Caesar Kleberg Wildlife Research Institute

© David Hewitt

Current Research 2010–2011

This year's cover features a photograph taken by David Hewitt symbolizing how important water is to the wildlife and habitats of South Texas. The recent droughts of 2009 and 2011 punctuate how vital water is to all living things.

Editor Alan M. Fedynich, Ph.D.

Reports in this issue of Current Research often represent preliminary analyses, and interpretations may be modified once additional data are collected and examined. Therefore, these reports should not be cited in published or non-published works without the approval of the appropriate investigator.

Use of trade names does not infer endorsement of product by TAMUK.

December 2011

Report of *Current Research*

September 1, 2010 to August 31, 2011

Caesar Kleberg Wildlife Research Institute

Dick and Mary Lewis Kleberg College of Agriculture, Natural Resources and Human Sciences
Texas A&M University-Kingsville
Kingsville, Texas

A Member of the Texas A&M University System

FOREWORD

When I wrote this essay last year in the fall of 2010, we had just come off the second wettest September–September on record. This came on the heels of the driest September–September period on record (2008–2009). I swore I never wanted to see another summer like 2009. It was a beat-down summer. Then came 2011. As I write this essay, I ache for the land and its wildlife.

On Bobwhites

In spite of the year we have had, bobwhite reproduction has surprised us—broods have been reported when none or few should exist. It does not mean a banner year or even huntable populations, but it is a testament to the hardy characteristics of this amazing bird and the will to live. If we can give it a good home (habitat), keep from parceling its home up into small pieces (fragmentation), and get a little help from Mother Nature, they will be in good shape in South Texas.

There has been an inexplicable and drastic decline of quail in the Rolling Plains, and our friends in that region have launched a study to see whether diseases and parasites might play a role in this disturbing trend. Our own Dr. Alan Fedynich was invited to participate because he is the "go-to" scientist when it comes to bird parasites. We are lucky to have Alan on our CKWRI team.

Texas Native Seeds

One of our successful programs, *South Texas Natives* (*STN*), was founded a decade ago by a few supportive landowners and **TxDOT**. With its partners at the *USDA Plant Materials Center* and at *Rio Farms*, it has been so successful that **TxDOT** has funded an extension of this project, ***Texas Native Seeds***, to begin working in central and west Texas as well. We applaud **TxDOT** for its vision and encouragement, but we need private funding to match the **TxDOT** funding. Private support has been lacking for the central and west Texas work.

Because of our work, **TxDOT** recently took <u>all</u> non-native plants out of their roadside specifications for the bottom half of South Texas. This is not only a tribute to *STN* but also to the commitment and confidence **TxDOT** has in our program and the commercial native seed industry, primarily *Douglass W. King Seed Co.* and *Pogue Agri Partners*. Native seeds developed by *STN* and their partners, and produced by these companies, are finding broad use, from levees in the Rio Grande Valley, to pipeline right-of-ways crisscrossing the Eagle Ford and on private lands. What an impact this program has had.

It's Not Just The Water Holes That Dried Up

Despite taking serious and unavoidable cuts ($140,000 over the next 2 years) to our state funding for the Institute, ***the Caesar Kleberg Partners and Sustaining Contributors*** saved our operating budget and several jobs. With our endowment working again, we are making progress toward recovery. Unfortunately, the research funding from Texas Parks and Wildlife Department (TPWD) and federal agencies is drying up just like your dove pond or stock tank did this past summer. Monies that were available to fund some of our work in the past will not be there in the foreseeable future.

That said, one of the newest partners we have been blessed to work with is the **East Wildlife Foundation**, one of the most exciting foundations to appear in South Texas in many years. Projects on ocelots, wintering birds, and large mammal baseline surveys are ongoing as we speak, and are collaborative efforts with TPWD and other institutions. Because wildlife on the Foundation's 200,000 acres will never be hunted or intensively managed, it provides a fantastic and fascinating laboratory to understand how wildlife populations tick when they are totally unaffected by man, except for cattle grazing. Thanks to the vision and generosity of **Robert East**, a man who lived South Texas ranching from sun-up to sun-down every day of his life, there is a lasting legacy to understand how ranching and wildlife can coexist. This is an amazing gift to every Texan.

The Eagle Ford Shale

The Eagle Ford will have the greatest impact on wildlife and its habitat of any single activity in the past 50 years. If you have driven south or east of San Antonio, you know what I mean. This is an opportunity for us to help understand the impacts and suggest options for reduced impact, but we have only had meager success at raising funds for this kind of research.

In October 2010, Carter Smith (TPWD Director) and I gave a presentation to 2,000 participants at the Eagle Ford DUG Conference in San Antonio. And yet, we have had little response from the industry to help with restoration techniques and best management practices. **Pioneer Natural Resources**, **ExxonMobil**, and **ConocoPhillips** have been the most interested, but it will take a far greater commitment to deal with all of the potential wildlife and habitat issues. Given there are upwards of 200 companies currently working in the Eagle Ford, there is great potential for a wildlife research initiative.

In closing, it is hard for me to express the outpouring of support we have in South Texas. And, it even goes beyond our beloved region. We receive donations from people who don't live, hunt, or own land in South Texas. They just send a donation and say "keep up the good work." It doesn't get more heart-warming than that.

Best wishes for a great Holiday and Christmas Season, and, close to my heart,

Good Hunting.

Fred C. Bryant

NAMED ENDOWMENTS

Endowed Center

Richard M. Kleberg, Jr. Center for Quail Research

Endowed Chairs

Stuart W. Stedman – Deer Research

Leroy G. Denman, Jr. – Director

C. C. (Charlie) Winn – Quail Research

Frank Daniel Yturria – Wild Cat Studies

Endowed Professorships

Algur H. and Virginia Meadows – Semi-Arid Lands Research

Alfred G. Glassell, Jr. – Quail Research

Endowed Fellowships

Sam Walton – Quail Research

Elliott and Adelle Bottom – Quail Research

Alice Kleberg Reynolds – Quail Research

Walter Fondren, III – Shorebird and Wading Bird Research

Jess Y. Womack, II – Wetland and Wetland Bird Research

Betty and George Coates – Habitat Restoration and Enhancement Research

Endowed Lectureship

David W. Killam – Deer Research

Named Endowments

T. Dan Friedkin – Deer Research

F. Peter Zoch – Habitat Enhancement

Ed Whitacre – Wildlife Research

Frank and Mary Grace Horlock – Wildlife Research

Tom C. Frost – Wild Turkey Research

Ben and Daphne Vaughan, III – Bird Research

Tim and Karen Hixon – Wild Cat Research

Jack Brittingham – Deer Research

Buddy and Ellen Temple – Native Plant Research

R. M. Kleberg – Native Plant Development

Neal King Memorial / Las Islas Wildlife Research Fund

Graduate Scholarships

Bob and Rebecca Palmer

Al E. Leonard

Phil M. Plant

NAMED FACILITIES AND COMPONENTS

Tio and Janell Kleberg – Wildlife Research Park

Buddy Temple – Wildlife Pathology and Diagnostic Building

Duane M. Leach – Avian Research Facility

Albert and Margaret Alkek – Ungulate Research Facility

Curtis and HP Pinnell – Auditorium

Petra Vela Kenedy – Conference Room

A. E. Leonard Family – Native Plant Garden

Water Feature – in honor of *Erma Colston Riedel*, given by the *Colston Family*

T. Dan Friedkin Family – Spanish Portico

Karen and Phil Hunke Family – Foyer and Reception Area

Henry and Ann Hamman – Bobcat Bronze

Gateway – in honor of *Tio and Janell Kleberg*, given by *Tim and Karen Hixon*

Frank and Mary Yturria – Mesquite Conference Table

Cactus Garden – in honor of *Larry Sheerin/Ed Randall*, given by *Betty Lou Sheerin and Ellen Randall*

Bordas Escarpment Theme – in honor of *Radcliffe and Sue Killam*, given by the *David Killam Family*

Lee and Ramona Bass – South Texas Oak Motte Theme

Jim McAllen Family – Unique South Texas Plants

Garden Benches – given by *Robert Hewitt; Betty and Bob Kelso*

South Texas Brushlands Theme – in honor of *Tio and Janell Kleberg*, given by *Danny and Shirley Butler*

Buddy and Ellen Temple – Native Plant Trellis

Native Prairie Theme – in honor of *Faye and Raye King*, given by *Diane King Scovell*

Spanish Doors – in honor of *Jack and Loyce Funk*, given by the *Funk Family*

Spanish Doors – given by *Ruth E. Sullivan*

Native Plants of the Sand Sheet – given by *Presnall and Stephanie Cage* and *Grady and Caroline Cage*

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...

Tobin Armstrong
William A. Bienhorn
Ralph Bingham
Michael Corbett
Bond Davis
Gaye Davis
Dan L. Duncan
Ruth Gilliland
Alfred Glassell, Jr.
"Slow" Grissom
Gus Groos
Felo Guerra
Annabell Guinn
Henry Hamman
Anne Harris
Bruce F. Harrison
Karen Higginbotham
Tim and Karen Hixon
Christopher Horton
Col. Sam W. Hoskins, Jr.
Buddy Jeffers
Curt Johnson
Simpson Kampman
John W. Kelsey
Neal King
Tio Kleberg
Scott Kneese
Rolanette and Berdon Lawrence
Christine Craft Leggett
Johnny Leslie
Annett Loyd
Rodolfo Madrid
Todd Martin
Mason L. Matthews, Jr.
Helen McFarland
John G. Muckleroy
Josephine Musselman
Betty Phillips
G. Allen Rasmussen
Juan Salinas
Wesley Sayers
Walter Schiel
Frates Seeligson
John Shivers, Jr.
Randy Toney
C. C. "Charlie" Winn
Jess Y. Womack, II
Seymour Wormser

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

CKWRI PERSONNEL

Scientists and Staff

Mr. Felix A. Alvarez, Temporary Research Worker
Ms. Lorena H. Alvarez, Administrative Assistant III
Dr. Bart M. Ballard, Associate Professor
Mrs. Yolanda Ballard, Office Manager
Mrs. Sara K. Barrera, Facilities Specialist
Mr. Jared T. Beaver, Temporary Research Worker
Dr. Leonard A. Brennan, III, Professor
Dr. Fred C. Bryant, Executive Director
Mr. Arturo Caso, Research Associate
Dr. Charles A. DeYoung, Jr., Research Scientist
Dr. Randy W. DeYoung, Assistant Professor
Mrs. Kim N. Echols, Director Comanche-Faith Deer Research Program
Mr. Anthony D. Falk, Manager, Native Plant Collections and Evaluations
Dr. Alan M. Fedynich, Associate Professor
Dr. Timothy E. Fulbright, Professor
Mrs. Venie A. Fulbright, Research Associate
Mr. Delmiro L. Garcia, Facilities Manager
Dr. Lon I. Grassman, Jr., Research Scientist
Ms. DeAnna L. Greer, Accounting Assistant
Dr. Scott E. Henke, Professor
Dr. Fidel Hernández, Associate Professor
Dr. David G. Hewitt, Professor
Mrs. Nancy T. Jennings, Coordinator, Special Projects
Mr. Curt P. Kleist, Research Assistant
Dr. William P. Kuvlesky, Jr., Associate Professor
Mr. Thomas M. Langschied, Research Associate
Dr. Andrea R. Litt, Assistant Professor
Mr. Mark A. Madrazo, Master Gardener
Ms. Mia McCraw, Research Associate
Mr. Robert Obregon, Research Associate
Mr. William R. Ocumpaugh, Research Associate
Dr. J. Alfonso Ortega-Santos, Associate Professor
Mr. Keith A. Pawelek, Assistant Director, South Texas Natives Program
Mrs. Annette E. Peterson, Administrative Assistant III
Mr. Justin M. Rattan, Temporary Research Worker
Mr. Eric J. Redeker, Research Scientist
Mrs. Christyn L. Reopelle, Purchasing Specialist
Dr. Sandra Rideout-Hanzak, Assistant Professor
Mrs. Selinda A. Rojas, Purchasing Specialist
Ms. Gina M. Ruiz, Support Service Specialist
Mr. Joseph P. Sands, Research Associate
Mrs. Jere C. Sepuvelda, Grants Compliance Specialist
Mr. Colin S. Shackelford, Research Associate
Mr. Forrest S. Smith, Director, South Texas Natives Program
Dr. Michael E. Tewes, Professor
Mrs. Anne B. Thurwalker, Coordinator, Development Relations
Mr. Aaron D. Tjelmeland, Research Invasive Grass Specialist
Mrs. Rebecca S. Trant, Administrative Officer
Dr. David B. Wester, Professor
Mr. Damon L. Williford, Lab Technician II

Graduate Students

Mr. Felix Ayala-Alvarez
Ms. Elizabeth M. Bates
Mr. Brian J. Bielfelt
Ms. Andrea Bruno
Ms. Sasha Carvajal-Villarreal
Mr. Arturo Caso
Mr. William C. Colson
Ms. Suzanne Contreras
Mr. Nathan S. Cook
Ms. Erin E. Cord
Mr. Kelly S. Corman
Ms. Brandi L. Crider
Mr. Chase R. Currie
Ms. Michele L. de Verteuil
Mr. Robin N. Donohue
Mr. Jeremy W. Edwardson
Ms. Joni S. Edwardson
Mr. Cord Eversole
Mr. Anthony D. Falk
Mr. Aaron M. Foley
Mr. Donald J. Folks
Mr. Kory R. Gann
Mr. Lucas W. Garver
Mr. Steven J. Goertz
Ms. Cristela Gonzalez
Mr. Eric D. Grahmann
Mr. Beau D. Hester
Mr. Joseph D. Holbrook
Ms. Kristan E. Jenschke
Mr. Donald C. Kahl, Jr.
Mr. Robert D. Kaiser, III
Mr. Dale F. Kane
Mr. Nathan D. Kelley
Ms. Jennifer M. Korn
Mr. John S. Lewis
Mr. Dawson W. Lilly
Ms. Karla G. Logan-López
Mr. Carlos A. Lopez-Morales
Mr. Ron A. Milgalter
Ms. Katherine S. Miller
Mr. Michael K. Mitchell
Mr. Chad J. Parent
Mr. Marshall B. Pierce
Ms. Whitney J. Priesmeyer
Mr. Daniel J. Reed
Mr. Joseph P. Sands
Mr. William C. Stasey
Mr. Trent W. Teinert
Mr. Ian C. Trewella
Mrs. Amy J. Turner
Mrs. Stacie M. (Mahan) Villarreal
Ms. Erin M. Wehland
Mr. Dean W. Wiemers
Mr. Damon L. Williford
Mr. Asa S. Wilson
Ms. Samantha S. Wisniewski
Mr. Mark J. Witecha
Mr. Cody J. Zabransky

EXTERNAL PROJECT SPONSORS AND COOPERATORS

Bo Adkins
Alligare, LLC
Les Allison
American Museum of Natural History
Bill Applegate
Arizona Game and Fish Department
Johnny Arredondo
Billy Atwell
Gene Aycock
Rene Barrientos
Lee and Ramona Bass Foundation
Bell Museum of Natural History
Albert Biedenharn, III
Borderlands Research Institute at Sul Ross State University
Elliot B. and Adelle Bottom Fellowship in Quail Research
Russell Bowers, Gaujolote Ranch
Mark Bowles
The Brown Foundation, Inc.
Cactus Jack Ranch
Caesar Kleberg Partners
Caesar Kleberg Wildlife Research Institute Project Tanglehead donors and contributors
Presnall Cage
Richard and Peggy Calvert
Gus T. Canales
Cargill, Inc.
David Carroll
Brady F. Carruth
Lou Carter
Chaparral Wildlife Management Area, Texas Parks and Wildlife Department
Elizabeth Huth Coates Charitable Foundation
George and Betty Coates Fellowship in Habitat Research
James and Kathy Collins
Comanche Ranch
ConocoPhillips
Consejo Nacional de Ciencia y Tecnologia
Loring Cook Foundation
Michael and Charles Corbett Scholarship
Cornell Laboratory of Ornithology
Joe Davis
David and Jamie Deming
Dudley T. Dougherty Foundation
Donnie Draeger, Comanche Ranch
D. Lynn Drawe, Rob and Bessie Welder Wildlife Foundation (retired)
Ducks Unlimited, Inc.
Tom T. East, Sr. and Alice K. East, and Alice H. East, and Robert C. East Wildlife Foundation
Louis Etzel
ExxonMobil
ExxonMobil Foundation
ExxonMobil Summer Internship Program
Faith Ranch
Field Museum of Chicago
Flint Hills Resources
James Floyd
Fondren Foundation
Walter Fondren III Fellowship in Shorebird and Wading Bird Research
Fort Worth Zoo
L. R. Robin French, III
T. Dan Friedkin
Friedkin Conservation Fund
Friends of Laguna Atascosa National Wildlife Refuge
Fundacion Produce Tamaulipas, A.C.
Tommy R. Funk, Sr.
James F. Gallagher, Texas AgriLife Extension Service
Regan and Billy Gammon
Mark Garrett
J. R. Gibbs
Alfred C. Glassell Jr. Endowed Professorship in Quail Research
Russell Gordy
Grasslans Charitable Foundation
Shawn Gray
Helen Groves
Guerra Brothers
Gulf Coast Joint Venture
Lauro A. Gutierrez
The Ewing Halsell Foundation
George and Mary Josephine Hamman Foundation
Henry R. Hamman
Will Harte
C. L. Hawkins
Michael W. Hehman, Hixon Ranch
Mickey Hellickson
Jeff Hildebrand
Paul Hinch
Hispanic Leaders in Agriculture and Environment
Hixon Ranch
Tim and Karen Hixon Foundation
Houston Gulf Coast Safari Club
Houston Livestock Show and Rodeo
Houston Safari Club
Dan Allen Hughes, Jr.
Karen and Phil Hunke
Thomas Hunt
Robin Hurt Safaris, Ltd.
International Bank of Commerce
A. C. Jones, IV
W. W. Jones, III
Kansas Department of Wildlife and Parks
Joan and Herb Kelleher Charitable Foundation
Betty Kelso and the Coates Foundation
David Killam
Killam Ranches
Craig King
King Ranch Family Trust
King Ranch, Inc.
Marc Bartoskewitz
Justin Feild
Mathew Schnupp
Butch Thompson
Douglass W. King Seed Company
David Kitner, Killam Ranches
Richard M. Kleberg, Jr. Center for Quail Research
Robert J. Kleberg, Jr. and Helen C. Kleberg Foundation
Tio Kleberg
Kolkhorst Petroleum
La Paloma Ranch
La Rucia Ranch
Laborcitas Creek Ranch
Celeste Lacy
Las Cautas Ranch
Las Lunas PMC
Berdon Lawrence
Lawrence Family Foundation
A. E. Leonard Family Giving Counsel
A. E. Leonard Scholarship
Ken Leonard
Rick Leverich
Pat Ley
John Lloyd-Reilley
Meridith Long
Cullen Looney
Louisiana Department of Wildlife and Fisheries
Louisiana State University
Lubbock Safari Club
Duane Lucia
James McAllen
Joseph McCord
Robert McNair
C. E. Miller and Family (Bill, Jill, Jason, Albert, Jody)
Gene Miller
Mississippi Department of Wildlife, Fisheries, and Parks
Missouri Department of Conservation
Malone Mitchell, III
Montana State University
Angel Montoya
Dale Murden
Museum of Texas Tech University
Charles Nash, Jr.
National Fish and Wildlife Foundation
National Museum of Natural History (Smithsonian Institution)
Native Plant Society of Texas
Natural History Museum of Los Angeles County
The Nature Conservancy
Naval Air Station Kingsville
Samuel Roberts Noble Foundation

Sustaining Donors and Contributors previously listed in the *Current Research* report are now presented in CKWRI's new publication *Annual Giving Report.*

Richard Nunley
Oklahoma Department of Wildlife
Oregon Department of Fish and Wildlife
Joseph Orr
Bob and Rebecca Palmer Scholarship
Dexter and Sara Peacock, Las Cuatas Ranch
Pecos River Water Control and Irrigation District #3
Kathryn and Scott Petty
Lica East Pinkston
Pioneer Natural Resources
Mike Pittman
Phil Plant Scholarship
Pogue Agri Partners
Marisue Potts
Quail Associates Program
Quail Forever (San Antonio Chapter)
Quail Unlimited (South Texas Chapter)
Quality Deer Management Association
Ed Rachal Foundation
Rancho Blanco
Rancho Caracol
Ellen Randall
Felipe Reveilhac
Alice Kleberg Reynolds Fellowship in Quail Research
Rio Farms, Inc.
Barry Roberts
Clay Roberts
Rolling Plains Quail Research Foundation
Rolling Plains Quail Research Ranch
Dale Rollins
Rosewood Foundation
Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust)
Chip Ruthven
Jimmy Rutledge
San Antonio Livestock Exposition, Inc.
Robert Sanders, Temple Ranch
John T. Saunders, Jr.
Sanford D. Schmenitz
Annaliese Scoggin
Andy Scott
Arthur A. Seeligson, Jr. Conservation Fund
Shining Ranch
Paula Skrobarczyk
Ford Smith
Greg and Nadine Smith
William A. and Madeline Welder Smith Foundation (Joe Coleman)
South Texas Charity Quail Hunts, Inc.
South Texas Natives Donors
South Texas Quail Coalition
South Texas Quail Research Project
Julie Kelleher Stacy
Stuart W. Stedman
Stuart W. Stedman Endowed Chair in Deer Research
Stedman West Foundation
Austin Stolte
Mike Sullins
Mark Sullivan
Misty Sumner
Danny Swepston
David Synatzske, Texas Parks and Wildlife Department
George Tanner
Frances Tapp
Tarleton State University
Billy Tarrant
Buddy and Ellen Temple, Temple Ranch
Temple Land and Cattle Company
Texas A&M University, College Station
Texas A&M University-Kingsville
Texas A&M University-Kingsville College of Graduate Studies
Texas A&M University-Kingsville Office of the Associate Vice President for Research
Texas A&M University-Kingsville's Title V-Promoting Post-baccalaureate Opportunities for Hispanic Americans Program
Texas A&M University-Kingsville's University Research Award
Texas Academy of Science/Texas Organization of Endangered Species
Texas AgriLife Extension Service
Texas AgriLife Research
Texas AgriLife Research Center in Stephenville
Texas AgriLife Research Center in Uvalde
Texas AgriLife Research Station in Beeville
Texas Chapter of The Wildlife Society
Texas Cooperative Wildlife Collection
Texas Department of Transportation
Texas Parks and Wildlife Department
Texas Quail Coalition (South Texas Chapter)
Texas State Council of the Quail Coalition
Texas Tech University
Trull Foundation
Mark Tyson
U.S. Army Corps of Engineers
U.S. Department of Defense
U.S. Department of Navy
U.S. Fish and Wildlife Service
U.S. Geological Survey
USDA Agricultural Research Service
USDA APHIS
USDA APHIS Veterinary Services
USDA APHIS Wildlife Services
USDA APHIS Wildlife Services Kingsville Field Station
USDA APHIS Wildlife Services National Wildlife Disease Program
USDA APHIS Wildlife Services National Wildlife Research Center
USDA CSREES
USDA CSREES Agriculture and Food Research Initiative
USDA CSREES Avian Influenza Coordinated Agricultural Project Grant
USDA National Institute of Food and Agriculture (NIFA)
USDA Natural Resources Conservation Service
USDA Natural Resources Conservation Service Plant Materials Program
USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center
USDA Natural Resources Conservation Service James E. "Bud" Smith Plant Materials Center
University of California-Los Angeles
University of Nebraska-Lincoln
University of Kentucky
Uranium Energy Corporation
Utah Division of Wildlife
Ben Vaughan, III
Victoria Chapter of the Grazing Lands Conservation Initiative
Victoria County Soil and Water Conservation District
William Eshleman Vogt
William T. Vogt, Jr.
Gary Waggerman Memorial Scholarship
Bryan Wagner
Wagner Ranch
Sam Walton Endowed Fellowship in Quail Research
Washington Department of Fish and Wildlife
Rob and Bessie Welder Wildlife Foundation
Jack R. and Loris J. Welhausen Experimental Station
Neva and Wesley West Foundation
Wild Cat Conservation, Inc.
Harry L. Willet Foundation
Charles A. Williams
Wallace Wilson
C. C. Charlie Winn Endowed Chair for Quail Research
Jess Y. Womack II Fellowship for Wetland and Wetland Bird Research
Louise S. Womack
Womack Ranch
Dana Wright
Yale Peabody Museum
Frank D. Yturria
Frank D. Yturria Chair in Cat Research
JP Zachary

TABLE OF CONTENTS

IN-PROGRESS RESEARCH

WHITE-TAILED DEER

The Comanche-Faith Project

******End of In-Progress Comanche-Faith Project Abstracts******

BOBWHITES AND OTHER QUAIL

INVASIVE PLANTS

WILD CATS

HABITAT ENHANCEMENT AND RELATIONSHIPS

BIOLOGY, ECOLOGY, AND MANAGEMENT

DISEASES AND PARASITES

COMPLETED RESEARCH

DEER AND QUAIL

HABITAT ENHANCEMENT AND RELATIONSHIPS

BIOLOGY, ECOLOGY, AND MANAGEMENT

The Comanche-Faith Project

Donald J. Folks, Kory R. Gann, Brandi L. Crider, Whitney J. Priesmeyer, Nathan S. Cook, Dawson W. Lilly, Asa S. Wilson, Charles A. DeYoung, Timothy E. Fulbright, David G. Hewitt, Kim N. Echols, Don A. Draeger, Eric D. Grahmann, Travis Hawkins, and Carlos E. Gonzalez

The Comanche-Faith Project, named after the 2 ranches on which the study is replicated, is a large, long-term enclosure project. The overall purpose of the research is to determine the best combination of supplemental feed and deer density for intensive deer managers.

The study design consists of 6 high-fenced enclosures of 200 acres each on both the Comanche and Faith ranches in Dimmit County, Texas. The enclosures were constructed in 2004, and the overall study is in its 7th year. There are 3 target deer densities for the enclosures consisting of 1 deer per 20 acres (low density, 10 deer per enclosure), 1 deer per 8 acres (medium density, 25 deer per enclosure), and 1 deer per 5 acres (high density, 40 deer per enclosure). These are real deer densities, not observed densities from helicopter surveys as is commonly used in South Texas. There are 2 enclosures of each density on both ranches, one enclosure contains supplemental feed and the other does not. All enclosures have a central water trough, and enclosures with a supplement have pelleted feed provided free-choice in 2 adjacent feeders near the water trough.

Numerous projects are being conducted within the overall experimental design described above. Some projects use all 12 enclosures, others a subset. Progress on each of these studies is described below.

Cooperative funding for the 12 projects below is being provided by the Comanche Ranch, T. Dan Friedkin, the Faith Ranch, and the Stedman West Foundation. Additional support for several graduate students is provided by the Houston Livestock Show and Rodeo, Houston Safari Club, the Texas Quail Coalition (South Texas Chapter), and Hispanic Leaders in Agriculture and Environment.

Influence of Population Density on Deer Foraging Dynamics

As browsing intensity increases with increasing white-tailed deer density, the most palatable forage species may be depleted, potentially causing a shift in the diet towards less-desirable food items and a decline in diet quality. Social factors also may influence deer foraging behavior as deer densities increase. Previous research suggests that deer in a high density population should have lower nutrient intake rates, higher dry matter intake rates, and greater diet breadth to account for lower nutritional quality.

To examine the effects of density on foraging behavior in South Texas, 3 tame does were placed in research enclosures that vary in deer density and have no supplemental feed. A voice recorder was used to record the species, bite size, and total number of bites for each plant consumed during a 2-hour foraging period for each doe, seasonally from summer 2009 to spring 2011. Samples of each plant species or parts consumed were collected for nutritional analyses.

Preliminary results show that deer in the high density treatment consumed 29% more browse and 35% less forbs than deer in the low density treatment across all seasons. Deer in the high density treatment tended to consume a greater number of plant species and consumed 139% more cacti during winter than deer in the low density treatment. These results suggest that at high densities and without supplement, deer in South Texas may shift towards less nutritious forage classes and expand the breadth of their diet.

Deer Density and Supplemental Feed Effects on White-tailed Deer Population Dynamics

Herd density and nutrition impact population dynamics in white-tailed deer such that as deer populations approach carrying capacity, diet quality declines resulting in lower body size, antler size, survival, and fawn production. Supplemental feed likely increases carrying capacity, allowing managers to support more deer before density dependent effects become evident. However, populations cannot increase indefinitely without habitat damage and behavioral stress resulting from overcrowding.

The objective of this project is to determine an optimum deer density with supplemental feeding at which the potential for producing trophy deer is greatest. To meet this objective, deer population size is being estimated twice a year using camera surveys after which adjustments to maintain target densities are completed. Various body measurements are taken on all captured

deer in addition to weight, body condition, and antler score for analysis of density dependent effects.

Results of this research will help landowners and land managers make decisions about the appropriate density needed to maintain their deer herd as well as the effects of pelleted rations on carrying capacity.

Population Density Effects on Supplemental Feed Use by White-tailed Deer

The provision of supplemental feed to white-tailed deer is a management technique widely used in Texas. However, deer densities may affect the proportion of feed in individual deer diets. At high densities, high quality forage may be lacking, forcing deer to consume more supplemental feed than deer occurring at low densities. Conversely, dominance hierarchies may limit access to supplemental feed for individuals of subdominant gender and age classes at high densities. The objective of this research is to determine the effects of population density on supplemental feed consumption by white-tailed deer.

The percentage of supplemental feed in the diet will be estimated using carbon stable isotope ratios of the vegetation, supplemental feed, and deer tissue. Tissue will be collected from deer with free-choice access to supplemental feed in the research enclosures. Tissue from deer without access to supplemental feed will be collected to determine isotope ratios of the natural vegetation. Estimates of supplemental feed in the diet of individual deer will allow us to determine if deer density, gender, and age class affect supplemental feed consumption of white-tailed deer.

Understanding the relationship between deer population density and supplemental feed consumption will help managers increase the effectiveness of their supplemental feeding program, thereby providing better deer herd management.

Patterns of Antler Growth in Male White-tailed Deer

Supplemental feed is often used to increase nutrient availability for white-tailed deer in Texas. The addition of a quality supplemental feed ration may improve antler growth in male white-tailed deer. Moreover, there may be an interaction between supplemental feed and deer density, which might affect antler growth. Our objective is to evaluate the effects of supplemental feed and deer density on antler growth in male white-tailed deer.

Antler growth will be examined using antler measurements taken from deer handled and photographed during research activities. Males will be evaluated by age class, antler characteristics, and antler size (gross Boone and Crockett antler score). When possible, antler scores will be obtained throughout successive years from the same buck to evaluate growth patterns over time. Comparisons among antler scores will be made to determine the effect of supplemental feed and deer density on antler growth.

Understanding the interaction between supplemental feed and deer density and their effects on antler growth can help landowners modify wildlife management techniques on their property to improve antler quality and size.

White-tailed Deer Fawn Survival and Bed-site Selection

White-tailed deer fawn mortality rates have been studied throughout South Texas, but bed-site selection, based on concealment or thermal characteristics, has not been examined. The objective of this project is to assess white-tailed fawn survival and bed-site selection as they relate to deer densities and access to supplemental feed.

In April 2011, vaginal implant transmitters (VIT) were placed into 50 does divided among enclosures varying in provision of supplement and deer density. VITs emit a different signal when expelled at birth allowing researchers to locate newborn fawns. Implanted does are being monitored 3 times daily. Newborn fawns will be fitted with radio collars, and their body measurements recorded. Radio signals from

© Larry Ditto

Learning about bed-site selection by fawns will provide information that can be used for better management.

collared fawns will be monitored several times each week for up to 6 months and all mortalities recorded. Each fawn birth site will be sampled for plant cover, along with a randomly selected control site. Radio collared fawns will be checked daily for survival. At 14- and 28-days of age, fawn bed-sites, along with a randomly paired site, will be sampled using the initial birth-site sampling procedures. Fawn bed-sites at different ages will be compared to determine whether there is a difference in site selection by age of fawn.

Survival data from this project will help clarify density and supplemental feed effects on deer population dynamics in South Texas. Greater understanding of fawn bed-site characteristics will provide guidance to those seeking to manage habitat to benefit fawns.

Patterns of Supplemental Feed Use by White-tailed Deer

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

Supplemental feed use will be measured weekly by tracking the amount of feed added to feeders. The number of deer in each enclosure will be used to express feed consumption on a per capita basis. Evaluations include the effect of number and sex ratio of deer, season, drought, and forage quality on supplemental feed use. Knowledge of factors influencing supplemental feed use can help managers make informed decisions about their supplemental feeding program to improve deer on their property.

Influence of Deer Density and Resource Enhancement on Vegetation Biomass

Availability of nutritious feeds may alter selection of natural forages by white-tailed deer, although it is unclear how feeding and increasing deer densities impact vegetation. Increasing deer densities and consumption of nutritionally balanced pelleted feeds by deer may lead to increased foraging pressure on palatable plants, reducing their abundance.

Twenty 164-ft transects were placed within each enclosure, and vegetation biomass was harvested each

© Steve Bentsen

CKWRI research is focused on learning what factors are needed to maintain and improve deer populations.

March and August from 2004–2011 in 20 randomly selected plots per enclosure. Browse biomass and cacti biomass were similar among deer densities and feeding treatments during both spring and summer. Deer density and feeding did not affect forb biomass during 2005–2009; however, in 2010 forb biomass declined with increasing deer density whether deer were provided supplemental feed or not.

Preliminary results indicate that it has taken several years for trends in biomass production to develop. Forb standing crop varied in response to annual variation in rainfall more than response to increasing deer density or feeding; variation in rainfall may contribute to a lag affect in vegetation response to the treatments.

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

Access to nutritious feeds may alter selection of natural forages by white-tailed deer, but the impacts of supplemental feeding and increasing deer density on highly palatable plants are unclear. Kidneywood, granjeno, guayacan, orange zexmenia, and bush sunflower are important in white-tailed deer diets and these plants are considered highly palatable.

Plant density was estimated by height class (small: less than 1.6 ft, medium: 1.6–5 ft, and large: greater than 5 ft) along 20 belt transects in each enclosure annually from 2004 to 2011.

Based on preliminary results, density of palatable plants appears to be more strongly related to annual variation in rainfall than to deer density and supplemental feeding.

Deer Density and Supplemental Feeding Effects on Density of Browse Species

Supplemental feed is used to meet a variety of management objectives, but may result in disproportionate consumption of palatable browse species. Each summer during 2004–2011, canopy cover of browse species was estimated along 20 transects within each enclosure. Change in canopy cover was compared from the beginning of the study in enclosures with and without supplemental feed and among deer densities to determine if supplemental feeding results in reduced canopy cover of palatable forbs and shrubs.

Deer density and supplemental feeding have had little effect on woody plant canopy cover. The results are unclear, in part, because of the variation in rainfall from year to year, which may mask treatment effects.

Influence of Deer Population Density and Supplemental Feed on Carrying Capacity

The evaluation of habitat quality is fundamental in making decisions about land management. Available forage quality and quantity determine the maximum number of animals an area can sustain. Managers may attempt to improve habitat; however, weather patterns characteristic of South Texas can cause wide variations in habitat carrying capacity. Providing supplemental feed is a common management practice in Texas, which is used to lessen the effects of variation in forage availability on deer nutrition.

Each of 20, 164-ft transects, evenly distributed throughout each enclosure, will be sampled to estimate plant biomass by forage class within plots annually in March and August. The forage availability model will be used, which accounts for an area's annual forage production and a nutritional-based model, which incorporates both forage nutrient content and biomass values to estimate carrying capacity seasonally on a per-enclosure and per-ranch basis. Understanding feed and density effects on nutritional and forage-based carrying capacities of a given rangeland will help improve current deer management strategies.

Studies are focusing on how supplemental feeding influences carrying capacity and foraging patterns.

Assessing the Consumption of Supplemental Feed by Raccoons

Supplemental feeding of white-tailed deer is a widespread management technique in Texas. The objective of this research is to determine the effect of raccoons on feed consumption by estimating the percentage of supplemental feed in raccoon diets using ratios of stable isotopes of carbon in blood and tissue.

Tissue will be collected from raccoons with and without access to supplemental feed. After raccoons are euthanized, blood and liver samples will be collected, frozen, and analyzed for stable isotope ratios. Results will be used to estimate the proportion of each raccoon's diet composed of supplemental feed.

Understanding the relationship between the influence of non-target species and supplemental feed consumption will allow managers to determine how much feed is being lost during summer months when deer most require the supplement for gestation and lactation, as well as body and antler growth. Information resulting from this research can be used to increase the effectiveness of supplemental feeding programs, thus providing better management of the deer herd.

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

Wildlife managers are interested in the driving forces behind habitat selection and preferences exhibited by white-tailed deer. The use of supplemental feed can increase the number of animals a given habitat can support, influencing deer habitat choices and habitat management strategies. Because deer can exhibit sexually dimorphic habitat preferences and complex social structures, it can be difficult to detect the ultimate factors responsible for their habitat choices.

Research was conducted from December 2009 to December 2010 on 37 deer equipped with Global Positioning Systems (GPS) radio collars. Deer

© Randy DeYoung

Individual deer may select specific habitats based on deer density, access to supplemental feed, and water availability.

locations were obtained at 30-minute intervals and activity levels were recorded every 15 minutes.

Preliminary analysis indicates a greater spatial separation between individuals in high deer density enclosures compared to the low-density enclosures, supporting the idea that social interactions play an important role in how deer use the surrounding habitat. Deer in low density enclosures also appear to travel greater daily distances than deer in high density enclosures. Additionally, deer in the high density enclosures with supplemental feed were found to use feed and water sites 67% more often than the deer in the low density enclosures.

These findings suggest that herd density and availability of feed influence the way deer distribute themselves and use the landscape. Further examination of deer habitat choices should help determine how deer density and the presence of supplemental feed alter deer habitat usage.

****End of In-Progress Comanche-Faith Project Abstracts****

Evaluation of DMP Pens for Increasing Antler Size on Texas Ranches

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

Texas Parks and Wildlife Department issues Deer Management Permits (DMPs) to qualified ranches for controlled breeding activities of white-tailed deer. These ranches are allowed 1 buck and up to 20 does to be held in an enclosure during the breeding season. This project is evaluating how antler size of a population is affected by this permit.

The study is being conducted on the Faith Ranch in Dimmit County, Texas. Adjacent 1,100-acre treatment and control areas surrounded by high fence were established in 2007. Both areas are under an intensive supplemental feeding program. Most resident deer were removed from the treatment area, and it is being restocked with offspring from DMP pens each year. The control area has resident deer that were enclosed when the surrounding high fence was built. DMP pens contain bucks and does captured on the Faith Ranch. 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 and antler size compared within age classes.

In 2008, 2009, and 2010, treatment yearlings (1.5 years) differed by an average of +9, -2, and 0 Boone and Crockett (B&C) inches from control yearlings. In 2009 and 2010, treatment 2.5-year-olds differed by +6 and +5 B&C inches from those in the control area. In 2010, 3.5-year-olds differed by +7 B&C inches from those in the control area.

Cooperative funding provided by the Faith Ranch.

Assessment of Nite Guard Solar Devices to Deter White-tailed Deer

Melinda Schwartz, Trevor Kalich, and Scott E. Henke

White-tailed deer often are cited as causing damage to residential gardens, ornamental trees, and silviculture plantings. Numerous coverings, shields, and devices have been developed to scare deer 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 deer from the area.

The efficacy of such devices will be evaluated by creating 6 baited areas to attract white-tailed deer. A remote digital wildlife camera will be placed at each site to record deer use. Three sites each night will be randomly chosen to have a Nite Guard Solar device placed directly across from the bait. Testing will be conducted for 30 nights (180 site-nights). This research will help landowners and foresters determine if Nite Guard devices deter white-tailed deer.

Genetic Divergence among Subspecies of White-tailed Deer in Mexico

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

The white-tailed deer is the most important game species in Mexico. Fourteen subspecies are recognized, but management has focused on the texanus and couesi. More landowners in Mexico are practicing intensive management aimed at increasing antler size in the managed populations. The texanus deer are valued for their relatively larger antlers, compared to the other subspecies, and they have been translocated outside their original range.

White-tailed deer subspecies were originally defined based on minor morphology, including variation in body size and coat coloration. However, the genetic distinctiveness of the subspecies is unknown. Therefore, information on the distribution of lineages is needed to focus conservation and management of deer in Mexico, and possibly to regulate translocations.

Tissue samples were collected throughout the range of 7 subspecies. DNA was extracted from the samples, and a portion of the mitochondrial DNA (mtDNA) control region was sequenced. Preliminary results revealed high levels of genetic diversity, with 76 mtDNA haplotypes. No clear relationship was found among mtDNA lineages and subspecies boundaries in northeastern Mexico. Subspecies from geographically distinct regions, such as the Yucatan peninsula or in the range of couesi and mexicanus might represent distinct genetic lineages. Additional samples will be included in this study as well as further analysis to gain a better understanding of the historical biogeography of white-tailed deer in Mexico.

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

Effects of Deer Density on Antler Size of DMP Sired Bucks

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

Deer Management Permits (DMPs) are issued by Texas Parks and Wildlife Department to qualified ranches for controlled breeding activities of white-tailed deer. Many ranches try to use the DMP program to maximize antler growth in a population. This study evaluates how antler size of DMP sired offspring is affected when they are released into areas with 2 different deer densities.

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 and 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 bucks and does captured on the Faith Ranch. Fawns are marked in DMP pens each year with ear tags specific to year-of-birth. On both study areas each fall, marked bucks that are DMP offspring will be captured and antler sizes compared within age classes.

Fall 2011 will be the first year that DMP sired fawns will be released. Tagged DMP sired bucks will be captured via helicopter and net gun in 2012 and subsequent years to collect antler measurements. This project will continue for several years.

Cooperative funding provided by the Faith Ranch.

Winter White-tailed Deer Fawn Mortality in South Texas

Robert D. Kaiser, III, David G. Hewitt, Mickey W. Hellickson, and Charles A. DeYoung

Fawn mortality during the first 2 months after birth can be high in South Texas, but little is known about fawn mortality during winter. Unlike northern regions of the white-tailed deer range, winters in South Texas

© Larry Ditto

CKWRI researchers are learning about mortality rates of older fawns during the winter period.

are relatively mild and, therefore, the assumption is that most fawns have little difficulty surviving and recruiting into the population. However, data from deer surveys, captures, and limited research studies suggest that winter mortality may be greater than currently assumed. The objective of this research is to measure fawn survival during winter (November–March) on a study site near Aguilares, Texas.

Thirty white-tailed deer fawns will be caught in 2010 and 2011 using the helicopter net gun technique, fitted with a radio transmitter ear tag, and released at the capture site. The fawns will be located at least twice weekly from November–March. Upon receiving a mortality signal, transmitters will be promptly located to determine cause of fawn death. Locations will be plotted and used to build winter home ranges for fawns with ArcGIS software, and the odds of survival will be calculated.

After the first field season, 56% of the fawns had survived the winter. Two deaths were attributed to bobcat predation, 2 to coyote predation, and 7 were unknown. Additionally, 2 detached transmitters were found with no visible signs that would indicate harm came to the fawn, which suggested these transmitters might have been pulled from the fawn's ear and no mortality had occurred. The above findings support the idea that fawn mortality during winter may be an important demographic process.

Cooperative funding provided by the International Bank of Commerce.

Effects of Dietary Protein Concentration on Water Consumption of White-tailed Deer

Jared McCulloch and David G. Hewitt

Supplemental feed for white-tailed deer is used on many ranches in semiarid habitats. Crude protein varies widely between feed types, and because nitrogen from excess protein must be excreted in the urine, water consumption may vary with protein content in the diet. Evidence for an effect of dietary protein on water consumption comes from a previous study in which deer consuming chopped alfalfa with a high percentage of protein drank 50% more water than those on a low protein diet dominated by guajillo (7.4 vs. 4.8 quarts per day).

This experiment will test if deer consuming a low protein diet (10%) require less drinking water than deer consuming a high protein diet (22–28%). The findings from this study will help ranch managers choose a supplemental feed appropriate for their situation and help determine the importance of providing drinking water to supplemented deer.

Water resources and their distribution are important features to consider for effective deer management.

Cooperative funding provided by the ExxonMobil Summer Internship Program.

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

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

Wildlife managers commonly believe that culling bucks leads to an improvement in the antler size of deer populations. A 10-year buck culling study is being conducted on the Comanche Ranch in Maverick County, Texas to help clarify the effects of various buck culling practices.

Bucks are captured at random on 3 areas of the ranch by helicopter and net gun, aged, and measured for Boone and Crockett (B&C) score. Bucks meeting culling criteria are sacrificed, and the meat is donated to worthy users. Bucks not meeting the culling criteria are implanted with a microchip at the base of their ear and released. On one of the areas, yearlings are culled with less than 6 points, 2-year-olds with less than 8 points, 3-year-olds 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 are culled

by the same criteria as above. The third area serves as a control and all bucks captured are released.

After 5 years, 2,620 individual bucks have been caught, of which 1,002 have been culled and 1,618 released. There have been 746 recaptures.

In addition to the culling study, white-tailed deer are captured in pastures with protein pellet feed, cottonseed, or no supplemental feed. These deer are sampled for (1) live weights for bucks and does, (2) buck weight loss from pre- to post-rut, (3) lactation rates, and (4) average gross B&C score. The study will continue for 5 more years.

Cooperative funding provided by the Friedkin Conservation Fund.

Water and Pelleted Feed Consumption by White-tailed Deer

Nick Kolbe, Charles A. DeYoung, and David G. Hewitt

The provision of supplemental feed to white-tailed deer is an increasingly popular management technique in southern Texas. Pelleted feeds have low moisture content and deer may limit intake depending on the availability of drinking water. Our project will test the hypothesis that deer with limited access to water will eat less supplemental feed than deer with unlimited access to water.

Six white-tailed deer housed within the Albert and Margaret Alkek Ungulate Research Facility at the Tio and Janell Kleberg Wildlife Research Park on the Texas A&M University-Kingsville campus will be randomly assigned to a treatment of either unlimited water or limited water access. Deer in the unlimited water treatment will have water provided in a large bucket next to their supplemental feed. Water will be offered to deer in the limited access treatment at least 100 yards from their feed in a bowl that refills slowly. The water bowl will be in an area with little cover where deer are unlikely to linger. The amount of feed and water consumed by each deer will be measured daily for 5 days. Each deer will then be switched to the opposite treatment, and the experiment repeated.

© David Hewitt

Tame white-tailed deer are being used to test the idea that water availability influences feed intake.

The results of this experiment will be useful to managers who must decide whether to provide water at supplemental feed sites, often at considerable expense.

Fences and the Effects on Feed Use by Deer Fawns

Robert D. Kaiser, III, David G. Hewitt, Mickey W. Hellickson, and Charles A. DeYoung

Poor nutrition because of drought and other factors has led to supplemental feeding becoming a prominent management technique in South Texas. Many ranches using supplemental feed have erected fences around feeders to reduce use of feed by non-target species. Recent studies indicate deer fawns may visit feeders at a much lower rate than other classes of deer, and fencing may serve as a barrier to feeder access. The present study will determine if fences limit fawn access to feed by modifying fences to allow for fawn access to feed sites.

Ten feed sites will be randomly selected and 5 will be modified by cutting 9 x 12 inch gaps in the fence 15 inches above the ground, which should be sufficient to allow fawn access to the feed site. Trail cameras will be used to monitor feeder use by does and fawns. Fawn use of feed sites will be monitored using remote cameras from September through November. Ratios of fawns:doe at feeder sites will be used to assess the effectiveness of the modifications to the fences.

If fawn visitations to feed sites are increased by fence modifications, deer managers will have a tool they can use to help fawns better access supplemental feed, thereby addressing poor fawn nutrition while excluding non-target species from the feed sites.

Cooperative funding provided by the International Bank of Commerce.

Influence of Abiotic and Biotic Factors on Northern Bobwhite Abundance

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

Research in South Texas has demonstrated that drought is one of the most influential factors affecting northern bobwhite population dynamics. Other proximate factors include practices such as harvest, supplemental feeding, and habitat management (i.e., grazing, prescribed fire, chemical, or mechanical treatments designed to improve bobwhite habitat). Precisely how these practices—principally, habitat management—interact synergistically with weather at the landscape level to influence bobwhite populations is the impetus for this work. Our objective is to quantify relationships among these variables and determine how they influence bobwhite population dynamics using simulation modeling.

A 10-year dataset (2000–2009) is being analyzed consisting of bobwhite relative abundance and abiotic and biotic variables on the King Ranch. Abiotic variables include precipitation, precipitation-based indices (e.g., Palmer Drought Severity Index), and maximum temperature. Biotic variables include grazing, habitat management, harvest, and supplemental feeding. Relationships among variables will be quantified using univariate statistical procedures and integrated into a systems model that simulates bobwhite population dynamics. The results from this work will improve our understanding of how habitat management and weather influence bobwhite population dynamics.

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

The Forgotten Quail Decline: The Plight of Scaled Quail in Texas

Fidel Hernández, Chad J. Parent, Ian C. Trewella, and Eric D. Grahmann

Several species of quail are experiencing range-wide declines in North America. However, the northern bobwhite has garnered the most research, conservation, and management attention. Although this has benefited bobwhites, an unfortunate consequence has been the neglect of other quail species declining at even more alarming rates. Our objective is to use long-term data obtained from the Breeding Bird Survey to characterize the spatial and temporal trends of scaled quail populations in Texas and to highlight this drastic and largely unnoticed decline.

Preliminary results indicate that scaled quail have declined at a rate of 5% per year in southern Texas. Anecdotal reports from landowners have long noted the gradual disappearance of scaled quail and replacement with bobwhites throughout southern Texas. The preliminary findings provide evidence for such species replacement. The ratio of quail detections in the core of the scaled quail range in southern Texas was 80:20 (scaled quail:bobwhite) during the 1960s, but currently represent about 5:95. In addition, the range of scaled quail has been contracting westward.

Findings from this research will be useful in understanding the causes for the scaled quail's decline, range contraction, and replacement by the bobwhite.

Cooperative funding provided by the Alfred C. Glassell Jr. Endowed Professorship in Quail Research, Sam Walton Endowed Fellowship in Quail Research, Texas Quail Coalition (South Texas Chapter), and the College of Graduate Studies at Texas A&M University-Kingsville.

Historical Phylogeography of the Northern Bobwhite

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

The bobwhite complex consists of 4 species distributed from the United States south to northern South America. The northern bobwhite has the largest range of the 4 species, being found in the eastern United States, Mexico, and Cuba. It is highly variable, with 16 subspecies that are based mostly on variations in male plumage coloration. The historical and genetic distinctiveness of the northern bobwhite's subspecies is not currently known nor is there any information on how it is related to its southern relatives: the Yucatán, spot-bellied, and crested bobwhites. Knowledge of the genetic relationships among the bobwhites will provide important insights into the evolutionary and demographic history of the bobwhite.

DNA was extracted from toe pad skin of museum specimens of all 4 bobwhite species. A portion of the mitochondrial DNA control region was sequenced from 241 northern bobwhites, representing 14 subspecies along with 16 Yucatán, 20 spot-bellied, and 28 crested bobwhites. Ninety haplotypes were found

among the 4 species. Northern bobwhites were the most diverse with 56 haplotypes followed by crested (28), spot-bellied (20), and Yucatán (7) bobwhites.

Preliminary phylogenetic analysis indicates that the northern and Yucatán bobwhites are more closely related to one another than either is to the spot-bellied and crested bobwhites. The spot-bellied/crested bobwhite group exhibits a greater degree of geographic structuring and genetic differentiation than the northern/Yucatan bobwhites. Analysis of the genetic data is continuing in order to fully assess the relationships of these 4 species.

Cooperative funding provided by the Elliot B. and Adelle Bottom Fellowship in Quail Research, Quail Associates Program, and the Richard M. Kleberg, Jr. Center for Quail Research.

Landscape Genetics of the Bobwhite in Texas and the Great Plains

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

Many northern bobwhite populations have been experiencing severe declines resulting from habitat loss. Because of the popularity of this species as a gamebird, this decline is of concern to wildlife biologists, landowners, and legislators. The northern bobwhite's seemingly sedentary nature suggests a high degree of population structure and relatively low genetic variation. However, previous molecular genetic analyses for bobwhites in South Texas indicate that the population is genetically diverse with a low degree of population structure. The goal of this research is to assess the genetic population structure and genetic diversity of northern bobwhites in intact and fragmented habitats throughout Texas and into the southern Great Plains as a comparison to data collected in South Texas.

Mitochondrial DNA will be extracted from wings of hunter-harvested bobwhites and analyzed. Data from a 9-year telemetry study on a bobwhite population from a large ranch in South Texas will be used to evaluate the magnitude and extent of bobwhite movements. By using telemetry and landscape modeling, the influence of intact and fragmented habitats on bobwhite population structure can be evaluated.

Cooperative funding provided by the Elliott B. and Adelle Bottom Fellowship in Quail Research and the Quail Associates Program.

Effects of the "Quailerator" on Brooding and Foraging Areas for Bobwhites

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

During the breeding season, nesting and foraging areas are crucial to bobwhite hens and their offspring. Bunchgrass species, such as seacoast bluestem, are used for nest sites. These grasses also help to provide concealment from predators and help to mitigate the effects of the summer heat. Additionally, foraging areas must have adequate bare ground for the bobwhites to feed on insects. Hens must consume large amounts of insects to obtain the protein needed for egg-laying, and the chicks require small insects as their main diet during their first 2 weeks of life.

Some of the disturbances used to stimulate growth of forb and grass species favored by northern bobwhites have been prescribed fire, cattle grazing, disking, and soil aeration. A modified soil aerator called the "Quailerator," which has welded squares instead of points on the drum, can be used to simulate cattle hoof-like disturbances to aerate the soil without damaging potential nesting habitat.

This study will assess the "Quailerator." The goal is to aerate the soil without damaging bunchgrasses that are commonly used for bobwhite nesting. Our objectives are to (1) evaluate the effect of the "Quailerator" on insect biomass, insect species richness, and vegetation structure and (2) examine if there is a significant difference when this aeration method is combined with prescribed fire.

Evaluating the "Quailerator" will help us gain information about the effectiveness of the technique

© Dustin Sanders

The "Quailerator" is designed to minimize compression of bunchgrass clumps that provide bobwhite nesting habitat.

for managing northern bobwhite nesting and foraging areas in South Texas.

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

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

The northern bobwhite has undergone dramatic declines and range contractions. However, there is insufficient genetic information to determine whether its subspecies should be managed separately. This study's objective is to examine the genetic structure of bobwhite populations west of the Mississippi River.

DNA was extracted from muscle tissue of hunter-harvested bobwhites and feathers of trapped bobwhites from Texas, Kansas, Oklahoma, and Missouri. A portion of the maternally inherited mitochondrial DNA (mtDNA) control region was then sequenced.

Preliminary analysis on 443 mtDNA sequences of bobwhites and 23 sequences from masked bobwhites captured in Sonora in the late 1990s revealed 67 closely related haplotypes. Masked bobwhites did not share any haplotypes with birds from the United States, but they were not well differentiated from them.

Plans are to acquire samples of bobwhites from Nebraska in order to conduct a more thorough analysis. Knowledge of population structure and patterns of genetic diversity within the northern bobwhite will aid in setting conservation priorities for this species.

Cooperative funding provided by the Elliot B. and Adelle Bottom Fellowship in Quail Research, Quail Associates Program, and the Richard M. Kleberg, Jr. Center for Quail Research.

Simulating Northern Bobwhite Response to Management and Weather

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

Population dynamics of the northern bobwhite involves complex ecological relationships. In South Texas, these relationships are characterized by boom-and-bust dynamics driven by rainfall. Systems modeling has been used extensively at the CKWRI to model northern bobwhite population dynamics. Consequently, much background information exists, but these models do not explicitly contain bobwhite-habitat relationships.

CKWRI researchers are studying bobwhites to learn how best to maintain huntable populations in South Texas.

An important question is whether habitat management can mitigate the effects of drought, and if so, to what extent. Our objective is to develop a stochastic systems model to simulate northern bobwhite population dynamics as a function of weather and habitat management. Systems modeling is a useful tool to evaluate complex relationships between northern bobwhite populations and the extraneous factors that influence them.

Our study makes use of a 10-year dataset with variables measuring northern bobwhite abundance, weather, grazing, harvest, and habitat management on the King Ranch in South Texas. Conceptually, the model will provide an understanding of the relationship between habitat management and bobwhite population dynamics. Additionally, because a stochastic model will be constructed, evaluations can be made for potential management scenarios using hypothetical values for each variable.

Results from this study will provide a more holistic understanding of the population dynamics of northern bobwhites and their response to management at a large scale in South Texas.

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

Phylogeography of the Scaled Quail in Southwestern North America

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

The scaled quail is an inhabitant of grasslands and scrublands throughout much of the southwestern United States and northwestern Mexico. This species has undergone range contraction and population declines within the United States because of overgrazing and brush encroachment. Variations in plumage coloration and differences in habitat among scaled quail populations have resulted in 4 subspecies being described. 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 this species.

The objectives of this research are to (1) examine the overall genetic structure of the scaled quail and (2) determine the distinctiveness of its subspecies. DNA was extracted from tissue of hunter-harvested birds, feathers of trapped birds, and toe pad skin of museum specimens. A portion of the maternally inherited mitochondrial DNA control region was sequenced for 180 contemporary specimens and 38 museum specimens from across the scaled quail's range.

Sixteen closely related haplotypes were found that exhibited little geographic structuring. The most common haplotype was carried by 77% of the individuals and was found in most of the areas sampled. The lack of genetic structuring suggests that the 4 subspecies may not represent historically independent lineages. Statistical analyses are continuing to fully assess the scaled quail's pattern of genetic variation and demographic history.

© Damon Williford

Chestnut-bellied scaled quail skins from the American Museum of Natural History showing color variation.

Cooperative funding provided by the Elliot B. and Adelle Bottom Fellowship in Quail Research, Quail Associates Program, and the Richard M. Kleberg, Jr. Center for Quail Research.

Landscape Spatial Distribution of Northern Bobwhite Abundance

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

Estimates of the northern bobwhite's population size are essential for making informative decisions about their management. However, this information is of little use to a manager when trying to identify where management treatments should be placed. Understanding bobwhite abundance in relation to spatial variables that reflect weather and habitat management could help prioritize management efforts.

Density-gradient mapping illustrates changes in population abundance across the landscape and is referred to as Spatial Distance Sampling Modeling (SDSM). The foundation of SDSM is distance sampling, a technique utilizing distances of detected objects from a line transect to estimate density. The study's objective is to relate the spatial distribution of bobwhite density to weather and habitat management using SDSM.

The study area is located on the King Ranch, a private ranch covering 6 counties (Brooks, Jim Wells, Kenedy, Kleberg, Nueces, and Willacy) in South Texas. The King Ranch conducts aerial surveys of northern bobwhites from helicopters along established transects and uses distance sampling. Estimates of relative abundance, density, and georeferenced covey locations exist for bobwhites beginning in 2008. The dataset will include weather and management variables collected during 2008–present. The dataset will be evaluated using Program DISTANCE, a density surface modeling platform, and Geographic Information Systems (GIS). Incorporating a GIS into the study will simplify a wildlife manager's decision regarding where habitat management treatments are most needed on the landscape.

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

Influence of Rainfall on Northern Bobwhite Reproduction

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

Northern bobwhite abundance in semiarid lands is correlated with the amount and timing of rainfall. The strong influence of rainfall often results in dramatic population fluctuations. These fluctuations have been referred to as "boom-and-bust" cycles.

In relatively unpredictable environments such as the Rio Grande Plains region of southern Texas, northern 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 of northern bobwhites to rainfall and temperature.

Data will be used from a long-term radio telemetry project on northern bobwhites (South Texas Quail Research Project). That study was conducted on the Encino Division of the King Ranch during 2000–2008. Approximately 60 radio-marked bobwhites were monitored year-round and basic demographic data were collected. Rainfall varied greatly during the study period. This information will be used to investigate how nesting rate (nests per hen), percentage of hens nesting, date of first nest, nest success, clutch size, and nesting-season length are affected by the amount and timing of rainfall.

If the hypothesis holds true, then a changing climate may pose significant challenges to northern bobwhite populations. This research will provide useful information on how projected changes in rainfall patterns may affect the species.

© Joseph Sands

Hen bobwhites are trapped, fitted with transmitters, and released to monitor their reproduction.

Cooperative funding provided by the Sam Walton Endowed Fellowship in Quail Research, Texas A&M University-Kingsville's University Research Award, and the Texas Quail Coalition (South Texas Chapter).

Assessing the Genetic Structure of the Gambel's Quail

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

The Gambel's quail occurs throughout much of the southwestern United States and northwestern Mexico. This species is divided into 7 subspecies, based on plumage differences. However, there is a lack of data on population structure, levels of genetic diversity, and how genetically distinct the various subspecies are from one another. It is also unknown whether the disjunct populations in Utah and Colorado are native or introduced. The evolutionary history that the Gambel's quail shares with its sister species, the California quail, has also not been thoroughly explored. Therefore, genetic studies of the Gambel's quail may provide important information that can be used for its management by determining whether any of its subspecies represents historically independent populations.

This study was initiated to (1) assess the genetic structure of the Gambel's quail, (2) examine relationships among its subspecies, and (3) explore the relationship between the Gambel's and the California quail. DNA was extracted from tissue of hunter-harvested Gambel's and California quail and from museum specimens. A portion of the maternally inherited mitochondrial DNA (mtDNA) control region was sequenced for 176 Gambel's and 53 California quail, representing specimens across their ranges.

Preliminary analysis revealed 33 mtDNA haplotypes clustered into 3 groups, one composed of haplotypes found only in California quail and 2 groups of Gambel's quail haplotypes. A mitochondrial protein-coding gene will be used in the analysis to fully assess genetic relationships between California quail and Gambel's quail and their respective subspecies.

Cooperative funding provided by the Elliot B. and Adelle Bottom Fellowship in Quail Research, Quail Associates Program, and the Richard M. Kleberg, Jr. Center for Quail Research.

Relationship Between Summer Population Indices and Fall Abundance of Bobwhites

Chad J. Parent, Fidel Hernández, Mickey W. Hellickson, Marc Bartoskewitz, and Matthew J. Schnupp

Reliable information on the fall abundance of northern bobwhites is necessary for proper harvest management. Aerial surveys can provide reliable estimates of abundance, but they can be expensive. Alternatively, whistle counts and roadside counts are relatively inexpensive, simple to perform, and commonly used by biologists. Our objectives are to compare whistle and roadside counts of bobwhites conducted during spring and summer to fall relative abundance (coveys per mile) estimates obtained using helicopter surveys.

Data were collected at the pasture scale on the King Ranch. Pasture sizes varied across divisions; the average area of the pastures surveyed ranged from 4,240–6,825 acres. Average survey effort was 152 miles per year (1999–2001) and 742 miles per year (1999–2007) for whistle and roadside counts, respectively, and 30 miles per pasture per year (1999–2009) for fall helicopter surveys. Age-based (chicks, juveniles, and adults) and population structure-based (singles, pairs, or coveys) data were collected for roadside counts.

Preliminary analyses demonstrate a moderate correlation between whistling males and fall relative abundance. Correlations between roadside counts and fall relative abundance varied by age and population structure. Moderate correlation was found between total juveniles and fall relative abundance; all of the other correlations were low. Our study will determine the feasibility of using summer whistle and roadside counts as a surrogate for fall relative abundance.

Cooperative funding provided by the Texas Quail Coalition (South Texas Chapter), King Ranch, Inc., Texas A&M University-Kingsville Title V-Promoting Post-baccalaureate Opportunities for Hispanic Americans Program, and the Houston Safari Club.

Foods of the Northern Bobwhite from the Rolling Plains of Texas

Cady L. Mercer, Stacie M. Villarreal, Alan M. Fedynich, and Dale Rollins

Food habitats studies provide important information about food availability and dietary preference. This research project will determine what types of food are being consumed by northern bobwhites from the Rolling Plains Ecoregion during an annual cycle and determine if food habits are related to season, age, and sex of the bobwhites.

© Stacie Villarreal

Crop contents of a bobwhite showing fragments of insects and various seeds and leaves.

Bobwhites were collected from the Rolling Plains Quail Research Ranch located in Fisher County, Texas. Twenty-five adults and 14 juveniles were collected from February–March 2010, 22 adults and 29 juveniles were collected in August 2010, and 21 adults and 33 juveniles were collected during December and January 2010–2011.

Preliminary findings from the first collection period indicated that most bobwhites consumed grasses, seeds, and some insects. The principal seeds found were corn and milo, indicating use of bait sites. Insects included grasshoppers, assassin bugs, and various beetles. Vegetative items have not been identified. Average dry weight of crop contents of adult males was 2.2 grams (0.078 oz), adult females 0.8 grams (0.03 oz), juvenile males 3.1 grams (0.11 oz), and juvenile females 0.3 grams (0.01 oz).

Findings from this study will provide a better understanding regarding what foods northern bobwhites are consuming on the Rolling Plains Quail Research Ranch throughout an annual cycle.

Cooperative funding provided by the Rolling Plains Quail Research Foundation.

Response of Tanglehead to Winter Burning in South Texas Landscapes

Aaron D. Tjelmeland, Forrest S. Smith, and Fred C. Bryant

Tanglehead has become a problem for wildlife managers in South Texas, reducing habitat quality for some wildlife species. Winter burning in South Texas is used to remove dead plants and encourage new grass and forb growth. In Australia, fire is commonly used to promote and restore tanglehead pastures.

To examine the effects of winter burning, controlled burns were conducted in 3 ungrazed tanglehead pastures during February 2010 in Jim Hogg County, Texas. A 3.3 x 3.3 ft frame was placed at 20 random points per pasture to sample cover, biomass, and seedling density of tanglehead prior to fire and 7 months after the burn.

Burned pastures, from February to July, exhibited a 19.5% increase in tanglehead cover while unburned pastures exhibited a 6.4% increase. The increase was largely due to an increase in seedlings, which averaged 20 per ft^2 on burned pastures and only 0.04 per ft^2 on unburned pastures. Seedlings germinated and grew in a 1–5 ft area surrounding most tanglehead patches, thereby increasing patch size. No differences in tanglehead cover or biomass were observed 7 months after the burn.

When winter burns are conducted on areas where tanglehead is encroaching, follow-up treatments should be applied to help mitigate the effects of seedling germination and colony growth.

Cooperative funding provided by the CKWRI Project Tanglehead donors and contributors.

Buffelgrass and Kleberg Bluestem Control 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 invasive, exotic grasses introduced into South Texas for cattle forage. These grasses pose a major threat by spreading into and replacing native plant communities and their associated wildlife. Until now, little research has been conducted regarding how to control these grasses in South Texas.

In 2008, a study was initiated on the Hixon Ranch in La Salle County, Texas to test various control methods, which included combinations of soil disturbance, fire, mowing, herbicides, and planting native species.

Preliminary results suggest that prolonged soil disturbance, repeated herbicide application, and reintroducing native species can aid in managing and diversifying exotic grass monocultures. Areas previously consisting of 99% buffelgrass canopy cover have been replaced with 80% native plant cover. Determining treatment longevity and economic viability are important goals. This 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), Houston Safari Club, Native Plant Society of Texas, and South Texas Charity Quail Hunts, Inc.

Understanding Implications of Tanglehead for Grassland Birds

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

Southwestern grasslands are important wintering grounds for many species of birds, but invasive plants threaten their integrity. Tanglehead is a native grass that was a minor component of grasslands in southern Texas, but has increased in distribution and dominance, behaving like an invasive species. Tanglehead could change food resources, concealment from predators, and availability of nest sites for grassland birds.

Seventy 15-acre plots were selected representing a gradient of tanglehead dominance (0–80%); plots were on 2 ranches in Jim Hogg County, Texas. On each plot, vegetation was quantified and birds surveyed using line transects during the winters of 2010 and 2011 along the gradient of tanglehead dominance.

As tanglehead increased, cover and the number of native grass and forb species decreased and vegetation thickness and height increased. Tanglehead was more dominant closer to roads and other high traffic areas. During winter following high precipitation in the growing season, eastern meadowlark, Cassin's sparrow, grasshopper sparrow, and western meadowlark were less likely to occur in areas with increased dominance by tanglehead; however, following drought, these species were more likely to be found in tanglehead.

These findings indicate that birds benefit from native grasslands in wet years, because of increased food resources and cover. However, in drought years when

there is very little cover in native grasslands, tanglehead provides concealment from predators.

Cooperative funding provided by 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).

Evaluating the Genetic Diversity of Tanglehead in Texas

Aaron D. Tjelmeland, James R. Manhart, Daniel Tarin, Valerie D. Hipkins, Randy W. DeYoung, Forrest S. Smith, and Fred C. Bryant

Tanglehead is known to have several ploidy levels (chromosome numbers), but only 1 was known to occur in Texas. Recently, 2 ploidy levels within a small tanglehead population on an island in the Laguna Madre have been discovered. No differences have been detected between "invasive" and "historical" populations. Also, 2 varieties of tanglehead have been found in Jim Hogg County and specimens have been collected for genetic analysis.

No evidence exists yet that one variety is invasive, and both varieties grew abundantly in 2010. Research is continuing on the DNA from the chloroplast region of the plant cells; the successful extraction of DNA has occurred for most Texas tanglehead populations sampled. Plans are to continue this research to determine if variation occurs between populations.

Continued research on the genetic and ploidy variation between populations will help to clarify the relationships that these populations have with each other and identify populations that might be considered an exotic or invasive genotype.

Cooperative funding provided by the CKWRI Project Tanglehead donors and contributors.

Use of Imazapyr to Control Tanglehead in South Texas

Aaron D. Tjelmeland

In areas of South Texas, tanglehead has rapidly increased in recent decades. It can form dense stands, which lead to a decrease in habitat quality. Tanglehead appears resistant to fire and moderate grazing regimes, thereby limiting large-scale control options.

Herbicides may be a cost-effective alternative. Recent pilot studies have shown that imazapyr may be effective in controlling tanglehead stands and keeping seedlings from establishing. To test this hypothesis, Imazapyr 2SL® (27.8% imazapyr) with surfactant was applied in early June 2011 using a backpack sprayer. Application was after a rain that initiated a short period of green growth in tanglehead. Five herbicide treatments are being evaluated: 4 ounces per acre, 8 ounces per acre, 16 ounces per acre, 32 ounces per acre, and not sprayed (control). The first post-treatment sampling is scheduled to occur July–August 2011.

While this study is designed to evaluate the rate of herbicide needed to control tanglehead, future studies are needed to examine application timing in relation to rainfall. If lower rates of this herbicide are effective at killing established plants and reducing seedling response, it may be a cost-effective and long-lasting method of controlling tanglehead.

Cooperative funding provided by the CKWRI Project Tanglehead donors and contributors and by Alligare, LLC.

Long-Term Vegetation Dynamics at the Welder Wildlife Refuge

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

Invasive exotic grasses such as Old World bluestems are becoming a major concern among land managers and ecologists alike, and there are likely many factors affecting invasion and establishment of these species.

Caucasian bluestem is one of several Old World bluestems that is found in South Texas.

The primary objective of this research is to evaluate long-term trends in vegetation within permanent transects to determine key factors affecting the invasive spread of Old World bluestems.

Canopy cover is being estimated along 150 transects previously established about 30 years ago on the 7,900-acre Welder Wildlife Refuge in San Patricio County, Texas. Relationships will be determined between abundance of Old World bluestems and proximity to roadways, influence of drought conditions through time, soil series, and varying levels of disturbance. This will help determine the factors that can increase or decrease the rate of spread of invasive Old World bluestems.

An understanding of conditions that facilitate the invasion of exotic grasses may help better predict factors that maintain native species diversity. This research may aid in making informed decisions by providing a better understanding about the conditions that lead to invasion of exotic grasses and woody plants.

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

Determining the Persistence of Tanglehead Seeds in Soil

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

Tanglehead is a prolific seed producer, and it spreads and persists solely by seed production. Recent research at the CKWRI has shown that winter fire is capable of germinating large numbers of seeds that have buried themselves within and around tanglehead colonies.

© Forrest Smith

CKWRI researchers and landowners are concerned about the rapid expansion of tanglehead in South Texas.

To aid future control efforts, it will be important to understand tanglehead seed persistence under various soil conditions.

Tanglehead seeds were collected in fall of 2010. In December 2010, seeds were placed in aluminum mesh bags and then buried at 2 sites in South Texas where tanglehead is considered invasive. Twenty bags, each containing approximately 30 seeds, were buried along a 20 m (65.6 ft) transect. Four transects were placed at each site. At 2 transects, seeds were buried 1–2 inches beneath the surface and at 2 transects, seeds were buried 3–4 inches. Recently, seed bags along 1 transect at each soil depth were recovered from each site (about 7 months after they were buried).

Seeds are currently being germinated. Although data have not been analyzed, preliminary results indicate a relatively high rate of germination of buried seeds. This is likely a result of dry conditions this year, which has resulted in low germination and decomposition of seeds while in the soil. The second set of seeds will be recovered during the winter of 2011–2012 and will again be tested for seed germination and viability. If seeds remain viable in the soil greater than 1 year, control efforts will need to focus on multi-year methods instead of single-season methods.

Cooperative funding provided by the CKWRI Project Tanglehead donors and contributors.

Assessment of Tanglehead Seedling Competition in South Texas

Jeremy W. Edwardson and Sandra Rideout-Hanzak

Although tanglehead is typically considered a native species, it has increased recently in abundance in South Texas to the point that it is considered an invasive species. Although tanglehead reproduces only once a year, it exhibits exceptionally high seedling recruitment in some areas. Little is known, however, about how varying densities of tanglehead interact with native species. Additionally, there are few data available on how timing of recruitment impacts growth of neighboring plants.

The present study was initiated to assess seedling competition between tanglehead and native perennial grass species. Our objective is to understand how tanglehead competes with more desirable native grass species in the early stages of its development.

Competition will be studied among seedlings planted in a greenhouse at different densities, timing, and soil moistures. Data will be collected on aboveground and

belowground biomass of competing seedlings as well as root length, shoot length, and root length density. This study will aid in determining how to control tanglehead in its earliest stages of development.

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

Burning and Grazing Exotic Grass Monocultures for Bobwhites

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

Exotic grasses pose a serious threat to biodiversity and wildlife habitat throughout the southwest by invading and replacing native plant communities. This is especially true for northern bobwhite habitat. Exotic grasses likely impede bobwhite travel, reduce food availability, and promote intense fires that reduce preferred woody cover. Native shrub and grasslands often preferred by bobwhites in southern Texas are disappearing because of the encroachment of exotic grasses.

This study evaluates the hypothesis that a mosaic of small prescribed burns followed by intense cattle grazing in exotic grass monocultures will (1) increase usable space for bobwhites, (2) decrease their overall home range size indicating better habitat quality, (3) improve nest success, and (4) ultimately result in bobwhite population growth. This research is being conducted in La Salle County, Texas.

Two 500-acre pastures dominated with buffelgrass were designated to receive a patch burn-graze treatment and 2 pastures will serve as controls (no treatment). Burning and grazing were conducted in January 2010–2011. Forty-eight radio-marked bobwhite hens are being tracked to estimate exotic grassland utilization and nest success.

Compared to pretreatment locations, bobwhites appear to be using exotic grass monocultures in areas where they were previously uncommon; however, this has been limited to a few burns where annual forbs or woody plants are common. Bobwhites continue to avoid areas including burns where there was no native vegetation regrowth. This study will conclude in 2011.

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 A. Seeligson, Jr. Conservation Fund, and South Texas Charity Quail Hunts, Inc.

The Use of Glyphosate for Management of Tanglehead

Aaron D. Tjelmeland

With the recent increase of tanglehead in South Texas rangelands and the dense growth that this grass is capable of exhibiting, wildlife managers are looking for effective methods of increasing wildlife habitat quality. While tanglehead is a highly productive grass, reaching 7,500 pounds per acre or more, livestock grazing can be difficult because of frequent burning required and the presence of more palatable species. Given the moderate stocking regimes in the region, chemical treatments may be a preferred option. Herbicides also have benefits over other management methods by being selective and flexible in the area covered and in the timing of application.

In October 2010, Mad Dog Plus® (41% glyphosate plus surfactant) was sprayed on tanglehead plots while the plants were green and flowering, but prior to development of viable seeds. The experiment consists of the following herbicide treatments: 24 ounces per acre, 48 ounces per acre, 64 ounces per acre, and not sprayed (control). The experiment is replicated on areas burned earlier the same year (February 2010) and on areas burned the previous year (February 2009).

The first post-treatment sampling began in July 2011. Observations indicate that on all sprayed treatments tanglehead plants and seeds have not yet responded while forbs have responded well. Spraying glyphosate on tanglehead burned in 2010 seemed more effective than on tanglehead burned in 2009. Burning in 2009 allowed 2 growing seasons in which tanglehead was able to produce enough biomass to shield parts of plants from the herbicide while burning in 2010 produced a more desirable plant structure for spraying.

Long-term monitoring and site replication will be necessary to further determine the effectiveness of the glyphosate herbicide treatments in controlling tanglehead on South Texas rangelands.

Cooperative funding provided by the CKWRI Project Tanglehead donors and contributors.

Translocation Strategies to Augment Texas Ocelot Populations using PVAs

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

Ocelot populations in the United States are vulnerable to extinction. Currently, there are only 2 known breeding ocelot populations in the United States, both occurring in extreme southern Texas. One is located in and around Laguna Atascosa National Wildlife Refuge and the other on private ranches in Willacy County. The Ocelot Recovery Plan and research conducted by scientists at the CKWRI have identified translocation and habitat restoration as 2 management actions with potential to reduce the probability of extinction.

Population Viability Analysis (PVA) models will be used to identify the duration and intensity of translocation of ocelots from Mexico required to prevent population extinction in Texas. Using sensitivity testing, minimal viable population (MVP) size will be defined. Requisite habitat restoration to support the theoretical MVP will then be calculated based on home ranges of resident ocelots in Texas. The success of this project will ultimately lead to increased survival and persistence of the ocelot populations in Texas.

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

Monitoring Ocelots and Bobcats in a Fragmented Landscape

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

Conservation of federally endangered ocelots has included monitoring using a combination of radio telemetry and remote-sensing cameras. The study site is a 269 acre tract of Tamaulipan thornscrub habitat protected as 2 federal conservation easements. Ongoing studies of ocelot and bobcat interactions reveal ocelots on this site primarily use the easements (95% of locations). It is likely that intensive camera surveys would capture all resident ocelots and show that ocelots and bobcats partition habitat for greatest avoidance.

Remote-sensing cameras were placed around the study site in a stratified random grid from 2003 to present. A plateau in the number of identifiable individuals sighted was observed, based on using cameras after 2 months. Live-trapping operations were also conducted, in which 5 ocelots were captured during 2010–2011 and 3 were radio-collared with traditional and Global Positioning Systems (GPS) tracking units. Additionally, 3 bobcats were captured and radio-collared.

Home ranges calculated from camera traps and radio telemetry did not differ for ocelots. An adult male ocelot had the largest home range (330 acres) using both easements. Two adult female ocelots resided in 1 easement at unequal proportions (170 and 44 acres), and shared it with 2 sub-adult ocelots. One adult female with young was not live-trapped, but home range (202 acres) was calculated from camera data. Sympatric bobcats had larger ranges (male = 1,057 acres, female = 721 acres, sub-adult male = 682 acres) than ocelots and used thornscrub at a lower intensity (21%, 20%, and 1%, respectively), preferring mixed habitats around the easements (53%, 39%, and 63%, respectively).

Our results support the need for remote camera surveys in conjunction with live-trapping and radio telemetry to monitor the population status of the endangered ocelot.

Cooperative funding provided by the Tim and Karen Hixon Foundation, Texas A&M University-Kingsville Title V-Promoting Post-baccalaureate Opportunities for Hispanic Americans Program, Gary Waggerman Memorial Scholarship, Hispanic Leaders in Agriculture and Environment, Houston Safari Club, Michael and Charles Corbett Scholarship, Texas Academy of Science/Texas Organization of Endangered Species, South Texas Quail Coalition, and South Texas Chapter of Quail Unlimited.

Ecological Patterns of Jaguarundis and Ocelots using Remote Cameras

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

Assessment of niche partitioning and possible competitive pathways between co-occurring jaguarundis and ocelots is important for developing conservation strategies for the recovery of these felids. Information on resource partitioning of time, space, and habitat is critical for this evaluation; however, it is difficult to obtain because of the reclusive behavior of these cats.

Cuddeback, Wildview, and Bushnell remote cameras are being used to obtain information about selected ecological patterns of jaguarundis and ocelots at the same study site at Rancho Caracol in the Sierra Tamaulipas of

northeast Mexico. Activity patterns, microhabitat use, and interspecific sharing of sites are being examined, based on 24-hour monitoring.

These data are unique in that they provide original information on sympatric ocelots and jaguarundis in an area where these felids occur at relatively high densities, which will assist ocelot conservation strategies.

Cooperative funding provided by the Tim and Karen Hixon Foundation, the Feline Research Center of the Caesar Kleberg Wildlife Research Institute, Wild Cat Conservation, Inc., Texas Parks and Wildlife Department, and Rancho Caracol.

Feline Survey at NAS Kingsville Escondido Ranch, McMullen County, Texas

Arturo Caso, William C. Stasey, Taylor Garrison, Paeton Phaup, and Michael E. Tewes

The distribution of wild cat species in Texas is not fully known because of a lack of field surveys. Therefore, it is important to survey different areas to determine the distribution of cat species in Texas. Understanding the distribution of felids in Texas will help establish future conservation and management strategies for these species.

As part of the above approach, surveys were conducted on the Escondido Ranch in McMullen County, Texas from October 2010 through August 2011 using remote sensing cameras. This property is operated by Naval Air Station Kingsville.

Over 187 bobcat photos have been obtained after 2,840 camera-nights, representing a success ratio of 1 bobcat photo per 15.2 camera-nights. Ocelots, jaguarundis, and mountain lions were not identified with the use of camera traps, but further surveys are needed to confirm if these species are present in the area.

Cooperative funding provided by the U.S. Department of Navy.

Mapping Vegetation Cover for Ocelots in the Northern Sierra Tamaulipas

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

There is a lack of information about the vegetation cover in the northern Sierra Tamaulipas, Mexico, and the types of cover preferred by ocelots in this region. Knowledge of the types and extent of vegetation and the specific tracts occupied by ocelots is essential for developing reliable population models.

The study area is on a private ranch in the northern Sierra Tamaulipas that encompasses all the vegetation types found in the region. Presence or absence of ocelots will be determined in each vegetation type using remote sensing cameras. Classified vegetation types on a Landsat 7 image will be buffered by 30 ft (10 m) at each site where ocelot presence is detected. The extent of the vegetation types identified within these buffers will then be used in the population models as the potential distribution of the ocelot in the northern Sierra Tamaulipas.

Clarification of vegetation cover mapping techniques will help to more accurately predict potential ocelot occurrence and assist managers in future monitoring and conservation efforts.

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

Long-Term Bobcat Prey Fluctuations using Scat Analysis

Jennifer M. Korn and Michael E. Tewes

Studies in Texas have shown rodent populations tend to fluctuate in response to wet and dry conditions. Bobcats in Texas prey primarily on hispid cotton rats and cottontail rabbits. When these prey are unavailable, bobcats will shift to less profitable prey such as smaller rodents, birds, and white-tailed deer.

Examination of scat for bone fragments, fur, and feathers yields valuable information about bobcat diets.

The most common way to assess food habits of carnivores is to examine feces (scat) for bones, hair, and other remains of consumed prey. Prey can be identified to the species level using skeletal features or by microhistological methods.

To learn more about dietary changes of bobcats, driving transects will be conducted along selected routes on the Santa Gertrudis Division of the King Ranch from which scats will be collected. The location of scats found will be marked using Global Positioning Systems (GPS) equipment and the scat will be placed in a plastic bag and frozen until analysis.

Scats will be analyzed and compared with museum specimens and reference collections of small animals collected throughout South Texas. Climatic data such as mean temperature, mean precipitation, and drought index information will be collected for the study period.

Bobcats are an apex predator in Texas playing an important ecological role with herbivorous species, particularly rodents and rabbits. Understanding differences in the bobcat's prey choices because of changes in prey populations related to wet and dry periods may assist in making better wildlife management decisions.

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

Genetic Pedigree Analysis of Ocelots in Texas

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

Ocelots occur mainly within 2 isolated populations in South Texas. Successful management of these populations is highly dependent on genetic information gathered from DNA samples of ocelots from contemporary and historical individuals. Creating a genetic pedigree of all individuals will allow researchers to have baseline information needed for continued genetic monitoring and for translocation efforts.

Approximately 200 samples exist for historical and contemporary ocelots occurring in Willacy and Cameron counties, Texas, as well as road-killed specimens outside of these areas. DNA will be extracted from each sample using a standard protocol and 15 to 20 microsatellite DNA loci will be amplified to create a genotype for each individual. Amplified segments will be tested against each other to construct a pedigree, including estimated age, years alive, and gender (sire or dam).

© Arturo Caso

CKWRI researchers are taking baseline information on a captured ocelot prior to its release back into the wild.

Demographic data from camera and live-trapping will be used to narrow results.

This information will allow researchers to track the genetic contribution of introduced ocelots in the population, provide information on movements between populations, relatedness of individuals across the entire South Texas range, population sizes, determine population origin of road-killed ocelots, and create a baseline for continued genetic monitoring (i.e., genetic diversity, connectivity among populations, etc.). These analyses will create the groundwork for long-term noninvasive monitoring of ocelots in Texas.

Cooperative funding provided by Friends of Laguna Atascosa National Wildlife Refuge, Tim and Karen Hixon Foundation, Texas A&M University-Kingsville Title V-Promoting Post-baccalaureate Opportunities for Hispanic Americans Program, Gary Waggerman Memorial Scholarship, Hispanic Leaders in Agriculture and Environment, Houston Safari Club, Michael and Charles Corbett Scholarship, Texas Academy of Science/Texas Organization of Endangered Species, South Texas Quail Coalition, South Texas Chapter of Quail Unlimited, 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

An ocelot population in the northern Sierra Tamaulipas, Mexico will be assessed as a potential source for obtaining individuals to supplement the Texas popula-

tions. Identifying ocelot source populations sufficiently robust to withstand removal for translocation purposes without jeopardizing population viability is a prerequisite of this translocation program.

Distribution and density estimates of ocelots will be obtained using remote camera capture-recapture techniques. These values will be extrapolated to the entire Sierra Tamaulipas, and they will be inputted into Population Viability Analysis (PVA) models to determine what level of translocation removal is appropriate for this ocelot population.

This study will provide information necessary for successful translocation efforts of ocelots. Translocation efforts will proceed once it is determined what degree of removal the source population can support.

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

Ocelot Population Estimation using Remote Sensing Cameras in Northeast Mexico

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

The ocelot is a federally endangered species in the United States and Mexico, and is classified by the Convention on International Trade in Endangered Species (CITES) as an Appendix I species. The objective of this study is to determine ocelot population density in Tamaulipas, northeast Mexico.

A grid of camera traps was deployed for 6 months to photo-capture ocelots. This grid covered an area of 34.7 mi^2 (90 km^2), and consisted of 30 camera stations separated by at least 0.6 miles (1 km). Individual ocelots were identified by their pelage pattern, and population density was estimated using capture-recapture statistical models with the aid of Program CAPTURE. To calculate the effective sampling area, buffers for each camera location were calculated using the mean maximum distance moved (MMDM) of individuals photographed at 2 or more stations.

© Feline Research Center of the CKWRI

Remote camera photos like the one above are being used to identify individual ocelots and assess population structure.

Remote sensing cameras have been used for over 5,380 camera-trap-nights. During that time, 25 (12 females and 13 males) ocelots have been documented. The information also allowed us to obtain a population density estimation of 16 ocelots per 38.6 mi^2 (100 km^2).

The aim of this study is to refine the camera trap method for censusing ocelots where they occur at healthy densities. This information can then be used to provide more accurate ocelot population monitoring in other geographic regions.

Cooperative funding provided by the Tim and Karen Hixon Foundation, the Feline Research Center of the Caesar Kleberg Wildlife Research Institute, Texas Parks and Wildlife Department, Wild Cat Conservation, Inc., and Rancho Caracol.

Prey Monitoring for the Ocelot Populations in Willacy and Cameron Counties

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

Ocelots prey primarily on small mammals. Consequently, understanding prey abundance is important for ocelot conservation. Prey populations have been monitored for several years on the Yturria Ranch in Willacy County, Texas and Laguna Atascosa National Wildlife Refuge (LANWR) in Cameron County, Texas.

On the Yturria Ranch, 5 transects of 60 Sherman live traps were set on and adjacent to 2 conservation easements. In LANWR, 4 transects of 50 traps were placed in areas that were identified as primary release sites for ocelot translocation, and 3 transects of 50 traps were placed at secondary release sites.

Trap success on the Yturria Ranch increased from a post-drought low of 1.6% in January 2010 to nearly 20% in August 2010. Success has declined as drought conditions returned (April 2011, 12.5%). The total number of individuals captured increased for all species following May 2010 after precipitation relieved drought conditions. Hispid cotton rats took longer to recover then became the most abundant captured species.

Rodent surveys on LANWR began in June 2010. Trap success was highest in summer 2010 on primary site transect 4 (32.5%) and lowest on primary site transect 2 (7.1%). Success increased from summer 2010 to winter 2011 on primary transects 1 and 3, increased on transect 2, and declined on transect 4. The 3 most abundant species for the Willacy and Cameron study sites were hispid cotton rat, Mexican spiny pocket mouse, and deer mouse.

Monitoring prey populations may provide an index for population health of ocelots and aid in 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., Texas A&M University-Kingsville Title V-Promoting Post-baccalaureate Opportunities for Hispanic Americans Program, Gary Waggerman Memorial Scholarship, Hispanic Leaders in Agriculture and Environment, Houston Safari Club, Michael and Charles Corbett Scholarship, Texas Academy of Science/ Texas Organization of Endangered Species, South Texas Quail Coalition, and South Texas Chapter of Quail Unlimited.

Survey of African Lions at Rungwa and Luganzo Game Reserves, Tanzania

Arturo Caso, Michael E. Tewes, Paul Funston, and Lon I. Grassman, Jr.

The African lion is the most important game species in East Africa. Tanzania is known to have the greatest number of lions in Africa. However, the population status of lions within game reserves has been poorly evaluated, and this information is needed when considering harvest regulations.

© Arturo Caso

CKWRI research associate Arturo Caso (right) and his field crew are using cameras to "capture" lions in Africa.

The lions occupying Rungwa use the Miomba woodland ecosystem, which is quite different from many of the more open grasslands such as the Serengeti where lions have been studied for many years. Lion ecology is different because of the differences in screening cover between grasslands and woodlands. For example, lion pride size in the grassland ecosystem is much larger than that found in the woodland ecosystem.

During summer 2011, a pilot project was initiated to assess population abundance and habitat use for lions using calling stations, remote sensing cameras, and track counts. This project expands upon the previous CKWRI work on leopards in Tanzania, and will encompass multiple years as funding permits. The aim of this project is to clarify the demographics and population status of lions in Rungwa and Miomba, and potentially determine appropriate hunting management strategies and harvest limits.

Cooperative funding provided by Lubbock Safari Club, Houston Gulf Coast Safari Club, Felipe Reveilhac, Robin Hurt Safaris, Ltd., Wild Cat Conservation, Inc., and the Feline Research Center of the Caesar Kleberg Wildlife Research Institute.

Discovery of a New Ocelot Subpopulation in South Texas

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

A new subpopulation of ocelots has recently been discovered that may represent the largest group of these endangered cats currently identified in the United States. This population of about 14 individuals was documented on the East El Sauz Ranch of northeastern Willacy County during a collaborative project for the East Wildlife Foundation between Texas Parks and Wildlife Department (TPWD) and the CKWRI.

The initial survey for ocelots began when Jimmy Rutledge (TPWD wildlife biologist) and Arturo Caso (CKWRI research associate) set remote cameras on the East El Sauz Ranch and discovered ocelots during the first month. Monitoring continued for several months by Jimmy Rutledge and later by Alan Cain and Daniel Kunz with support from the CKWRI. Although this was the first systematic assessment of the population size, Michael Tewes and Juan Beltran of the CKWRI previously captured 2 ocelots on this ranch during a brief visit in the early 1990s.

On 10 March 2011, box-traps were used to begin capturing ocelots on this ranch. Global Positioning Systems (GPS) collars were attached to those captured. The initial GPS collars will detach, and data will be retrieved during winter 2012. This information should help researchers identify new areas to survey and expand the knowledge about population size and habitat use. An important goal of future research is to determine if these ocelots belong to the existing Willacy population or constitute an independent population.

Cooperative funding provided by the Tom T. East, Sr. and Alice K. East, and Alice H. East, and Robert C. East Wildlife Foundation.

© Mickey Hellickson

Bobcats are commonly found in South Texas and play an important role in the ecosystem as top-level predators.

Spatial and Ecological Response of Bobcats to Habitat Management

Jennifer M. Korn, Michael E. Tewes, Arturo Caso, and Marc Bartoskewitz

Bobcats are an important predator in the ecosystems of Texas, likely acting in top-down processes aiding in the regulation of prey populations and plant communities in which the prey feed upon. Changing land practices and brush management likely alter bobcat use of a landscape. Additionally, predator use of the habitat after manipulation tactics (such as brush management, fire, etc.) may effect game species (e.g., white-tailed deer, northern bobwhite). Understanding how predators react within these shifting environments is important for wildlife biologists seeking to manage these lands for overall ecosystem health and productive game management.

The main objective of this research study is to determine the spatial and behavioral response of bobcats to different brush cover densities and habitat manipulation. Additional objectives will be to determine ecological patterns of bobcats and estimating populations and demographics of bobcats over years and changing conditions (e.g., drought).

This study is being conducted on the Santa Gertrudis Division of the King Ranch. Bobcats were live-trapped and fitted with Global Positioning Systems (GPS) collars and radio telemetry collars beginning in spring 2011. One adult male bobcat was fitted with a GPS collar in June 2011 with trapping continuing through the year.

Vegetation will be analyzed in a Geographic Information Systems (GIS) database using land cover maps and ground truthing methods. Additionally, blood and tissue samples will be assessed for changes in stress levels related to drought conditions. DNA analysis from the samples will aid in determining the genetic relatedness of interacting bobcats.

Cooperative funding provided by Texas A&M University-Kingsville Title V-Promoting Post-baccalaureate Opportunities for Hispanic Americans Program, Gary Waggerman Memorial Scholarship, Hispanic Leaders in Agriculture and Environment, Houston Safari Club, Michael and Charles Corbett Scholarship, Texas Academy of Science/ Texas Organization of Endangered Species, South Texas Quail Coalition, and South Texas Chapter of Quail Unlimited.

Planning for Effective Restoration in the Eagle Ford Shale of South Texas

Forrest S. Smith, Brian Smith, Eric J. Redeker, Keith Walters, and Brian Wille

Oil and natural gas production in the Eagle Ford Shale (EFS) has the potential to negatively impact South Texas wildlife habitat by disturbing or destroying native plant communities. Restoring native plants by reseeding is one method widely recommended to minimize this impact. However, because of the broad geographic area encompassed by the EFS and the natural diversity of soils and vegetation in the area, planning for reseeding efforts can be difficult. Pioneer Natural Resources (PNR) is a major leaseholder in the EFS. *South Texas Natives* (STN), commercial seed growers, and the CKWRI Wildlife Research Technologies Laboratory (WRTL) are working with PNR to ensure effective native habitat restoration will be conducted in PNR's EFS lease holdings.

To date, STN and WRTL have combined PNR lease holding maps with remote sensing data on wildlife habitat attributes and soils data from the USDA Natural Resources Conservation Service. Using the model created, 3 major wildlife habitat/soil delineations have been made, each corresponding to a native plant restoration seed mix designed by STN. PNR personnel are projecting native seed needs in each area, and this information will be communicated to commercial seed growers annually so that adequate quantities of native seed can be produced and made available for use by PNR.

Hopefully, this collaboration for restoration in the EFS can serve as a model for other oil and gas operators in South Texas to minimize the effects of oil and gas exploration on wildlife habitat in South Texas.

Cooperative funding provided by Pioneer Natural Resources and donors to South Texas Natives.

Native Halophyte Vegetation and Soil Salinity at the Site 55 Field Station

Sandra Rideout-Hanzak and David B. Wester

Site 55 is approximately 160 acres of native rangeland located along Baffin Bay in Kleberg and Kenedy counties, Texas and is one of the properties held by Texas A&M University-Kingsville. The bay is part of the largest hypersaline ecosystem in the world known as the Laguna Madre. Because evaporation exceeds precipitation in the bay, the water and surrounding soils have high salinity contents.

Halophytes are plants that tolerate, or even require, salt in the soil water they take up. If soil salinity decreases, glycophytes (plants that do not tolerate high soil salinity) may be able to invade around the bases of halophytes forming successional islands. Site 55 is an ideal field laboratory suited to learning more about halophytes and vegetation dynamics in halophytic ecosystems. Therefore, this study was initiated to assess the native range vegetation for halophyte species and for initial analyses of soil properties including salinity.

Plots were established for surveying vegetation for native halophytes. Possible halophytes that may be present include coastal saltgrass, coastal bermudagrass, seashore paspalum, Kleberg's saltbush, Virginia glasswort, and annual seepweed. Also, analysis of soils is being conducted for pH, macronutrients, micronutrients, organic matter, and salinity.

Establishment of long-term, permanent study plots will provide essential baseline data for future research. In future studies, vegetation treatments may be included such as summer burning, winter burning, or mowing plus removal of residual matter to assess methods for reducing soil salinity quickly. Because hurricanes bring salty ocean water many miles inland, research on saline soil remediation at Site 55 will enhance our understanding of restoration in hurricane-impacted coastal regions.

Cooperative funding provided by Texas A&M University-Kingsville Office of the Associate Vice President for Research.

Restoration of Native Grasses on Naval Air Station Kingsville

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

Many agencies have an interest in using native shortgrasses to re-vegetate disturbed soils and prevent erosion. Potential benefits of native shortgrasses include (1) ease of establishment, (2) good drought hardiness, and (3) reduced potential to invade surrounding areas compared to non-native grasses. Furthermore, low growing native species should require less mowing to maintain their short stature because their maximum height is lower than many exotic species.

To test the ability of a native shortgrass seed mix to stabilize soil on U.S. Navy lands, *South Texas Natives* (STN) and the Naval Air Station (NAS) Kingsville are evaluating a mixture of slender grama, Texas grama, hairy grama, shortspike windmillgrass, and hooded windmillgrass on a disturbed site at NAS Kingsville. The test site is adjacent to a perimeter road, and low-growing vegetation is desired because of security requirements of the facility.

Land preparation was concluded at the beginning of October 2010, and the area was seeded with a shortgrass seed mixture shortly thereafter by STN personnel. Additionally, an area surrounding a pond outflow was stabilized in spring 2011 using native grass transplants and erosion control matting.

This restoration site will be monitored at 3, 6, 12, 24, and 36 months following seeding. Based on the findings, recommendations for future seed mix usage will be prepared for NAS Kingsville.

Cooperative funding provided by Naval Air Station Kingsville and South Texas Natives.

Seed Production of Native Seed Releases for Distribution to Commercial Growers

Keith A. Pawelek, Juan Garza, Andrew W. Scott, Jr., Robert Obregon, Anthony D. Falk, Forrest S. Smith, John Lloyd-Reilley, Jamie L. Foster, and Jeff Rahmes

South Texas Natives and Rio Farms have worked for the last 6 years to produce seed of native plants for distribution to commercial growers. This spring, 5 accessions of silver bluestem were planted to assist the USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center with seed increase of this future seed release. An accession of multiflowered false rhodesgrass was also added to assist with providing seed for the 2011 seed release of this species. In 2010, 40 lbs of seed of the proposed release of Halls panicum was produced, enough to be distributed to a commercial grower to begin commercial production.

Seed increase efforts are also ongoing in Kingsville at the Tio and Janell Kleberg Wildlife Research Park. Current projects include increases of selections of slim tridens, rough tridens, false rhodesgrass, and awnless bush sunflower. Also at Kingsville, breeder seed plots of Dilley Germplasm slender grama and Chaparral Germplasm hairy grama have been established to free up space at Rio Farms for future projects.

At Beeville, with the help of Texas AgriLife Research, seed production is continuing for redseed plantain and Hookers plantain, in which the seed will be distributed to commercial growers. Seed increase efforts will continue, as needed, to ensure adequate supplies of breeder seed and foundation seed of native seed releases are available so that commercial seed production will continue.

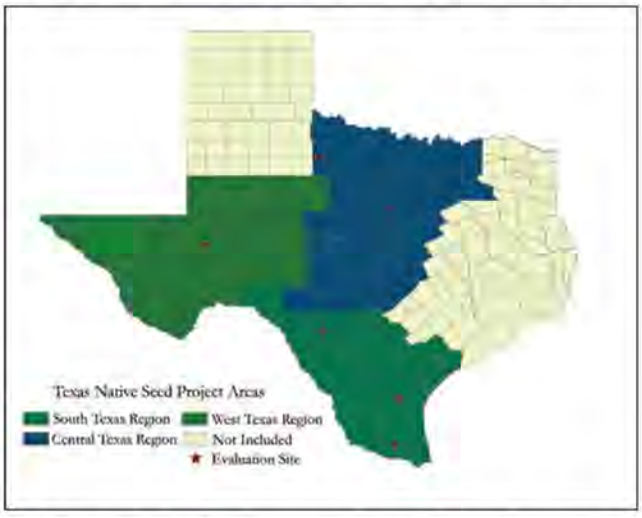
Cooperative funding provided by the Joan and Herb Kelleher Charitable Foundation, Rio Farms, Inc., USDA Natural Resources Conservation Service, Texas AgriLife Research, and numerous donors to South Texas Natives.

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

Forrest S. Smith, James P. Muir, Jeff Breeden, Bonnie Warnock, Gary Rea, John Lloyd-Reilley, Sandra Rideout-Hanzak, Fred C. Bryant, Keith A. Pawelek, Anthony D. Falk, Colin S. Shackelford, and Mia McCraw

The Texas Department of Transportation (TxDOT) is interested in using native plants for roadside restoration efforts in Texas. However, in much of Texas, there is a lack of a commercial supply of ecotypic native seed, which prohibits the use of native species for roadside plantings. Additive to the lack of supply of native seeds for many areas in Texas is the poor performance of many available seed sources in roadside reclamation settings. Such poor performance fails to meet federal requirements of vegetative cover for roadside projects.

To improve the availability of native seed sources for use by TxDOT, the Native Plant Integration



The Texas Native Seeds project is working to develop and evaluate native seed sources for a large portion of Texas.

Program for south, central, and west Texas was initiated in September 2010. Following the model of *South Texas Natives*, this project (known as Texas Native Seeds) will work to collect, evaluate, select, increase, and release ecotypic selections of native species that can be used by TxDOT.

Seed collectors stationed in Stephenville, Alpine, and Kingsville, Texas have begun making collections of native species of interest. Following collection efforts, evaluations will be conducted to select populations with superior characteristics for roadside restoration. These accessions will then be increased and released to the commercial seed industry to provide seed for TxDOT. This project is anticipated to require up to 10 years for completion.

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

Evaluation of Drill and Aerial Seeding Application Methods

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

The King Ranch and *South Texas Natives* have initiated a study comparing native seed application techniques and evaluating the effectiveness of native grass reseeding to increase forage production and facilitate maintenance treatments following brush management. On large acreages, benefits of reseeding in the context of native grass forage production as well as the cost-to-benefit relationship of common seeding methods need to be quantified.

Airplanes are being used to seed large acreages with native plant species on South Texas rangelands.

This study is being conducted on the Laureles Division of the King Ranch. The study site was chained, root plowed, raked, stacked, and double-disked in late summer 2010; plots were seeded in autumn 2010. Four replicates of 3 treatments will be evaluated: (1) brush management only, (2) brush management plus native grass seed mix planted using fixed-wing aircraft, and (3) brush management plus native grass seed mix planted using a rangeland seed drill. Vegetation sampling will be conducted twice annually for 3 years to determine if native grass reseeding success (plant density and cover) varies by seed application method and if native grass forage production can be increased by reseeding following brush management.

To date, drought conditions since planting have limited vegetation emergence in the treatments. Results of this study will be used to make recommendations to land managers desiring to improve forage production of native grasses through seeding, and to determine the cost-to-benefit relationship of common planting methods following intensive brush management.

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

Evaluation and Release of a Deer Pea Vetch Seed Source for South Texas

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

Deer pea vetch is a winter annual legume native to South Texas. In wet winters, deer pea vetch produces copious amounts of seed and forage that is beneficial to livestock and wildlife. In addition, deer pea vetch is very competitive with exotic grasses and is a rapid colonizer of disturbed soils.

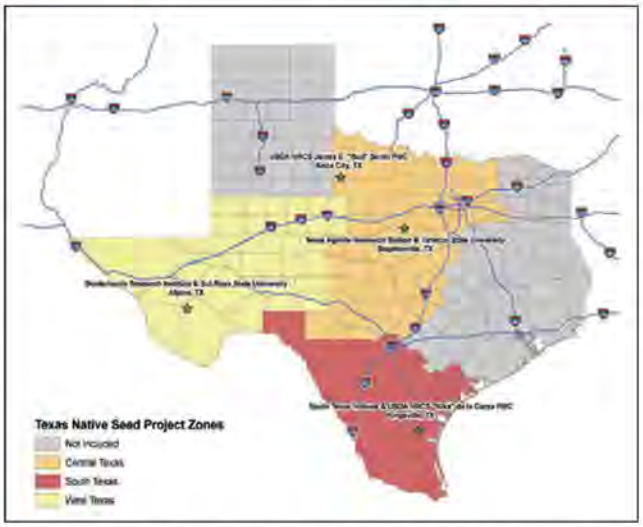
Work by the Texas AgriLife Research Station at Beeville (TARSB) resulted in a selection of a South Texas ecotype of deer pea vetch over 10 years ago, however, the variety was not formally released because of a lack of commercial interest at the time. Because of current interest in native seed sources for restoration, including the critical need for cool-season native plants for oil and gas field reclamation, *South Texas Natives* (STN) began testing this selection in 2008.

Seeds of the TARSB selection were planted in rangeland sites and controlled evaluation plots from 2008–2010. The TARSB selection performed very

well in a number of settings, and provided excellent first-year winter cover in mixed-species seedings on rangelands. Additionally, deer pea vetch proved to be a competitive and prolific native forb for the use of inter-seeding into monoculture stands of buffelgrass and Kleberg bluestem.

Our results suggest that deer pea vetch may be valuable for habitat reclamation activities in South Texas, and a good plant for those that are interested in improving the productivity of exotic grass monocultures for wildlife. STN will assist a commercial seed grower to establish commercial seed fields of this selection. STN will begin drafting formal release documents in 2012.

Cooperative funding provided by the numerous donors to South Texas Natives and the Rotary Club of Corpus Christi (Harvey Weil Sportsman Conservationist Award Trust).



Texas Native Seeds personnel are collecting native plant seed throughout south, central and west Texas to use for the development of restoration seed sources.

Native Seed Collections from Central and West Texas

Mia McCraw, Colin S. Shackelford, and Anthony D. Falk

Developing regionally adapted native seed sources begins with the collection of representative seeds from the intended area of use. Through support from the Texas Department of Transportation (TxDOT) and private donors, and in collaboration with the Borderlands Research Institute at Sul Ross State University, Texas AgriLife Research in Stephenville, Tarleton State University, and the USDA Natural Resources Conservation Service (NRCS) Plant Materials centers in Kingsville and Knox City, native seed collections from central and west Texas are being obtained. This collection effort is part of the new Texas Native Seeds (TNS) project.

Thirty collections of 45 plant species native to central and west Texas are being sought. Through outreach and networking with cooperating landowners and agencies, collections will be obtained from private lands, state and government lands, and roadsides. Throughout the next 3 years when seed of target species is ripe, collectors will hand strip the seed from plants and place it into paper bags to dry. Location information for each seed collection will be recorded. The cleaned seed will be sent to the NRCS Plant Materials centers for inventory and storage.

Persistent drought conditions throughout much of the state have limited seed collection efforts in 2010–2011. This project will facilitate research by TNS and other scientists in developing ecotypic commercial sources of native plants that can be used by private landowners, TxDOT, and other customers to meet restoration goals in central and west Texas.

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

Sand Dropseed and Red Lovegrass Development

Anthony D. Falk, Forrest S. Smith, Allison Logan, Brian Wilde, John Orsak, William R. Ocumpaugh, John Lloyd-Reilley, and Shelly D. Maher

Sand dropseed and red lovegrass are common native grasses found on sand and sandy loam rangelands in South Texas. The growing need for native plants in the South Texas sand sheet and other sand and sandy loam soil areas in the region is driving the evaluation of these species for their possible release to commercial seed growers.

In spring 2010, transplants of 16 red lovegrass accessions and 17 sand dropseed accessions, which were obtained from native populations within South Texas, were planted at the *South Texas Natives* farm in Kingsville, Rancho Blanco near Laredo, and Rio Farms in the Lower Rio Grande Valley. Commercial seeds of sand dropseed and red lovegrass were also obtained and planted for comparison purposes.

Beginning in spring 2010, monthly evaluations of plant survival, growth habitat, and seed production characteristics of each accession were made under irrigated conditions at each evaluation site. In 2011, seeds collected from each accession will be tested for quality, and evaluations of plant performance under drought conditions will be made. The seeds will again be collected from each accession throughout the year at each site in 2011 and tested for quality in 2012. Following third year field observations in 2012, data will be analyzed and accessions possessing the necessary traits for restoration (i.e., survival, high seed quality, broad-based adaptation) will be chosen for seed increase and possible release.

Ecotypic seed sources of red lovegrass and sand dropseed should help improve native grass restoration success on sand and sandy loam rangelands found in South Texas.

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

Development of a Sideoats Grama Seed Source for South Texas

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

Sideoats grama is a native bunchgrass found in the central and western portions of the Rio Grande Plains of South Texas. It has good forage value and provides excellent cover for wildlife. Potential use of this species is good in South Texas for rangeland restoration, highway right-of-way seeding, and oil and gas reclamation sites. Several commercial sideoats grama cultivars from Texas and surrounding states have been developed including Haskell, Niner, Vaughan, Premier, and Uvalde cultivars.

More than 50 native collections of sideoats grama from South Texas, along with available varieties, were evaluated from 2002–2006. Evaluations of Haskell, Niner, and Vaughan sideoats grama had poor performance in terms of stand longevity in South Texas. Premier showed good performance, but seed stocks for increase do not exist. Uvalde sideoats grama seed could not be obtained for evaluation. Since existing sources had poor performance in the region, *South Texas Natives* and its collaborators selected 10 of the 50 native sideoats grama populations evaluated for seed increase based on performance data.

Sideoats grama is a native species being evaluated for its use in restoration projects throughout South Texas.

Following seed increase work from 2005–2011, 7 populations were identified with superior seed yields, concurrent seed ripening, and acceptable stand longevity. These originate from Val Verde (1), Atascosa (2), Frio (2), Kinney (1), and Medina (1) counties. Release procedures for this South Texas ecotype of sideoats grama will be completed, and the seed will be distributed to a commercial producer by spring 2012; it should be available to customers by autumn 2012.

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

Commercial Production Status of Native Seed Releases

Keith A. Pawelek, Dean Williams, Keith Walters, Forrest S. Smith, and William R. Ocumpaugh

Commercial seed production of seed releases made by *South Texas Natives* (STN), the USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center, and Texas AgriLife Research Station at Beeville has substantially increased in the last year. Based on current production acreages and production plans, 23,000 lbs of native seed of our releases should be produced in 2011, providing native seed for up to 11,000 acres of restoration.

Most of the 2008 seed releases are now well established in commercial production and available to customers. Catarina Blend bristlegrass is produced by a consortium of native seed growers.

Mariah Germplasm hooded windmillgrass, Chaparral Germplasm hairy grama, Dilley Germplasm slender grama, and Atascosa Germplasm Texas grama are produced by Douglass W. King Seed Company and Welder Germplasm shortspike windmillgrass and LaSalle Germplasm Arizona cottontop are produced by Pogue Agri Partners. Other seed releases are beginning to be produced in large commercial quantities including Maverick Germplasm pink pappusgrass and Divot Tallow Weed Blend by Pogue Agri Partners and Webb Germplasm whiplash pappusgrass, Falfurrias Germplasm big sacaton, and Kinney Germplasm false rhodesgrass by Douglass W. King Seed Company.

Increases in production of most species are planned by the commercial growers in response to demand from the Texas Department of Transportation and oil and gas field reclamation projects. STN personnel will continue to provide assistance and technical support to collaborating seed companies to positively influence the availability of native seed for restoration projects.

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

No-Till Drilling Native Seed to Restore and Enhance Native Vegetation

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

Restoring natural habitats through seeding is a complex process that has many possible starting points. In some cases, traditional seedbed preparation (e.g., disking or plowing) prior to seeding may induce adverse impacts by promoting erosion, removing established native plants, or facilitating exotic grass invasions. *South Texas Natives* and the Temple Ranch are exploring the effectiveness of no-till drilling as a low cost, low disturbance method of establishing native species on South Texas rangelands.

© Anthony Falk

No-till drilling techniques are being evaluated for native restoration projects in South Texas.

The experiment is being conducted at the Temple Ranch in Duval County, Texas. Treatments consist of a variety of pre-planting restoration treatments including herbicide application, mowing, and prescribed fire in combination with no-till drilling of a high-diversity native seed mix. Following pre-planting treatments conducted from spring 2010–August 2010, replicated plots were planted using a Truax™ no-till seed drill. Treatments were replicated in degraded, native plant dominated areas as well in areas previously dominated by buffelgrass or Kleberg bluestem.

Vegetation surveys conducted in late fall 2010 and spring 2011 indicated excellent establishment of most seed mixes in a number of the treatments after no-till drilling, despite persistent drought conditions since planting. Stand emergence and establishment will be monitored for 2 years. The data collected will be used to make recommendations for site preparation prior to the use of no-till drill seeding of native plants on South Texas rangelands. Observations indicate no-till drilling may be an excellent planting method for native seeds in South Texas.

Cooperative funding provided by the Temple Ranch and donors to South Texas Natives.

Evaluation of Texas Native Seed Sources for South, Central, and West Texas

Colin S. Shackelford, Mia McCraw, Anthony D. Falk, Forrest S. Smith, Keith A. Pawelek, James P. Muir, Gary Rea, Bonnie Warnock, John Lloyd-Reilley, and David Forbes

The Texas Native Seeds project is evaluating 66 seed releases at 6 locations to determine performance and adaptation regions of native seed sources. Seed releases originate from the USDA Natural Resources Conservation Service (NRCS) Plant Material centers in Kingsville and Knox City, Texas and Los Lunas, New Mexico; *South Texas Natives*; and Texas AgriLife Research (TAR). Evaluation locations are the *South Texas Natives* farm in Kingsville, Rio Farms in the Lower Rio Grande Valley, NRCS James E. "Bud" Smith Plant Materials Center in Knox City,

TAR Stephenville, TAR Uvalde, and the Pecos County Water Improvement District #3 Research Farm in Imperial. Transplant and seed plots have been established to assess performance of each seed release at each of the above locations. Data will be collected monthly at each evaluation site for 3 years.

Preliminary data indicate performance is strongly correlated with the distance between the evaluation site and origin of each seed source. Similarity of soil characteristics at the evaluation site to soil characteristics at the seed source collection site has also influenced plant performance.

This project should help define geographic regions of various seed sources, and will guide commercial seed production and consumer use of these seed sources. The project should also identify areas where native plant materials are lacking, guide seed source development efforts of the Texas Native Seeds project, and help to improve native plant restoration efforts conducted by the Texas Department of Transportation.

Cooperative funding provided by the Texas Department of Transportation, South Texas Natives, Texas AgriLife Research, and the USDA Natural Resources Conservation Service Plant Materials Program.

Native Plant Restoration on Plugged and Abandoned Oil and Gas Well Sites

Anthony D. Falk, Keith A. Pawelek, Forrest S. Smith, Clay Powell, and Marc Bartoskewitz

Restoration of native plants on plugged and abandoned oil and gas (P&A) well sites is a common requirement of oil and gas land surface use agreements. However, factors such as soil compaction and altered soil chemistry make the establishment of native vegetation on such sites difficult. *South Texas Natives*, ExxonMobil, and the King Ranch are conducting research on the Santa Gertrudis Division of the King Ranch aimed at developing native plant restoration practices for P&A well sites on the King Ranch. The goal of this project is to develop a native seed mix and protocol that will improve restoration success and increase use of P&A sites by cattle and wildlife.

© Anthony Falk

One of the growing areas of interest involves how to restore abandoned oil and gas sites back to native vegetation.

The project began in spring 2011 with the selection of 4 P&A sites, where attempts to restore native vegetation will be made. Following plugging and removal of the well infrastructure, pad site base materials will be removed, and soils will be tested. These samples will be compared to adjacent native plant dominated sites. The pad sites will then be ripped to alleviate soil compaction, and the soils will be remediated to return soil conditions to those of adjacent soils supporting native plants. Each site will then be disked to prepare an adequate seedbed and planted with a high diversity native seed mix in late summer 2011.

In subsequent years, data will be collected on restoration performance of the various seed mix components. Results will be used to determine native plant species best suited for restoration of P&A sites on the King Ranch and to draft native seed mix recommendations for ExxonMobil to use on other P&A sites on the King Ranch.

Cooperative funding provided by ExxonMobil.

Development of Seed Inoculants for Native Grass Restoration

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

In addition to developing native seed sources, *South Texas Natives*' (STN) mission includes the goal of developing effective restoration methodologies. In South Texas, standard techniques to establish native plants from seed often result in sporadic success on intensely disturbed sites. Research suggests the absence of plant-associated microorganisms may be one factor limiting native grass restoration success on such sites.

Personnel at STN and the King Ranch have initiated an experiment aimed at restoring native plant microsymbiots to degraded planting sites, simultaneously

with seed, to increase native grass restoration success. STN personnel and a private inoculant company developed species-specific native seed inoculants for each of 4 native grasses (pink pappusgrass, Arizona cottontop, plains bristlegrass, and multiflowered false rhodesgrass) using rhizosphere samples from native populations of these grasses. The inoculants incorporated into the seed coating were added to the seed of each species and were planted in a replicated experiment (including controls) along with untreated seeds in October 2009 at the Santa Gertrudis Division of the King Ranch.

Long-term data of the influence of each inoculant on native grass establishment will be collected to determine if these types of treatments hold promise for improving native grass reseeding success on degraded sites in South Texas.

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

Soil Modification as a Restoration Tool to Reduce Old World Bluestems

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

Non-native Old World bluestem (OWB) grasses have become dominant throughout the southern and central Great Plains. Dominance by these grasses can alter the structure of the native plant community as well as change soil chemistry. Many conventional vegetation management procedures (e.g., soil disturbance, prescribed fire, or grazing by livestock) have not resulted in long-term control of these grasses. Modifying soil conditions to favor native plants may be an alternative restoration tool for grasslands invaded by OWBs.

The efficacy of 10 soil modification treatments (pH increase, pH reduction, carbon addition, addition of soil mycorrhizae, soil disturbance alone, and each of the previous combined with seeding of native vegetation) will be examined as restoration tools in grasslands dominated by OWBs. Comparisons of treated areas to undisturbed areas dominated by OWBs will be made, as well as areas dominated by native plants. Restoration success will be assessed by sampling soils, vegetation, and arthropod response to each treatment.

Sixty 20 ft x 30 ft (6 m x 9 m) (5 replicates of each treatment) research plots were established at the Welder Wildlife Foundation Refuge. Soil modification

Soil modification techniques are being assessed to determine their effectiveness for use as a restoration tool.

treatments were applied in June 2011. Sampling will include soil chemistry, vegetation density, cover, and height, as well as presence and abundance of soil, terrestrial, and flying arthropods 4 and 8 weeks after initial treatments. Sampling will be continued for 2 years. It is hoped that this study will help find an effective tool to restore native grasslands in areas dominated by OWBs.

Cooperative funding provided by the Rob and Bessie Welder Wildlife Foundation, Texas A&M University-Kingsville's University Research Award, Montana State University, and South Texas Natives.

The Chronology of Migratory Birds in Southern Texas

Trevor Kalich, Melinda Schwartz, and Scott E. Henke

Bird watching is the single largest wildlife-related enterprise in the United States. More people partake in bird watching than in hunting and fishing combined. No single location is better than southern Texas for bird watching, with nearly 400 species of birds migrating through the region annually.

Because of its unique location in North America, southern Texas is an overlap zone for birds migrating south for the winter from northern latitudes and for birds migrating north during the spring. Monitoring of bird species richness, diversity, and relative abundance is planned to occur throughout the year.

Fifty locations will be identified within southern Texas and all birds observed for 10 minutes within a standard circular plot will be recorded. Each location will be monitored 6 times during each month, twice in the morning, afternoon, and evening hours for 12 months. A monthly birding guide will be developed, based on the findings to assist bird watchers in the chronology and relative abundance of species.

Cooperative funding provided by Texas A&M University-Kingsville's University Research Award.

Seasonal Movements and Use of Habitats by Adult Reddish Egrets

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

The reddish egret is listed as a species of global concern with the National Audubon Society and is listed by the state of Texas as threatened. While there is support for conservation of this iconic coastal bird, little is known of its life history and ecology.

This project will examine aspects of the reddish egret's behavior. The objectives of this study include evaluating the distance of foraging flights from breeding colonies, estimating colony site fidelity among breeding seasons, documenting important wintering and stopover areas, and estimating habitat use along the Texas Coast.

Twenty-one adult reddish egrets were captured at breeding colonies using a monofilament noose trap. Upon capture, culmen length, tarsus length, middle toe length, and body weight were measured. A coded colored leg band and a solar powered Global Positioning Systems satellite transmitter were attached to each adult. Satellites receive data on each bird's location at several intervals throughout the day, which coincide with peak foraging and roosting periods. The information is downloaded to a website for retrieval.

During the first year of the study, approximately 2,300 locations were collected on each reddish egret. Half of the radio-marked egrets wintered in Mexico while the others remained in the Laguna Madre of Texas. Two areas along the Gulf Coast of Mexico appear to be important migratory stopover areas for reddish egrets, one is the Laguna Madre in Tamaulipas and the other is just north of Veracruz. Two individuals made relatively long (greater than 500 miles [805 km]) nonstop flights from the stopover areas to the wintering areas.

This study will continue for the next 2 years. The information obtained will provide important insights on foraging, stopover, and wintering habitats of reddish egrets that can be used to develop a better long-term recovery plan.

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

Avian Migration Patterns along the Lower Texas Coast

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

The Texas Gulf Coast serves as a major migration corridor for millions of birds each fall and spring. The coastal stopover habitats of this region play an increasingly important role to migrating birds by providing areas to rest and forage in order to complete their long migrations. The continuing development of coastal areas represents a significant concern for migratory bird biologists. Accordingly, the limited information available makes it problematic to assess the impacts on migrating birds under these changing conditions within the region.

Baseline information was collected on the timing, magnitude, direction, and altitude of bird migration along the lower Texas Coast using radar technology. Certain aspects of bird migration differed markedly between fall and spring. For example, the magnitude

of bird migration in fall was about 3 times greater than in spring and included some of the highest passage rates recorded anywhere on Earth. Peak fall passage was closely related to the timing of cold fronts. During fall, most birds migrated during daytime. In contrast, spring migration predominantly occurred at night. Additionally, migrating birds were found to occur at greater altitudes during spring compared to fall. Peak spring migration occurred during the middle of April to late May.

Currently, this investigation is focusing on the role that weather plays on the timing, flight altitudes, and flight directions of migrating birds, as well as how migration disperses inland once the birds reach the coast. This information should provide insights about the potential impacts of coastal development on migrating birds along the Texas Gulf Coast.

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

Pond Ecology in Hunted and Non-hunted Alligator Populations

Cord Eversole, Scott E. Henke, and Bart M. Ballard

The American alligator was listed as an endangered species in 1967. Today, alligators have been delisted, and their recovery has been attributed to harvest restrictions and wetland conservation.

American alligators are known to be long-lived, experience variable growth rates, and reach sexual maturity at a minimum size instead of a minimum age. Statewide management strategies for alligators are based upon data from harvested populations. However, because population demographics of alligators are thought to vary by habitat type, habitat condition, geographic region, and alligator density, a generalized population model and management plan may not be appropriate. Such an approach could lead to management decisions that are counter to healthy alligator populations, and possibly return alligator populations back to "endangered status" levels.

In this study, pond ecology and alligator life history characteristics of hunted and non-hunted alligator populations will be investigated. Four similar sites with existing alligator populations will be chosen. A year of baseline data will be collected to assess habitat conditions and alligator life history characteristics on each site. Then, alligator hunting will be allowed at 2 of the study sites, whereas alligator hunting will still be prohibited at the other 2 sites.

Alligator parameters such as density, age structure, size and weight, nest features, reproductive success, and dispersal of young and habitat characteristics such as pond surface area, water depth, shallow to deep water ratio, percentage of emergent vegetation, water quality, and prey abundance will be determined on the study sites.

Data from this project are expected to provide greater insight into alligator population dynamics. This information can be used to further assist in the management of the species.

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

The South Texas Wintering Birds Program: A Resource for Landowners

Thomas M. Langschied and Fred C. Bryant

The 2010–2011 winter season of the South Texas Wintering Birds (STWB) program has concluded and for the third year in a row over 260 bird species have been reported! This is also the first winter season in which 200 or more species were reported each month of the monitoring period. That is quite remarkable. Additionally, 14 new species were seen and reported during this past winter season.

Among the new species added to the STWB winter list was the white-throated thrush, which is a resident of Mexico and Central America. This thrush, a relative of the American robin, was found in Kenedy

The American kestrel is one of the many species that overwinters in South Texas.

County. This particular sighting may represent the most northern record of the white-throated thrush. Interestingly, this past winter there were only 2 reports of scaled quail. It is surprising so few records of this species have been submitted. Overall, including other seasons, 418 bird species have been reported to the STWB program.

As you can see, the winter season can be a great time to find birds in South Texas. What birds do you have on your place? The STWB program is a great opportunity for you to enter the birds you see on your property or the places you visit. This information is private at the property level, but provides important distributional information at the county and regional levels. So, take the plunge and become a citizen scientist of the STWB program by submitting your bird sightings at www.stwb.org.

Additionally, the CKWRI has just published a birding guide for beginning bird watchers entitled *A Guide to Bird-watching and South Texas Wintering Birds*, which is available in hard copy and PDF download on the CKWRI and STWB web sites.

Cooperative funding provided by the Cornell Laboratory of Ornithology, Fondren Foundation, King Ranch Family Trust, Trull Foundation, George and Mary Josephine Hamman Foundation, Elizabeth Huth Coates Charitable Foundation, and the Tom T. East, Sr. and Alice K. East, and Alice H. East, and Robert C. East Wildlife Foundation.

Delineation of Reddish Egret Foraging Habitat in the Laguna Madre of Texas

Elizabeth M. Bates, Bart M. Ballard, and Andrew C. Kasner

The reddish egret is the rarest species of heron in North America. It is a coastal wetland specialist found primarily along the Gulf Coast. There are about 2,000 breeding pairs in the United States with about 75% occurring in Texas. Currently, information is lacking regarding what characteristics define optimal foraging habitat for reddish egrets.

The specific objectives of this research are to (1) document characteristics of foraging habitat for reddish egrets, (2) delineate foraging habitat within the Laguna Madre of Texas based on water depth and substrate characteristics, and (3) assess the temporal dynamics of foraging habitat availability throughout the annual cycle.

Foraging reddish egrets were recorded with a 1–40x camcorder throughout the Laguna Madre of Texas from March 2008 to April 2010. Water depth and seagrass coverage were recorded at each foraging location. Foraging habitat was delineated using benthic habitat characteristics, bathymetry, and tidal readings in the Laguna Madre.

A juvenile, white-morph reddish egret rests between foraging bouts on a tidal flat in the Laguna Madre.

Eighty-six percent of reddish egrets foraged in water depths from 2 to 8 inches and in areas with less than 10% seagrass coverage. Foraging habitat fluctuated between 3,500 and 34,600 acres throughout the year with only 250 acres available over 50% of the time. Large amounts of foraging habitat remained available from August–October when both post-breeding adults and young of the year were present. Foraging habitat fluctuated widely during the breeding season.

Preliminary findings suggest that large areas of potential foraging habitat may be required to ensure that an adequate amount of foraging habitat is available at any given time to support the reddish egret population in Texas.

Cooperative funding provided by the Walter Fondren III Fellowship in Shorebird and Wading Bird Research, the Arthur A. Seeligson, Jr. Conservation Fund, and Fort Worth Zoo.

Waterfowl Foraging Values of Freshwater Wetlands in Southern Texas

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

Wetland habitat conservation is an important waterfowl management topic in today's changing environment. Wetlands have been lost and degraded over the

past 200 years due primarily to agriculture and various types of human-related development. Wetlands along the Texas Coast are important for various species of wintering waterfowl and waterbirds by supporting their energy needs. The goal of this study is to assess waterfowl carrying capacity of freshwater wetlands in southern Texas. This will be determined by measuring the energy in foods sampled from the major wetland types throughout the region.

Invertebrates, seeds, roots, tubers, and submerged aquatic vegetation were sampled in September and November 2010 to coincide with peak abundance of early and late migrating waterfowl, respectively. Sampling will occur during the same months in 2011. Samples are being processed to estimate the available food types and the energy they contain.

Estimates of available energy will be determined for each wetland type and extrapolated across the southern Texas region to estimate total available energy during early and mid-winter. This information will be used to refine bioenergetic models used by the Gulf Coast Joint Venture to update regional wetland management plans for the Western Gulf Coast.

Cooperative funding provided by Ducks Unlimited, Inc.

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

TAMUK Student Wildlife Society and Scott E. Henke

The Mexican free-tailed bat is the most common and numerous bat species found in southern Texas.

© Alan Fedynich

Bat roosting boxes were placed in trees to provide alternate roosting sites near traditional roost buildings.

This particular species frequently uses urban dwellings as roosting sites.

Colonies of Mexican free-tailed bats have become established in the Spanish tile roofs of buildings on the Texas A&M University-Kingsville (TAMUK) campus, prompting concern about bat-human contacts. Building maintenance personnel at TAMUK have placed end caps on the roof tiles of buildings in an effort to keep bats from entering the structures to roost. The TAMUK Student Wildlife Society built bat houses for placement on campus to assist the bats in moving to alternate roost sites.

There is some evidence that suggests bat houses may need to be in place for up to 2 years before bats begin using them. However, bats may quickly use the bat houses if their scent were present in the houses. As a test, 2 bat houses were placed at least 15 ft above the ground in trees adjacent to the bat roost buildings. Bat guano from those buildings was placed in 1 bat house (treatment), whereas the other bat house was not treated with guano (control).

Bat use of the houses will be monitored throughout the year by direct observation at dusk by TAMUK Wildlife Society personnel and with remote digital wildlife cameras. Such information can aid building maintenance personnel with requests from the university community to keep bats from entering campus buildings and also provide alternate roost sites.

Cooperative funding provided by Texas A&M University-Kingsville's University Research Award.

Landscape Appearance as a Visual Cue for Avian Breeding

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

In predictable environments (e.g., temperate ecosystems), avian species use photoperiod as a reliable indicator of upcoming favorable conditions for breeding. However, in unpredictable environments such as semiarid and arid lands photoperiod may not be a reliable cue to time reproduction. Rainfall has been correlated with breeding for many species in arid environments (e.g., zebra finches).

Traditionally, breeding responses are thought to be driven by the materialized effects of the rainfall (e.g., increased food abundance); however, evidence suggests that rainfall itself (or factors tied closely to rainfall) may be the cue triggering breeding. The objective

of this research is to test the influence of vegetation color on the reproductive responses of northern bobwhites, scaled quail, and Cassin's sparrows.

Females of the species previously mentioned will be trapped and housed at the Duane M. Leach Research Aviary at Texas A&M University-Kingsville. Females will be randomly assigned to 1 of 3 treatments. One treatment will consist of a cage in which potted lush green bunchgrasses will be present while a second treatment will consist of a cage with dead bunchgrasses to simulate drought conditions. The third treatment will consist of an abrupt change of vegetation color from dead bunchgrasses to green bunchgrasses. The reproductive response (reproductive hormone levels, percentage of hens laying, timing of egg laying, and reproductive behavior) of the birds will be quantified in all 3 treatments.

Understanding the environmental cues used by birds to time breeding is important given the dynamic climate of South Texas. This knowledge will help lead to better management and conservation practices for these avian species.

© David Hewitt

Photos from the same location in South Texas during a wet year (top) and a dry year (bottom) demonstrate the variation in visual cues that birds may use to assess whether or not to begin breeding activities.

Cooperative funding provided by the Sam Walton Endowed Fellowship in Quail Research, Texas A&M University-Kingsville's University Research Award, and the Texas Quail Coalition (South Texas Chapter).

Post-breeding Habitat Use and Philopatry of Mottled Ducks

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

Little information is available concerning mottled duck habitat use during the post-breeding period. This period may be a stressful time because of increased vulnerability to predators during the flightless molt stage and the nutritional demands of feather replacement. Insights into habitat requirements during this sensitive period in the mottled duck's annual cycle are vital in order to design successful conservation plans to reverse the long-term population decline.

During August–September 2009 and 2010, 19 wetlands were evaluated that were used by either radio-marked mottled ducks or molting mottled ducks caught during state and federal banding operations. Plant height, screening cover, plant composition, water salinity, and water depth were measured along with that of 226 randomly selected wetlands to compare with known-use wetlands.

Wetland availability varied between years due to varying climatic patterns (2009 was considerably drier than 2010). Estuaries with more than 30% emergent vegetation comprised over 59% of wetland types used in both years. Freshwater vegetated wetlands were generally not available as molting sites in 2009, and were used in proportion to their availability in 2010.

Molting mottled ducks selected wetlands with approximately 35% open water and 45% emergent vegetation both years. Water depth and amount of submerged aquatic vegetation were greater in 2010, whereas salinities and amount of exposed mudflats were lower in 2010 compared to 2009.

Analysis of habitat characteristics is continuing. Additionally, assessments will be made of molt site fidelity using 20 years of capture and recapture data of banded mottled ducks.

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

Field Testing the Captive Aging Key for Wild White-winged Dove Nestlings

William C. Colson, Trevor Kalich, Joshua A. Berckenhoff, Alan M. Fedynich, and Shelly Kremer

White-winged dove nestling feather development has not been well documented, compared to the mourning dove. A CKWRI study was conducted in 2008–2009, which led to the development of the first comprehensive aging key of white-winged dove nestlings from 1–14 days old. Although this research provided important data on specific developmental traits of nestlings from which an aging key was developed, its results were based on captive-reared nestlings housed in the Duane M. Leach Research Aviary at Texas A&M University-Kingsville, which may not be reflective of nestling development in the wild. The present study is focused on determining the accuracy of the aging key on wild white-winged dove nestlings.

White-winged dove nestling information was collected from over 100 nests during 2009–2010 from several cities across South Texas. Wild nestling development was documented for the same 10 characteristics identified in the captive study, from which the captive aging key was developed.

As a preliminary test, 25 wild nestlings were aged using the captive aging key. While there was similar progression of developmental traits in both wild and captive nestlings, aging wild nestlings with the aging key lacked sufficient accuracy.

Data analysis is ongoing to develop a more accurate aging key for wild nestlings. Once a more accurate key is developed, volunteers will use the key to determine its reliability and ease of use. Results from this study, including the final aging key for wild white-winged dove nestlings, will allow biologists and researchers to determine nestling age, which is useful for estimating various population parameters.

Cooperative funding provided by Texas Parks and Wildlife Department.

Habitat Selection of Fox Squirrels on a South Texas University Campus

Trevor Kalich and Scott E. Henke

Eastern fox squirrels are the largest tree squirrels native to the United States. They are a common occupant of suburban neighborhoods that have sufficient trees and forest-edge habitat. Fox squirrels prefer stands of trees that produce winter-storable foods such as oak, hickory, walnut, and pine.

CKWRI researchers are studying how fox squirrels exploit the suburban habitats found on the TAMUK campus.

Fox squirrels occur on the Texas A&M University-Kingsville (TAMUK) campus. However, they are not distributed evenly across campus. The present study was conducted to learn more about eastern fox squirrels occurring on the TAMUK campus with the primary objective of determining habitat use and preference. This project also will be used as a teaching component for several undergraduate courses. A comparison will be made of fox squirrel use to availability for habitat types, tree species selection, and tree species parameters such as tree density, height, canopy features, and diameter.

This study will provide insight into the habitat needs of fox squirrels in a suburban setting. Such information can be used by urban and suburban biologists to increase wildlife diversity and improve the aesthetic value of neighborhoods.

Cooperative funding provided by Texas A&M University-Kingsville's University Research Award.

Prevalence of *Rhipicephalus microplus* on White-tailed Deer in Southern Texas

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

White-tailed deer serve as alternative hosts for the cattle fever tick (CFT). Because cattle commonly share pastures with white-tailed deer in southern Texas, treating deer is now part of the CFT eradication program. Treating deer to remove CFTs is complicated because CFTs are endemic to Mexico and white-tailed deer freely move across the international border. The objective of this study is to determine the prevalence of the CFT *Rhipicephalus microplus* as a function of sex-specific bait site visitation rates of white-tailed deer and determine the relationship among CFT numbers, serum stable isotope ratios in deer, and ivermectin treatment concentrations.

In March, September, and November of 2010 and February, March, and April of 2011, 240 white-tailed deer were captured using a net gun fired from a helicopter in Zapata County, Texas along the Rio Grande River. Sex, age, and body condition score were recorded. Each deer also received 2 cattle ear tags for identification purposes. Blood samples were collected via jugular venipuncture, and all ticks found on the deer were collected.

Preliminary results indicate male deer spend more time at feeders and visit feeders more often than females. Therefore, corn makes up a larger proportion of the diet for males resulting in higher ivermectin levels in the serum. However, average tick numbers are similar for both sexes (males = 8.8, females = 8.3). Results of this study will be used to promote the effectiveness of ongoing efforts to treat CFTs on deer.

Cooperative funding provided by the USDA CSREES Agriculture and Food Research Initiative.

Assessing Helminth Community Ecology of Migrating Blue-winged Teal

Nathan D. Kelley and Alan M. Fedynich

Helminth parasites have been known to cause tissue damage, illness, and death in various species of waterfowl and are thought to serve as indicators of host population vitality. Therefore, it is important to fully understand the dynamics of the parasite fauna in order to become better waterfowl managers. The objectives of this study are to assess parasitic helminth prevalence, intensity of infection, abundance, species richness, and diversity in blue-winged teal migrating to their wintering grounds in the fall and migrating back to their breeding grounds in the spring.

As part of a larger study, 50 blue-winged teal were collected in the fall of 2000 and 50 collected in the spring of 2001 from freshwater and saline wetlands in Kleberg and Kenedy counties, Texas. This collection area serves as a major migratory corridor for blue-winged teal in the Central Flyway. Helminths occurring in each of the 100 blue-winged teal will be identified and counted. The appropriate statistical methods will be used to test how season of host collection, host age, and host sex influences helminth populations and communities.

The findings from this study will help further our understanding of helminth parasite infections in blue-winged teal during the critical migration phase of this species as well as providing insight about the structure and patterns of helminth populations and communities occurring in blue-winged teal.

Cooperative funding provided by the Rosewood Foundation.

Environmental Factors and the Longevity of Infective *Baylisascaris procyonis* Eggs

Cord Eversole and Scott E. Henke

Baylisascaris procyonis, a large roundworm found in the small intestine of raccoons, is an emerging zoonosis that is considered a potential weapon of bioterrorism. The life cycle begins when the adult female worms produce eggs, which are shed in the feces of infected raccoons. Raccoons can become infected by ingesting the eggs containing infective larvae or by ingesting infected secondary hosts that have previously ingested eggs in areas containing contaminated raccoon feces.

Humans can become infected by ingesting eggs of *B. procyonis*. Infection with the larva of *B. procyonis* can produce blindness, paralysis, and death in humans. It is speculated that *B. procyonis* eggs can remain viable for years in northern latitudes, but it is assumed that the hot climate of southern latitudes will desiccate eggs, thereby killing them. In addition, *B. procyonis* eggs are large and heavy and may sink into the soil substrate, thus reducing their likelihood of being con-

sumed by a secondary host and, therefore, halting the life cycle of the parasite.

Baylisascaris procyonis eggs will be placed in containers filled with sand, silt, clay, and loam soils, which will be placed in full sunlight or shade. Also, moisture content of the containers will be altered to simulate rainfall or drought conditions. Soil samples will be collected at 0, 1, 3, 6, 12, 18, and 24 months to determine the quantity and viability of *B. procyonis* eggs at various soil depths. Results will aid in the development of predictive models regarding egg viability and the potential rate of spread for this zoonotic disease.

Cooperative funding provided by the Harry L. Willet Foundation.

Analysis of Helminths in Northern Shoveler Gizzards

Stacie M. Villarreal, Britani N. Lolley, Alan M. Fedynich, Autumn J. Smith, Pamela J. Ferro, Markus J. Peterson, David A. Butler, and Blanca Lupiani

The northern shoveler is a dabbling duck that breeds in northern North America and overwinters in southern areas of the United States. Numerous studies have been conducted to better understand the life history of the northern shoveler and other dabbling ducks. One aspect of the northern shoveler's life history that is not well known pertains to parasitic infections, particularly factors that influence the dynamics of parasite populations and the possible role that parasites play in this host. The objectives of this study are to identify and determine prevalence and intensity of helminths occurring under the gizzard lining of northern shovelers and evaluate the influence of host age and host sex on parasite populations.

Eighty-five gizzards, representing 40 juveniles, 45 adults, 45 females, and 40 males were collected from hunter shot northern shovelers during the 2007–2008 hunting season at the Justin Hurst Wildlife Management Area waterfowl check station in Brazoria County, Texas. Seventy-eight (92%) northern shovelers were infected with 1 or more species of helminth. Of those ducks infected, 29 had 1 species, 37 had 2 species, 10 had 3 species, and 2 had 4 species. Overall, 89% of the gizzards were infected with *Amidostomum acutum*, 12% were infected with *Streptocara crassicauda*, 32% were infected with *Epomidiostomum uncinatum* all of which are gizzard nematodes, and 33% were infected with the gizzard cestode *Gastrotaenia cygni*.

Upon completion of this study, wildlife parasitologists will have better insight about the prevalence, intensity of infection, and abundance of gizzard helminths occurring in northern shovelers overwintering in the mid-coastal areas of Texas.

Cooperative funding provided by the USDA CSREES Avian Influenza Coordinated Agricultural Project Grant to B.L.

White-tailed Deer Visitation Patterns at Medicated Bait Sites

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

Eradicating cattle fever ticks from rangelands in southern Texas requires treating white-tailed deer. Medicated bait sites are established in areas of concern. These sites consist of ivermectin treated corn during half the year and a topical treatment device the other half. The objective of this research is to determine visitation patterns of white-tailed deer at medicated bait sites and the influence of deer sex and season (spring, summer, autumn, and winter).

In March, September, and November 2010 and February, March, and April 2011, 240 white-tailed deer were captured on 4 study sites in Zapata County, Texas along the Rio Grande River. Sex, age, and body condition were recorded. Each deer was uniquely marked with colored and numbered ear tags. The normal operational density of medicated bait sites (1 per 86 acres) was established on the study sites in March 2010 and then doubled in March 2011. Motion triggered cameras were used to monitor deer at bait

© Chase Currie

Corn treated with ivermectin is delivered to white-tailed deer using a feeder to help eradicate cattle fever ticks.

sites monthly from March 2010–April 2012 to determine the proportion of the population using bait sites, the number of nights per week that deer visit the bait sites, and the number of feeders per night that deer use. The number of photos per week of each deer is being used to measure intensity of use at the bait sites.

Preliminary data suggest that males visit bait sites at a higher proportion (62%) than females (13%) across all seasons, with visitation being highest in spring for both males (69%) and females (20%). Nights per week, feeders per night, and photos per week were also highest during the spring for males; no differences were found for females among seasons. These results suggest that current techniques may not consistently treat some sex classes of deer.

Cooperative funding provided by the USDA CSREES Agriculture and Food Research Initiative.

Tetrameres pattersoni in Bobwhites from the Rolling Plains Ecoregion of Texas

Stacie M. Villarreal, Alan M. Fedynich, and Dale Rollins

Tetrameres americana and *Tetrameres pattersoni* are 2 indirect lifecycle nematodes that occur in the mucosal glands of the proventriculus of birds. Of the two, *T. pattersoni* is more pathogenic to bobwhites. Although previous parasitological studies of bobwhites in Texas have reported the occurrence of *Tetrameres*, identification to species has not been determined. Thus, there has been a need to identify which species occurs in Texas.

Thirty-seven bobwhites (12 juveniles, 25 adults; 18 males, 19 females) collected from the Rolling Plains Ecoregion of Texas during February–March 2010 were examined. Forty-six *T. pattersoni* were recovered from 16 (43%) bobwhites, whereas *T. americana* was not observed. Mean intensity of infection (average number of parasites per infected host) was 3 worms; infections ranged from 1 to 8 worms. Prevalence of infection did not vary between bobwhite age or sex, whereas analysis of the ranked intensity values indicated that infected adult bobwhites averaged more *T. pattersoni* individuals than infected juveniles.

Preliminary findings suggest that (1) *T. pattersoni* is a common nematode of bobwhites in the Rolling Plains Ecoregion, (2) bobwhites, regardless of host age and sex, are equally exposed to the parasite infective stages, and (3) *T. pattersoni* individuals accumulate in older hosts. Additional research is needed to determine the occurrence of *T. pattersoni* in other ecoregions within Texas and assess the pathological effects of this parasite on northern bobwhites.

© Alan Fedynich

Posterior ends of *Tetrameres pattersoni*; male (left) with long spicule and female (right) with expanded egg-filled body.

Cooperative funding provided by the Rolling Plains Quail Research Foundation.

Raccoon Scat Rate of Decay in Relation to *Baylisascaris procyonis* Eggs

Cord Eversole and Scott E. Henke

Baylisascaris procyonis is a parasitic roundworm of raccoons. It is a zoonotic threat with the ability to cause central nervous system disorders and death in secondary hosts, including humans. Infected raccoons can shed millions of *B. procyonis* eggs in their feces. Once the eggs become larvated (about 32 days after raccoon defecation in Texas), a potential zoonotic threat exists.

Animals that forage for seeds in raccoon fecal material, or herbivores that eat plants that grew in soil after feces decayed, are potentially at risk of infection. This study will investigate the length of time for raccoon scat to decay, document wildlife species that forage in raccoon fecal material, and quantify the number of *B. procyonis* eggs that becomes attached to plants growing in the contaminated soil.

Raccoons will be housed at Texas A&M University-Kingsville's South Pasture kennel facility. Individual raccoons will be fed a wild diet consisting of rodents, birds, and vegetable matter. Fresh scats will be placed

in the environment to observe their natural rate of decay. Remote digital cameras will be used to document wildlife species that forage within the raccoon scats. Grass seeds will be grown in buckets of soil containing eggs of *B. procyonis*. Once mature, the grass will be clipped and eggs of *B. procyonis* will be quantified. Such data will aid in developing a predictive model for *B. procyonis* infections.

Cooperative funding provided by the Harry L. Willet Foundation.

Survey for *Oxyspirura petrowi*: A Parasitic Eyeworm in Bobwhites

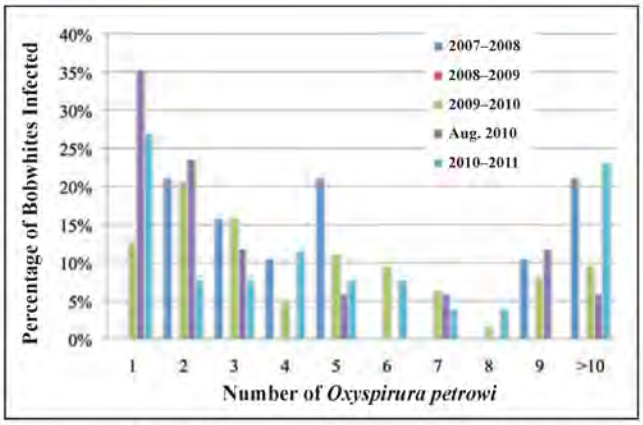
Stacie M. Villarreal, Alan M. Fedynich, Leonard A. Brennan, Fidel Hernández, Dale F. Kane, and Dale Rollins

Oxyspirura petrowi is an indirect lifecycle nematode, requiring an invertebrate intermediate host for transmission (likely grasshoppers or cockroaches). This parasite occurs on the eye surface and under the nictitating membrane of birds. Studies conducted several decades ago in western and northwestern regions of Texas reported this species in northern bobwhites, scaled quail, and Montezuma quail. However, it is unclear if *O. petrowi* occurs in other regions of Texas. This study was initiated to learn more about the occurrence of *O. petrowi* in bobwhites from the Rolling Plains, a region where *O. petrowi* has been reported, and bobwhites from South Texas, a region where it has not been previously looked for and/or reported.

A total of 314 bobwhites collected during 2007–2011 was examined, which represented 236 birds

© Stacie Villarreal

***Oxyspirura petrowi* (cream-colored worm marked by yellow arrow) extending from the eye of a northern bobwhite.**



Distribution of *Oxyspirura petrowi* in 314 bobwhites collected from the Rolling Plains and South Texas.

from the Rolling Plains and 78 from South Texas. Across the entire sample, 125 (40%) bobwhites were infected with 705 *O. petrowi* individuals; however, all those infected were from the Rolling Plains (53% of all Rolling Plains birds). Mean intensity (average number of worms per infected host) of *O. petrowi* was 6, and infections ranged from 1–40 worms.

Findings suggest that *O. petrowi* is common in the Rolling Plains, whereas it is absent or occurs at extremely low levels in South Texas. Additional samples of bobwhites from South Texas are needed before definitive conclusions can be made about the presence or absence of *O. petrowi* in this geographic region.

Cooperative funding provided by the Rolling Plains Quail Research Ranch, the Quail Associates Program, the Richard M. Kleberg, Jr. Center for Quail Research, and Texas AgriLife Research.

White-tailed Deer Distribution on Premises Quarantined for Cattle Fever Ticks

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

White-tailed deer along the Mexico and Texas border have been found heavily infested with the cattle fever tick (CFT), seem to be capable of maintaining CFTs in pastures, and pose a threat to the U.S. Cattle Fever Tick Eradication Program (CFTEP). Furthermore, the rate at which CFTs are spreading among pastures is far greater than that feasible if only cattle were maintaining the ticks. The objective of this study is to assess movements of male and female white-tailed deer relative to supplemental bait sites,

habitat types (open, brush, and dense), and the size of the area typically quarantined for CFT eradication.

In March 2010 and 2011, 48 white-tailed deer were captured using a net gun fired from a helicopter on 3 study sites in Zapata County, Texas along the Rio Grande River. Each site was more than 1,000 acres, surrounded by a standard livestock fence, and quarantined because of the presence of CFTs. Deer received 2 cattle ear tags with different color and number combinations to ensure that each animal was uniquely marked. Additionally, each deer was fitted with a collar containing a Global Positioning Systems (GPS) unit, which takes the deer's location every 30 minutes. The GPS collars were retrieved in February 2011 and redeployed on different deer. The collars will be retrieved again in February 2012.

Movement data will help quantify the extent at which white-tailed deer use and move across the landscape allowing those working with the CFTEP to understand the relationship between white-tailed deer and quarantined pastures.

Cooperative funding provided by the USDA CSREES Agriculture and Food Research Initiative.

Effect of Extreme Temperatures on the Viability of *Baylisascaris procyonis* Eggs

Cord Eversole and Scott E. Henke

Baylisascaris procyonis is a common intestinal parasite of raccoons in the northeastern, midwestern, and Pacific coast of the United States. Infected raccoons can shed millions of eggs per day in their feces.

© Alan Fedynich

The raccoon parasite *Baylisascaris procyonis* is a large nematode that is extremely harmful to humans.

Recently, the parasite has been found in raccoons from Texas, Georgia, and Kentucky. The expanding distribution of this parasite is of concern because of its zoonotic potential. Humans can become infected with *B. procyonis* after ingestion of the infective eggs and can lead to liver dysfunction, pneumonia, blindness, seizures, paralysis, and death. Children, especially toddlers, are considered to be at high risk because they typically play outdoors, have poor hygiene behaviors, and have a greater propensity to explore their environment orally. Human infection has been documented from ingestion of *B. procyonis* eggs obtained at backyard playgrounds, firewood piles, gardens, barns, and attics where infected raccoons defecated.

It has been suggested that *B. procyonis* eggs can remain viable in the environment for many years. Therefore, our objective is to determine whether certain climatic conditions can kill *B. procyonis* eggs.

Baylisascaris procyonis eggs will be placed in a variety of climates (i.e., temperature and humidity combinations) to determine the lethal extremes required to kill 100% of the eggs. Such data will provide medical and wildlife personnel with knowledge of the climatic conditions that influence the persistence of viable *B. procyonis* eggs.

Cooperative funding provided by the Harry L. Willet Foundation.

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 are suspected to affect other animals in addition to avian species. Questions are being raised about several species in their ability to transmit the disease. The purpose of this study is to characterize influenza A virus in mammals.

Mammals are being harvested or trapped in several locations of South Texas during August 2009 to August 2011 from which nasal swabs and serum samples are being collected. Nasal swabs will be sent to the National Wildlife Health Center in Madison, Wisconsin for testing. Analysis will be conducted using the Enzyme-Linked Immunosorbent Assay (ELISA) test, which is a biochemical technique used to detect antibodies, and the Polymerase Chain Reaction (PCR) method, which is a technique used to amplify genetic material.

This study will provide valuable information needed to better understand the ecology of influenza A in mammals. It will better define risks to general human health and those working in agricultural and wildlife related positions where contact with wild animals occurs.

Cooperative funding provided by the U.S. Geological Survey and USDA Animal Plant Health Inspection Service.

Survey of Helminths in Bobwhites from the Rolling Plains of Texas

Stacie M. Villarreal, Alan M. Fedynich, Leonard A. Brennan, and Dale Rollins

Northern bobwhites are a popular gamebird. Unfortunately, assessment of helminth parasites infecting bobwhites in Texas has not been extensively examined. Additionally, most studies have used hunter-shot bobwhites, which sample the "survivors" of the critical breeding stage of the bobwhite's lifecycle. The objective of the present research is to assess the prevalence, intensity, and abundance of helminths in bobwhites from the Rolling Plains Ecoregion during an annual cycle and determine whether infections are related to season, host age, and host sex.

Bobwhites were collected in spring 2010, summer 2010, and winter 2010–2011. Nematodes were the most prevalent and numerically dominant group, represented in order of abundance by *Aulonocephalus pennula*, *Oxyspirura petrowi*, *Tetrameres pattersoni*, and *Dispharynx nastua*, whereas cestodes (*Rhabdometra odiosa* and *Rallietina* spp.) and acanthocephalans (cystacanth stage) occurred infrequently and in low numbers. *Dispharynx nastua* and cystacanths are reported for the first time in bobwhites from the Rolling Plains. Additionally, it was confirmed that the previously unknown species of *Tetrameres* occurring in bobwhites from this region is *T. pattersoni*.

© Alan Fedynich

A cystacanth (encysted larval acanthocephalan) found in a bobwhite from the Rolling Plains of Texas.

Preliminary findings indicate that most of the helminth infections increase with host age and vary between summer and winter periods, but infections are similar between host sexes. Our findings indicate the importance of sampling hosts over an entire annual cycle, thereby documenting when juvenile hosts become infected and how helminth infections vary through time. Upon conclusion of this study, bobwhite biologists will have better insight regarding the dynamics of helminth infections in bobwhites from the Rolling Plains of Texas.

Cooperative funding provided by the Rolling Plains Quail Research Foundation.

Descriptive statistics for helminths collected from northern bobwhites in the Rolling Plains Ecoregion during 2010–2011.

	Prevalence	Intensity		Abundance	
Helminths	No. Infected	Mean ± Standard Error	Range	Mean ± Standard Error	Total
Aulonocephalus pennula (C, S, L)	117 (82%)	134 ± 11	2 – 518	111 ± 10	15,716
Oxyspirura petrowi (E)	67 (47%)	6 ± 0.7	1 – 23	3 ± 0.4	373
Tetrameres pattersoni (P)	37 (26%)	3 ± 0.3	1 – 8	0.8 ± 0.1	108
Dispharynx nastua (P)	1 (0.7%)	1	1	0.01 ± 0.01	1
Acanthocephalan larvae (N)	26 (18%)	4 ± 2	1 – 43	0.8 ± 0.3	113
Cestode spp. (S)	13 (9%)	—	—	—	—

C = ceca, E = eye and nictitating membrane, L = large intestine, N = neck muscle, P = proventriculus, S = small intestine

Effects of Diet Choice on Yearling Buck Antler Growth

Megan R. Kolbe, Donald C. Kahl, Jr., and David G. Hewitt

Individual animals of the same species, sex, age, and productive status may have different nutrient requirements because of differences in physiology. For this reason, feeding a single pelleted diet may not meet the nutrient requirements of all the animals in a given population. This idea was tested by comparing antler size of captive yearling white-tailed deer males consuming a single pelleted ration to those given free-choice access to multiple feeds that differ in protein and energy concentration.

- No difference was found in mean antler size between deer provided a single formulated diet and deer provided diets that varied in protein and energy content.
- Deer with a choice of diets had lower variation in antler size than deer provided a single formulated diet, suggesting that deer with a choice in diets were able to better match their nutritional needs.
- It appears that yearlings can select a diet that supports their specific requirements if given access to feed that varies in nutrient concentration.
- Management strategies should strive for diverse vegetation communities so that whitetails can select a diet that will meet their nutritional needs.
- Management practices that restrict a deer's ability to choose a proper diet may limit the ability of deer to reach their genetic potential.

Search Patterns of Male White-tailed Deer during the Breeding Season

Aaron M. Foley, David G. Hewitt, Randy W. DeYoung, Mickey W. Hellickson, Kenneth L. Gee, Mitch A. Lockwood, and Karl V. Miller

Previous studies indicate mature males sire most offspring, but antler size or body size does not explain breeding success. Breeding success may be related to search patterns. Experienced mature males may exhibit different patterns than inexperienced young males. During 2005–2009, 106 males were captured and fitted with Global Positioning Systems (GPS) collars. The GPS collars recorded locations hourly during the rut. The dataset was partitioned into 4 phases: early, peak, late, and post rut. Males were grouped into 3 age classes: 1.5, 2.5, and 3.5+.

- Most males moved in a patch-to-patch fashion (a patch is defined as an area where deer were located frequently). The number of patches decreased during peak rut while patch visitation rates increased, suggesting males focused on a small number of areas, perhaps because of the presence of females.
- Over 50% of the males exhibited recurring movements, usually every 24 hours, suggesting that they were not moving chaotically, but repeatedly visiting patches to assess receptiveness of females.
- Not all males moved in a patch-to-patch fashion; some were relatively stationary. The increase in stationary males from early rut to peak rut was larger in the young age classes.
- Changes in movement patterns indicate a potential alternative mating strategy used by young males, maybe because of their inability to secure females.
- Relative to other age classes, yearlings were stationary indicating low investment in locating females.
- Two-year-old males had a higher movement rate than mature males, which illustrated difficulty in locating and securing resources. The higher movement rates in 2-year-olds indicate that male-to-male competition may prevent female access.

Cooperative funding provided by King Ranch, Inc., Texas Parks and Wildlife Department, National Fish and Wildlife Foundation, and the Quality Deer Management Association.

A Latitudinal Comparison of Density and Weather on Bobwhite Production

Joseph P. Sands, Stephen J. DeMaso, Matthew J. Schnupp, Trent W. Teinert, Fidel Hernández, Leonard A. Brennan, Dale Rollins, and Robert M. Perez

Density-dependent reproduction has been documented in bobwhite populations in northern latitudes (Illinois, Iowa, Massachusetts, Tennessee, Virginia, and Wisconsin) and has strong implications for bobwhite harvest management. In southern latitudes (Oklahoma and Texas), the existence of density-dependent effects in bobwhite populations is less evident and thought to be weaker than in northern latitudes. The objectives of this research were to conduct a meta-analysis of exist-

ing data to quantify the impacts of spring density and weather (rainfall and temperature) on percent summer gain (PSG) in bobwhites.

- Southern latitude populations had higher spring and fall densities, but lower PSG than northern latitude populations.
- Northern latitude populations exhibited a negative relationship between PSG and spring density. They also exhibited an approximately neutral relationship between PSG and breeding season rainfall.
- Southern latitude populations exhibited negative relationships between PSG and spring density and temperature and an approximately neutral relationship between PSG and breeding season rainfall.
- Sustained-yield harvest theory depends partly on density-dependent reproduction after the harvest. Where populations exhibit weak density-dependence (as southern populations appear to do), they may be more susceptible to over harvest because they lack post-hunting compensation for losses from harvesting.

Cooperative funding provided by Texas Parks and Wildlife Department, South Texas Quail Research Project, Quail Associates Program, and the Rolling Plains Quail Research Ranch.

Thermal Cover in a Semiarid Habitat: Shedding Light on a Shady Area

Dean W. Wiemers, Timothy E. Fulbright, J. Alfonso Ortega-Santos, G. Allen Rasmussen, David G. Hewitt, Mickey W. Hellickson, Beau D. Hester, and Marcus Blum

The importance of thermal cover in habitat selection by white-tailed deer is unclear relative to food availability and escape cover in subtropical environments that have extremely hot summers. Our primary objective was to test the hypothesis that operative temperature is more important than forage nutritional quality, forage abundance, and screening cover in microsites selected by deer at midday during summer.

Operative temperatures were quantified in 10 plant communities, which incorporates solar radiation, thermal radiation, and ambient temperature. Light detection and ranging (LIDAR) imagery was used to determine vegetation height where each deer was located. Fourteen male white-tailed deer were captured in 2008 and 2009; each was fitted with a Global Positioning Systems (GPS) collar. Locations used in statistical analyses were collected from June 17th through July 22nd. Biomass, screening cover, and nutritional quality of 8 plant species were collected annually in July.

- Male white-tailed deer selected taller vegetation with greater forage crude protein or screening cover and cooler operative temperatures during midday.
- Areas with greater forage standing crop or more crude protein were selected during morning, evening, and night in 2008 and 2009.
- In 2009, deer selected areas with shorter vegetation except at midday.
- Habitat selection is driven by combinations of variables that change in importance over time. Thermal cover may influence habitat selection during midday in summer, but forage quality or quantity appears to be prevailing drivers of habitat selection.

Cooperative funding provided by the USDA Natural Resources Conservation Service, the Jack R. and Loris J. Welhausen Experimental Station, King Ranch, Inc., College of Graduate Studies at Texas A&M University-Kingsville, Houston Safari Club, Texas Quail Coalition (South Texas Chapter), and the Houston Livestock Show and Rodeo.

Practicality of Video Camera Collars for Collecting Data from Deer

Michael J. Lavelle, Kurt C. VerCauteren, Aaron M. Hildreth, Tyler A. Campbell, David B. Long, David G. Hewitt, and Scott E. Hygnstrom

Rapidly evolving electronic technology has enabled wildlife researchers to collect previously unobtainable information. To this end, researchers have extended

© Scott Conard

Having the ability to view the habitat as the deer sees it is an important feature of the video camera monitoring system.

the traditional methods, such as direct observation of the animal, to now collecting behavioral data from an animal's point of view using data-collecting video camera systems or animal-borne video and environmental data collection systems. The video camera monitoring system was evaluated in this study.

Twenty-six adult male white-tailed deer were captured and fitted with animal-borne cameras (ABCs) within a closed population (1,000-acre high fence pasture) in southern Texas just prior to the breeding season during autumn 2010.

- From 17 ABCs, 21,474 video clips were successfully retrieved.
- This research effort furthered the development of ABCs and demonstrated the practicality of using such devices to acquire data on wildlife pertaining to issues such as disease transmission, behavior, diet, and habitat use.

Cooperative funding provided by the University of Nebraska-Lincoln and the USDA APHIS Wildlife Services National Wildlife Research Center.

Temporal and Spatial Trends in Northern Bobwhite Population Parameters

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

Northern bobwhites have been declining in abundance across North America for many years, but it is unclear if other demographic variables share this downward trajectory. The objectives of this study were to quantify the historical, spatial, and temporal trends in bobwhite survival, nest success, and clutch size and compare these trends to trends in abundance. Therefore, a meta-analysis was conducted using 78 northern bobwhite studies published in the peer-reviewed literature.

- Mean annual survival (± standard deviation) pooled across studies was 0.15 ± 0.15 (1929–2004; 32 studies). Survival was non-trending prior to 1990, but increased thereafter by 0.02 per year.
- The increases after 1990 occurred along a spatial gradient in which survival decreased at the northern and western periphery of the bobwhite's range.
- Mean nest success was 0.44 ± 0.14 (1924–2008; 33 studies) and increased by 0.02 per year. A spatial gradient was detected prior to 1990, but not thereafter. Nest success was lowest at the northern and eastern periphery of the bobwhite's range.
- Mean clutch size was 13.1 ± 1.0 eggs (1931–2008; 13 studies) and exhibited no biologically meaningful trend through time. A latitudinal gradient was detected, in which clutch size increased by 0.2 eggs per degree of latitude.
- Despite continued bobwhite declines, some demographic variables exhibited positive trends in recent decades, which may be the result of a paradigm shift in the early 1990s that generated conservation and management attention for bobwhites.
- These results demonstrate spatial variation in some demographic variables; findings suggest a need for greater management attention at the edge of the bobwhite's range.

© Scott Conard

Knowledge about the causes of bobwhite population declines is needed to improve management strategies.

Cooperative funding provided by the Texas Quail Coalition (South Texas Chapter), King Ranch, Inc., Texas A&M University-Kingsville Title V-Promoting Post-baccalaureate Opportunities for Hispanic Americans Program, and Houston Safari Club.

Demographic and Supplemental Feed Effects on Deer Reproductive Success

Aaron M. Foley, Randy W. DeYoung, David G. Hewitt, Timothy E. Fulbright, Charles A. DeYoung, and Don A. Draeger

Supplemental feeding is popular in South Texas; however, because of a lack of controlled studies, it is unknown how feed and demographics influence male

and female reproductive success. Five years of parentage data were analyzed from deer in 12 enclosures with 2 feed treatments (fed and unfed) and 3 deer density levels. Deer were grouped into young (1–2 years) and mature (3+ years) age classes for the analysis.

- None of the young males in enclosures without the supplement sired offspring while young males in enclosures with supplement sired 13% of the offspring. Young males without the supplement might have been in poor condition, thereby preventing breeding success, although low fawn recruitment rates and enclosures skewed towards mature males might have limited the inferences that can be made.
- In the enclosures with supplemental feed, mature males sired most of the offspring; however, young males were also successful breeders (12–27%) regardless of deer density, male age structure, and sex ratios.
- Most fetal offspring sired by young males were conceived during peak rut. Multiple paternities often included a young and a mature male. Opportunities for young males to breed, perhaps by sneaking a copulation, appeared to be enhanced when male-to-male competition was high.
- Young females with access to supplemental feed had higher fecundity and recruitment rates than young females without access to supplemental feed. However, mature females consistently recruited more fawns (76–83%) than young females regardless of feed availability, indicating that maternal experience is important.
- Young males were more likely to copulate with young females even when populations contained a high proportion of mature females.

© Randy DeYoung

Buck reproductive success appears to be influenced by age and nutritional status.

- Lower recruitment rates in young females resulted in young males having lower realized breeding success because few of their offspring reached recruitment age.

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

A Simulation Model of Sustained-Yield Harvest for Bobwhites in South Texas

Joseph P. Sands, Matthew J. Schnupp, Trent W. Teinert, Stephen J. DeMaso, Fidel Hernández, Leonard A. Brennan, Dale Rollins, and Robert M. Perez

Recommended sustainable harvest rates for northern bobwhites vary greatly and range from 25–70% of the pre-hunt population. Because bobwhite populations are declining across their geographic range, determining sustainable harvest levels is critical for conscientious management of this species. Our objectives were to use simulation modeling to identify optimal bobwhite harvest rates and assess the impacts of harvest on probability of population persistence.

A simulation model was constructed for a hypothetical bobwhite population on a 1,977-acre (800 ha) study area in the South Texas Plains. The model assessed population dynamics to 100 years over a range of harvest rates from 0 to 40%.

- A harvest rate of 20% produced the greatest average yields (231 ± 10 [mean ± standard error] bobwhites harvested per year).
- A 30% harvest rate resulted in a high probability of extinction (PE = 0.75) with a time to extinction of 47.8 ± 2.3 years.
- A 40% harvest rate was not sustainable (PE = 1.0), with extinction occurring in 15.5 ± 2.6 years.
- Harvesting northern bobwhite populations in South Texas at rates of 20–25% of the pre-hunt population should maximize long-term harvest while minimizing the probability of population extinction.
- Harvest rates of northern bobwhites greater than 30% are likely excessive with respect to long-term population persistence for populations in the South Texas Plains.

Cooperative funding provided by Texas Parks and Wildlife Department, the South Texas Quail Research Project, Quail Associates Program, and the Rolling Plains Quail Research Ranch.

Aggressive Interactions among Deer at Feed Sites

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

Supplemental feed is used in deer management, but aggressive interactions may limit access for some individuals. This study's objective was to determine if population density or season affected aggressive interactions among sex and age groups of white-tailed deer at supplemental feed sites. This study was conducted using 6, 200-acre enclosures located on the Comanche and Faith ranches and managed at varying deer densities. Aggressive interactions were recorded using digital trail cameras placed at supplemental feed sites.

- Bucks 2 years and older were dominant over the other age and sex groups in over 87% of their interactions. Bucks dominated does to a greater extent in high density enclosures during summer, but density had little effect in any other season.
- Yearling bucks were dominant in 81% of their interactions with does during spring; however, in other seasons there was no clear dominance hierarchy.
- The rate of aggressive interactions increased with deer density.
- Ten percent of interactions were severe (defined as physical contact); this percentage did not change with population density or season.
- At all population densities and during all seasons, does avoided bucks at supplemental feed sites; however, the degree of avoidance declined with increasing deer density in all seasons except during the spring.

© Larry Ditto

Aggressive interactions tend to increase under conditions of higher deer densities.

- These results indicate that as population density increases, so do social pressures that may limit the accessibility of supplement to subordinate age and sex groups. Consequently, the effectiveness and potential benefits of supplemental feeding programs may become increasingly limited as population density increases.

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

Abiotic Characteristics Influencing Activity of Male Deer in a Semiarid Habitat

Dean W. Wiemers, Timothy E. Fulbright, J. Alfonso Ortega-Santos, G. Allen Rasmussen, David G. Hewitt, Mickey W. Hellickson, Beau D. Hester, and Marcus Blum

White-tailed deer activity is influenced by many environmental variables including temperature, forage nutritional quality and abundance, wind speed, cloud cover, and vapor pressure. The objective of this study was to determine abiotic characteristics that influence deer activity in a randomly varying environment.

Fourteen male white-tailed deer were captured in November of 2008 and 2009. Each deer was fitted with a Global Positioning Systems (GPS) collar that recorded locations and ambient temperatures of the environment where each deer was located. Activity was quantified by calculating the distance between 2 successive individual deer locations. A weather station 7 miles from the study area recorded wind speed, cloud cover, and vapor pressure deficit. Lunar presence was also investigated by using daily moon rise, moon set, moon superior transit, and moon inferior transit. Moon superior transit was defined as the mean time between moon rise and moon set, while moon inferior transit was the mean time between moon set and moon rise. Specific points in time were included in the analyses by using deer locations at sunrise, solar noon, sunset, and midnight.

- At solar noon, sunset, and midnight, male white-tailed deer activity increased with decreasing temperature in all seasons.
- During the morning and night, activity increased as the moon inferior transit occurred later in the evening; activity also increased during the night in the spring as the moon rise occurred near midnight or slightly thereafter.

- During summer 2008, activity increased as wind speed increased during midday and night.
- Activity of white-tailed deer increased with increasing vapor pressure deficit at midnight in the spring and summer.
- A variety of environmental factors influence deer activity, but during the daytime in summer, temperature is the major factor governing deer behavior.

Cooperative funding provided by the USDA Natural Resources Conservation Service, the Jack R. and Loris J. Welhausen Experimental Station, King Ranch, Inc., College of Graduate Studies at Texas A&M University-Kingsville, Houston Safari Club, Texas Quail Coalition (South Texas Chapter), and the Houston Livestock Show and Rodeo.

© Greg Lasley

Understanding summer diets of scaled quail is necessary for developing better management strategies.

Late Summer Dietary Survey of Scaled Quail from Elephant Mountain WMA

Jeff H. Bardwell, Christopher M. Ritzi, Scott P. Lerich, and Alan M. Fedynich

The scaled quail is an important gamebird with its distribution centered in the Chihuahuan Desert region of the southwestern United States. In Texas, scaled quail occur in the western half of the state. Diets of scaled quail have been examined during various seasons and within various parts of their range, but rarely in late summer.

Our objective was to survey late summer dietary trends of scaled quail at the Elephant Mountain Wildlife Management Area using a sample of 48 individuals (10 juveniles, 12 sub-adults, and 26 adults) that were collected for a parasitological study. Crop contents of each quail were frozen in the field and stored in laboratory freezers until examination.

- Grass, forbs, woody plant seeds, and insects were the major dietary categories. Grass dietary components consisted of bristlegrass, panicum, and Johnsongrass in high, moderate, and low abundances, respectively, but only bristlegrass was consumed by all age classes.
- All age classes primarily consumed forbs (hophornbeam copperleaf, common fiddleneck, carpetweed, and *Verbena* sp.), whereas woody plants (mainly mesquite and white-thorn acacia) were primarily consumed by sub-adults and adults; cactus was not found.
- Adults consumed more forbs by percent volume than any other age class, resulting in the lowest consumed volumes of woody plant material.
- Insects consumed by scaled quail included those from the taxonomic orders Coleoptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, and Orthoptera. Sub-adults and adults consumed insects in higher percentage volumes than juveniles, whereas juveniles consumed a greater percentage of grasses by volume.
- Results suggest that scaled quail have a broad diet and opportunistically exploit food resources. Additionally, age groups may be avoiding direct competition for limiting food resources by using different food types within their arid habitat.

Cooperative funding provided by Texas A&M University-Kingsville's University Research Award.

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

Felix Ayala-Alvarez, J. Alfonso Ortega-Santos, Timothy E. Fulbright, G. Allen Rasmussen, D. Lynn Drawe, David R. Synatzske, and Andrea R. Litt

The invasion of exotic grasses into grasslands dominated by native plants changes fire cycles and reduces biodiversity. The hypothesis that the long-term effect of roller chopping and prescribed burning results in an increase in exotic grasses was tested.

The study was conducted at the Chaparral Wildlife Management Area in the western South Texas Plains. Four treatments were evaluated: roller chopping in 1999 or 2000, roller chopping in 1999 or 2000 followed by a warm-season burn in 2005, warm-season burn in 2005, and control (no manipulation). In 2007, the percentage of canopy cover of exotic grasses, native grasses, forbs, litter, bare ground, woody plants, and succulent plants was determined.

- Variables that were significantly influenced by the treatments were canopy cover of litter and canopy cover of native grasses.
- Canopy cover of exotic grasses was 31% higher in the control site than in the prescribed burn site.
- Native grass canopy cover was 30% higher in the prescribed burn site than in the control site.
- Under the environmental conditions at the time of the study, roller chopping and/or prescribed burning did not increase exotic grasses.

Cooperative funding provided by the USDA Natural Resources Conservation Service and Texas Parks and Wildlife Department.

Texas Department of Transportation South Texas Native Plant Restoration Project

Forrest S. Smith, Timothy E. Fulbright, and Dennis K. Markwardt

The South Texas Native Plant Restoration Project (known as *South Texas Natives*, STN), which was begun in 2001, has substantially met the goals of providing native plant seed sources for highway restoration projects in South Texas. Through the support of the Texas Department of Transportation (TxDOT) and other stakeholders and collaborators, STN has helped make native seeds commercially available for use by TxDOT on South Texas roadsides.

- STN and partners at the USDA Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center (PMC), Texas AgriLife Research Station at Beeville, and Rio Farms developed 17 native plant seed releases, and ensured the successful commercialization of 3 previous seed releases developed by the PMC. Sixteen of these seed sources are now available for purchase.
- STN and TxDOT personnel met in May 2011 to develop a native seeding protocol for the Pharr and Corpus Christi TxDOT districts. This action will lead to the use of the adapted native seeds in highway right-of-way seeding efforts by TxDOT in a large portion of South Texas by August 2011.
- Future work to maintain breeder and foundation seed stocks will be needed for commercial success of the seed releases made by the project.
- The stable demand for native seed sources provided by TxDOT's specification of STN and PMC seed releases should lead to beneficial increases in seed availability for TxDOT and other seed customers in the region.

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

Demonstration Plantings of Native Plant Species on South Texas Rangelands

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

Reliable establishment of native plants from seed has been a problem of past restoration projects in South Texas, primarily because of a lack of locally adapted seed. As locally adapted seed sources become commercially available through the efforts of *South Texas Natives* (STN), it is important to quantify the performance of these seed sources for rangeland restoration. STN personnel seeded 9, 1-acre demonstration plots on 7 South Texas ranches with a mixture of native seeds currently available to the public and evaluated the performance of each planting for 3 years.

- Seven of 9 plantings met or exceeded USDA Natural Resources Conservation Service Range

Planting standards for establishment by having 0.5 seeded plants per ft^2 a year after planting.

- Most of the unsuccessful plantings occurred on sandy soils.
- By 2 years after planting across all sites, seeded native species contributed greater cover than volunteer natives or exotic grasses.
- Findings indicate little change in the cover of native or exotic species after initial establishment through 2 years after seeding. This indicates that exotic species did not out-compete native species on these sites.
- Changes in plant cover of native seeded vegetation and exotic grasses were influenced similarly by moisture conditions.
- Results suggest many seed sources currently available are marginally adapted to very sandy soils. These findings will be used to guide future seed release development efforts by STN.

Cooperative funding provided by the Temple Ranch, Cactus Jack Ranch, Killam Ranches, Las Cuatas Ranch, Rancho Blanco, Comanche Ranch, Greg Smith, Butch Thompson, Womack Ranch, Victoria County Soil and Water Conservation District, and the Victoria Chapter of the Grazing Lands Conservation Initiative.

Re-establishment of Herbaceous Native Plants with Roller Chopping

Felix Ayala-Alvarez, J. Alfonso Ortega-Santos, Timothy E. Fulbright, G. Allen Rasmussen, and D. Lynn Drawe

Native plants are important components of wildlife habitat. In semiarid environments, such as South Texas, allowing herbaceous native plants to re-establish from soil seed banks can benefit wildlife as well as domestic animals. Seeding roller chopped areas with monocultures of introduced species negatively affects habitat quality for important wildlife species. The objective of this research study was to determine if reseeding is required following roller chopping in South Texas mixed brush communities to improve or re-establish herbaceous plant vegetation.

The study was conducted at 3 locations in South Texas. Study sites were selected in order to have a high-to-low gradient of precipitation. Treatments were roller chopping, roller chopping plus seeding a native plant mix, and control (no manipulation).

- There was no evidence to suggest that seeding native species after roller chopping increases the canopy cover of herbaceous vegetation in comparison to only roller chopping.
- The mechanical brush management practice of roller chopping by itself is enough to re-establish herbaceous vegetation canopy cover.
- The species of grass or forb that will grow after the disturbance will depend on the composition of the original herbaceous vegetation.
- Results indicate that seeding is not necessary after roller chopping to re-establish or increase herbaceous vegetation cover in South Texas independently of the precipitation regime.
- The invasion of exotic grass species was not reduced by seeding native plants and it was higher as rainfall increased.

Cooperative funding provided by the USDA Natural Resources Conservation Service, Rob and Bessie Welder Wildlife Foundation, Shining Ranch, and Jack R. and Loris J. Welhausen Experimental Station.

Invasion Patterns of Kleberg Bluestem in South Texas

Beau D. Hester, Timothy E. Fulbright, J. Alfonso Ortega-Santos, G. Allen Rasmussen, and Dean W. Wiemers

Kleberg bluestem is an exotic grass that has invaded extensive tracts of South Texas rangeland. This study was conducted to determine relationships between disturbance, soil properties, and patterns of Kleberg bluestem establishment. The study area was the 3,375-acre Gallito pasture, located on the Laureles Division of the King Ranch in Kleberg County, Texas. Biomass was

Kleberg bluestem shown here invading along a fence line and ranch trail on a South Texas ranch.

estimated for grasses, forbs, browse, half-shrubs, and cacti using 4, 1-ft^2 plots per transect along 7 transects within each of 11 plant communities during spring and summer 2008 and 2009. The line intercept method was used to estimate woody plant canopy cover.

- Canopy cover of Kleberg bluestem tended to increase with declining woody plant cover.
- Canopy cover of Kleberg bluestem declined with distance from roads.
- Canopy cover of Kleberg bluestem was greater in sites disturbed by chaining or root plowing.
- To minimize invasion of rangelands by Kleberg bluestem, land managers should minimize soil disturbance and ensure that ranch vehicles are not accidentally transporting and spreading Kleberg bluestem seeds.

Cooperative funding provided by King Ranch, Inc., the USDA Natural Resources Conservation Service, and the Jack R. and Loris J. Welhausen Experimental Station.

Effects of Invasive Grasses on Arthropod Diversity and Abundance

Erin E. Cord, Andrea R. Litt, Timothy E. Fulbright, and Greta L. Schuster

Invasive grasses can alter the composition and structure of vegetation communities. Arthropods may be affected disproportionately by these changes because of their specialized relationships with certain plants for food resources and as reproduction sites. To better understand the effects of invasive plants, arthropod abundance and diversity were compared in 90 patches of Kleberg bluestem, tanglehead, and native grasses (30 patches of each grass type). Kleberg bluestem is native to the Old World and although tanglehead is native to the United States, this species has recently increased in dominance in parts of South Texas.

© Aaron Tjelmeland

Snout butterflies on the invasive tanglehead grass found in South Texas rangelands.

Vegetation and arthropods were sampled during spring and summer 2009–2010 on a portion of the King Ranch located in Kleberg County, Texas. Arthropods were identified to taxonomic order and family and their occurrence compared among the 3 grass types.

- The number of arthropod taxonomic orders decreased by 14%, number of taxonomic families decreased by 17%, and total abundance of arthropods, abundance of 8 orders, and presence of 12 families decreased in invasive grass patches, relative to native grass patches.
- One order and 7 families were less likely to occur in tanglehead and equally likely to occur in Kleberg bluestem and native grasses.
- In general, an overall decline was detected in arthropod abundance and diversity within invasive grass stands. Such changes may affect pollination, decomposition, and the abundance of food resources for wildlife species.
- Although complete eradication of invasive grasses is unlikely, managers can focus on maintaining or increasing vegetation heterogeneity to support diverse floral and faunal communities.

Cooperative funding provided by Betty Kelso and the Coates Foundation.

Assessment of Herbicides and Seeding to Restore Exotic Bluestem Invaded Prairie

Marvin E. Ruffner, Thomas Barnes, Forrest S. Smith, and Keith A. Pawelek

Old World bluestems such as King Ranch, Kleberg, Angleton, Australian, Caucasian, and silky bluestems are becoming persistent invaders in grasslands of the central and southern United States. However, little is known about how to reverse the invasion of these exotic species and restore the impacted grasslands back to native habitat.

From 2007–2009, at the Welder Wildlife Foundation Refuge near Sinton, Texas, evaluations of treatment combinations were made for soil disturbance, pre- and post-emergence herbicide applications, and native

seeding in early summer and fall to determine their effectiveness as restoration methods for Old World bluestem-dominated grasslands.

- For treatments conducted in early summer, Old World bluestem control was highest in disking, followed by imazapyr and glyphosate.
- For treatments conducted in the fall, Old World bluestem control was similar among treatments.
- Native seed establishment in summer and fall seedings was similar in the soil disturbance, glyphosate herbicide, and imazapyr herbicide treatments.
- Volunteer and seeded native grass cover were negatively correlated with post-treatment Old World bluestem cover.
- Efforts to restore native grasses to sites previously dominated by Old World bluestems following disking or treatment with glyphosate or imazapyr herbicides are unlikely to be successful for more than 2 years after treatment.
- Methods to eliminate the seed bank of Old World bluestems or prevent Old World bluestem seed germination are needed for restoration of native grasses on sites dominated by these exotic species.

Cooperative funding provided by the Rob and Bessie Welder Wildlife Foundation, University of Kentucky, and donors to South Texas Natives.

Effect of Previous Roller Chopping and Fire on Vegetation Response to Wildfire

Felix Ayala-Alvarez, J. Alfonso Ortega-Santos, Timothy E. Fulbright, G. Allen Rasmussen, D. Lynn Drawe, David R. Synatzske, and Andrea R. Litt

Vegetation diversity may be affected by disturbances such as mechanical treatments, prescribed burning, and wildfires. Our objectives were to determine if previous disturbances can influence the response of herbaceous vegetation to wildfire in the mixed brush plant communities within western South Texas and to test the hypothesis that previous disturbances can lead to a greater increase of exotic grasses than sites with no disturbance.

The study was conducted at the Chaparral Wildlife Management Area in the western South Texas Plains. Four treatments were evaluated before and after a wildfire occurred during spring 2008 on the study site: roller chopping in 1999 or 2000, roller chopping in 1999 or 2000 followed by a warm season prescribed burn in 2005, warm season prescribed burn in 2005, and control (only wildfire). Changes from 2007 to 2008 in the percentage of canopy cover of exotic grasses, native grasses, forbs, litter, bare ground, woody plants, and succulent plants were examined.

Dr. Alfonso Ortega-Santos supervises a prescribed burn on a South Texas rangeland pasture.

- There was a multivariate effect of the wildfire on the canopy cover of exotic grasses, native grasses, forbs, litter, and bare ground. This resulted from greater exotic grass canopy cover in the control site than found in the prescribed fire and roller chopped treatment sites.
- The percentage of exotic grasses in the control site increased from 37% in 2007 to 78% in 2008 after the wildfire.
- Previous management disturbances affected the response of herbaceous vegetation to the wildfire. Maintenance management did not lead to more grasses that are exotic.

Cooperative funding provided by the USDA Natural Resources Conservation Service and Texas Parks and Wildlife Department.

Distribution of Nesting Bird Species on the TAMUK Campus

Trevor Kalich, William C. Colson, Alan M. Fedynich, and Shelly Kremer

One of the interesting aspects about urban bird ecology is how species partition nesting habitat. To learn more about this aspect of avian ecology, tree-nesting birds were surveyed and monitored on the Texas A&M University-Kingsville main campus during May to August 2010. Habitat on campus consists of open grass lawns, various bushes, and trees such as palm and live oak.

- There were 139 white-winged dove nests, 10 mourning dove nests, 50 Couch's kingbird nests, 7 northern mockingbird nests, and 22 nests that were either empty or built by an unknown species.
- The main tree species used for nesting was the Rio Grande live oak (over 80% of all tree species) in which 95% of the white-winged dove nests were found; mean height of white-winged dove nests was 12.8 ft (± 2.7 ft).
- Couch's kingbird nests were located highest in the tree canopy at 18.8 ft (± 5.5 ft); nest trees were often found near open spaces such as parking lots.
- White-winged doves and mourning doves tended to nest in the lower canopy between 6.6–19.7 ft; nests of white-winged doves as well as mourning doves were found in areas that appeared to provide more seclusion or protection from predators.
- Findings provide insight into the nesting preferences of bird species and are useful for those wishing to provide avian nesting habitat within urbanized landscapes.

Cooperative funding provided by Texas Parks and Wildlife Department.

Genetic Variability and Effective Size of Texas Lesser Prairie-Chickens

Kelly S. Corman, Randy W. DeYoung, Leonard A. Brennan, Stephen J. DeMaso, Warren B. Ballard, Mark C. Wallace, Clint W. Boal, Heather A. Whitlaw, and Robert M. Perez

The lesser prairie-chicken was once common in the Texas Panhandle. Today, viable populations are present only in the northeast and southwest portions of the panhandle. The lesser prairie-chicken is a state conservation priority in Texas and a candidate species for protection under the Endangered Species Act.

Samples for genetic analyses were collected from 544 lesser prairie-chickens in Texas and New Mexico from 2004 to 2010. Genetic analyses included using microsatellite DNA loci and the mitochondrial (mtDNA) control region to estimate genetic diversity and effective population size.

- Genetic diversity was high and comparable to previous genetic studies of lesser prairie-chickens in other states.
- Greater mtDNA haplotype diversity was found in the northeast panhandle of Texas. Lower genetic diversity was detected in an isolated peripheral population in Deaf Smith County, Texas.
- The mtDNA effective population size was higher in the northeast panhandle, but the contemporary effective size estimates were greater for the southwest panhandle populations.
- The contemporary population effective size estimates are consistent with population status. Populations in the southwest panhandle region are doing well compared to the northeast panhandle, which is experiencing fragmentation because of energy development.
- Effective population size based on mtDNA is influenced by events hundreds to thousands of generations in the past, while the microsatellite data represent recent generations.
- Populations in the northeast panhandle and the isolated peripheral population in Deaf Smith County are most at risk. These results emphasize the need to conserve existing habitat and provide insight about the scale of population size and degree of isolation at which genetic erosion becomes evident.

Cooperative funding provided by Texas Parks and Wildlife Department.

How Have Mountain Lion Populations Changed Over Time in Texas?

Joseph D. Holbrook, Randy W. DeYoung, Michael E. Tewes, and John H. Young

Mountain lions are secretive and occur at low densities, making it difficult to estimate population size and population trends. An alternative survey method

is to compare genetic characteristics of contemporary populations to historical (museum) specimens. Samples of 299 mountain lions collected in Texas during 1935–2010 were analyzed, representing the 2 breeding populations of mountain lions occurring in Texas (southern and western populations). Tissues donated by hunters and trappers were used to index the contemporary populations and specimens from museum collections to represent historical populations. Our goal was to examine how the populations have changed during the past century. Genetic diversity, genetic differentiation, and effective population size were estimated.

- The historical populations from the 1930s had similar levels of genetic diversity in southern and western Texas, with minimal genetic differentiation.
- Genetic diversity in contemporary southern Texas mountain lions declined 10 to 20%, while diversity of mountain lions in western Texas remained stable over time. Genetic differentiation between the western and southern Texas populations has increased more than twofold.
- Effective population size in southern Texas declined by more than 50%, whereas effective population size in western Texas remained stable.
- Mountain lions in southern Texas have experienced a loss of genetic diversity and reduced effective population size during the past 70 years. If the trend continues, this population will not be viable.
- Additional data are needed concerning the distribution, reproduction, and survival of mountain lions in southern Texas. If mountain lions are to persist in that region, a specific management plan will be needed to define population goals and guide monitoring efforts.
- This study is a good example of how genetic tools and museum specimens can be applied to assist wildlife management efforts.

Cooperative funding provided by Texas Parks and Wildlife Department.

Dynamics of Wading Bird Colonies along the Texas Coast

Amy J. Turner, Bart M. Ballard, and Andrew C. Kasner

Populations of breeding colonial waterbirds historically have been affected by predation and human disturbance. Ten species of wading birds were surveyed annually from 1977 to 2007 along the Gulf Coast of Texas to document the changes in breeding populations. Additionally, relationships were modeled between wading bird abundance and prey availability, net freshwater inflow into bays, and distance of breeding colonies to the mainland.

- Wading birds were active breeders on 307 of the 385 islands surveyed along the Texas Coast over the 31-year survey period.
- Great blue heron, tricolored heron, snowy egret, cattle egret, little blue heron, black-crowned night-heron, reddish egret, and great egret populations exhibited significant declines in their abundance along the Texas Coast from 1977 to 2007.
- Roseate spoonbill and white ibis populations remained stable from 1977 to 2007.
- The breeding abundance of great blue herons and tricolored herons was more stable in colonies that were located further from the mainland.
- Tricolored heron and snowy egret populations fluctuated in relation to changes in prey availability across the survey period.

Simulating Feral Swine Population Growth in Texas

Janell M. Mellish, Aaron Sumrall, William H. Neill, Billy J. Higginbotham, Roel R. Lopez, and Tyler A. Campbell

Management of feral swine in the United States, including Texas, is becoming increasingly necessary because of the prolific breeding potential

Feral swine populations have grown dramatically in Texas and are a concern for many wildlife managers.

and environmental impacts caused by the species. Estimates of population abundance and growth rates are important factors to consider in the management and control of feral swine. The existing population demographic data for feral swine in the southeastern United States were synthesized, from which a feral swine population model was constructed.

- The baseline feral swine model predicted an intrinsic rate of natural increase r = 0.21 per year, over a 5-year period.
- In varying model parameters between low and high estimates, it was found that piglet mortality and adult mortality were the most sensitive parameters influencing model output.
- Ending population sizes from initial abundances in the model increased approximately 2.5 times within a 5-year period.
- Actual estimates of trend data growth rates (r = 0.19–0.25 per year, mean = 0.21 per year) were comparable to population trajectories simulated using this model.
- Assuming that 1.8 million feral swine resided in Texas in 1990, the model predicted a feral swine population in Texas of approximately 8.3 million individuals in 2010.
- The findings from this study could be beneficial for wildlife managers in anticipating feral swine population growth and developing effective population control measures.

Cooperative funding provided by Texas A&M University, Texas AgriLife Extension Service, and USDA APHIS Wildlife Services National Wildlife Research Center.

A Synthesis of the Impacts of Harvest on Galliformes

Joseph P. Sands, Fidel Hernández, Stephen J. DeMaso, Leonard A. Brennan, Dale Rollins, and Robert M. Perez

Birds within the Order Galliformes are hunted throughout the world and are important from both economic and cultural standpoints. Of the 24 species of Galliformes with established breeding populations in the United States (excluding Hawaii), 23 have legal hunting seasons, and at least 1 species is pursued in each state (range: 1–13 species). Although much research has been conducted on the impacts of harvest on galliform population dynamics, this topic is still debated.

The spruce grouse is a gamebird found in northern regions of North America.

The objectives of this study were to synthesize the extensive literature on how harvest impacts galliform population dynamics and develop an understanding of applied harvest theory by (1) comparing evidence for competing models of harvest impacts on mortality (doomed surplus versus additive mortality), (2) evaluating evidence of the biological justification of harvest (density-dependent mortality and reproduction), and (3) assessing variability in suggested sustainable harvest rates.

- The literature review indicated that harvest generally resulted in additive mortality, but that additive mortality from hunting was not always detrimental to the population.
- Of the 24 studies reviewed, only 11 (46%) provided evidence of either density-dependent mortality or reproduction. Suggestions for sustainable harvest rates remain quite variable for even well-studied species (e.g., 25−70% of the pre-hunt population for northern bobwhites).
- Data-based simulation models, where parameters can be adjusted based on available estimates of population parameters (e.g., survival/mortality rates, production, and dispersal rates), may represent a tool for evaluating the effects of harvest on populations and providing harvest recommendations to managers.

Cooperative funding provided by Texas Parks and Wildlife Department, South Texas Quail Research Project, Quail Associates Program, and the Rolling Plains Quail Research Ranch.

Effects of Wildfire and Precipitation on Small Mammals

Mark J. Witecha, Andrea R. Litt, Timothy E. Fulbright, Susan M. Cooper, and Daniel P. Walker

Small mammals are influenced by vegetation structure. As a result, disturbances such as fire can change the composition of small mammal communities. In March 2008, a wildfire occurred on the Chaparral Wildlife Management Area in southern Texas, which presented an opportunity to examine the effects of a large-scale, high-intensity fire on small mammals.

Fifteen 2.5-acre plots were established representing 3 levels of fire intensity (unburned, low-intensity, and high-intensity), 5 plots for each level. Small mammal populations and vegetation were sampled March–April and October–November 2009 and 2010 and the effects of precipitation and fire intensity on presence and abundance of small mammals and vegetation structure were evaluated.

- Rainfall during the growing season was positively related to presence and abundance of small mammals, whereas rainfall in the non-growing season typically resulted in little to no effect. Increased vegetation growth associated with growing season rainfall likely provided abundant food resources for small mammals, which would lead to increased reproduction efforts.
- Fire created heterogeneity in the vegetation structure that provided an array of conditions necessary to meet the habitat requirements of many species.
- The wildfire affected the abundance of small mammals differently, based on species-specific habitat requirements. Merriam's pocket mouse and hispid pocket mouse, 2 species that feed on seeds, were more abundant on burned sites, whereas the hispid pocket mouse, a species that prefers woody cover, was most abundant on unburned sites.
- Based on these results, it is recommended that land managers apply fire of varying intensity and frequency to maximize diversity in both the small mammal and vegetation communities.

© Alfonso Ortega-Santos

Ecologists are gaining a better understanding of how fire influences small mammal communities.

Cooperative funding provided by Texas Parks and Wildlife Department.

Foraging Behavior and Success of Reddish Egrets in the Laguna Madre of Texas

Elizabeth M. Bates and Bart M. Ballard

The reddish egret is highly restricted in its distribution, relying primarily on coastal wetland habitats along the Gulf Coast. There is an estimated 2,000 breeding pairs in the United States, making it the rarest species of heron. The goal of this research was to gain a better understanding of the reddish egret's foraging ecology. The specific objective was to investigate the relationships between foraging success, foraging tactics, and an array of environmental variables.

Foraging reddish egrets were recorded with a 1–40x camcorder from March 2008 to April 2010 along with the environmental variables wind speed, light intensity, water depth, and percentage of seagrass coverage. During video analysis, foraging tactics used by reddish egrets were documented as well as the number of total foraging strikes and whether the strikes were successful or not.

- Eight foraging behaviors were identified including standing, stand and probe, walking, running, hovering, canopy, wing-flicking, and foot-stirring.
- Adult reddish egrets were 30% more successful foragers than juveniles.
- Adults spent 267% more time foot-stirring and 15% more time walking while foraging than juveniles, whereas juveniles spent 29% more time standing and foraging. Reddish egrets foraging in groups were more efficient and had a higher prey capture rate than those foraging alone.
- Reddish egrets in groups spent 250% more time foot-stirring, whereas individual foragers spent 50% more time wing-flicking.
- All 4 environmental variables influenced foraging

© Bart Ballard

Coastal wetlands in Texas provide essential habitat for the reddish egret.

success, but did not account for much variation in foraging behavior. This suggests other variables, such as prey type and density, may be better predictors of foraging behavior.
- The lower foraging success of hatch-year reddish egrets suggests juvenile survival may be low.

Cooperative funding provided by the Walter Fondren III Fellowship in Shorebird and Wading Bird Research, Arthur A. Seeligson, Jr. Conservation Fund, and Fort Worth Zoo.

Risk Assessment Model for Brown Tree Snake Invasion into the United States

Samantha S. Wisniewski, Scott E. Henke, Gad Perry, and David Britton

The brown tree snake is an invasive species on the island of Guam and it is considered a potential ecological threat to other ecosystems. Brown tree snakes were accidentally introduced into Guam following World War II in cargo shipments from the Admiralty Islands. The ecological and economic impacts of this species in the invaded range have been extensive.

A United States military relocation from Okinawa, Japan to Guam began in 2010 with an expectation of increasing the human population on Guam from 178,000 to over 210,000. High densities of brown tree snakes along with changes in Guam's transportation network because of the relocation of the United States military may greatly affect the potential for brown tree snake dispersal.

A risk assessment model was developed using Program Maxent that incorporated climatic data from the native and invaded ranges of brown tree snakes with the biological requirements of brown tree snakes. This model was then used to determine high-risk areas for invasion within the continental United States.

- Identified pathways for brown tree snake invasion included military cargo shipments, military personnel shipments, military personnel flights, commercial flights, and the pet trade.
- San Diego, California has the highest risk of potential invasion by brown tree snakes because of the quantity of military shipments it receives and the region's mild climate.
- Texas, Georgia, Florida, and several eastern coast states were identified as high-risk areas for potential invasion.
- Our model can be used to identify specific geographic locations where public education efforts would be warranted to increase awareness of the brown tree snake and its environmental threat.

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

Absence of *Mycobacterium bovis* in Feral Swine from the Southern Texas Border

Tyler A. Campbell, David B. Long, Luis R. Bazan, Bruce V. Thomsen, Suelee Robbe-Austerman, Ronald B. Davey, Liza A. Soliz, Seth R. Swafford, and Kurt C. VerCauteren

Free-ranging wildlife, like feral swine, often harbor diseases that are transmissible to livestock, which could negatively impact agricultural production activities focused on these domestic animals. Therefore, information is needed regarding the exposure and infection rates of diseases and parasites in feral swine, particularly in the Texas border region.

One disease agent that needs more study is *Mycobacterium bovis*, which causes tuberculosis. The main objective of this study was to determine exposure rates and possible infection rates of *M. bovis* in feral swine by opportunistically sampling feral swine within the Texas border region.

- Samples were obtained from 396 feral swine from June to September 2010 of which 98 of these samples were tested for *M. bovis* by histopathology and mycobacterologic culture.

- No evidence of *M. bovis* infection was found.
- It is important to sample feral swine periodically for *M. bovis* in high-risk areas of the United States because they are capable of becoming reservoirs of the disease.

Cooperative funding provided by the USDA APHIS Wildlife Services National Wildlife Research Center and USDA APHIS Wildlife Services National Wildlife Disease Program.

Survival of the Western Gulf Coast Mottled Duck

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

The mottled duck is non-migratory and inhabits coastal marshes and freshwater wetlands along the Western Gulf Coast. It has undergone a long-term population decline and loss of habitat over most of its range. Despite its relatively sedentary nature, little information is available regarding survival throughout the annual cycle. Identification of critical periods during the annual cycle may assist in focusing conservation efforts during specific periods and areas that would provide the most benefit to the mottled duck.

This study used 590 radio-marked female mottled ducks captured along the Texas and Louisiana coasts. They were monitored from July 2007–September 2010 to assess their survival.

- Annual survival was 37% for juveniles and 48% for adults and was similar across the 3 study years.
- Seasonal survival for juveniles was lower during the breeding (early March–mid-July) and hunting seasons (69%) than during the post-breeding (mid-July–early November: 84%) and late winter (late January–late February: 90%) periods.
- Adults had a similar pattern of seasonal survival as observed in juveniles with lower survival during the breeding and the hunting seasons (76%) than during the post-breeding (88%) and late winter (93%) periods.
- Results of this study will be useful in creating conservation plans aimed at reversing the long-term decline of the Western Gulf Coast mottled duck in Texas and Louisiana.

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

Refining the Mule Deer Census in Texas using Sightability Models

Cody J. Zabransky, David G. Hewitt, Randy W. DeYoung, Louis A. Harveson, Calvin L. Richardson, Shawn S. Gray, Eric J. Redeker, and Charles A. DeYoung

Aerial surveys are used to assess mule deer populations, but are biased because not all deer are counted. Our objectives were to quantify factors affecting visibility of mule deer during helicopter surveys and to develop a sightability model to reduce bias in population estimates.

Global Positioning Systems (GPS) collars were placed on 215 deer at 6 sites located in the Trans-Pecos and panhandle regions of Texas. Fifty helicopter surveys were flown in which data were obtained on group size, vegetation, activity, light conditions, terrain, and the distance from the transect for deer seen on surveys and deer not seen. Regression statistical analysis was used to derive 2 sightability models, one in which all measured variables were included and one that excluded group size because of the difficulty in measuring group size of unseen groups.

- Sightability of GPS-collared deer was 42% ± 16% (mean ± standard deviation) and varied among surveys from 19–77%.
- Vegetation, activity, light, terrain, and distance were important variables in determining the probability of sighting mule deer when not including group size.
- An interaction effect occurred between mule deer activity and vegetation such that activity of the animals made little difference in observing them in

© Randy DeYoung

Better methods to census mule deer have been developed, thereby providing more accurate population estimates.

open habitats, but increased the sightability of mule deer in brushy habitats.
- Group size, vegetation, activity, light, terrain, and distance influenced sightability of mule deer, and there was an interaction between group size and vegetation, such that groups between 2–6 deer were more visible in areas without brushy cover.
- Population size, estimated using the sightability models, averaged 93% of the estimates derived using mark-reobservation techniques.
- Findings indicate that sightability models can be used to improve mule deer management in Texas.

Cooperative funding provided by Texas Parks and Wildlife Department, Houston Safari Club, and South Texas Chapter of Quail Unlimited.

Impacts of Wildfire on Avian Communities of South Texas

Michele de Verteuil, William P. Kuvlesky, Jr., Andrea R. Litt, Leonard A. Brennan, James F. Gallagher, and Daniel P. Walker

High-intensity wildfires can significantly affect foraging and nesting habitat for birds. However, wildfire impacts on avian communities in the mixed-brush ecosystem of South Texas are mostly unknown because most research has focused on prescribed winter burning.

On March 14, 2008, an intense wildfire occurred on the Chaparral Wildlife Management Area located approximately 100 miles southwest of San Antonio, Texas, but leaving an adjacent private ranch largely unburned. Transect and point-count surveys on burned and unburned sites were conducted February–March (winter) and May–June (summer) during 2009 and 2010. Avian species richness, density, presence, and vegetation characteristics between burned and unburned sites were quantified.

- Species richness was 34% higher on burned sites during both winters; a 73% increase was observed on both burned and unburned sites between winters 2009 and 2010. No differences in species richness were observed on burned sites in summer, but species richness declined by 28% from 2009 to 2010.
- Out of 16 avian species analyzed, 9 species increased between winters 2009 and 2010. Conversely, there was a decrease in 9 species between summers 2009 and 2010.

© Michele de Verteuil

Fire can alter the landscape by changing plant succession favoring some bird species and negatively affecting others.

- Two migratory wintering grassland species, white-crowned sparrow and vesper sparrow, had higher densities on burned sites. During summer 2009 and 2010, increases in density were greater on burned sites (compared to unburned) for black-tailed gnatcatcher, northern mockingbird, and pyrrhuloxia.
- The wildfire produced mixed results between seasons, but increased overall habitat suitability for grassland species. A relatively quick recovery was observed for most vegetation components (such as ground cover) by the end of the study.
- An extended drought in 2009 might have caused a confounding effect on the results, and may help explain some increases in species richness, presence, and density over time.

Cooperative funding provided by Texas Parks and Wildlife Department.

Assessing Knowledge Gained by Teenagers at a Wildlife Ecology Camp

Trevor Kalich and Scott E. Henke

Today's youth spends more time with video games and much less time outdoors. Therefore, their generation does not have the knowledge of outdoor skills or their environment, compared to previous generations. To offset this situation, faculty and students from the CKWRI teamed up with Flint Hills Resources in Corpus Christi, Texas to conduct weekly ecology camps for junior high and high school students. The

goal of the camp was to familiarize individuals with regional wildlife species, their habitat requirements, and behaviors. Teenage participants were given a pre- and post-test, which assessed their knowledge before and after the camp.

- A total of 123 teenagers (68 boys and 55 girls) participated in the camp.
- Based on the pre-test prior to camp, participants had a very cursory and basic knowledge of ecosystem function, their environment, and wildlife species.
- Overall scores on the post-test improved by 30% after participating in the ecology camp.
- It appears that providing hands-on experience is the catalyst required to make young people enthusiastic about being outdoors.

Cooperative funding provided by Flint Hills Resources.

Cattle Fever Ticks: Perceptions of Land Owners along the U.S. Border

Joni S. Edwardson, Eduardo A. Gonzalez-Valenzuela, J. Alfonso Ortega-Santos, Tyler A. Campbell, and David G. Hewitt

The range cattle industry has long played an integral role in Texas and northern Mexico economies. Today, portions of this region are in a permanent quarantine zone for cattle fever ticks—the primary vector of bovine babesiosis. Ranchers were the first to attempt eradication of the parasite, and the government aided efforts with the formation of the National Cattle Fever Tick Eradication Program in 1906. It is now known that wildlife act as secondary hosts for cattle fever ticks. This study determined landowner perceptions about cattle fever ticks as well as land use practices along the border region of Texas and northern Mexico.

© Alfonso Ortega-Santos

Cattle and deer are infected with ticks that may transmit the disease agent that causes bovine babesiosis.

Surveys were mailed to landowners in Texas and Mexico located along the border region. The survey questions were designed to evaluate landowners' knowledge of cattle fever ticks and provide information about the primary use of their property.

- Approximately 945 surveys were distributed to landowners; 433 were returned and included in the analysis of results. Of these, 233 respondents were from Texas and 200 were from Mexico.
- Landowner knowledge of cattle fever ticks varied between Texas and Mexico. Texan respondents typically had less knowledge of cattle fever ticks than Mexican respondents.
- The primary activities conducted on ranches varied between Texas and Mexico. Mexican respondents tended to focus on livestock-related activities (cattle, goats, sheep, etc.), whereas Texan respondents tended to focus on white-tailed deer hunting as the primary activity.

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

Assessing the Habitat of Rio Grande Wild Turkeys in South Texas

Chase R. Currie, J. Alfonso Ortega-Santos, William P. Kuvlesky, Jr., Leonard A. Brennan, and Stephen J. DeMaso

The Rio Grande wild turkey requires a variety of habitats to maintain a stable population. Consequently, effective habitat management is critical for Rio Grande wild turkey populations to remain viable.

Rio Grande wild turkey habitat and use were evaluated for nesting, brood rearing, feeding, and roosting near Falfurrias, Texas from September 2008 through June 2010. Birds were trapped and fitted with backpack radio transmitters from January to March each year, resulting in 63 hens and 16 gobblers captured, tagged with transmitters, and monitored. Vegetation characteristics were measured using a modified Daubenmire frame.

- Hens used nest sites with taller vertical vegetation and greater amounts of litter (over 60%), and they nested close to large trees.

- Ninety-three percent of the nests occurred in areas free from cattle grazing.
- Brood rearing sites typically had less than 44% bare ground, more than 43% herbaceous cover, less than 23 inches of vertical vegetation height, and close proximity to woody cover (less than 6 ft).
- Characteristics at feeding sites included the following: 31–84% bare ground, 25–68% herbaceous cover, less than 18% litter, and less than 3 or over 10 plant species.
- At roosting sites, Rio Grande wild turkeys used trees with a height greater than 26.2 ft (8 m), a diameter at breast height (DBH) more than 10 inches, and canopy cover over 53%.
- Removing cattle grazing from pastures with the best nesting cover as well as avoiding practices that reduce vegetative litter will be beneficial for nesting turkeys. Brood rearing, feeding, and roosting sites have specific vegetation characteristics that should be considered when managing for Rio Grande wild turkeys.

Cooperative funding provided by Texas Parks and Wildlife Department and King Ranch, Inc.

Genetic Structure and Long-Distance Movements of Mountain Lions

Joseph D. Holbrook, Randy W. DeYoung, Michael E. Tewes, and John H. Young

In Texas, mountain lions are present in the Trans-Pecos region and in portions of southern Texas. Mountain lions are elusive and mobile, thereby creating difficulties for monitoring efforts. Genetic diversity, genetic differentiation among regions, and long distance movements were evaluated. Over 250 tissue samples were collected for genetics analyses from harvested, trapped, and road-killed mountain lions throughout Texas and portions of New Mexico.

© Branson Reynolds

CKWRI researchers have found that mountain lions can move long distances from their original source populations.

- Genetic diversity was comparable to previous studies of mountain lions with the exception of southern Texas where lower diversity was found compared to the Trans-Pecos or New Mexico populations. Similarly, mountain lions from southern Texas were genetically differentiated from both the Trans-Pecos and New Mexico populations.
- Long-distance movements of mountain lions were identified, and evidence was observed for dispersal among southern Texas, the Trans-Pecos, and New Mexico populations. However, low genetic diversity in southern Texas and genetic differentiation from the other 2 regions suggest that mountain lions dispersing to southern Texas do not successfully reproduce there.
- Our results suggest mountain lions in Texas are composed of 2 distinct populations or management units (Trans-Pecos and southern Texas).
- The future of the southern Texas population will depend on immigration and survival of adults and young within the region. Management actions may be necessary if this population is to be maintained.
- Mountain lions in New Mexico and the Trans-Pecos appear to be sources for mountain lions dispersing eastward into areas without breeding populations. Identification of dispersal paths will be important to delineate travel corridors and areas of potential mountain lion-human conflict.

Cooperative funding provided by Texas Parks and Wildlife Department.

Evaluating the Genetic Structure of Texas Lesser Prairie-Chickens

Kelly S. Corman, Randy W. DeYoung, Leonard A. Brennan, Stephen J. DeMaso, Warren B. Ballard, Mark C. Wallace, Clint W. Boal, Heather A. Whitlaw, and Robert M. Perez

Lesser prairie-chickens presently occupy less than 10% of their former geographic range. Because of low population numbers, this species is a conservation priority for the Texas Parks and Wildlife Department and the U.S. Fish and Wildlife Service. In Texas, lesser

prairie-chickens are restricted to grassland areas of the northeast and southwest panhandle.

A panel of genetic markers was used to assess genetic differentiation among populations of lesser prairie-chickens in Texas. Samples from 544 lesser prairie-chickens were taken in Texas and adjacent sites in New Mexico from 2004 to 2010. Five microsatellite loci and DNA sequence data from the mitochondrial (mtDNA) control region were used to assess population structure.

- Moderate population structure was found; genetic differentiation coincided with the geographic discontinuities in habitat. The mtDNA haplotypes were not associated with geographic location, indicating connectivity among historical populations.
- At the regional scale, genetic differentiation was correlated with geographic distance; isolated sites may be experiencing accelerated genetic drift.
- At finer scales within regions, leks contained male relatives, while females were unrelated. The results from the genetics analysis support field observations of female-biased dispersal.
- Genetic data support 2 management units, one each in the northeast and southwest panhandle region. Evidence for substructure within each region was found, indicating some populations are partially or completely isolated.
- Within continuous habitats, lesser prairie-chickens appear to be capable dispersers. In fragmented habitats, patches may need to be located less than 10 miles apart to facilitate colonization.

Cooperative funding provided by Texas Parks and Wildlife Department.

Landscape-Genetic Analyses of Rio Grande Wild Turkeys in South Texas

Carlos A. Lopez-Morales, Randy W. DeYoung, Stephen J. DeMaso, J. Alfonso Ortega-Santos, William P. Kuvlesky, Jr., David G. Hewitt, and Jason B. Hardin

Habitat features can promote or inhibit animal movements. As a result, the landscape may have a strong influence on population structuring and differentiation among populations. Dispersal and movements of wild turkeys are poorly understood in semiarid habitats. Some restoration programs for wild turkeys are unsuccessful because translocated populations fail to expand or establish connectivity to adjacent populations. A panel of genetic markers was used to evaluate dispersal and putative landscape barriers to movements in the South Texas region.

Genetic analysis is providing insight into turkey dispersal patterns that otherwise would be difficult to determine.

- Little differentiation was found among populations in contiguous habitats where genetic similarity was correlated with geographic distance among populations.
- Coastal estuaries, extensive farmlands, and urban development appeared to act as barriers to movements in the coastal areas of South Texas. Elsewhere, genetic differences among populations were not associated with geographic distance or habitat features and may be the result of past translocation efforts.
- Greater genetic differentiation was observed among males than females. Males captured at the same site were related at the level of first cousins, whereas most females were unrelated.
- The genetic data suggest that wild turkey females are the primary dispersers. Therefore, population expansion and connectivity among populations may depend on female survival and reproduction.

Cooperative funding provided by Texas Parks and Wildlife Department.

ABSTRACT EXTERNAL AUTHORS AND CO-AUTHORS

Dr. Warren B. Ballard, Texas Tech University
Dr. Jeff H. Bardwell, Department of Biology, Baylor University
Dr. Thomas Barnes, University of Kentucky
Mr. Marc Bartoskewitz, King Ranch, Inc.
Mr. Luis R. Bazan, USDA APHIS Wildlife Services
Dr. Terry L. Blankenship, Rob and Bessie Welder Wildlife Foundation
Dr. Clint W. Boal, USGS, Texas Cooperative Fish and Wildlife Research Unit, Lubbock, TX
Mrs. Kathy Boydston, Texas Parks and Wildlife Department
Dr. Michael G. Brasher, Gulf Coast Joint Venture
Dr. Jeff Breeden, Tarleton State University
Dr. David Britton, U.S. Fish and Wildlife Service
Mr. David A. Butler, Texas Parks and Wildlife Department
Mr. Alan Cain, Texas Parks and Wildlife Department
Dr. Tyler A. Campbell, USDA APHIS Wildlife Services National Wildlife Research Center
Dr. Susan M. Cooper, Texas AgriLife Research Center, Uvalde
Dr. Ronald B. Davey, USDA Agricultural Research Service
Mr. Bruce E. Davis, Louisiana State University
Dr. Stephen J. DeMaso, Gulf Coast Joint Venture, U.S. Fish and Wildlife Service
Mr. Don A. Draeger, Comanche Ranch
Dr. D. Lynn Drawe, Rob and Bessie Welder Wildlife Foundation (retired)
Ms. Pamela J. Ferro, Department of Veterinary Pathology, Texas A&M University
Dr. David Forbes, Texas AgriLife Research Center, Uvalde
Dr. Jamie L. Foster, Texas AgriLife Research Station, Beeville
Mr. Donnie Frels, Texas Parks and Wildlife Department
Mr. T. Dan Friedkin
Dr. Paul Funston, Tshwane University of Technology, South Africa
Dr. James F. Gallagher
Mr. Juan Garza, Rio Farms, Inc.
Mr. Brock Geary, Texas State University
Mr. Kenneth L. Gee, Samuel Roberts Noble Foundation
Dr. Eduardo A. Gonazalez-Valenzuela, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Mexico
Mr. Shawn S. Gray, Texas Parks and Wildlife Department
Dr. M. Clay Green, Texas State University
Dr. Jeffrey S. Hall, USGS National Wildlife Health Center, Madison, WI
Mr. Jason B. Hardin, Texas Parks and Wildlife Department
Dr. Louis A. Harveson, Sul Ross State University and Borderlands Research Institute
Mr. Michael W. Hehman, Hixon Ranch
Dr. Mickey W. Hellickson, Orion Wildlife Management Services
Dr. Billy J. Higginbotham, Texas AgriLife Extension Service
Mr. Aaron M. Hildreth, University of Nebraska-Lincoln
Ms. Valerie D. Hipkins, U.S. Forest Service, National Forest Genetics Laboratory
Dr. Rodney L. Honeycutt, Pepperdine University, CA
Dr. Scott E. Hygnstrom, University of Nebraska-Lincoln
Dr. Jan Janečka, Department of Veterinary Integrative Biosciences, Texas A&M University
Dr. Andrew C. Kasner, Audubon Texas
Ms. Shelly Kremer, Texas Parks and Wildlife Department
Mr. Daniel Kunz, Texas Parks and Wildlife Department
Mr. Michael J. Lavelle, USDA APHIS Wildlife Services National Wildlife Research Center
Mr. Scott P. Lerich, National Wild Turkey Federation, La Luz, NM
Dr. Andrea R. Litt, Department of Ecology, Montana State University
Mr. John Lloyd-Reilley, USDA NRCS E. "Kika" de la Garza Plant Materials Center
Mr. Mitch A. Lockwood, Texas Parks and Wildlife Department
Dr. Kimberly Lohmeyer, USDA ARS
Mr. David B. Long, USDA APHIS Wildlife Services National Wildlife Research Center
Dr. Roel R. Lopez, Texas A&M University
Dr. Blanca Lupiani, Department of Veterinary Pathology, Texas A&M University
Ms. Shelly D. Maher, USDA NRCS E. "Kika" de la Garza Plant Materials Center
Dr. James R. Manhart, Department of Biology, Texas A&M University
Mr. Dennis K. Markwardt, Texas Department of Transportation
Ms. Janell M. Mellish, Texas A&M University
Dr. Karl V. Miller, University of Georgia
Mr. Adam B. Mitchell, Department of Ecology, Montana State University
Ms. Nancy Mitton, Naval Air Station Kingsville
Mr. Matthew T. Moore, Faith Ranch
Dr. Michael L. Morrison, Texas A&M University
Dr. James P. Muir, Texas AgriLife Research Center, Stephenville
Dr. William H. Neill, Texas A&M University
Mr. William R. Ocumpaugh, Texas AgriLife Research Station, Beeville

Mr. Alfonso Ortega-Sanchez, Tom T. East, Sr. and Alice K. East, and Alice H. East, and Robert C. East Wildlife Foundation
Mr. Robert M. Perez, Texas Parks and Wildlife Department
Dr. Gad Perry, Texas Tech University
Dr. Markus J. Peterson, Department of Wildlife and Fisheries Sciences, Texas A&M University
Mr. Clay Powell, ExxonMobil
Mr. Jeff Rahmes, Texas AgriLife Research Station, Beeville
Dr. Gary Rea, USDA NRCS James E. "Bud" Smith Plant Materials Center
Mr. Calvin L. Richardson, Texas Parks and Wildlife Department
Dr. Christopher M. Ritzi, Department of Biology, Sul Ross State University
Dr. Suelee Robbe-Austerman, USDA APHIS Veterinary Services
Dr. Frank C. Rohwer, Louisiana State University
Dr. Dale Rollins, Texas AgriLife Extension Service
Mr. Marvin E. Ruffner, University of Kentucky
Mr. Jimmy Rutledge, Texas Parks and Wildlife Department
Mr. Robert Sanders, Temple Ranch
Mr. Matthew J. Schnupp, King Ranch, Inc.
Dr. Greta L. Schuster, Department of Agronomy and Resource Sciences, TAMUK
Mr. Andrew W. Scott, Jr., Rio Farms, Inc.
Dr. Autumn J. Smith, Department of Biological Sciences, Sam Houston State University
Mr. Brian Smith, Pioneer Natural Resources
Ms. Liza A. Soliz, USDA APHIS Wildlife Services National Wildlife Research Center
Mr. Stuart W. Stedman, Faith Ranch
Dr. Aaron Sumrall, Texas AgriLife Extension Service
Mr. Seth R. Swafford, USDA APHIS Wildlife Services
Mr. David R. Synatzske, Texas Parks and Wildlife Department
Mr. Daniel Tarin, Department of Biology, Texas A&M University
Dr. Bruce V. Thomsen, USDA APHIS Veterinary Services
Dr. Kurt C. VerCauteren, USDA APHIS Wildlife Services National Wildlife Research Center
Dr. Jenneke M. Visser, University of Louisiana at Lafayette
Mr. Tom Wacek
Mr. Daniel P. Walker, Texas Parks and Wildlife Department
Dr. Mark C. Wallace, Texas Tech University
Mr. Keith Walters, Pogue Agri Partners
Dr. Bonnie Warnock, Borderlands Research Institute, Sul Ross State University
Ms. Heather A. Whitlaw, U.S. Fish and Wildlife Service
Mr. Brian Wille, Douglass W. King Seed Company
Mr. Dean Williams, Douglass W. King Seed Company
Dr. X. Ben Wu, Texas A&M University
Dr. John H. Young, Texas Parks and Wildlife Department

TAMUK Undergraduate Students

Mr. Joshua A. Berckenhoff
Mr. Marcus Blum
Mr. Taylor Garrison
Mr. Carlos E. Gonzalez
Mr. Travis Hawkins
Mr. Trevor Kalich
Ms. Megan R. Kolbe
Mr. Nick Kolbe
Ms. Allison Logan
Ms. Britani N. Lolley
Mr. Blake A. Martin
Mr. Jared McCulloch
Ms. Cady L. Mercer
Mr. John Orsak
Mr. Paeton Phaup
Mrs. Melinda Schwartz
Mr. Brian Wilde

PUBLICATIONS 2010–IN PRESS

Books

Hewitt, D. G. 2011. Biology and Management of White-tailed Deer. CRC Press, Boca Raton, FL. 674 p.

Larson, J., T. E. Fulbright, L. A. Brennan, F. Hernández, and F. C. Bryant. 2010. Texas Bobwhites: A Guide to Their Foods and Habitat Management. University of Texas Press, Austin, TX. 280 p.

Book Chapters

Archer, S. R., K. W. Davies, T. E. Fulbright, K. C. McDaniel, B. P. Wilcox, and K. I. Predick. Brush Management as a Rangeland Conservation Tool: A Critical Evaluation. *In* Conservation Benefits of Rangeland Practices: Assessment, Recommendations, and Knowledge Gaps, D. D. Briske, editor. Allen Press, Lawrence, KS. (*In-Press*)

Brennan, L. A. 2011. A Biological Basis for the Northern Bobwhite Conservation Initiative. *In* Northern Bobwhite Conservation Initiative, W. E. Palmer and T. Terhune, editors. Tall Timbers Research Station, Tallahassee, FL. Available on line www.bringbackbobwhites.org

Brennan, L. A., and F. C. Bryant. 2011. Game Animals. Pages 264–270 *in* Encyclopedia of Invasive Species, D. Simberloff and M. Rejmanek, editors. University of California Press, Berkeley, CA.

Campbell, T. A., and K. C. VerCauteren. 2011. Diseases and Parasites. Pages 219–249 *in* Biology and Management of White-tailed Deer, D. G. Hewitt, editor. CRC Press, Boca Raton, FL.

DeMaso, S. J., F. Hernández, and L. A. Brennan. 2011. Assessing and Managing Wildland Recreational Disturbance. *In* Techniques for Wildlife Investigations and Management, N. J. Silvy, editor. The Wildlife Society, Bethesda, MD. (*In-Press*)

DeYoung, C. A. 2011. Population Dynamics. Pages 147–180 *in* Biology and Management of White-tailed Deer, D. G. Hewitt, editor. CRC Press, Boca Raton, FL.

DeYoung, R. W., and K. V. Miller. 2011. White-tailed Deer Behavior. Pages 311–351 *in* Biology and Management of White-tailed Deer, D. G. Hewitt, editor. CRC Press, Boca Raton, FL.

Fall, M. W., M. L. Avery, T. A. Campbell, P. Egan, R. M. Engeman, D. Pimentel, W. Pitt, S. A. Shwiff, and G. W. Witmer. 2011. Rodents and Other Vertebrate Invaders in the United States. Pages 381–410 *in* Biological Invasions, 2nd edition, D. Pimentel, editor. CRC Press, Boca Raton, FL.

Fulbright, T. E. 2011. Managing White-tailed Deer: Western North America. Pages 537–563 *in* Biology and Management of White-tailed Deer, D. G. Hewitt, editor. CRC Press, Boca Raton, FL.

Hewitt, D. G. 2011. Nutrition. Pages 75–106 *in* Biology and Management of White-tailed Deer, D. G. Hewitt, editor. CRC Press, Boca Raton, FL.

Jacobson, H. A., C. A. DeYoung, R. W. DeYoung, T. E. Fulbright, and D. G. Hewitt. 2011. Management on Private Property. Pages 453–480 *in* Biology and Management of White-tailed Deer, D. G. Hewitt, editor. CRC Press, Boca Raton, FL.

Kuvlesky, W. P., Jr., B. M. Ballard, L. A. Brennan, F. C. Bryant, T. A. Campbell, C. A. DeYoung, F. Hernández, S. E. Henke, and D. G. Hewitt. Managing Populations. *In* Wildlife Management: Contemporary Principles and Practices, P. R. Krausman and J. W. Cain, III, editors. John Hopkins University Press, Baltimore, MD. (*In-Press*)

Litt, A. R. 2010. Population. *In* Encyclopedia of Research Design. SAGE Publications, Inc., Thousand Oaks, CA.

Scientific Journals and Proceedings

Ballard, B. M., J. D. James, B. C. Wilson, and M. J. Petrie. 2010. Coastal pond use by redheads wintering in the Laguna Madre, Texas. Wetlands 30:669–674.

Bingham, R. L., L. A. Brennan, and B. M. Ballard. 2010. Discrepancies between Euclidean distance and compositional analysis of resource selection data with known parameters. Journal of Wildlife Management 74:582–587.

Blizzard, E. L., C. D. Davis, S. E. Henke, D. B. Long, C. A. Hall, and M. J. Yabsley. 2010. Distribution, prevalence, and genetic characterization of *Baylisascaris procyonis* in selected areas of Georgia. Journal of Parasitology 96:1128–1133.

Brown, S. D., C. M. Britton, and S. Rideout-Hanzak. 2010. Summer and winter burn effects on vegetation of Matagorda Island, Texas. Southwestern Naturalist 55:193–202.

Bullock, S. L., D. G. Hewitt, R. L. Stanko, M. K. Dowd, J. Rutledge, and D. A. Draeger. 2010. Plasma gossypol dynamics in white-tailed deer: Implications for whole cottonseed as a supplemental feed. Small Ruminant Research 93:165–170.

Campbell, T. A., and D. B. Long. 2010. Activity patterns of wild boar in southern Texas. Southwestern Naturalist 55:564–567.

Campbell, T. A., D. B. Long, and B. R. Leland. 2010. Feral swine behavior relative to aerial gunning in southern Texas. Journal of Wildlife Management 74:337–341.

Campbell, T. A., S. L. Bullock, D. B. Long, D. G. Hewitt, and M. K. Dowd. 2010. Visitation to cottonseed storage sites by feral swine and evidence of gossypol exposure. Human-Wildlife Interactions 4:145–151.

Campbell, T. A., M. R. Garcia, L. A. Miller, M. A. Ramirez, D. B. Long, J. Marchand, and F. Hill. 2010. Immunocontraception of male feral swine with a recombinant GnRH vaccine. Journal of Swine Health and Production 18:118–124.

Campbell, T. A., D. B. Long, and G. Massei. 2011. Efficacy of the Boar-Operated-System to deliver baits to feral swine. Preventive Veterinary Medicine 98:243–249.

Campbell, T. A., D. B. Long, L. R. Bazan, B. V. Thomsen, S. Robbe-Austerman, R. B. Davey, L. A. Soliz, S. R. Swafford, and K. C. VerCauteren. 2011. Absence of *Mycobacterium bovis* in feral swine (*Sus scrofa*) from the southern Texas border region. Journal of Wildlife Diseases 47:(*In-Press*).

Cardenas-Canales, E. M., J. A. Ortega-Santos, T. A. Campbell, Z. Garcia-Vazquez, A. Cantu-Covarrubias, J. V. Figueroa-Millan, R. W. DeYoung, D. G. Hewitt, and F. C. Bryant. 2011. Nilgai antelope in northern Mexico as a possible carrier for cattle fever ticks and *Babesia bovis* and *Babesia bigemina*. Journal of Wildlife Diseases 47:777–779.

Colson, W., T. Kalich, A. Fedynich, and S. Kremer. 2011. Predation of a white-winged dove nest by a fox squirrel. Bulletin of the Texas Ornithological Society 44:(*In-Press*).

Delgado-Acevedo, J., A. Zamorano, R. W. DeYoung, T. A. Campbell, D. G. Hewitt, and D. B. Long. 2010. Promiscuous mating in feral pigs (*Sus scrofa*) from Texas, USA. Wildlife Research 37:539–546.

DeMaso, S. J., W. E. Grant, F. Hernández, L. A. Brennan, N. J. Silvy, X. B. Wu, and F. C. Bryant. 2010. A population model to simulate northern bobwhite population dynamics in southern Texas. Journal of Wildlife Management 75:319–332.

DeMaso, S. J., F. Hernández, L. A. Brennan, and R. L. Bingham. 2011. Application of the simple saddlepoint approximation to estimate distributions in wildlife research. Journal of Wildlife Management 75:740–746.

Elston, J. J., and D. G. Hewitt. 2010. Intake of mast by wildlife in Texas and the potential for competition with wild boars. Southwestern Naturalist 55:57–66.

Elston, J. J., and D. G. Hewitt. 2010. Comparative digestion of food among wildlife in Texas: implications for competition. Southwestern Naturalist 55:67–77.

Erxleben, D. R., M. J. Butler, W. B. Ballard, M. C. Wallace, M. J. Peterson, N. J. Silvy, W. P. Kuvlesky, Jr., D. G. Hewitt, S. J. DeMaso, J. B. Hardin, and M. K. Dominguez-Brazil. 2010. Wild turkey (*Meleagris gallopavo*) association to roads: implications for distance sampling. European Journal of Wildlife Research 57:57–65.

Fedynich, A. M., T. B. Fredricks, and S. Benn. 2010. Lead concentrations of white-winged doves, *Zenaida asiatica* L., collected in the Lower Rio Grande Valley of Texas, USA. Bulletin of Environmental Contamination and Toxicology 85:344–347.

Fredricks, T. B., A. M. Fedynich, and S. J. Benn. 2010. Evaluation of a new technique for determining sex of adult white-winged doves (*Zenaida asiatica*). Southwestern Naturalist 55:225–228.

Fulbright, T. E., E. C. Dacy, and D. L. Drawe. 2011. Does browsing reduce shrub survival and vigor following summer fires? Acta OEcologica 37:10–15.

Garrison, D. A., A. M. Fedynich, A. J. Smith, P. J. Ferro, D. A. Butler, M. J. Peterson, and B. Lupiani. 2011. Ingestion of lead and nontoxic shot by green-winged teal (*Anas crecca*) and northern shovelers (*Anas clypeata*) from the mid-Gulf Coast of Texas, USA. Journal of Wildlife Diseases 47:784–786.

Garvon, J. M., A. M. Fedynich, M. J. Peterson, and D. B. Pence. 2011. Helminth community dynamics in populations of blue-winged teal (*Anas discors*) using two distinct migratory corridors. Journal of Parasitology Research. DOI:101155/2011/306257.

Gonzalez-Valenzuela, E. A., D. G. Hewitt, J. A. Ortega-Santos, R. W. DeYoung, T. A. Campbell, and F. C. Bryant. 2010. Ganadería y fauna silveste del norteste de México y sur de Texas e implicaciones de la garrapata *Boophilus*: opción de los ganaderos. Seminario Internacional Sobre Venado Cola Blanca, Unión Ganadera Regional de Nuevo León 12:12–23.

Hernández, F., J. L. Roberson, R. L. Bingham, S. J. DeMaso, R. M. Perez, T. E. Fulbright, and L. A. Brennan. 2010. Vegetation response to timing of discing to manage northern bobwhite habitat in Texas. Proceedings of the Southeastern Association of Fish and Wildlife Agencies:(*In-Press*).

Holbrook, J. D., R. W. DeYoung, M. E. Tewes, and J. H. Young. 2011. Demographic history of peripheral mountain lions. Proceedings of the 10th Mountain Lion Workshop. Montana Fish, Wildlife, and Parks, Bozeman, MT.

Holbrook, J. D., R. W. DeYoung, A. Caso, M. E. Tewes, and J. H. Young. Hog-nosed skunks (*Conepatus leuconotus*) along the Gulf of Mexico: Population status and genetics. Southwestern Naturalist:(*In-Press*).

Holbrook, J. D., R. W. DeYoung, M. E. Tewes, J. H. Young, J. L. Mays, and E. Meyers. Natural dispersal or illegal pets? Limitations on assigning origin to road-killed ocelots (*Leopardus pardalis*) in the southwestern United States. Wildlife Society Bulletin:(*In-Press*).

Janečka, J. E., M. E. Tewes, L. L. Laack, A. Caso, L. I. Grassman, Jr., A. M. Haines, D. B. Shindle, B. W. Davis, W. J. Murphy, and R. L. Honeycutt. 2011. Reduced genetic diversity and isolation of remnant ocelot populations occupying a severely fragmented landscape in southern Texas. Animal Conservation. DOI:10.1111/j.14691795.2011.00475.x

Jones, P. D., B. K. Strickland, S. Demarais, and R. W. DeYoung. 2011. Inconsistent association of male body mass with breeding success in captive white-tailed deer. Journal of Mammalogy 92:527–533.

Kresta, A. M., S. E. Henke, and D. B. Pence. 2010. *Baylisascaris procyonis* in raccoons in Texas and its relationship to habitat characteristics. Journal of Wildlife Diseases 46:843–853.

Lavelle, M. J., K. C. VerCauteren, J. W. Fischer, G. E. Phillips, T. Hefley, S. E. Hygnstrom, S. R. Swafford, D. B. Long, and T. A. Campbell. 2011. Evaluation of fences for containing feral swine under simulated depopulation conditions. Journal of Wildlife Management 75:1200–1208.

Litt, A. R., and R. J. Steidl. 2010. Insect assemblages change along a gradient of invasion by a nonnative grass. Biological Invasions. DOI:10.1007/s10530-010-9743-6.

Litt, A. R., and R. J. Steidl. 2010. Improving estimates of abundance by aggregating sparse capture-recapture data. The Journal of Agricultural, Biological, and Environmental Statistics 15:228–247.

Litt, A. R., and R. J. Steidl. 2011. Interactive effects of fire and nonnative plants on small mammals in grasslands. Wildlife Monographs 176:1–31.

Lloyd-Reilley, J., S. D. Maher, P. D. Maywald, and F. S. Smith. 2010. Notice of release of Goliad Germplasm orange zexmenia: Selected class of natural germplasm. Native Plants Journal 11:321–325.

Lloyd-Reilley, J., S. D. Maher, W. R. Ocumpaugh, P. D. Maywald, and F. S. Smith. 2010. Notice of release of Catarina Blend bristlegrass: Selected class of natural germplasm. Native Plants Journal 11:305–309.

Lloyd-Reilley, J., S. D. Maher, W. R. Ocumpaugh, P. D. Maywald, and F. S. Smith. 2010. Notice of release of Mariah Germplasm hooded windmillgrass: Selected class of natural germplasm. Native Plants Journal 11:311–315.

Lloyd-Reilley, J., S. D. Maher, W. R. Ocumpaugh, P. D. Maywald, and F. S. Smith. 2010. Notice of release of Welder Germplasm shortspike windmillgrass: Selected class of natural germplasm. Native Plants Journal 11:317–320.

Long, D. B., T. A. Campbell, and G. Massei. 2010. Evaluation of feral swine-specific feeder systems. Rangelands 32:8–13.

López-García, J. A., W. R. Ocumpaugh, J. A. Ortega-Santos, J. Lloyd-Reilley, and J. P. Muir. 2011. North American bristlegrass seed yield response to nitrogen fertilizer and environment. Crop Science 51:361–369.

Miller, B. F., T. A. Campbell, B. R. Laseter, W. M. Ford, and K. V. Miller. 2010. A test of localized management for reducing white-tailed deer herbivory in central Appalachian regeneration sites. Journal of Wildlife Management 74:370–378.

Miller, B. F., R. W. DeYoung, T. A. Campbell, B. R. Laseter, W. M. Ford, and K. V. Miller. 2010. Fine-scale genetic and social structuring in a central Appalachian white-tailed deer herd. Journal of Mammalogy 91:681–689.

Moczygemba, J. D., D. G. Hewitt, T. A. Campbell, J. A. Ortega-S., J. Feild, and M. W. Hellickson. 2011. Home ranges of nilgai antelope (*Boselaphus tragocamelus*) in Texas. Southwestern Naturalist 56:(*In-Press*).

Moseley, W. A., S. M. Cooper, D. G. Hewitt, T. E. Fulbright, and C. A. DeYoung. 2011. Effects of supplemental feeding and density of white-tailed deer on small mammals. Journal of Wildlife Management 75:675–681.

Muir, J. P., T. J. Butler, W. R. Ocumpaugh, and C. E. Simpson. 2010. 'Latitude 34', a perennial peanut for cool, dry climates. Journal of Plant Registrations 4:106–108.

Passler, T., S. S. Ditchkoff, M. D. Givens, K. V. Brock, R. W. DeYoung, and P. H. Walz. 2010. Transmission of bovine viral diarrhea virus among white-tailed deer (*Odocoileus virginianus*). Veterinary Research. DOI:10.1051/vetres/2009068.

Pérez de León, A., D. A. Strickman, D. P. Knowles, D. Fish, E. Thacker, J. Fuente, P. J. Krause, S. K. Wikel, R. S. Miller, G. G. Wagner, C. Almazán, R. Hillman, M. T. Messenger, P. O. Ugstad, R. A. Duhaime, P. D. Teel, A. Ortega-Santos, D. G. Hewitt, E. J. Bowers, S. J. Bent, M. H. Cochran, T. F. McElwain, G. A. Scoles, C. E. Suarez, R. Davey, J. M. Howell-Freeman, K. Lohmeyer, A. Y. Li, F. D. Guerrero, D. M. Kammlah, P. Phillips, and J. M. Pound. 2010. One health approach to identify research needs in bovine and human babesioses: workshop report. Parasites and Vectors 3:36.

Phillips, C. E., W. P. Kuvlesky, Jr., S. J. DeMaso, L. A. Brennan, and D. G. Hewitt. 2011. Landscape metrics related to Rio Grande wild turkey winter roosts in South Texas. Proceedings of the National Wild Turkey Symposium:(*In-Press*).

Rader, M. J., L. A. Brennan, K. A. Brazil, F. Hernández, and N. J. Silvy. 2011. Simulating northern bobwhite population responses to nest predation, nesting habitat and weather in southern Texas. Journal of Wildlife Management 75:61–70.

Ramirez, E. R., M. C. Dominguez-Brazil, C. W. Lawson, S. M. Burns, R. Guarneros-Altimirano, S. J. DeMaso, W. P. Kuvlesky, Jr., D. G. Hewitt, J. A. Ortega-S., and T. A. Campbell. 2011. Home ranges of female Rio Grande wild turkeys in southern Texas. Southwestern Naturalist 56:(*In-Press*).

Rattan, J. M., B. J. Higginbotham, D. B. Long, and T. A. Campbell. 2010. Exclusion fencing for feral hogs at white-tailed deer feeders. Texas Journal of Agriculture and Natural Resources 23:83–89.

Reed, C., S. E. Henke, and A. E. Kresta. 2011. Frequency of deposition and location of *Baylisascaris procyonis* eggs in raccoon feces. Journal of Wildlife Diseases:(*In-Press*).

Reidy, M. M., T. A. Campbell, and D. G. Hewitt. 2011. A mark-recapture technique for monitoring feral swine populations. Rangeland Ecology and Management 64:316–318.

Reyes, E., W. Kuvlesky, Jr., D. G. Hewitt, J. A. Ortega-S., and T. A. Campbell. 2010. Home ranges of female Rio Grande wild turkeys in southern Texas. Southwestern Naturalist:(*In-Press*).

Rideout-Hanzak, S., D. B. Wester, C. M. Britton, and H. A. Whitlaw. 2011. Biomass not linked to perennial grass mortality following severe wildfire in the Southern High Plains. Rangeland Ecology and Management 64:47–55.

Sanders, D. L., F. Xie, R. E. Mauldin, J. C. Hurley, L. A. Miller, M. R. Garcia, R. W. DeYoung, D. B. Long, and T. A. Campbell. 2011. Efficacy of ERL-4221 as an ovotoxin for feral pigs (*Sus scrofa*). Wildlife Research 38:168–172.

Seijo, F., R. W. Gray, and S. Rideout-Hanzak. Special Issue: 4th International Fire Congress: Fire as a Global Process. Fire Ecology:(*In-Press*).

Smith, F. S. 2010. Texas today: A sea of the wrong grasses. Ecological Restoration 28:112–117.

Smith, F. S., W. R. Ocumpaugh, and J. Lloyd-Reilley. 2010. South Texas Natives: a collaborative regional effort to meet restoration needs in South Texas. Native Plants Journal 11:252–268.

Smith, F. S., P. D. Maywald, W. R. Ocumpaugh, J. Lloyd-Reilley, S. D. Maher, and K. A. Pawelek. 2010. Notice of release of Divot Tallow Weed Blend: Selected class of natural germplasm. Native Plants Journal 11:289–294.

Smith, F. S., P. D. Maywald, W. R. Ocumpaugh, J. Lloyd-Reilley, S. D. Maher, and K. A. Pawelek. 2010. Notice of release of Chaparral Germplasm hairy grama: Selected class of natural germplasm. Native Plants Journal 11:295–298.

Smith, F. S., P. D. Maywald, W. R. Ocumpaugh, J. Lloyd-Reilley, S. D. Maher, and K. A. Pawelek. 2010. Notice of release of Atascosa Germplasm Texas grama: Selected class of natural germplasm. Native Plants Journal 11:299–304.

Smith, F. S., P. D. Maywald, J. Lloyd-Reilley, S. D. Maher, K. A. Pawelek, A. W. Scott, Jr., and J. Garza. 2010. Notice of release of Zapata Germplasm Rio Grande clammyweed: Selected class of natural germplasm. Native Plants Journal 11:269–273.

Smith, F. S., P. D. Maywald, W. R. Ocumpaugh, J. Lloyd-Reilley, S. D. Maher, K. A. Pawelek, A. S. Scott, Jr., and J. Garza. 2010. Notice of release of Webb Germplasm whiplash pappusgrass: Selected class of natural germplasm. Native Plants Journal 11:275–280.

Smith, F. S., P. D. Maywald, W. R. Ocumpaugh, J. Lloyd-Reilley, S. D. Maher, K. A. Pawelek, A. S. Scott, Jr., and J. Garza. 2010. Notice of release of Maverick Germplasm pink pappusgrass: Selected class of natural germplasm. Native Plants Journal 11:283–288.

Strickland, B. K., S. Demarais, A. Zamorano, R. W. DeYoung, and C. M. Dacus. 2011. Accuracy for determining sex of white-tailed deer fetuses. Wildlife Society Bulletin 34:54–58.

Timmons, G. R., D. G. Hewitt, C. A. DeYoung, T. E. Fulbright, and D. A. Draeger. 2010. Does supplemental feed increase selective foraging in a browsing ungulate? Journal of Wildlife Management 74:995–1002.

Webb, S. L., S. Demarais, and D. G. Hewitt. 2010. Size of home ranges and movements determine size and configuration of management units and potential spread of disease in white-tailed deer (*Odocoileus virginianus*). Southwestern Naturalist 55:488–492.

Webb , S. L., K. L. Gee, B. K. Strickland, S. Demarais, and R. W. DeYoung. 2010. Measuring fine-scale white-tailed deer movements and environmental influences using GPS collars. International Journal of Ecology. DOI:10.1155/2010/459610.

Webb, S. L., S. Demarais, B. K. Strickland, R. W. DeYoung, B. P. Kinghorn, and K. L. Gee. Effects of selective harvest on antler size in white-tailed deer: A modeling approach. Journal of Wildlife Management:(*In-Press*).

Windels, S. K., and D. G. Hewitt. 2011. Effects of plant secondary compounds on nutritional carrying capacity estimates of a browsing ungulate. Rangeland Ecology and Management 64:264–275.

Wyckoff, A. C., S. E. Henke, T. A. Campbell, D. G. Hewitt, and K. C. VerCauteren. 2011. Movement and habitat use of feral swine near domestic swine facilities. Journal of Wildlife Management:(*In-Press*).

Young, J. H., M. E. Tewes, A. M. Haines, G. Guzman, and S. J. DeMaso. 2010. Survival and mortality of cougars in the Trans-Pecos region. Southwestern Naturalist 55:412–419.

Popular Literature

Ballard, B. 2010. A river of birds. South Texas Wildlife 14(1):1–2.

Brennan, L. A. 2010. South Texas bobwhites on the rebound. South Texas Wildlife 14(4):1–2.

Brennan, L. A. 2010. Managing bobwhite nest predation: the issues and the evidence. The Bobwhite Post 13(4):3–4.

Brennan, L. A. 2010. Running early and flushing wild. CKWRI Quail e-News, January 2010. http://hosted-p0.vresp.com/541410/9c530e087b/ARCHIVE

Brennan, L. A. 2010. Quails ex libris. CKWRI Quail e-News, July 2010. http://hosted-p0.vresp.com/541410/0c4a4823cc

Brennan, L. A. 2010. A decade of progress. CKWRI Quail e-News, October 2010. http://hosted-p0.vresp.com/541410/5dd523797a/ARCHIVE

Brennan, L. A., M. C. Buelow, T. Fulbright, J. A. Ortega, and F. C. Bryant. 2010. Untangling the tanglehead dilemma. CKWRI Quail e-News, April 2010. http://hosted-p0.vresp.com/541410/b0decc5f99/ARCHIVE

Bryant, F. 2010. The year 2010. South Texas Wildlife 14(4):3–4.

Campbell, T. A. 2010. Reducing the risk of human exposure to wildlife diseases. Texas Wildlife 25(August):38.

Corman, K. S., and R. D. DeYoung. 2011. Genetic techniques and Texas prairie chickens. South Texas Wildlife 15(1):3–4.

DeMaso, S. J., M. J. Schnupp, E. J. Redeker, F. Hernández, L. A. Brennan, J. P. Sands, T. W. Teinert, A. M. Fedynich, F. C. Bryant, R. M. Perez, and D. Rollins. 2010. A practical and efficient helicopter survey technique to estimate bobwhite abundance on Texas rangelands. Caesar Kleberg Wildlife Research Institute Wildlife Technical Publication No. 2, Texas A&M University-Kingsville.

DeYoung, C. A. 2011. Setting wildlife management goals. South Texas Wildlife 15(1):1–2.

DeYoung, R. W. 2010. Maternal effects and the tarnishing of the silver spoon. CKWRI Deer Associates e-News, April 2010.

DeYoung, R. W. 2010. Factors influencing efficiency of intensive management. Proceedings of the Texas Deer Study Group, Kingsville, TX.

DeYoung, R. W. 2010. Population dynamics, diseases, predators, and other mortality factors. Quality Deer Management Association Deer Steward Certification Course, Kingsville, TX.

Falk, T. 2010. Native habitat restoration as a tool to improve bobwhite quail nesting habitat. South Texas Natives 6(1):3–4.

Falk, T., C. Shackelford, M. McCraw, and F. S. Smith. 2011. Texas native seeds effort to work to improve native seed sources across the state. Grass Roots 63(2):4–5.

Foley, A. M., R. W. DeYoung, and D. G. Hewitt. 2010. Post-rut mortality: The enduring legacy of the 2009 drought? CKWRI Deer Associates e-News, March 2010.

Fulbright, T. 2010. Does brush management improve habitat for wildlife? Or not...Part II. South Texas Wildlife 14(2):3–4.

Gann, K., and D. Hewitt. 2011. Benefits of "bad" brush. South Texas Wildlife 15(2):3–4.

Hamrick, W., T. Campbell, B. Higginbotham, and S. Lapidge. 2011. Managing an invasion: effective measures to control wild pigs. Wildlife Professional 5(2):41–42.

Hernández, F. 2010. The new South Texas research project. CKWRI Quail e-News, February 2010. http://hosted-p0.vresp.com/541410/ebaaa4895f/ARCHIVE

Hernández, F. 2010. A matter of time. Texas Wildlife 26(December):24–25.

Hewitt, D. G. 2010. Elk reproduction improved with mature bulls. Boone and Crockett website. http://www.boone-crockett.org/news/featured_story.asp?area=news&ID=85

Hewitt, D. G. 2010. Amazing insights from the insides of a deer. CKWRI Deer Associates e-News, May 2010. http://ckwri.tamuk.edu/fileadmin/user_upload/docs/Deer_Research/eNews_Archives/Insides_of_a_Deer_Hewitt_Mayl_2010.pdf

Hewitt, D. G. 2011. Pronghorn evolution and management. Boone and Crockett website. http://www.boone-crockett.org/news/featured_story.asp?area=news&ID=94

Hewitt, D., and R. DeYoung. 2010. Survey time: Evaluating the past and peering into the future. CKWRI Deer Associates e-News, September 2010.

Hewitt, D., and R. DeYoung. 2011. A hard day's night: The lingering effects of the rut. CKWRI Deer Associates e-News, March 2011.

Kunz, D., and D. G. Hewitt. 2011. Early antler shedding. CKWRI Deer Associates e-News, January 2011.

Kuvlesky, Jr., W. 2011. South Texas raptor ecology. South Texas Wildlife 15(2):1–2.

Langschied, T. 2010. Exploring the wide world of autumn and winter birds. South Texas Wildlife 14(3):1–2.

Langschied, T. 2011. A guide to bird-watching and South Texas wintering birds. Caesar Kleberg Wildlife Research Institute Special Publication No. 2, Texas A&M University-Kingsville.

McCraw, M. 2011. Filling the native seed gap for Central and North-Central Texas. The Reverchon Naturalist 1(8):6.

Ortega-Santos, J. A. 2010. Is the drought over when it rains? South Texas Wildlife 14(3):3–4.

Redeker, E. 2010. Rangeland photo monitoring. South Texas Wildlife 14(2):1–2.

Sands, J. P. 2010. A biological approach to regulating northern bobwhite harvest. CKWRI Quail e-News, June 2010. http://hosted-p0.vresp.com/541410/ab95fd0a3d

Sands, J. P. 2010. For sake of old times. CKWRI Quail e-News, Holidays 2010. http://hosted-p0.vresp.com/541410/63270ff2f9/ARCHIVE

Sands, J. P., and F. Hernández. 2010. Sustained-yield harvest of bobwhites: findings of a 4-yr study. The Bobwhite Post 13(2):1–2.

Smith, F. S. 2010. Restoring retired croplands in Texas. Texas Wildlife 25(12):18.

Smith, F. S. 2010. Native seeds now available for South Texas restoration. The South Texas Quarterly 1(3):6–7.

Smith, F. S. 2010. South Texas Natives Project update. South Texas Natives 6(1):1.

Smith, F. S. 2010. TxDOT provides multi-region support for native seed source development through STN. South Texas Natives 6(2):2–3.

Smith, F. S. 2010. South Texas partnership yields native forbs for habitat restoration and wildlife. The Cattleman XCVII(3):84–89.

Smith, F. S. 2011. South Texas Natives celebrates 10th anniversary. Texas Wildlife 26(10):22–23.

Smith, F. S., and K. Pawelek. 2010. Release of Webb Germplasm whiplash and Maverick Germplasm pink pappusgrass finalized. South Texas Natives 6(2):3.

Tjelmeland, A., and F. C. Bryant. 2010. Tanglehead: Understanding an emerging threat to quail habitat in South Texas. The Bobwhite Post 13(1):1–2.

Tjelmeland, A., A. Litt, and F. Smith. 2010. Tanglehead: A new threat to South Texas wildlife? Texas Wildlife 25(10):10.

Tri, A. N. 2010. Supplemental feeding and northern bobwhite reproduction in South Texas. CKWRI Quail e-News, March 2010. http://hosted-p0.vresp.com/541410/803e1c0be3/ARCHIVE

Tri, A. N. 2010. Rainfall and quail in South Texas. CKWRI Quail e-News, August 2010. http://hosted-p0.vresp.com/541410/664a847cfc/ARCHIVE

Wiemers, D., T. Fulbright, and D. G. Hewitt. 2010. Being a cool deer during the hot summer. CKWRI Deer Associates e-News, July 2010. http://ckwri.tamuk.edu/ fileadmin/user_upload/docs/Deer_Research/eNews_Archives/

Williford, D. 2010. Molecular genetics and New World quail. CKWRI Quail e-News, May 2010. http://hosted-p0.vresp.com/541410/0703c96e54/ARCHIVE

Caesar Kleberg Wildlife Research Institute
Texas A&M University-Kingsville
700 University Boulevard, MSC 218
Kingsville, Texas 78363-8202

(361) 593-3922

http://www.ckwri.tamuk.edu

Caesar Kleberg Wildlife Research Institute is a component of Texas A&M University-Kingsville

printed on recycled paper