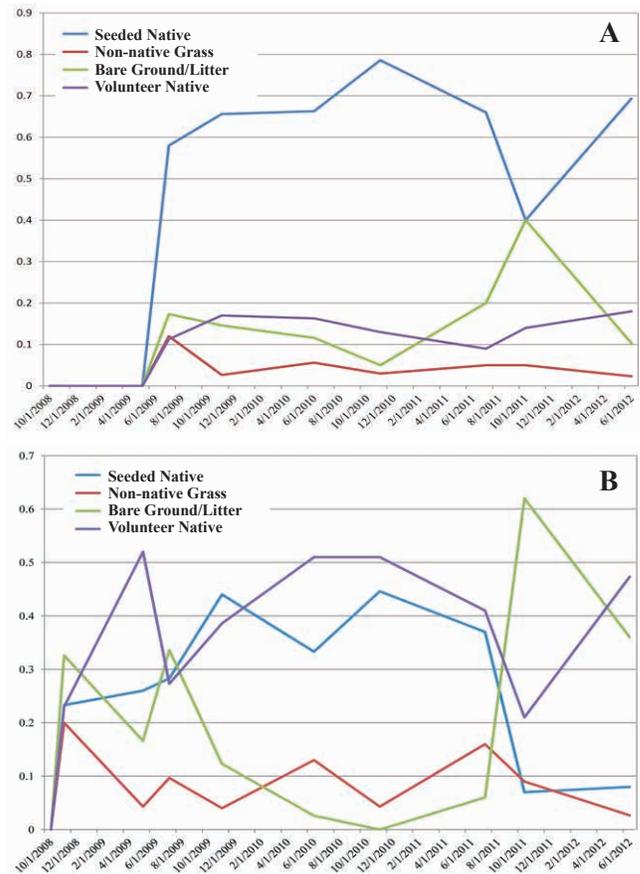
Anthony D. Falk, Forrest S. Smith, and Keith A. Pawelek

As *South Texas Natives* (STN) releases become available to consumers, we are working to conduct seeding trials across the region to develop site preparation, planting, and management recommendations to ensure successful native plant restoration projects. With the collaboration of numerous landowners, STN has conducted over 20 rangeland restoration experiments in South Texas since 2008.

Biannual vegetation sampling of each site has provided relatively long-term data on the performance of reseeded native plants throughout the region. The evaluation period for many plantings has now included 2 severe droughts and the exceptionally wet year of 2010, providing data on extreme conditions found within the region.

In 10 plantings made over 3 years ago that were planted with similar seed mixes, 60% had seeded species density exceeding 0.5 plants per ft², meeting the USDA Natural Resources Conservation Service standards for successful range seeding. While inferences across planting sites are difficult because of site variability, 2 trends in response to the 2011 drought were obvious. Native seeded species cover declined by an average of 20% from fall 2010 (following rainy summer) to summer 2012 (following year-long drought). The native seeded species recovered quickly on sites where adequate rainfall fell in spring 2012, but continued to decline on sites still subject to drought conditions, with changes in cover ranging -9% to +29% from fall 2011 to summer 2012.

We will continue monitoring our planting trial plots to obtain long-term data on rangeland restoration



Basal cover of restoration seedings in Maverick County 2009–2012 (A) and Jim Hogg County 2008–2012 (B). Figures illustrate impacts of the 2011 drought on seeded native plants. The Maverick County planting received copious rain in winter 2011–2012 and recovered to pre-drought plant cover quickly, while the Jim Hogg County site had little rain to promote recovery up to June 2012.

efforts in South Texas. The findings will be used to guide recommendations for landowners, wildlife managers, and governmental agencies in the region.

Cooperative funding provided by the numerous donors to South Texas Natives.

Long-term Vegetation Dynamics at the Welder Wildlife Refuge

Steven J. Goertz, Timothy E. Fulbright, Terry L. Blankenship, J. Alfonso Ortega-Santos, David B. Wester, and Eric J. Redeker

Invasive exotic grasses pose a significant threat to native plant species diversity, and there are many conditions driving the establishment and spread of these species. There is concern about Old World bluestem

(OWB) species spreading throughout much of South Texas and reducing habitat quality for wildlife and biodiversity. Our primary objective is to use data from long-term permanent vegetation transects to determine spatial and temporal patterns of OWB invasion in relation to disturbance, roads, and soils.

Canopy cover was estimated using data collected annually since 1976 from 150 transects distributed throughout 7,800 acres on the Welder Wildlife Refuge in San Patricio County, Texas. We will evaluate spatial distribution of plants in conjunction with proximity to roadways and pipeline easements, rainfall conditions, soil biogeochemical properties, and variable levels of disturbance. This will be conducted to determine mechanisms underlying the invasive nature of OWBs.

An understanding of conditions that are conducive to OWB invasion may help us to better predict areas where these invasions will occur. Knowing the ecological variables that drive invasion may help range-land managers develop ways to reduce the potential for invasion and better maintain native species diversity.

Cooperative funding provided by the Rob and Bessie Welder Wildlife Foundation.

Revegetation of Retired Oil and Gas Well Pad Sites

Anthony D. Falk, Keith A. Pawelek, Forrest S. Smith, and Verl Cash

Many landowners desire to restore native vegetation to drilling pad sites after wells have been plugged and abandoned. Little is known about the best techniques,



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South Texas Natives is studying native plant restoration on plugged and abandoned well sites.

seed mix compositions, or timelines for successful restoration of these sites.

Beginning in 2011, 4 abandoned well pad sites on 4 soil types were selected for a restoration experiment on the Santa Gertrudis Division of the King Ranch. We developed a native seed mix of 20 locally adapted native species for these plantings. After plugging and caliche removal, each site was ripped and disked. Soil tests were conducted to determine if soil characteristics were conducive for restoration. Following rain to re-aggregate the seedbed and germinate weeds, we sprayed each site to control emerging weeds and then planted the native seed mix using a Truax drill. The foraging effects of livestock were assessed by comparing plant growth within exclosures to plant growth outside the exclosures.

Even with below average rains in winter and spring 2012, these sites have met emergence and establishment standards used to define successful native plantings. By June 2012, 80% of 20 species planted were present on at least one pad site, and seeded plants occurred at an average density of 1.0 plants per ft². Besides drought, grazing pressure has greatly limited vegetative cover outside the exclosures.

This project will be continued for several more years to determine persistence of restored native vegetation. Information can be used to refine seeding recommendations for this type of restoration.

Cooperative funding provided by ExxonMobil, King Ranch, Inc., and the numerous donors to South Texas Natives.

Evaluation and Release of Multiflowered False Rhodes Grass

John Lloyd-Reilly, Forrest S. Smith, and Shelly D. Maher

Multiflowered false Rhodes grass is a native, warm-season perennial bunchgrass reaching 4 to 5 feet tall. It occurs on gray sandy loam, loamy bottomland, and clay loam range sites. This plant is also associated with false Rhodes grass, pink pappusgrass, plains bristlegrass, and Arizona cottontop.

Multiflowered false Rhodes grass provides fair to good forage for wildlife. It also provides good hiding cover for fawns and nesting cover for various upland game birds. Its stature and productivity allow it to compete with introduced exotic grasses, especially on sandy loam and sandy clay loam soils.

As part of an effort to collect, evaluate, and release germplasms of a variety of plants native to South

Texas, personnel from the E. "Kika" de la Garza Plant Materials Center and *South Texas Natives* (STN) obtained seed of multiflowered false Rhodes grass from 43 field locations throughout South Texas.

After 10 years of evaluation, 6 multiflowered false Rhodes grass populations were selected for release as the Hidalgo Germplasm. The 6 collections that comprise the Hidalgo Germplasm originate from Jim Wells, Webb, Medina, Jim Hogg, Wilson, and Hidalgo counties, Texas. They were selected for their superior seed germination, greater seed production, and higher plant vigor ratings than the other collections of multiflowered false Rhodes grass that were being evaluated.

Release procedures for this South Texas ecotype have been completed. Seed has been distributed to a commercial dealer who has planted 5 acres for seed production. Seed of Hidalgo Germplasm multiflowered false Rhodes grass should be available in limited supplies by autumn 2012.

Cooperative funding provided by the USDA Natural Resources Conservation Service and the numerous donors to South Texas Natives.

Evaluation of Restoration Seeding Techniques for the Eagle Ford Shale

Anthony D. Falk, Forrest S. Smith, Keith A. Pawelek, Wallace Nichols, Michael W. Hehman, Kason Haby, Dale Rankin, and Megan K. Clayton

Soil and vegetation disturbance caused by oil and gas exploration often necessitates native plant reseeded to restore the impacted wildlife habitat. We are



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Native grasses selected and released by *South Texas Natives* are being used on Eagle Ford Shale pipeline right-of-ways.

conducting experiments to determine which native plant seeding methods work best in combination with *South Texas Natives* (STN) released seeds for Eagle Ford Shale applications.

Ongoing experimental trials are replicated on pipeline right-of-ways at the Dobie Ranch in Live Oak County, the Hixon Ranch in La Salle County, and in irrigated plots at the Tio and Janell Kleberg Wildlife Research Park (WRP) located on the campus of Texas A&M University-Kingsville in Kleberg County.

Treatments include drill seeding using a Truax Flex II native seed drill, hydroseeding and mulching using a Finn hydroseeder, and broadcast seeding and packing (Dobie and WRP sites only). Plots were seeded in spring 2012 using native seed mixes developed for the specific soil series and native vegetation community of each location.

As of June 2012, there was no difference in seeded native plant density or cover among the planting methods used at any location. Across the treatments, seeded plant density was 1.00, 0.51, and 5.20 plants per ft² at the WRP, Hixon Ranch, and Dobie Ranch, respectively. Native plant seedlings are typically deemed successful if more than 0.50 plants per ft² are established within a year of planting.

We will continue to monitor these plots for the next 2 years to determine long-term effects of the planting methods on native plant restoration success. Clearly though, in the initial months after seeding, our results indicate drill, hydro, and broadcast seeding are all viable establishment methods for STN released native plants in the Eagle Ford region.

Cooperative funding provided by the numerous donors to South Texas Natives, Nichols Equipment, Hixon Ranch, Dobie Ranch, USDA Natural Resources Conservation Service, and Texas AgriLife Research and Extension Center Corpus Christi.

Seed Increase of Native Plants to Support Commercial Production

Keith A. Pawelek, Juan Garza, Forrest S. Smith, Andrew W. Scott, Jr., Robert Obregon, Anthony D. Falk, John Lloyd-Reilly, Albert Quiroga, and William R. Ocumpaugh

For successful commercialization of native plant seed sources, sufficient seed is needed to establish commercial production fields. *South Texas Natives* (STN) has had an 8-year partnership with Rio Farms near Monte Alto, Texas to grow foundation seed of native grass and forb seed releases for South Texas.

Increases are also conducted in Kingsville at the STN Farm and the USDA Natural Resources Conservation Service Plant Materials Center. Despite exceptional drought in 2011, we were able to grow and provide the needed seed for commercialization of 3 native grasses, 2 legumes, and 3 forbs in 2011 and 2012.

Seed of South Texas Germplasm sideoats grama was distributed to Douglass King Seed Company to start 5 acres of commercial production using 50,000 greenhouse-grown transplants. Fifteen pounds of Oso Germplasm Halls panicum seed were distributed to commercial growers to establish 15 acres of commercial production. Other species provided to growers in the past year were 4-flower trichloris, prairie acacia, deer pea vetch, Rio Grande clammyweed, redseed plantain, and Hookers plantain.

Seed increase efforts for future releases of awnless bush sunflower, silver bluestem, yellow Indiangrass, and little bluestem continued in 2012. Distribution of awnless bush sunflower seed to growers is anticipated by autumn 2012. Ten pounds of little bluestem and yellow Indiangrass seed were transplanted into 1-acre blocks for seed companies to evaluate production potential. Seed increase efforts will continue, as needed, to meet the goals of the STN project and ensure sufficient seed supplies for consumers.

Cooperative funding provided by Rio Farms, Inc., USDA Natural Resources Conservation Service, Texas AgriLife Research, Joan and Herb Kelleher Charitable Foundation, Pioneer Natural Resources, Robert J. Kleberg, Jr. and Helen C. Kleberg Foundation, Lee and Ramona Bass Foundation, Ewing Halsell Foundation, David Killam, Reñe Barrientos, and numerous donors to South Texas Natives.

Evaluation of White Tridens and Purple Threawn for Seed Release

Forrest S. Smith, Anthony D. Falk, Colin S. Shackelford, Mia A. McCraw, Keith A. Pawelek, Bonnie Warnock, James P. Muir, Jeff Breeden, Gary Rea, John Lloyd-Reilley, David Forbes, Andrew W. Scott, Jr., and Randy Bow

In spring 2012, we began research on white tridens and purple threawn to determine the potential for seed releases of these native species. These grasses occur in almost every county where Texas Native Seeds (TNS) is focusing its efforts.

Both species have been ignored by seed source developers because of their poor forage value to livestock. However, given current emphasis on use of native plants for reclamation projects in Texas, both



© Mia McCraw

White tridens is an early successional native grass being evaluated for future commercial seed release.

species could find widespread use if commercial seed sources were available.

These native grasses are early successional species and are naturally adapted to colonizing and thriving on recently disturbed soils. Furthermore, both grasses are common components of roadside vegetation, indicating a tolerance to right-of-way conditions and vegetation management regimes currently used by the Texas Department of Transportation.

From 2010–2012, we obtained 36 seed collections of white tridens and 37 seed collections of purple threawn from native populations on private ranches, government properties, and along roadsides. After growing plants from each seed collection, we planted replicated evaluation plots at 5 locations in spring 2012. Current evaluation sites are the *South Texas Natives* Farm in Kingsville, Rio Farms in the Lower Rio Grande Valley, Texas AgriLife Research Center in Uvalde, Texas AgriLife Research Center in Stephenville, and the USDA Natural Resources Conservation Service James E. "Bud" Smith Plant Materials Center in Knox City.

Two additional evaluation locations in west Texas will be added in 2013. If data and growth characteristics support release of these species, we could release ecotypic seed as soon as 2016.

Cooperative funding provided by the Texas Department of Transportation, USDA Natural Resources Conservation Service, Rio Farms, Inc., Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust), Will Harte, Dixon Water Foundation, Faye L. and William L. Cowden Foundation, and the numerous donors to the Texas Native Seeds Project.

Selection and Advanced Evaluation of Plants for South Texas Restoration

Forrest S. Smith, John Lloyd-Reilley, Anthony D. Falk, Keith A. Pawelek, William R. Ocumpaugh, and Shelly D. Maher

A number of native plant species continues to be evaluated and increased for future seed releases for use in South Texas through the efforts of the *South Texas Natives* (STN) partnership. The native species being considered for release include several widely distributed forbs and legumes and a number of grasses and are aimed at improved restoration seeding success

in the South Texas Sand Sheet and on shallow soils found within the central and western Rio Grande Plains of Texas.

Many of the plant species are being monitored to determine if commercial seed production is feasible and to evaluate field planting performance of these species on various restoration sites. Advanced evaluation plots are also used to provide seed for STN's and cooperator's research projects.

Following collection of sufficient data supporting release, results are summarized for release proposals, and releases are made if commercial interest in production of the plant exists. Test plots for these studies

Current status of seed source development efforts for native plants selected by the original *South Texas Natives* Technical Committee in 2001.

Grass Species	Status	Forb and Legume Species	Status
2-flower trichloris	Commercialized 2009	Orange zexmenia	Released 2008
Arizona cottontop	Released 2007	Redseed plantain	Released 2009
Plains bristlegrass	Released 2007	Hookers plantain	Released 2009
Hooded windmillgrass	Released 2007	Rio Grande clammyweed	Released 2009
Streambed bristlegrass	Released 2007	Prairie acacia	Released 2012
Hairy grama	Released 2007	Deer pea vetch	Released 2012
Slender grama	Released 2007	Awnless bush sunflower	To be released by 2013
Texas grama	Released 2007	Bundleflower	To be released by 2014
Shortspike windmillgrass	Released 2007	Indian blanket	To be released by 2014
Whiplash pappusgrass	Released 2010	Engelmann daisy	Advanced evaluation
Pink pappusgrass	Released 2010	Gayfeather	Advanced evaluation
Halls panicum	Released 2011	Golden dalea	Advanced evaluation
4-flower trichloris	Released 2011	Pussyfoot dalea	Advanced evaluation
Sideoats grama	Released 2012	White prairie clover	Advanced evaluation
Little bluestem	To be released by 2013	Frostweed	Advanced evaluation
Silver bluestem	To be released by 2013	Tropical neptunia	Advanced evaluation
Slim tridens	To be released by 2014	Partridge pea	Initial evaluation
Rough tridens	To be released by 2014	Croton	Existing materials suitable
Sand dropseed	To be released by 2014	Blackfoot daisy	Not suitable for release
Red lovegrass	To be released by 2014	Low menodora	Not suitable for release
Brownseed paspalum	To be released by 2015	Lazy daisy	Not suitable for release
Switchgrass	To be released by 2015	Bladderpod	Not suitable for release
Seacoast bluestem	Advanced evaluation	Ground cherry	Not suitable for release
Yellow Indiangrass	Advanced evaluation	Shaggy portulaca	Not suitable for release
Big bluestem	Advanced evaluation	Western ragweed	Not suitable for release
Threeawn	Initial evaluation	Snoutbean	Not suitable for release
Fall witchgrass	Initial evaluation	Milkpea	Not suitable for release
Green sprangletop	Existing materials suitable	Lindheimer tephrosia	Not suitable for release
Buffalograss	Existing materials suitable	Dwarf dalea	Not suitable for release
Texas panicum	Existing materials suitable	Purple prairie clover	Not suitable for release
Vine mesquite	Not suitable for release	Mistflower	Not suitable for release
Common curly mesquite	Not suitable for release	Dayflower	Not suitable for release
Red grama	Not suitable for release	Globemallow	Not suitable for release
Thin paspalum	Not suitable for release	Prickly sida	Not suitable for release
Texasgrass	Not suitable for release	Mexican hat	Evaluation discontinued
Crinkleawn	Not suitable for release		
Tanglehead	Evaluation discontinued		

are currently managed at the STN Farm located at Texas A&M University-Kingsville, the USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center in Kingsville, and at Rio Farms in the Lower Rio Grande Valley of Texas. As a result of these projects, we will continue to release native plant species to meet the specific needs of consumers in South Texas.

To date, 20 species of native plants have been released and distributed to commercial growers for production. By the 14th year of the project, we will have released 59% of the grasses and 25% of the forbs and legumes that were identified by the original STN technical committee as important for restoration efforts within South Texas.

Cooperative funding provided by donors to the South Texas Natives Project, USDA Natural Resources Conservation Service, Rio Farms, Inc., and Texas AgriLife Research Station Beeville.

Release of a Seed Source of Halls Panicum for South Texas

John Lloyd-Reilley, Forrest S. Smith, Shelly D. Maher, and Keith A. Pawelek

Halls panicum is a short-lived, warm season perennial bunchgrass with mature foliage height ranging from 0.5 to 2.5 feet. This native species grows on sandy to clayey calcareous soils. It will tolerate soils that are weakly saline. Halls panicum provides fair forage for wildlife. It is a good seed producer, and its seeds can provide a source of food for birds and other wildlife. In addition, Halls panicum can provide plant diversity to rangeland plantings. It is also recommended for highway right-of-way plantings because of its short stature.

To learn more about the features of this species, 29 collections of Halls panicum from the South Texas region were evaluated over a 10-year period. In 2011, the USDA E. "Kika" de la Garza Plant Materials Center along with *South Texas Natives* and its collaborators selected 2 populations of Halls panicum for release as Oso Germplasm Halls panicum. These 2 collections originated from the South Texas counties of Nueces and Cameron. They were chosen for release because of their superior active seed germination, their greater overall seed production, and their higher plant vigor ratings than the other collections evaluated in the study.



© John Lloyd-Reilley

Halls panicum has been evaluated in test plots to determine its suitability for native plant restoration efforts.

Release procedures for this South Texas ecotype of Halls panicum have been completed. Seed has been distributed to a commercial dealer who plans to plant 15 acres this fall. Seed of Oso Germplasm Halls panicum should be available in limited supplies to customers by spring 2013.

Cooperative funding provided by the USDA Natural Resources Conservation Service and the numerous donors to South Texas Natives.

Evaluation of Growth Characteristics of Native Seed Sources for TxDOT

Anthony D. Falk, Colin S. Shackelford, Mia A. McCraw, Forrest S. Smith, James P. Muir, Gary Rea, Bonnie Warnock, David Forbes, and Dennis K. Markwardt

Numerous native seed varieties have been released for Texas, but many have not been evaluated for their usefulness in roadside revegetation projects. Texas Native Seeds (TNS) is evaluating plant growth characteristics of 60 native seed varieties to identify releases that could be used by the Texas Department of Transportation (TxDOT). Evaluations are being conducted using greenhouse-grown transplants in cultivated plots to assess mature plant characteristics of each species. Criteria for use of plants by TxDOT being measured include long-term survival, growth rate, coverage ability, and stature. We are in the second year of this 3-year project.

At the Kingsville study site, the best performance in context of this project was from Dilley slender

grama and Kinney 2-flower trichloris. At Rio Farms, *South Texas Natives* (STN) bush sunflower and Rio Grande Germplasm prairie acacia had superior performance. STN bush sunflower also excelled at the Uvalde evaluation site. At the west Texas evaluation site near Imperial, just 30% of the 60 native species survived a year after planting; the surviving species were saline and alkaline soil-tolerant plants, with Webb whiplash pappusgrass and Maverick pink pappusgrass performing best. At the Knox City evaluation site, Hondo velvet bundleflower and Cuero purple prairie clover were top performers. At Stephenville, Eldorado Engelmann daisy and Cuero purple prairie clover were standout species.

This project has identified a number of native forbs and legumes that may be useful for roadside restoration. Findings also underscore the lack of available native plants for west Texas restoration projects.

Cooperative funding provided by Texas Department of Transportation.

TxDOT Native Plant Integration Program for South, Central, and West Texas

Forrest S. Smith, Dennis K. Markwardt, Anthony D. Falk, Colin S. Shackelford, Mia A. McCraw, Keith A. Pawelek, Fred C. Bryant, Bonnie Warnock, James P. Muir, Jeff Breeden, Gary Rea, John Lloyd-Reilly, David Forbes, and Randy Bow

As part of a 3-year grant by the Texas Department of Transportation (TxDOT), we are working to (1) identify and/or develop native plant seed sources that



© Anthony Falk

Native plants are being evaluated for future use by the Texas Department of Transportation.

are suitable for highway right-of-ways in west, central, and south Texas and (2) ensure the seeds are commercially available in quantities needed by TxDOT.

Our initial objective was to evaluate available native seed sources for use by TxDOT. Beginning in spring 2011, we screened 60 native seed varieties and 5 commonly used exotic grasses (as standards for comparison) for regional adaptation and performance in highway seeding across Texas.

Results indicate South Texas has the greatest number of suitable seed sources, which are primarily those released by *South Texas Natives*. West Texas had few suitable native seed materials, while the central Texas projects identified several previously released native seed sources that do meet current TxDOT seeding needs. However, seeds of many of these releases are not available in the quantities needed by the agency. Obvious in all regions examined was the lack of cool-season native plant material, which could be used by TxDOT.

Our second objective, based on the findings of the first objective and on input from regional technical committees, has been to identify important native plants for roadside revegetation that do not have commercial seed sources available presently. We are working to obtain seed collections of these plants throughout the project areas, and we will eventually work to develop locally adapted commercial seed releases of these native plants. A 5-year contract extension is being sought from TxDOT to continue this project.

Cooperative funding provided by the Texas Department of Transportation.

The West Texas Native Plant Materials Initiative

Colin S. Shackelford, Bonnie Warnock, and Forrest S. Smith

The west Texas portion of Texas Native Seeds (TNS) is beginning construction of a new native plant evaluation site near the town of Alpine. The site will be developed in collaboration with the Borderlands Research Institute at Sul Ross State University, CF Properties, and the Sierra la Rana Development.

The 25-acre facility will operate as a home base for TNS evaluations and seed increases for west Texas. With the existing evaluation site in Imperial, Texas, we will be increasing the diversity of locations available for native plant research in west Texas.

A new research project in summer 2012 will evaluate restoration options for degraded saline sites along the Pecos River. The project is a collaborative effort between TNS, USDA Natural Resources Conservation Service (NRCS), Borderlands Research Institute, and Pecos County Water Improvement District No. 3. Saline soils on the Pecos River are a significant restoration challenge for landowners and resource agencies. The project will evaluate multiple planting techniques using existing plant materials developed by the *South Texas Natives* project and the NRCS Plant Materials Program that have performed well at the west Texas plant evaluation site at Imperial.

Landowner and agency outreach has resulted in a number of productive partnerships across west Texas. Project personnel accessed 46 properties across the 32-county west Texas region in 2011 and 2012. These partnerships increase the diversity of new plant materials available for research. They also help to educate landowners about the goals and benefits of TNS.

Cooperative funding provided by the Texas Department of Transportation, Will Harte, Dixon Water Foundation, Faye L. and William L. Cowden Foundation, Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust), Pecos County Water Improvement District No. 3, CF Properties, and the Sierra la Rana Development.

Texas Native Seeds: The Central Texas Program

Mia A. McCraw, James P. Muir, Gary Rea, Jeff Breeden, Randy Bow, and Forrest S. Smith

The central Texas portion of Texas Native Seeds (TNS) expanded over the past year through increased awareness of the project and improvements to facilities. Public outreach and education have been a priority of TNS in central Texas. Private landowner contacts facilitating more than 150 seed collections have been made with the help of several collaborators. Texas Parks and Wildlife regional biologists have been especially helpful in linking TNS with landowners who have an interest in our work. Personnel from the USDA Natural Resources Conservation Service have also been invaluable in landowner introductions and by including project information in agency newsletters for the region.

In spring 2012, we participated in 5 landowner workshops in the region, and we had an overwhelming response of landowners willing to assist the project. To date, 80 landowners, agencies, and non-governmental



© Mia McCraw

Texas Native Seeds is conducting evaluations on plots at the Texas AgriLife Research Station in Stephenville.

organizations in central Texas have allowed access to land or committed their time toward helping us obtain seed collections.

During the past year, improvements were made to greenhouse and germination facilities at the Stephenville AgriLife Center. We grew transplants of new collections of white tridens and purple three-awn for initial evaluations and future seed releases. In summer 2012, student technicians were added to the project in Stephenville and at the Knox City Plant Materials Center. These students will help maintain research plots, process seed collections, and assist in germination testing. We will continue to expand and develop the central Texas portion of TNS as we work to make additional native seed sources available for central Texas.

Cooperative funding provided by the Texas Department of Transportation, Lee and Ramona Bass Foundation, Charles Williams, and the Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust).

The Commercial Release of Rio Grande Germplasm Prairie Acacia

John Lloyd-Reilley, Forrest S. Smith, William R. Ocumpaugh, and Shelly D. Maher

Prairie acacia is a native perennial legume reaching 3 to 4 feet tall. Prairie acacia produces high quality forage for all types of grazing livestock. Crude protein of prairie acacia leaves have ranged from 16 to 29% with good digestibility. Prairie acacia also



© John Lloyd-Reilley

Prairie acacia is a desirable native plant that is beneficial to many wildlife species in South Texas rangelands.

provides good forage for wildlife, valuable cover for white-tailed deer fawns, and seed and cover for various upland game birds. Potential use of this species in South Texas is for rangeland restoration, wildlife habitat improvement, native landscaping, and oil and gas land reclamation.

Fifteen collections of prairie acacia from South Texas, along with Plains Germplasm prairie acacia released by the Knox City Plant Materials Center in 2008, were evaluated. After 7 years of evaluation, the E. "Kika" de la Garza Plant Materials Center along with *South Texas Natives* and its collaborators selected 3 native prairie acacia populations for release as the Rio Grande Germplasm prairie acacia. These populations were selected for their superior survivability, vigor, forage production, and seed production characteristics. The 3 collections that make up Rio Grande Germplasm prairie acacia originate from McMullen, Webb, and Dimmit counties, Texas. During the years of evaluation, Plains Germplasm prairie acacia had poor performance in growth and longevity in South Texas, making it unsuitable for this region.

Release procedures for the South Texas ecotype of prairie acacia have just been completed. Plains Germplasm prairie acacia seed has been distributed to a commercial dealer who has planted 3 acres for seed production. Seed of Rio Grande Germplasm prairie acacia should be available in limited supplies by autumn 2012.

Cooperative funding provided by the USDA Natural Resources Conservation Service and the numerous donors to South Texas Natives.

Commercial Seed Production of South Texas Native Seed Releases

Keith A. Pawelek, Forrest S. Smith, Dean Williams, Brian C. Wille, Keith J. Walters, and William R. Ocumpaugh

Over 28,000 pounds of seed from *South Texas Natives*, USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center, and Texas AgriLife Research Station Beeville seed releases were produced and made available to consumers by commercial seed growers in 2011. This represents a record year for both production and sale of these releases, despite drought and high temperatures resulting in poor growing conditions. By comparison, commercial seed production in 2010 was 13,000 pounds. Douglass King Seed Company and Pogue Agri Partners have made rapid progress in expanding native seed production to meet current demand.

Production reported through June indicates 2012 will far exceed 2011 figures. Timely spring rains facilitated early harvests this year, and many species had the largest per acre yields observed to date, a testament to the development of improved production methods by our seed industry partners. In addition, 4 new seed releases have been added to the native seed production lineup for 2012 including South Texas Germplasm sideoats grama, Oso Germplasm Halls panicum, Hidalgo Germplasm 4-flower trichloris, and Rio Grande Germplasm prairie acacia. The addition of these species and added production acreage of past releases will likely double the amount of seed available to consumers in 2012 compared to 2011.

Due in large part to Eagle Ford Shale land reclamation needs, demand remains extremely high for seeds. Landowners are advised to consider preordering and

Commercial seed production totals of South Texas native plant seed releases in 2011.

Species	Seed Production
Catarina Blend bristlegrass	9,900 lbs
Maverick Germplasm pink pappusgrass	5,000 lbs
Mariah Germplasm hooded windmillgrass	1,700 lbs
Webb Germplasm whiplash pappusgrass	1,000 lbs
Chaparral Germplasm hairy grama	766 lbs
Divot Tallow Weed blend	300 lbs
Atascosa Germplasm Texas grama	2,500 lbs
Falfurrias Germplasm big sacaton	220 lbs
La Salle Germplasm Arizona cottontop	2,000 lbs
Dilley Germplasm slender grama	4,500 lbs
Kinney Germplasm 2-flower trichloris	230 lbs
Total production (all species)	28,116 lbs

prepaying for seed for large projects to ensure availability when needed.

Cooperative funding provided by the numerous donors to South Texas Natives, USDA Natural Resources Conservation Service, Douglass W. King Seed Company, and Pogue Agri Partners.

Evaluation of Seedling Emergence of Native Seed Sources for TxDOT

Anthony D. Falk, Colin S. Shackelford, Mia A. McCraw, Forrest S. Smith, James P. Muir, Gary Rea, Bonnie Warnock, David Forbes, and Dennis K. Markwardt

We are evaluating the ability of 60 native seed varieties to establish and persist when seeded in harsh conditions in south, central, and west Texas. Our goal is to identify native seed sources for use by the Texas Department of Transportation (TxDOT) that will reliably establish and provide needed cover in roadside seeding projects. Commonly used exotic grass species are being evaluated for comparison.

Experimental plots were established at 2 locations each in south, central, and west Texas. At the Rio Farms site (south location), there were very few seedlings the first year because of drought and weed competition. In Kingsville (south location), the top performing seed sources were South Texas Germplasm sideoats grama and Oso Germplasm Halls panicum, averaging 2.9 plants per ft². These native grasses exceeded Bermudagrass emergence, which was 2.1 plants per ft².

In Imperial (west location), there was no seedling emergence because this location had extreme drought conditions. At Uvalde (west location), 46% of the native species emerged in the first year, with Comanche partridge pea and South Texas Germplasm sideoats grama having the highest densities of 2.9 and 2.0 plants per ft², respectively.

At Knox City (central location), South Texas releases of redseed plantain and Hookers plantain had the highest plant densities of all native grass species seeded. The fields at Stephenville (central location) had limited seedling emergence in the first year because of weed competition.

Plantings in this project will be evaluated for 3 years. The results will be used to make recommendations for native seed mixes that can be used by TxDOT.

Cooperative funding provided by the Texas Department of Transportation.

Effect of Population Density on American Alligator Growth Rates

Cord B. Eversole, Jacob Ogdee, Scott E. Henke, and Bart M. Ballard

The American alligator was declared an endangered species in 1967. Market hunting, poaching, and wetland habitat losses resulted in a reduction of this species throughout its range. Federal protection has allowed the American alligator to repopulate, flourish, and even expand its range throughout the Gulf Coast. In some areas where the alligator is protected, alligator populations have increased substantially. It is unknown what effect these high population densities have on various life history characteristics of the American alligator.

In this study, mark-recapture methods will be used to gain knowledge on growth rates of alligators in high-density populations. Individuals will be captured and tagged with several uniquely numbered tags. Various body measurements will be recorded. The following year, individuals will be recaptured, re-measured, and the data compared. This will allow us to determine differences in growth rates of alligators in populations that have varying densities.

Data collected from this study will help aid in the understanding of alligator population dynamics. The information can be used by biologists to further assist in the management of this species.

Cooperative funding provided by the East Texas Herpetological Society, Brazos Bend State Park Volunteer Organization, and the Armand Bayou Nature Center.

Habitat Use by Adult Reddish Egrets during Breeding

Daniel J. Reed, Bart M. Ballard, Brock J. Geary, and M. Clay Green

Reddish egrets were negatively affected by the plume trade during the early 1900s, and their populations have remained relatively low since. Consequently, the reddish egret is rare in North America, and only a general understanding exists of this species' ecology.

Reddish egrets are habitat specialists that breed in mixed-species colonies and forage in estuaries along the Texas coast. The Laguna Madre of Texas supports the largest concentration of reddish egrets in

North America during the breeding period. Recently, much interest has been expressed about the habitat requirements of the reddish egret as human development pressures increase in key parts of its range. Our project examines relationships between breeding colonies and foraging sites of reddish egrets in the Laguna Madre of Texas.

We captured 21 adult reddish egrets during the breeding season from 5 waterbird colonies. We fitted each captured individual with a solar powered Global Positioning Systems (GPS) backpack transmitter. Transmitters record 6 locations each day of which 4 locations are taken during peak foraging times and 2 during nocturnal hours.

To date, we have 500–800 observations per radio-marked bird during the breeding season. All individuals have shown fidelity to the Laguna Madre and foraged within 15 miles of their breeding colony.

Preliminary analysis has identified 3 areas where most of the foraging activity occurred. The information obtained in this study will provide a better understanding of specific habitat needs of the reddish egret during the breeding season and aid in developing conservation plans.

Cooperative funding provided by the U.S. Fish and Wildlife Service and the National Fish and Wildlife Foundation.

Effect of Time and Weather Parameters on Nighttime Alligator Activity

Cord B. Eversole, Jacob Ogdee, Scott E. Henke, and Bart M. Ballard

Night counts are a common method used to gather information on American alligator populations because the technique is uncomplicated and provides usable information on the size and composition of the population. It is known that reptilian activity increases with temperature. This is why spotlight surveys for alligators historically have been scheduled around warm temperatures. However, it is unknown what other weather parameters affect the activity of alligators. It is also unknown what effect time of night has on the activity of these animals.

In this study, nighttime population surveys will be conducted during varying weather conditions. Data such as wind speed, wind direction, barometric pressure, water temperature, air temperature, moon phase, and time since the last rain event will be recorded.

The nighttime counts will be conducted for 4 consecutive nights. Each night the order of wetlands to be surveyed will be changed resulting in a different start time. This will detect the effect of time of night on alligator activity.

Information from this study will aid in determining what weather conditions are the most important to attaining a more accurate estimate of alligator populations. By restricting surveys to times and weather patterns that are best for high alligator activity, wildlife managers will be able to obtain reliable data of alligator population density and make better management decisions for this unique wildlife species.

Cooperative funding provided by the East Texas Herpetological Society, Brazos Bend State Park Volunteer Organization, and the Armand Bayou Nature Center.

Population Trends of Conservation Priority Bird Species in the Gulf Coast Joint Venture

Joseph P. Sands, Leonard A. Brennan, and Stephen J. DeMaso

The Gulf Coast Joint Venture (GCJV) has identified 22 species of landbirds, shorebirds, and waterbirds that have high priority for the GCJV partnership. In addition, other species of conservation concern have been identified that require monitoring. The GCJV is interested in evaluating the potential of using existing landscape-scale surveys such as the Breeding Bird Survey (BBS) and/or the Christmas Bird Count (CBC) at multiple scales within and at the GCJV scale as an alternative to implementing individual monitoring programs.

We collected count data from BBS (27 species from 65 routes) and CBC (37 species from 58 count circles) within the GCJV and estimated the mean count per year for each BBS route (1966–2007) and each CBC count circle (1966–2008). We used parameter estimates and confidence intervals from our regression analysis to estimate statistical significance of trends. Given that approximately 36% of species detected by the BBS and 11% of species detected by the CBC appear to be declining in abundance at the GCJV scale, it is important for managers to be able to detect declining trends from population monitoring data.

The use of a Monte Carlo simulation power analysis on these broad scale survey data allowed us to determine which survey method provided suitable monitoring data for a particular bird species. It allowed us to identify which species may require more intensive

surveys for the entire GCJV. Finally, it also allowed us to examine specific Bird Conservation Regions within the GCJV by incorporating the variation associated with 2 long-term bird monitoring datasets.

Cooperative funding provided by the U.S. Fish and Wildlife Service, Quail Associates Program, and the Richard M. Kleberg, Jr. Center for Quail Research.

Assessing Habitat Characteristics of Nesting American Alligators

Cord B. Eversole, Jacob Ogdee, Scott E. Henke, and Bart M. Ballard

Some of the least studied aspects of American alligator ecology are habitat use, habitat preference, and how quality of habitat affects populations across their range. It is known that alligator habitat use and activity may vary by gender, age class, and season.

In this study, nests will be located by walking the perimeter, as well as nearby areas, of all major bodies of water located within each study site. Once identified, nests will be opened and checked for the presence of eggs. If eggs are present, they will be counted and timing of egg deposition will be determined according to the growth stage table for alligator embryos. Measurements such as distance from water, slope of the bank, percentage canopy cover, surrounding vegetation, nesting material, wetland classification, and water quality (i.e., salinity, conductivity, total dissolved solids, pH, dissolved oxygen, turbidity, water temperature, water depth) will be recorded. Nests will be monitored until hatchlings emerge from the nest.



© Cord Eversole

Alligator nests are being characterized to determine what environmental features are important for successful nests.

The hatchlings surrounding the nest will be captured, sexed, measured, and tagged. These data will provide information on alligator sex ratios, nest success, and hatchling survival.

This information will provide insight into the nesting ecology of this species. Results will help to guide management decisions based upon what constitutes "optimum" nesting habitat as well as the differences in male and female habitat occupancy that is the most conducive to healthy alligator populations.

Cooperative funding provided by the East Texas Herpetological Society, Brazos Bend State Park Volunteer Organization, and the Armand Bayou Nature Center.

Reproductive Ecology of American Oystercatchers

Lianne M. Koczur, Bart M. Ballard, Alexandra E. Munters, Fidel Hernández, David B. Wester, M. Clay Green, and Susan A. Heath

A small population, low productivity, and habitat loss warranted the listing of the American oystercatcher as a Species of High Concern in the U.S. Shorebird Conservation Plan. Although a significant amount of research has focused on the Atlantic population, little is known about the western Gulf Coast population. The objectives of this study are to determine the reproductive success of American oystercatchers along the Gulf Coast of Texas and to identify causes of nest failure and chick mortality.

Pairs will be monitored from March through June 2012 and 2013. Nests will be checked once weekly



© Bart Ballard

CKWRI research is providing insight into the ecology of the American oystercatcher along the Gulf Coast of Texas.

until nest fate is determined. Nests will be considered successful when one or more eggs hatch, and chicks will be considered successfully fledged at 35 days. We will examine several features of nest sites and the surrounding landscape to help explain variation in nest and chick survival.

As of June 2012, 49 oystercatcher pairs have produced 66 nests; 33 nests have failed and 19 nests have successfully hatched 28 chicks. Examination of reproductive success and the parameters affecting productivity of the western Gulf Coast population of the American oystercatcher will be important in implementing conservation efforts in this region.

Cooperative funding provided by the Walter Fondren, III Fellowship in Shorebird and Wading Bird Research and the Gulf Coast Bird Observatory.

Duration of Marking Tags on American Alligators

Cord B. Eversole, Jacob Ogdee, Scott E. Henke, and Bart M. Ballard

The size of various wildlife populations is often estimated using mark-recapture methods. A primary assumption of such studies is that identifying marks remain permanent throughout the study. The American alligator is known to inhabit areas of rough terrain. Such terrain makes tagging individuals for mark and recapture studies difficult. The longevity of tags on alligators often has been a challenge for researchers to overcome in the pursuit of knowledge of the species.

In this study, alligators will be tagged using 4 types of tags. Each captured individual will be marked by a uniquely numbered tail tag, a Kemco ear tag that will be placed on the back left foot, an individual passive integrated transponder (PIT) tag that will be placed internally at the base of the tail, and a uniquely numbered and colored T-Bar Anchor fish tag that will be placed at the base of the head. The duration and effectiveness of each tag will be determined after one year by the presence or absence of each tag type on each individual upon their recapture.

This study will aid in determining the efficacy of marking tags on American alligators. Findings from our research will aid biologists in improving population estimates of American alligators.

Cooperative funding provided by the East Texas Herpetological Society, Brazos Bend State Park Volunteer Organization, and the Armand Bayou Nature Center.

Movements, Home Ranges, and Habitat Use of the Jamaican Boa

Brent Newman, Susan Koenig, and Scott E. Henke

The Jamaican boa is a non-venomous snake that occurs in the humid tropical montane forest, dry limestone scrubland, and mangrove swampland of Jamaica. The species is classified as Vulnerable on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, and it has a high risk of extinction in the wild.

Habitat alteration, predation by introduced mammals (feral pig, domestic cat, and mongoose), and killing by humans have had a negative effect on this species. Jamaican boas occur now as isolated populations instead of being distributed island-wide. They are mainly arboreal, but their behavior has recently changed; they will search for prey on the ground, presumably because of human habitat alterations.

In this study, we will monitor Jamaican boa movements and habitat use with radio telemetry. Data will provide insight into the habitat needs of this threatened species and offer justification to protect the remaining habitat of the Jamaican boa.

Cooperative funding provided by the Fulbright Scholarship Program of the United States and the Windsor Research Centre.

Carnivore Survey on Three East Wildlife Foundation Ranches

Arturo Caso, Alfonso Ortega-Sanchez, Jr., Lon I. Grassman, William C. Stasey, Sasha Carvajal-Villarreal, Jennifer M. Korn, Kent Williamson, Eric Garza, Nick Perez, and Michael E. Tewes

Carnivores are indicators of ecosystem health. Their populations and distributions may be related to different habitat types and the availability of other resources such as prey and water. It is important to survey different areas to determine the species and distribution of carnivores in South Texas. Knowledge of the distribution of carnivores will help to establish future conservation or control strategies for certain species. The purpose of this project is to document the presence of wild carnivore species with an emphasis on the felid community.

From July 2011 through May 2012, we surveyed the San Antonio Viejo, Buena Vista, and Santa Rosa



© Larry Ditto

The coyote is one of the more abundant predator species found in South Texas rangelands.

ranches (cattle ranches managed by the East Wildlife Foundation) using remote sensing cameras. After 23,152 camera-nights of surveys, we have obtained photographs of 7 carnivore species: coyote, bobcat, raccoon, gray fox, badger, striped skunk, and eastern hog-nosed skunk. Relative abundance indices indicate that coyotes are the most abundant carnivore followed by raccoons and bobcats. No other feline species besides bobcats were documented on these ranches.

These results are preliminary as this study is ongoing. Additional data will be needed for interpretation.

Cooperative funding provided by the East Wildlife Foundation and Wild Cat Conservation, Inc.

Effect of Water Quality and Quantity on American Alligator Density

Cord B. Eversole, Jacob Ogdee, Scott E. Henke, and Bart M. Ballard

The American alligator is known to occupy variable environments throughout the entirety of its range, from highly saline waters to freshwater. The success of this species has been attributed, in part, to the adaptive ability of these animals to occupy habitats that are considered less than optimum for other vertebrate species. However, the range of tolerance for alligators is unknown regarding water quality and quantity within the habitats in which they live as well as the effect that such parameters have on the population density of American alligators.

We propose to investigate levels of water quality and quantity that constitute optimum habitat and examine their relationship to alligator population density. Water quality will be collected monthly concurrent with night surveys. The area of inundation will be determined by mapping the boundary of each water body with a hand-held Global Positioning Systems (GPS) unit; water depth will be collected by sonar. Water chemistry such as temperature, dissolved oxygen, salinity, conductivity, and pH will be collected at 3 random points within each wetland.

Data collected in this investigation will aid in the determination of what constitutes optimum American alligator habitat. By determining this, sound management plans can be developed and more accurate management decisions can be executed to better conserve this once endangered species.

Cooperative funding provided by the East Texas Herpetological Society, Brazos Bend State Park Volunteer Organization, and the Armand Bayou Nature Center.

Training Dogs to Locate Endangered Houston Toads

Sandra Rideout-Hanzak, Scott E. Henke, Paul S. Crump, and Rebecca V. Ross

The largest known populations of endangered Houston toads occur within the Lost Pines ecosystem of Bastrop County in Texas. Much of the Houston toad's habitat was affected by wildfires in 2011. Currently, researchers can locate Houston toads only during the breeding season on evenings when they are vocalizing. Outside the breeding season very little is known about their habitat preferences, including the dormant periods (winter and dry periods of summer) in which they burrow under leaf litter and into the sandy soil. There are currently no effective methods for finding toads while they are dormant.

We are training a dog to alert researchers when the scent of a Houston toad is detected. We are currently using gauze strips swiped across toads at the Houston Zoo, toad feces, and dead toads obtained from the zoo for the training. Dog training will be designed for discrimination of only the Houston toad instead of 2 other toad species that share the Houston toad's range.

Our short-term goal is to determine the accuracy with which the dog can detect a Houston toad in its native habitat. Long-term goals include using trained search dogs as tools to locate dormant Houston toads



© Rebecca Ross

Dogs are being trained to locate the Houston toad to gain additional knowledge about this endangered species.

to determine their habitat requirements outside the breeding season. This will allow improved management and conservation of year-round habitat for the Houston toad as well as providing more accurate estimations of their population size.

Influence of Weather on Avian Migration Dynamics Along the Lower Texas Coast

Suzanne Contreras, Bart M. Ballard, David B. Wester, William P. Kuvlesky, Jr., Leonard A. Brennan, Michael L. Morrison, and Kathy Boydston

The lower Texas coast is a major migration corridor that enables migratory birds to complete their migratory journey each fall and spring. The stopover habitat of this region becomes vital to migratory birds when inclement weather over the Gulf of Mexico interrupts their migration. Weather has been shown to be a significant factor that influences migratory bird movements. Thus, our objective is to examine the effects of weather on bird migration dynamics along the lower Texas coast.

During 2007 to 2010, we used radar technology to monitor migratory bird movements in 3 fall (15 August to 17 November) and 3 spring (15 March to 1 June) migration periods. Bird migration characteristics were gathered at 2 study sites along the lower Texas coast. Local weather data were collected at each study site using an automated weather station. Upper air weather data were obtained from the nearest National Weather Service station.

Preliminary modeling of the influence of weather on bird passage rates found wind direction, wind speed, and fog to be the best predictors at flight altitudes below 1,500 feet. At altitudes above 1,500 feet, wind direction, barometric pressure, and temperature were the strongest predictors influencing bird passage.

This study will provide a better understanding of how weather variables influence bird migration along the lower Texas coast. This information can be used to predict the increased magnitude of bird migration through an area and reduce potential impacts to birds from wind turbines (by turning them off during those critical periods) or scheduling training flights by naval air stations to reduce bird strikes.

Cooperative funding provided by Texas Parks and Wildlife Department and the Robert J. Kleberg, Jr. and Helen C. Kleberg Foundation.

Growth Rates of American Alligators at Three Southcentral Texas Sites

Cord B. Eversole, Jacob Ogdee, Scott E. Henke, and Bart M. Ballard

The American alligator is an endemic species characteristic of the Gulf Coast and lower Atlantic coastal plains of North America. The American alligator inhabits wetland ecosystems throughout the south-central Texas landscape.

American alligators are long-lived species, experience variable growth rates, and reach sexual maturity at a minimum size instead of a particular age. It is thought that variable growth rates occur across



© Kim Dankert

Graduate student Cord Eversole (left) is studying alligators to learn about the ecology of this species in coastal Texas.

geographic regions. The relationship between size and age is an important life-history trait of crocodylians because it allows age at maturity and senescence to be measured, and it is directly related to the age structure of the population.

In this study, an intensive mark-recapture effort will be used to assess the growth rates of alligators at 3 sites. Individuals will be captured and tagged with several uniquely numbered tags. Measurements such as total body length, snout-to-vent length, tail girth, eye-to-nare length, total head length, and live weight will be recorded. The following year, individuals will be recaptured, and the aforementioned data will be recorded and used to determine the growth rate of individuals in a year's time.

Wildlife agencies base their management decisions on growth data collected from other regions of the American alligator's range. The exploration of growth patterns and rates of American alligators throughout their range is essential because growth rates may be a regional phenomenon. Through examination of growth patterns among wild populations of American alligators, management practices can become more site specific as opposed to a "one size fits all" approach.

Cooperative funding provided by the East Texas Herpetological Society, Brazos Bend State Park Volunteer Organization, and the Armand Bayou Nature Center.

South Texas Wintering Birds Program: 2011–2012 Winter Season

Thomas M. Langschied and Fred C. Bryant

Mountain bluebirds invade South Texas! The mountain bluebird is typically a winter resident of the southwestern United States (including west Texas) and northern Mexico. During the earlier 6 winter seasons of the South Texas Wintering Birds (STWB) program, no mountain bluebirds were reported. But, within the 2011–2012 winter season there were 10 entries across 6 counties. The largest number reported was 15 individuals in Maverick County. This represents a notable and widespread winter movement of mountain bluebirds into South Texas.

Overall, 271 bird species were submitted to the STWB website during the 2011–2012 winter season (November–March) and 3 out of 5 months had 200 or more species reported. Participants from 19 South Texas counties reported their sightings. Some of the rarer species reported include surf scoter, white-winged



© David Hewitt

The mountain bluebird is a species that has begun to winter in South Texas.

scoter, prairie falcon, chestnut-collared longspur, crimson-collared grosbeak, and black-vented oriole.

The STWB website is designed for you the landowner and provides privacy of information at the property level. Help us better understand the winter bird life of South Texas by becoming a participant in the STWB program. The STWB program is a cooperative project between the CKWRI and Cornell Laboratory of Ornithology; to visit the STWB website go to www.stwb.org. And, if you need help with bird ID, do not forget that CKWRI recently published a birding guide for beginning bird-watchers entitled *A Guide to Birdwatching and South Texas Wintering Birds*, which is available in hard copy and PDF download.

Cooperative funding provided by the Elizabeth Huth Coates Charitable Foundation, Cornell Laboratory of Ornithology, Fondren Foundation, King Ranch Family Trust, Trull Foundation, George and Mary Josephine Hamman Foundation, and East Wildlife Foundation.

Determining Prevalence of Mange in Wild Animals in Southern Texas

M. Eric Mehlenbacher, Scott E. Henke, and Alfonso Ortega-Sanchez, Jr.

Sarcoptic mange, also called scabies, is a common, highly contagious skin disease of various species of mammals caused by mites. The life expectancy of the mite is only up to 6 weeks, but development is rapid. Fertilized adult female mites burrow into the skin of their hosts and lay 3 to 4 eggs per day. Hatching of

the eggs occurs within 3 days, of which the larvae dig burrows in the skin and create an intense burning and itching sensation within their host.

Mange has been reported from more than 100 species of mammals including humans, but sarcoptic mange has been most notable in canid species. High densities of social animals are at greatest risk, but any species that comes into contact with the mites can develop sarcoptic mange.

Clinical signs of acute sarcoptic mange include intense itching, abnormally oily skin, hair loss sometimes covering the entire body, thickening of the skin resulting in a bluish-gray skin color, emaciation, and death. Secondary infections by bacteria are common because of excessive scratching of the infected areas. Infected adult female hosts could have reduced ovulation and pregnancy rates. Severe mange can lead to about 80% host mortality.

In this study, wild mammals will be collected from southern Texas. Skin scrapings for mites, photographs, and blood samples will be obtained. Mites from the skin samples will be identified. Infected host species and the prevalence of sarcoptic mange will be determined. A map will be developed to highlight "hot spots" of mange and associated habitats.

Cooperative funding provided by the East Wildlife Foundation.

Human Attitudes towards the American Alligator

Jacob Ogdee, Cord B. Eversole, Scott E. Henke, and Bart M. Ballard

The American alligator is one of North America's top predators. It is considered a dangerous and well-adapted animal that can be found in a variety of wetland environments. This species inhabits the Gulf Coast region from Florida to Texas and the southern Atlantic states. For many humans the American alligator is shrouded in myth, sparked by Hollywood movies such as *Lake Placid*.

In order to acquire information about human attitudes toward alligators, and the thoughts that manifest those attitudes, we will be conducting a human dimensions study at Brazos Bend State Park. The park's main attraction is its alligators and is frequented by visitors primarily from the greater Houston area.

In our study, human fear, knowledge, and support for various alligator management practices will be assessed via a questionnaire. Park guests will be asked

to complete the survey with the intentions of attaining information to better manage alligators in Texas. Examples of questions include if citizens are willing to support alligator management that involves lethal or nonlethal methods and if citizens support programs that relocate alligators to sites near residential areas. The goal is to have over 200 completed surveys.

Upon completion of the study, data will be presented and shared with the Texas Parks and Wildlife Department to guide management strategies for the Texas American alligator program. In addition, information obtained will be useful in addressing solutions to human-alligator conflicts.

Cooperative funding provided by the East Texas Herpetological Society, Brazos Bend State Park Volunteer Organization, and the Armand Bayou Nature Center.

Landscape Appearance as a Cue for Avian Breeding in Unpredictable Environments

Ian C. Trewella, Fidel Hernández, Bart M. Ballard, David B. Wester, and David G. Hewitt

For avian species inhabiting predictable environments (e.g., temperate-zone ecosystems), day length is often used as a reliable indicator of upcoming favorable conditions. Day length, however, may prove to be an unreliable cue for reproduction in certain unpredictable environments (e.g., semiarid and arid lands) because of annual fluctuations in weather patterns. Breeding responses correlated with rainfall in unpredictable environments are traditionally thought to be driven by the materialized effects of rainfall (i.e., increased food abundance); however, evidence suggests that rainfall and its effect on vegetation may be the cue triggering breeding in certain species. The objective of our research is to experimentally test the influence of vegetation color on the reproductive responses of the northern bobwhite.

We are currently conducting an experiment at the Duane M. Leach Aviary, located on the Texas A&M University-Kingsville campus. Pen-raised bobwhite hens (one generation removed from wild birds) were randomly assigned to 1 of 4 treatments (9 hens per treatment, 3 replications per treatment): cages filled with (1) potted lush green bunchgrasses to simulate a wet environment, (2) potted dead bunchgrasses to simulate drought conditions, (3) an abrupt change of vegetation color from dead bunchgrasses to green bunchgrasses during the experiment, and (4) a control

treatment (no plants). We will quantify the reproductive response (i.e., reproductive hormone levels, number of eggs laid, and the timing of egg laying).

With the consequences of climate change bound to affect our natural world, understanding how avian species perceive and interact with their environment is becoming increasingly important. By using this knowledge to develop more efficient and productive management practices, we can help ensure the conservation of our desert species.

Cooperative funding provided by the TAMUK University Research Award and the South Texas Chapter of the Quail Coalition.

Movement of Adult Alligators within the Armand Bayou Watershed

Cord B. Eversole, Jacob Ogdee, Scott E. Henke, and Bart M. Ballard

The American alligator is known to be an elusive species and little is known about their daily activity patterns. Few studies have attempted to gather data concerning habitats that sexually mature American alligators occupy at different times of the day.

In this study, alligator movements will be documented from individuals that are native to the Armand Bayou watershed. This unique habitat includes multiple waterways that range from brackish to fresh water areas. Individuals will be trapped using swim-in live traps. Alligators at least 7 feet in length will be fitted with a radio telemetry transmitter and tracked at different times throughout the day. Behavior of the animal at the time of location also will be recorded.

Data obtained from this study will aid in the compilation of information to gain a more in-depth understanding of American alligator ecology and the relationship that the species has with its environment. By collecting data concerning habitat types that alligators prefer at different times throughout the day, biologists can better understand this complex species.

Cooperative funding provided by the East Texas Herpetological Society, Brazos Bend State Park Volunteer Organization, and the Armand Bayou Nature Center.

Molt-site Fidelity by Mottled Ducks in the Western Gulf Coast

Erin M. Wehland, Bruce E. Davis, Bart M. Ballard, Frank C. Rohwer, and Michael G. Brasher

We estimated molt-site fidelity for male and female mottled ducks throughout Texas and Louisiana. We evaluated all records of banded mottled ducks in Texas and Louisiana from 1967–2010. We used records of mottled ducks that were captured during molt and recaptured during molt in a subsequent year.

Fidelity was defined as an individual being recaptured in the same location as the initial capture location. We investigated the effects of age, gender, and habitat conditions on the probability of returning to the same location. We used the Palmer Drought Severity Index and age ratios of harvested mottled ducks as indices of habitat conditions.

- Of our sample of recaptured mottled ducks, 276 were females and 400 were males.
- Overall, 49.8% of recaptured females and 38.2% of recaptured males displayed site fidelity.
- Age, gender, and the Palmer Drought Severity Index were not significant factors explaining molt-site fidelity in mottled ducks.
- A significant negative relationship between habitat conditions (as indexed by harvest age ratios) and fidelity was detected for both males and females, suggesting that molt-site fidelity increases when habitat conditions are dry.
- Our findings suggest that during molt, mottled ducks use relatively permanent, stable wetlands that remain available during dry years when many other wetlands become dry.

Cooperative funding provided by Gulf Coast Joint Venture, Ducks Unlimited, Inc., Texas Parks and Wildlife Department, and Louisiana Department of Wildlife and Fisheries.

Waterfowl Foraging Values of Wetlands in Southern Texas

Michael K. Mitchell, Bart M. Ballard, Michael G. Brasher, and Jenneke M. Visser

During winter, waterfowl forage on a variety of seeds, invertebrates, and vegetation that provides energy for energy demanding events such as molt,

courtship, and migration. These foods vary in composition of macronutrients and amount of energy available. As a result, waterfowl will modify their diet based on their energy needs or on food availability.

Our study estimated the biomass of foods consumed by waterfowl, the energy they provide, and the carrying capacity of freshwater wetland types in southern Texas (Nueces, Kleberg, Kenedy, Willacy, and Cameron counties). Invertebrates, seeds, tubers, and submerged aquatic vegetation were sampled during the early migration period (September) and the early winter period (mid-November) in 2010 and 2011. We extrapolated our estimated energy values to the available wetland area in southern Texas during a winter of average precipitation.

- We identified waterfowl foods from 18 plant families and 29 invertebrate families.
- Wetland plant seeds and snails were the dominant foods found in the freshwater wetlands.
- Approximately 15,684 acres of freshwater wetlands were available in the 5 county study area.
- Approximately 1.6 trillion calories of energy in waterfowl foods are available during winter in southern Texas.
- The amount of energy estimated from freshwater wetlands in southern Texas will support the energy needs of about 51,000 ducks during a year of average rainfall.
- Our food energy and wetland area estimates will be used to support the bioenergetics model used by the Gulf Coast Joint Venture to estimate habitat deficit/surplus for waterfowl in southern Texas.

Cooperative funding provided by the Gulf Coast Joint Venture.

Molting Habitat Use by Female Mottled Ducks in Texas and Louisiana

Erin M. Wehland, Bruce E. Davis, Bart M. Ballard, Frank C. Rohwer, and Michael G. Brasher

During post-breeding, mottled ducks undergo wing molt and become flightless for about 3 weeks. During this period, wetland habitats that provide adequate cover and high-quality foods are important because of the mottled duck's increased risk of depredation while flightless and their increased nutrient requirements. Limited information exists regarding habitat use of molting mottled ducks.

During 2009 and 2010, we measured plant species composition, vegetation height, percentage of open water, percentage of mudflat coverage, water depth, and water salinity for 32 wetlands used by radio-marked female mottled ducks in Texas and Louisiana during the molting period. We also classified wetland type for 226 randomly selected wetlands of unknown use by molting mottled ducks to assess availability of wetland types throughout the coastal plain of Texas and Louisiana.

- It was considerably drier in 2009 than 2010, which affected wetland availability. For instance, 81% of randomly selected wetlands were dry, and thus unavailable in 2009, compared to 18% in 2010.
- Molting mottled ducks selected tidally influenced wetlands both years of the study, probably because water levels fluctuate less as a result of drought in these wetland types and they are more likely to be available in drier years compared to inland, non-tidal wetlands.
- Wetlands used by molting mottled ducks were characterized by 35% open water and 45% emergent vegetation (primarily smooth cordgrass and American bulrush).
- Basin size and amount of emergent vegetation were greater in wetlands used by molting mottled ducks compared to random wetlands.
- Submergent aquatic vegetation, such as wigeon-grass, was an important component of mottled duck molting sites in the wetter year. These plants are known to harbor diverse aquatic invertebrate communities that are high in protein, which is needed for feather growth.
- Management of wetlands during the post-breeding period should focus on providing intertidal, emergent marsh with submergent vegetation.

Cooperative funding provided by Gulf Coast Joint Venture, Ducks Unlimited, Inc., Texas Parks and Wildlife Department, and Louisiana Department of Wildlife and Fisheries.

Seasonal Movements by Adult Reddish Egrets

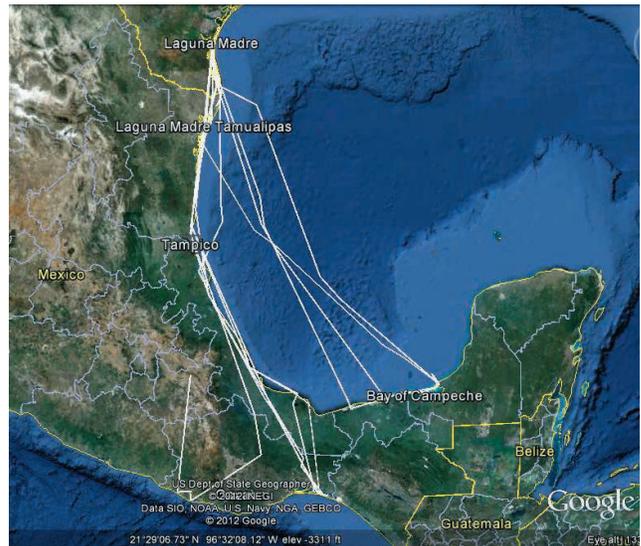
Daniel J. Reed, Bart M. Ballard, Brock J. Geary, and M. Clay Green

The reddish egret is North America's rarest and least studied heron. Its migration routes, stopover sites, and wintering areas are relatively unknown. We

monitored 21 adult reddish egrets marked with satellite Global Positioning Systems (GPS) transmitters during the breeding seasons of 2010 and 2011 and obtained 6 locations each day during migration and winter.

- Approximately half of the radio-marked adult reddish egrets migrated each winter while the other half remained near breeding sites.
- Fall migration was initiated in late October to mid-November when individuals made initial flights to the east coast of Mexico. Spring migration from wintering sites was initiated in mid-March and adults returned to the Texas Laguna Madre from late March to early April.
- During winters of 2010–2011 and 2011–2012, 3 individuals wintered in the Tamaulipan Laguna Madre, one wintered in the Bay of Campeche on the Yucatan Peninsula, and 3 wintered on the Pacific Coast of Mexico in Oaxaca.
- All migratory individuals, except the bird migrating to the Bay of Campeche, made stopovers to forage in an estuary just north of Tampico, Mexico, thereby identifying this area as a critical stopover site for migratory reddish egrets.
- Reddish egrets exhibited high winter site fidelity by returning to the same site as the previous winter.
- Identification of important stopover and wintering areas will help guide management plans and increase our understanding of habitat needs for this rare species.

Cooperative funding provided by the U.S. Fish and Wildlife Service, the National Fish and Wildlife Foundation, and the Walter Fondren, III Fellowship in Shorebird and Wading Bird Research.



Google map showing the migratory pathways used by monitored reddish egrets.

Understanding Implications of Tanglehead for Grassland Birds

Brian J. Bielfelt, Andrea R. Litt, Fred C. Bryant, Leonard A. Brennan, and Thomas M. Langschied

Invasive plants that alter native vegetation communities can affect grassland birds, but the effects may vary seasonally because of different habitat requirements throughout the year. Previous research has focused on examining the effects of invasive plants during the breeding season, with minimal investigation in winter. South Texas has ample and diverse summer and winter bird populations, thereby allowing investigation of seasonal responses.

Tanglehead is a native bunchgrass that behaves like an invasive grass. This species can dramatically change plant community composition and structure, which likely result in species-specific or season-specific responses by birds. In this study, we quantified changes in vegetation and monitored avian characteristics on 70, 15-acre plots representing a range of tanglehead dominance (0–80%) during the winter and summer periods of 2010 and 2011.

- Differences in structure and composition of the plant community were apparent, especially the increase observed in cover and density of the grass canopy with an increase in dominance of tanglehead. Conversely, diversity and abundance of native plants decreased.
- Changes in the plant community were consistent between seasons; however, avian responses depended on season. Three of 5 bird species detected in both seasons had different seasonal responses to tanglehead in winter compared to summer. In addition, avian species richness increased with tanglehead dominance in summer, but decreased in winter 2011.
- Some bird species did not differ across the tanglehead dominance gradient. Of the species that responded to tanglehead, presence or density decreased for 2 of 6 breeding bird species, whereas presence or density decreased for 4 of 7 wintering bird species.
- Only the Cassin's sparrow increased in presence and density in both seasons. No avian species decreased in presence or density in both seasons.
- Our results emphasize the need to examine the effects of invasive plants on wildlife during more than just one season.

- Tanglehead could have a greater negative effect on wintering grassland bird species compared to breeding grassland birds. Further, not all bird species are negatively affected by the recent increased dominance of tanglehead.

Cooperative funding provided by the donors to our Tanglehead Project, Texas A&M University-Kingsville, the George and Mary Josephine Hamman Foundation, and the Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust).

Release of South Texas Germplasm Sideoats Grama

Keith A. Pawelek, Forrest S. Smith, Anthony D. Falk, William R. Ocumpaugh, John Lloyd-Reilley, Shelly D. Maher, Robert Obregon, Juan Garza, and Andrew W. Scott, Jr.

Sideoats grama is the State Grass of Texas. It provides good cover for wildlife and is excellent forage for livestock on native rangelands. It is a bunchgrass that provides good nesting habitat for quail and is one of the most sought after and beneficial native plants for restoration, revegetation, and reclamation across the state. However, until now, South Texas did not have an adapted seed source for use in the region.

South Texas Natives, the USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center, and Texas AgriLife Research in Beeville released South Texas Germplasm sideoats grama for commercial production in late 2012. This release should greatly improve restoration seed mixes for our region.

- South Texas Germplasm sideoats grama is a blend of 6 populations of sideoats grama collected in the Rio Grande Plains of South Texas. Components of the blend originate from Atascosa, Frio, Medina, Uvalde, and Val Verde counties.
- The components of the release were selected after extensive evaluations of 47 native populations of sideoats grama over a 5-year period at 3 locations in South Texas.
- The seed for initial commercial production was distributed to Douglass King Seed Company in March 2012. The initial seed distributed was used to produce transplants for 5 acres of seed production. The first harvest of seeds from this planting will be replanted to establish 70 additional acres of commercial production by spring 2013.

- Limited seed of this release should be available for purchase by spring 2013.

Cooperative funding provided by the numerous donors to South Texas Natives.

Habitat Selection of Fox Squirrels on a College Campus

Trevor Kalich and Scott E. Henke

Eastern fox squirrels are a common occupant of suburban neighborhoods that have sufficient trees and forest-edge habitat. Fox squirrels can be found on the Texas A&M University-Kingsville (TAMUK) campus; however, they are not distributed throughout campus evenly. Our objective was to determine habitat preferences of eastern fox squirrels at TAMUK.

The TAMUK campus was divided into 4 habitat types: concrete, grassland, landscaped, and brushland. The relative abundance of fox squirrels within each habitat type was assessed monthly during 2011. In addition, fox squirrels were caught in live traps, anesthetized, marked, and released at the site of capture. Marked squirrels were observed throughout several 24-hour periods and specific habitat use and behavior were noted. Habitat preference or avoidance and usage of specific species of trees were evaluated using chi-square statistical analysis.

- Fox squirrels preferred landscaped areas and avoided the other habitat types.
- Squirrels avoided palm trees on campus, used mesquite trees in proportion to their availability, and preferred live oak trees.
- Squirrels used live oak trees for foraging and roosting, while the few palm and mesquite trees that were used by squirrels were only for roosting.
- Squirrel foraging behavior was inversely related to human activity; squirrels preferred to forage during morning hours, but switched to late afternoon during times when student activity on campus increased during the mornings.
- Information from this study can be used by urban wildlife biologists to improve the aesthetic value of city parks and neighborhoods by encouraging fox squirrel use.

Cooperative funding provided by the TAMUK University Research Award.

Delineation of Coastal Marsh Types Along the Central Texas Coast

Michael K. Mitchell, Bart M. Ballard, Michael G. Brasher, Jenneke M. Visser, and Eric J. Redeker

Wetlands along the Texas coast provide critical habitat for wintering waterfowl and many other water birds. The availability and quality of most foods consumed by waterfowl decreases as coastal marsh type changes from fresh to saline. Currently, spatial datasets only separate marsh types into 2 categories: fresh and estuarine. The goal of our research was to delineate coastal marsh along the central Texas coast into fresh, intermediate, brackish, and saline to improve our ability to estimate available energy of foods within these wetlands for waterfowl.

We delineated coastal marsh types in a portion of the central Texas coast using spatial data from the National Wetlands Inventory, Coastal Change Analysis Program, and Texas Parks and Wildlife Department as well as Landsat imagery. We sampled vegetation via a helicopter at systematically placed points during October 2011; marsh type was assessed based on the dominant vegetation community.

- We visited 342 sampling points and recorded the dominant vegetation community within a 100-foot diameter sample area.
- Our classification methods yielded an overall accuracy of 77.3%.
- We classified 213,310 acres as coastal marsh within the study area in Matagorda and Brazoria counties.
- Within the coastal marsh zone, 1,240 acres were classified as fresh marsh, 74,386 acres as



© Bart Ballard

Coastal freshwater marshes are a valuable resource for many resident and migratory wildlife species.

intermediate marsh, 63,533 acres as brackish marsh, and 74,151 acres as saline marsh. The remaining area was comprised of 29,761 acres of open water and 60,854 acres of other, non-marsh habitats (urban areas, forest, etc.).

- We found that fresh coastal marsh was relatively scarce (about 1%) in this portion of the central Texas coast, whereas intermediate, brackish, and saline marsh types comprised about equal (approximately 30%) distributions.
- The ability to delineate coastal marsh zones will allow biologists to better estimate marsh value to waterfowl and refine estimates of habitat requirements for wintering waterfowl populations within the central Texas coast.

Cooperative funding provided by the Jess Y. Womack, II Endowed Fellowship in Wetlands and Wetland Birds Research and the Gulf Coast Joint Venture.

Evaluation of Ecotypic Native Grasses for Reseeding Federal Lands in South Texas

Anthony D. Falk, Keith A. Pawelek, and Forrest S. Smith

Federal agencies are mandated to use native plant species when available to revegetate disturbed areas under their control. However, many agencies are reluctant to use native plants in reseeded projects because of the poor results often obtained when using maladapted native seeds.

To demonstrate the ability of *South Texas Natives* Program releases to be used on disturbed sites in South Texas, we reseeded a section along a roadway constructed in 2010 on Naval Air Station Kingsville (NASK). For this project, the seed mix consisted of low-growing native grasses to meet an additional goal of reduced mowing frequency and to maintain maximum visibility for security purposes. The seed mix was planted during autumn 2010 using a Truax native seed drill.

- By 2 years post-planting, density of native grasses averaged 0.52 seeded grass plants per ft².
- All 5 native grasses planted (slender, hairy, and Texas grama; hooded and shortspike windmill-grass) established within a year after seeding and persisted to 2 years after seeding.
- Vegetation cover of the site was 45% seeded native species and only 6% non-native grass at 1.5 years after planting.



© Anthony Falk

Despite drought conditions, successful revegetation has occurred along a federal land roadway in South Texas.

- While this site has received little rain to date, results by 2 years after seeding indicate that native plants performed adequately to meet coverage requirements and satisfy NASK goals.
- Based on the results of this project, we concluded that even under severe to extreme drought conditions, adapted native grasses can meet federal revegetation requirements on public lands located within South Texas.

Cooperative funding provided by Naval Air Station Kingsville and the numerous donors to South Texas Natives.

The Release of Hoverson Germplasm Deer Pea Vetch

William R. Ocumpaugh, Anthony D. Falk, Keith A. Pawelek, Jeff Rahmes, Robert Obregon, and Forrest S. Smith

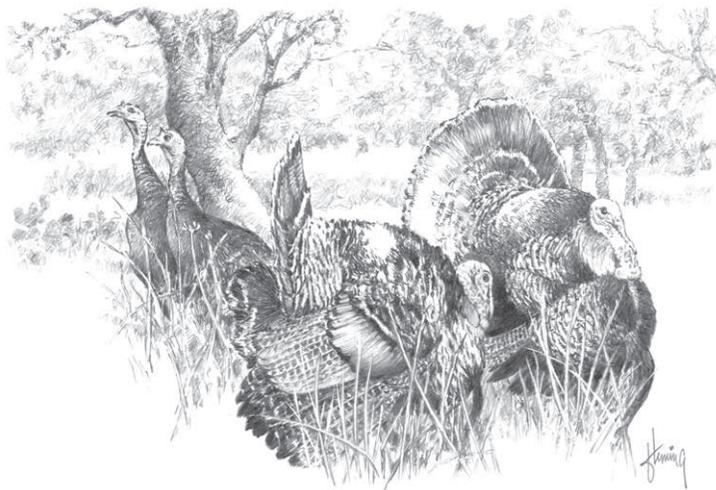
In 2012, Hoverson Germplasm deer pea vetch was released by Texas AgriLife Research Beeville, *South Texas Natives* (STN), and the USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center (PMC). This release provides the first cool season, annual native legume for rangeland plantings and will improve wildlife habitat and help enhance rangeland plant communities in South Texas and adjacent regions.

Source material of the release was collected by Dr. Richard Hoverson in 1998 from native plants located on the Eddie Knight property in La Salle County, Texas. The original evaluation and selection were

made by Texas AgriLife Beeville; the increase and distribution to commercial growers were made possible by STN and the PMC.

- Hoverson Germplasm deer pea vetch has shown consistent emergence (21 of 25 plots) and persistence (16 of 25 plots) in trial plantings throughout the Rio Grande Plains, Gulf Prairies and Marshes, Coastal Sand Plains, and Edwards Plateau of Texas.
- Good performance has been documented on sand, loamy sand, sandy loam, clay, and clay loam soils.
- Under ideal production conditions, Hoverson Germplasm can produce 300–600 pounds dry matter per acre averaging 24% crude protein.
- Hoverson Germplasm deer pea vetch has excellent competitive ability with buffelgrass and Kleberg bluestem; this release may be especially useful for efforts to diversify non-native grass monocultures to benefit wildlife.
- The seed of Hoverson Germplasm deer pea vetch should be available to consumers by fall 2013.

Cooperative funding provided by Texas AgriLife Research Station Beeville and the numerous donors to South Texas Natives.



Courtesy Texas Parks and Wildlife Department

Wild Felid Population Survey at NAS Kingsville's Escondido Ranch

Arturo Caso, William C. Stasey, Sasha Carvajal-Villarreal, and Michael E. Tewes

The distribution record of wild cat species throughout Texas is hindered by a lack of proper field surveys. Consequently, little is known about what species occurs within certain geographic regions. It is important to determine species occurrence and population trends throughout Texas to better address conservation and management strategies for cat species.

To learn more about the occurrence of wild cats, we used remote sensing cameras as a survey technique for cats on the Naval Air Station Kingsville's Escondido Ranch, located in McMullen County, from October 2010 through May 2011.

- After 2,840 camera-nights of surveys, we obtained 187 bobcat photos, yielding a success ratio of one bobcat photo per 15.1 camera-nights.
- Sixty (38 females, 22 males) bobcat individuals were identified with the aid of the computer program CAPTURE.
- Population density was calculated at a high level of 99 bobcats per 38.6 mi².
- No ocelots, jaguarundis, or mountain lions were identified with the use of remote-sensing cameras on the ranch.
- Our findings, based on using the camera survey technique, suggest that the bobcat population appears to be robust on Naval Air Station Kingsville's Escondido Ranch.

Cooperative funding provided by the U.S. Department of Navy and Wild Cat Conservation, Inc.

Use of Bat Houses by Mexican Free-tailed Bats on the TAMUK Campus

Scott E. Henke and the TAMUK Wildlife Society

Mexican free-tailed bats are commonly found in southern Texas. They often use the Spanish roof tiles as roosting sites on the Texas A&M University-Kingsville (TAMUK) campus.

In an effort to relocate Mexican free-tailed bats from campus buildings, the TAMUK Wildlife Society built and placed bat houses in trees at least 15 feet

above the ground and adjacent to buildings in which the bats were known to roost.

Unfortunately, bat houses may need to be established for months to years before they become occupied. In an attempt to reduce the time required for occupancy, bat guano was collected from an adjacent building used for roosting and smeared inside one of each pair of bat houses. The bat houses were monitored at dusk each week to determine bat use.

- The first bats began using the houses 3.5 months after establishment.
- Houses that were smeared with guano were occupied before the "clean" houses.
- Nearly 2 times more bats occupied the guano-smeared houses than the "clean" houses.
- Urban developers may wish to consider adding bat houses to design plans as a strategy to reduce bat populations within buildings.

Cooperative funding provided by the TAMUK University Research Award.

Temporal and Spatial Trends in Northern Bobwhite Survival and Nest Success

Chad J. Parent, Fidel Hernández, Fred C. Bryant, and David B. Wester

Northern bobwhite populations have been declining range-wide at a rate of 3.8% per year since 1966 based on Breeding Bird Survey data. To learn more about this decline, we conducted a retrospective analysis of 2 population parameters commonly reported for bobwhite populations: annual survival and nest success. Our purpose was to evaluate spatial and temporal trends in survival and nest success.

We attempted to determine the direction and magnitude of change in survival and nest success, and determine if survival and nest success were significantly different following a period of greater research and management attention in the 1990s.

- Mean (\pm Standard Deviation) annual survival of bobwhites was $13.8 \pm 9.4\%$ across 31 studies covering the period 1970–2007. Annual bobwhite survival decreased -0.51% per year during 1970–1994, but stabilized thereafter.
- Although stable through time, bobwhite survival decreased along latitudinal and longitudinal gradi-

ents in which survival was lowest at the northern and western periphery of the bobwhite's range.

- Mean nest success was $44.4 \pm 15.2\%$ across 33 studies from 1924–2008 and was stable throughout the 1990s. Nest success was lowest at the northern periphery of the bobwhite's range.
- Management efforts devoted to bobwhites appeared to have little influence on nest success.
- Logically, decreases in bobwhite survival should result in decreases in relative abundance. However, our analyses showed stabilization in survival after 1994 (according to radio telemetry estimates in the literature) despite a continuing decline in abundance. Assuming our analysis reflects reality, this suggests a possible decoupling of survival and abundance at broad scales.
- Our results also indicate a need for greater management attention to bobwhites at the periphery of their geographic range.

Cooperative funding provided by the South Texas Chapter of the Quail Coalition.

Potential Brown Treesnake Transport Pathways from Guam to the U.S.

Samantha S. Kahl, Scott E. Henke, Marc A. Hall, David Britton, Andrea R. Litt, David B. Wester, and Gad Perry

The brown treesnake is an arboreal predator whose accidental introduction and population explosion on the island of Guam have caused the extirpation of the avifauna on Guam and numerous other harmful effects to the island ecosystem. Shipments of cargo and household goods have been recognized as a pathway for brown treesnake transport to locations for which the snake is not native. Brown treesnakes have been stowaways in cargo of ships and planes that arrived in Hawaii, Texas, Oklahoma, Alaska, and Florida.

In this study, we analyzed shipments of military household goods leaving Guam during the period 2006–2009 in order to determine areas within the mainland United States that are receiving the bulk of items from the island. These terminal cargo points represent locations by which the brown treesnake can enter the United States.

- Of the 8,936 military shipments leaving Guam during 2006–2009, 98% originated from the Navy (66%) and Air Force (32%), with naval shipments increasing over time.

- Shipments from Guam were highest during April–June, with a second peak occurring during October and November.
- California receives more shipments (23% of total shipments) from Guam than any other state in the continental United States; Washington, Virginia, Florida, and Texas each received between 7 and 10% of all shipments.
- Guam is currently undergoing a military buildup during which cargo shipments are expected to increase. Therefore, information from this study can be helpful in inspection prioritization efforts for brown treesnakes.
- Our data demonstrate that there is a high potential for human transport of a highly invasive reptile species that, if established in the United States, could negatively impact native wildlife.

Cooperative funding provided by the U.S. Fish and Wildlife Service.

Evaluation of Nite Guard Solar Devices to Deter Wildlife Species

Melinda Schwartz, Will Fredericks, and Scott E. Henke

Wildlife inhabiting urban and suburban areas often cause damage to residential gardens and ornamental trees as well as over-turning garbage cans. Numerous coverings, shields, and devices have been developed to scare wildlife and keep them from depredating plants. Nite Guard Solar devices produce a continuous bright red flash of light from dusk to dawn, which is intended to scare wildlife from the area.



© David Hewitt

There is much interest in finding nonlethal ways of deterring nuisance wildlife such as this opossum.

Building on a previous study, we evaluated the efficacy of such devices by creating 6 baited areas (3 experimental sites with Nite Guard devices and 3 sites as controls with no devices) to attract various species of wildlife. A remote digital wildlife camera was placed at each site to record animal use. Three sites each night were randomly chosen to have a Nite Guard Solar device placed directly across from the bait at eye level to record small (e.g., skunks, opossums), medium (e.g., raccoons, coyotes), and large (e.g., deer) species for 30 nights.

- Bait sites were visited by raccoons (24%), coyotes (20%), skunks (38%), bobcats (0.5%), opossums (11%), javelinas (17%), and deer (26%).
- No differences were observed in the species of wildlife that visited the baits, frequency of species visits, and time spent at each site per visit between the control and experimental sites.
- Nite Guard solar devices did not appear to deter wildlife species in this particular study.

Cooperative funding provided by the TAMUK University Research Award.

Bird Migration Patterns Along the Lower Texas Gulf Coast

Suzanne Contreras, Bart M. Ballard, David B. Wester, William P. Kuvlesky, Jr., Leonard A. Brennan, Michael L. Morrison, and Kathy Boydston

The Texas Gulf coast is a critical migration corridor that facilitates the passage of millions of birds between



© Bart Ballard

The lower Texas Gulf coast is an important area for many species of migratory birds.

Number and average flight altitude of bird targets (individual birds and flocks) passing across a 0.62 mile wide radar sampling area during fall and spring migration at 2 sites along the lower Texas coast.

Site	Season	No. Targets	Average Altitude (ft)
Northern			
	Fall 2007	2,021,609	1,660
	Fall 2008	3,255,060	1,542
	Fall 2009	2,453,610	1,509
	Spring 2008	1,463,224	1,873
	Spring 2009	1,304,670	1,965
	Spring 2010	382,050	1,607
Southern			
	Fall 2008	1,108,442	1,040
	Fall 2009	1,527,012	1,056
	Spring 2009	567,664	1,466
	Spring 2010	653,270	1,414

their breeding and wintering grounds. Although migratory birds are known to rely heavily on the stop-over habitat in this region, many characteristics of bird migration have not been well studied. This gap in knowledge has been of great concern as coastal development in the region has increased.

This study monitored migratory bird movements using radar technology from fall 2007 through spring 2010. The timing, magnitude, flight direction, and flight altitude of birds were measured at 2 study sites along the lower Texas coast.

- Bird passage rates along the lower Texas coast were 2–19 times greater than bird passage rates estimated in other areas of North America.
- The peak passage of migratory birds during fall was extended over a longer period than during spring. In spring, peak migratory bird passage occurred during a 4-week period from mid-April to mid-May.
- On average, we recorded 2.8 times more bird targets (individual birds and flocks) migrating along the lower Texas coast during fall migration than during spring migration.
- During spring, bird migration was primarily at night, whereas migration was primarily during the daytime during fall.
- We detected bird migration up to 8,944 feet above ground level. However, 67% of birds migrated at altitudes below 1,500 feet, and 15% migrated below 500 feet. Average flight altitudes were 30% higher in spring than in fall.

- The results of this study provide detailed information on bird migration dynamics that is needed to improve coastal management decisions regarding the potential impacts of human-related development on migrating birds.

Cooperative funding provided by Texas Parks and Wildlife Department and the Robert J. Kleberg, Jr. and Helen C. Kleberg Foundation.

Population Genetics of Jaguarundis in Northern Mexico

Joseph D. Holbrook, Arturo Caso, Randy W. DeYoung, and Michael E. Tewes

The jaguarundi is a Neotropical felid that ranges from South America to northern Mexico. The species status has been designated as threatened in Mexico and declining in Central and North America. Many aspects of jaguarundi population ecology and genetic characteristics are poorly understood.

The objective of this study was to estimate the genetic diversity at neutral and adaptive loci in a peripheral population of jaguarundis in northern Mexico. From 1991–2004, we live-trapped 11 jaguarundis in Tamaulipas, Mexico, and collected blood samples of these cats for genetic analyses.

- We observed moderate levels of heterozygosity and allelic richness at 10 microsatellite loci.
- We observed no genetic diversity in mitochondrial DNA, but we documented diversity in a genetic locus that codes for coat coloration. The frequency of the melanistic mutation (gray coat phenotype) was 33%, whereas the frequency was 67% for the ancestral allele (red coat phenotype).
- The frequency of the melanistic mutation was lower in our sample than that previously reported in captive jaguarundis, which implies non-assortative mating is occurring in the wild population.
- Microsatellite loci provided adequate diversity, thereby allowing the use of noninvasive genetic tools to better understand the ecology of the elusive jaguarundi. However, microsatellite diversity of sampled jaguarundis was less than in sympatric populations of ocelots in Tamaulipas.
- Further study is needed to determine if low genetic diversity is a result of recent or historical events, or because the sampled population occurs at the periphery of the geographic range.



© Arturo Caso

A sedated jaguarundi in which measurements and blood samples were collected before its release back into the wild.

- This study represents the first genetic evaluation of free-ranging jaguarundis, and provides important baseline information for future research and conservation efforts.

Cooperative funding provided by Tim Hixon and the Feline Research Center of the Caesar Kleberg Wildlife Research Institute.

Field Testing an Aging Key on White-winged Dove Nestlings

William C. Colson, Trevor Kalich, Joshua A. Berckenhoff, Alan M. Fedynich, David. B. Wester, and Corey Mason

There is a limited amount of information on wild white-winged dove nestling development stages. It is important to be able to accurately estimate the age of wild white-winged dove nestlings, which will aid in determining nest initiation, egg laying, incubation, and hatch dates from examination of selected characteristics of the wild nestlings and back-dating. By having population-level information, biologists will be able to better manage the eastern white-winged dove population in Texas. Our study evaluated the usefulness of a captive white-winged dove aging key (developed in 2009) to age wild nestlings.

- Though characteristics of wild nestlings occurred in a progression similar to captive nestlings, there was extensive overlap in developmental characteristics for wild nestlings.



© William Colson

Being able to age nestlings allows wildlife biologists to evaluate various aspects of the reproduction effort.

- For 9 of 10 developmental characteristics monitored, significant differences occurred between captive and wild nestlings, necessitating the development of a new aging key.
- Several preliminary aging keys were developed, but all had low accuracy when attempting to age nestlings ± 1 day of actual age. The final aging key used a partitioning statistical procedure that identified attributes for 2 age classes (nestlings 1–6 days old and nestlings 7–14 days old) that had high levels of accuracy.
- Overall, 10 of 14 age categories were correctly scored 100% of the time to exact age or within ± 1 day of hatching.
- With sufficient training, individuals should be able to (1) age most nestlings within ± 1 day of hatching and (2) age nestlings that have extensive overlap in developmental characteristics within ± 2 days.

- A supplemental photograph guide of each day of nestling growth was also created to facilitate aging nestlings accurately. The new key will further enable biologists and researchers to accurately age nestlings, and aid in determining when nesting begins, and when nestlings leave their nests.

Cooperative funding provided by Texas Parks and Wildlife Department.

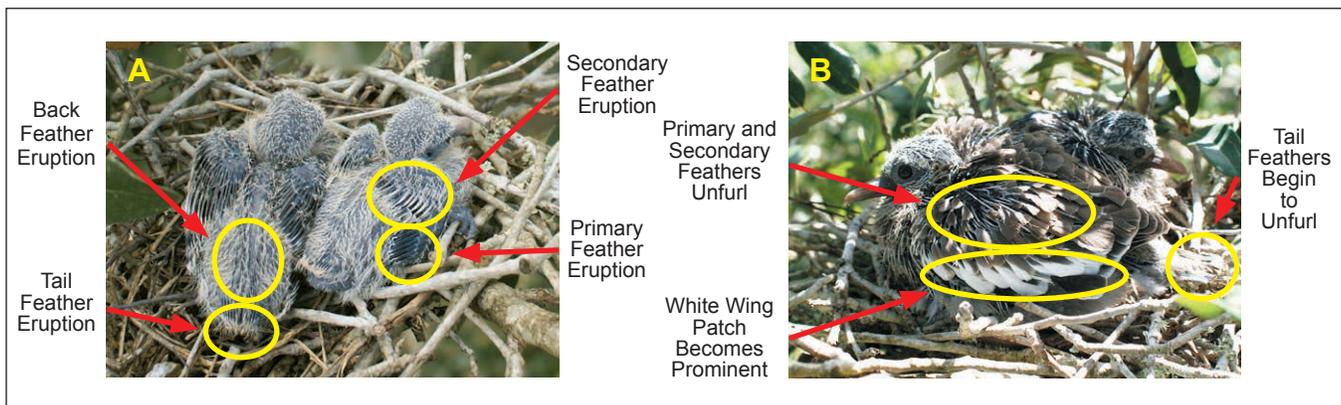
Effects of Population Density on Deer Foraging Dynamics

Kory R. Gann, Donald J. Folks, David G. Hewitt, Timothy E. Fulbright, Charles A. DeYoung, Kim N. Echols, and Don A. Draeger

Selective foraging by white-tailed deer at high deer densities may lead to over utilization of higher quality forages, causing reduced biomass, abundance, and nutritional quality of available vegetation. This selective foraging may ultimately affect deer productivity and survival.

The objective of our study was to determine the effects of white-tailed deer density on deer foraging behavior, forage use, and diet quality in southern Texas. These effects were evaluated using the deer bite count technique from summer 2009 to spring 2011 with tame does placed permanently in 200-acre enclosures that contained either low (10 deer) or high (40 deer) population densities. Each season was sampled under drought conditions in one year and non-drought conditions in the other.

- Researchers observed 241,166 bites taken by tame female deer during 165 hours of foraging time. The

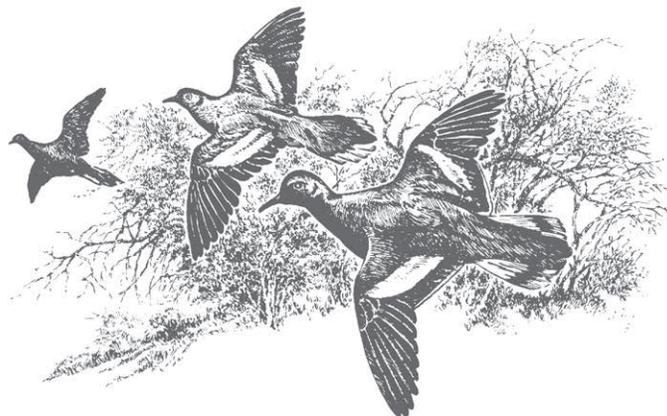


Important features of younger (A: 1–6 days old) and older (B: 7–14 days old) white-winged dove nestlings used to age nestlings to day or ± 1 day.

white-tailed deer took bites of 137 plant species during the study.

- Deer population density did not appear to affect deer foraging behavior, diet diversity, forage use, or diet quality.
- Grasses comprised a higher proportion of deer diets in high density deer enclosures compared to low density deer enclosures (1.3 vs. 0.3%), but biologically the difference was unimportant.
- Drought conditions, rather than overall white-tailed deer density, affected many measures of deer foraging dynamics.
- During drought, digestible protein in deer diets was lower during the autumn, winter, and spring when compared to non-drought conditions. In addition, deer diets tended to be less diverse and consisted of more browse and less forbs during drought.
- In the stochastic (random), semiarid environment of South Texas, precipitation appears to have a much greater affect on white-tailed deer foraging dynamics than deer density.

Cooperative funding provided by the Comanche Ranch and T. Dan Friedkin, Faith Ranch, and Stedman West Foundation.



Courtesy Texas Parks and Wildlife Department

Deer Visitation Rates at Medicated Bait Sites in Southern Texas

Chase R. Currie, David G. Hewitt, Greta L. Schuster, J. Alfonso Ortega-Santos, David B. Wester, Tyler A. Campbell, and Kimberly Lohmeyer

Eradicating cattle fever ticks from rangelands in southern Texas requires treating deer with systemic or topical pesticides. Our objective was to determine visitation rates of white-tailed deer at medicated bait sites and whether rates varied by sex and season.

We captured 240 deer on 4 study sites in Zapata County along the Rio Grande River. Each deer was uniquely marked with colored and numbered ear tags for subsequent identification. We used motion-triggered cameras to monitor deer visitation at bait sites monthly from March 2010–February 2012.

- A greater proportion of marked bucks (65%) visited bait sites than marked does (32%), averaged across all survey periods.
- Bucks were photographed more per sampling period (11.3 vs. 5.3) and had a higher probability of being photographed (0.33 vs. 0.17) on any given night during the sampling period than does.
- Seasonally, buck visitation was highest during spring and lowest during winter, whereas doe visitation was similar in all seasons.
- Fawn visitation was lower than doe visitation at bait sites; visitation of marked fawns ranged from 0–25% throughout the study.
- The effectiveness of treatment techniques could be improved by increasing doe and fawn visitation rates to medicated bait sites.

Cooperative funding provided by USDA CSREES Agriculture and Food Research Initiative (AFRI) and South Texas Chapter of the Quail Coalition.

Longevity and Viability of *Baylisascaris procyonis* Eggs in Soil

Jacob Ogden, Scott E. Henke, and David B. Wester

Baylisascaris procyonis is a large raccoon parasite with zoonotic potential. Females can produce millions of eggs per day, which are shed in raccoon feces. Once defecated, scats decay and the eggs leach into the soil, posing a health risk to susceptible hosts.

In this study, we placed *B. procyonis* eggs on the surface of wet and dry sand, silt, clay, and loam soils in full sun and shade, and monitored egg leaching and viability within the soil column for 2 years. Soil columns were divided into depths of 0–0.4 inches, 0.5–1.2 inches, 1.3–2.4 inches, and 2.5–4.0 inches.

- All *B. procyonis* eggs were recovered within 4 inches of the soil surface of all soil textures with associated moistures and vegetation canopies.
- About 60% of the *B. procyonis* eggs remained on the surface of dry sand, silt, and loam soils, whereas 100% of the eggs remained on the surface of dry clay soils.
- Over 92% of *B. procyonis* eggs remained viable after 2 years in the southern Texas environment.
- *Baylisascaris procyonis* is an important zoonotic parasite that physicians and veterinarians should include in differential diagnosis.

Cooperative funding provided by the Harry L. Willet Foundation.

Genetic Analysis and the Management of Chronic Wasting Disease in West Virginia

Randy W. DeYoung, Aaron M. Foley, David G. Hewitt, James M. Crum, and Kip P. Adams

Chronic wasting disease (CWD) occurs in various species of deer, including white-tailed deer. Management efforts for CWD often aim to reduce the density of female deer in the affected area to limit contacts among individuals. We obtained genetic data from 550 white-tailed deer sampled in the CWD focal region in West Virginia from 2006–2011 to determine the effects of harvest on population structure.

- A positive spatial autocorrelation was observed between female pairs occurring less than 0.5 miles apart, probably because of female relatives in close geographic proximity. The autocorrelation values for pairs of females within 0.5 miles increased from 2006–2011, coincident with changes in female age structure because of harvest.
- Increased autocorrelation as doe age structure decreased suggested fewer generations of female relatives in the sample.
- Some pairs of CWD-positive females collected within 6 miles of each other were closely related,

while CWD-positive male relatives were collected up to 18 miles apart.

- Females had positive values of FIS (an index of genetic structure that reflects the presence of inbreeding or related individuals within social groups), whereas the FIS for males fluctuated.
- Harvesting affected fine-scale genetic structure, but the effects were subtle. Changes to the substructure of males may reflect delays in timing of dispersal or removal of putative dispersers through harvest.
- Dispersing males are likely agents of CWD transmission over greater spatial distances, while females likely transmit the disease through local contact. Thus, spread of CWD is influenced by the differing behavior of males and females.

Cooperative funding provided by the Quality Deer Management Association, National Fish and Wildlife Foundation, and the West Virginia Division of Natural Resources.

Rate of Decay of Raccoon Scats Infected with *Baylisascaris procyonis* Eggs

Jacob Ogden, Scott E. Henke, and David B. Wester

Baylisascaris procyonis is a large nematode that occurs in the small intestine of raccoons. The prevalence of *B. procyonis* in humans is unknown, but potentially can be high, especially in endemic areas where suburban sprawl increases the likelihood of frequent human contact with raccoons and their feces. In this study, we investigated the length of time and weather conditions necessary for raccoon feces to decay to determine the likelihood of infected raccoons contaminating their environment with *B. procyonis*.

Raccoons were captured and maintained in captivity to determine the frequency of defecation. A 136-acre area was searched each week for 8 weeks, and the number and location of raccoon scats were recorded using a Global Positioning Systems (GPS) unit. Also, 25 fresh, *B. procyonis*-infected scats were placed on level terrain in southern Texas to monitor decay rates.

- On average, raccoons produced one scat per day.
- Only 5% of the 884 scats found on the study area were identified as "latrine" sites.
- Fresh raccoon scats decayed in direct relation to the amount of precipitation they received (i.e., 8 inches of precipitation for complete decay).
- Eggs from decayed scats were found up to 20 inches from where the scat was originally deposited.

- A single *B. procyonis*-infected raccoon can contaminate 0.7 acres per year with *B. procyonis* eggs.

Cooperative funding provided by the Harry L. Willet Foundation.

Prevalence of Cattle Fever Ticks on Deer in Southern Texas

Chase R. Currie, David G. Hewitt, Greta L. Schuster, J. Alfonso Ortega-Santos, David B. Wester, Tyler A. Campbell, and Kimberly Lohmeyer

Several studies have indicated that deer can serve as alternative hosts for cattle fever ticks (CFT), thus complicating the treatment and eradication of these ticks in livestock. White-tailed deer are treated systemically (ivermectin laced corn) from 1 February to 31 July and topically (permethrin) from 1 August to 31 January for cattle fever ticks in southern Texas.

Our objective was to determine the prevalence of the tick *Rhipicephalus microplus* as a function of bait-site visitation rates of white-tailed deer and assess the relationship between tick numbers and permethrin levels and ivermectin concentrations.

We captured 240 deer in Zapata County along the Rio Grande River on 4 study sites. Blood samples were collected from each deer, deer were wiped for the presence of permethrin, and all ticks found on the deer were collected. Deer visitation at medicated bait sites was monitored using motion-triggered cameras.

- Males had more photos per sampling period (11.3 vs. 5.3) and higher levels of ivermectin (32 parts



© Randy DeYoung

Captured white-tailed deer were examined for ticks that transmit cattle fever.

per billion vs. 13 parts per billion) than females. Furthermore, 50% of does did not have detectable ivermectin in their serum.

- Premethrin was present on 94% of the bucks and 53% of the does tested.
- Results indicate that males spend more time at medicated bait sites; therefore, males should have lower levels of CFTs. However, averaged between years, tick numbers were statistically similar for both sexes (males = 5.8, females = 6.3).

Cooperative funding provided by USDA CSREES Agriculture and Food Research Initiative (AFRI) and South Texas Chapter of the Quail Coalition.

Assessment of Helminths in Bobwhites from the Rolling Plains of Texas

Stacie M. Villarreal, Alan M. Fedynich, Leonard A. Brennan, and Dale Rollins

The bobwhite in Texas has been declining over the past several decades, generating growing concerns about possible causes. Studies of parasites infecting bobwhites in Texas are lacking and most have used hunter-harvested bobwhites, thereby providing little insight about infections throughout the year. Our objectives were to assess helminths in bobwhites during an annual cycle and determine whether infections are related to season, host age, and host sex.

- Nematodes were the most prevalent and numerically dominant, represented in order of abundance by the cecal worm *Aulonocephalus pennula*,



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Graduate student Stacie Villarreal studied parasites found in northern bobwhites.

eyeworm *Oxyspirura petrowi*, proventricular worm *Tetrameres pattersoni*, and gizzard worm *Dispharynx nasuta*. Cestodes (*Rhabdometra odiosa* and *Rallietina* spp.) and acanthocephalans (found in the cystacanth stage) occurred infrequently and in low numbers.

- Adult bobwhites were infected with more individual helminths than young juveniles (6–10 weeks old) or old juveniles (over 10 weeks old).
- Prevalence and abundance values of *A. pennula*, *O. petrowi*, and *T. pattersoni* did not vary by host sex, indicating that males and females were similarly exposed to infective stages of these species.
- The juveniles in August had the most dissimilarity in helminth prevalence and abundance, compared to the other periods and age groups. This resulted from most young juveniles not being infected.
- *Dispharynx nasuta* and cystacanths are reported for the first time in bobwhites from the Rolling Plains.
- We confirmed that the *Tetrameres* occurring in bobwhites from this region is *T. pattersoni*, which is thought to be more harmful than *T. americana*.

Cooperative funding provided by the Rolling Plains Quail Research Foundation.

Deer Use of the Landscape in Areas under Quarantine for Cattle Fever Ticks

Chase R. Currie, David G. Hewitt, Greta L. Schuster, J. Alfonso Ortega-Santos, David B. Wester, Tyler A. Campbell, and Kimberly Lohmeyer

White-tailed deer occurring along the Mexico and Texas border may be heavily infested with the cattle fever tick (CFT) and can maintain CFTs in pastures. Furthermore, the rate of CFT spread among pastures is greater than if only cattle were maintaining the ticks.

Our objective was to assess the scale of deer movements in the quarantine zone relative to bait sites, and determine what habitat types deer preferred. We captured 48 deer on 3 sites in Zapata County along the Rio Grande River. Each deer was fitted with a collar containing a Global Positioning Systems (GPS) unit, which recorded the deer's location every 30 minutes.

- Bucks had larger home ranges (2,072 vs. 1,027 acres) and larger areas of concentrated use (360 vs. 224 acres) than does.
- The maximum axis of each deer's home range was greater for bucks than does (2.8 vs. 2.2 miles).

- All bucks had locations near bait sites; only 66% of does had locations within 50 yards of a bait site.
- Deer preferred mesquite/riparian habitat over mixed-brush, herbaceous, and bare ground habitat types throughout the year.
- Findings suggest bucks may pose a greater threat to disease spread on a landscape scale than does. Furthermore, deer preferred habitat conducive to tick production.

Cooperative funding provided by USDA CSREES Agriculture and Food Research Initiative (AFRI) and South Texas Chapter of the Quail Coalition.



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Influenza A Virus in Mammalian Species of Texas

Joni S. Edwardson, J. Alfonso Ortega-Santos, Tyler A. Campbell, and Jeffrey S. Hall

Avian influenza viruses may affect mammals in addition to avian species. The purpose of this study was to characterize influenza A virus in mammals.

We collected 1,032 nasal swabs and 762 serum samples from mammals across Texas and sent them to the National Wildlife Health Center in Madison, Wisconsin. Samples were analyzed there using the enzyme-linked immunosorbent assay (ELISA), a technique to detect antibodies, and the polymerase chain reaction (PCR), a technique to amplify DNA and RNA.

- Influenza A virus was successfully isolated from 0.39% of the nasal swabs.
- Antibodies were detected in 0.5% of serum samples.
- Findings will allow influenza A to be further narrowed down to specific hosts. These results can better define human risk of contracting influenza A from wild mammalian species in Texas.

Cooperative funding provided by the U.S. Geological Survey and USDA Animal and Plant Health Inspection Service.

Effect of Extreme Temperatures on the Viability of *Baylisascaris procyonis* Eggs

Jacob Ogdee, Scott E. Henke, and David B. Wester

Baylisascaris procyonis is a nematode of raccoons and is considered an emerging zoonotic health threat. Raccoons enter attics of houses, use pet doors, live

The raccoon roundworm *Baylisascaris procyonis* is a parasite that can harm humans.

in garages, and forage in vehicles if windows are not tightly closed. Infected raccoons that defecate in such areas greatly enhance the risk of *B. procyonis* exposure to humans.

The lethal temperature for *B. procyonis* eggs is considered to be 150°F. We investigated the viability of *B. procyonis* eggs placed in attics with and without exhaust fans, garages, vehicles, and in the southern Texas environment. Temperature and humidity data loggers recorded measurements every 30 minutes throughout the year. Our hypothesis was that locations where temperatures exceed 150°F will kill *B. procyonis* eggs, which in turn, would eliminate the health risk to humans.

- Differences in extreme temperatures occurred between locations, but only vehicles parked in the sun with windows closed exceeded 150°F.
- Temperatures above 150°F occurred only in July and August.
- Viability of *B. procyonis* eggs in vehicles that exceeded 150°F was 12–23%; eggs in the other locations remained viable (above 90% survival).
- Conditions to render all *B. procyonis* eggs unviable did not occur in southern Texas. Therefore, *B. procyonis*-infected raccoons that defecate within or near dwellings and vehicles can pose a health risk to humans.

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