![Caesar Kleberg Wildlife Research Institute logo]

CAESAR KLEBERG
WILDLIFE RESEARCH INSTITUTE
TEXAS A&M UNIVERSITY · KINGSVILLE®

CURRENT RESEARCH REPORT

2022-2023

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Providing the Science Behind Wildlife Conservation and Management

REPORT OF CURRENT RESEARCH

September 1, 2022 to August 31, 2023
Caesar Kleberg Wildlife Research Institute

ABOUT

The Caesar Kleberg Wildlife Research Institute at Texas A&M University - Kingsville is the leading wildlife research organization in Texas and one of the finest in the nation. Established in 1981 by a grant from the Caesar Kleberg Foundation for Wildlife Conservation, the Institute operates as a nonprofit organization and depends financially upon private contributions and faculty grantsmanship. Our mission is to provide science-based information for enhancing the conservation and management of Texas wildlife.

The Caesar Kleberg Wildlife Research Institute is located on the campus of Texas A&M University - Kingsville and functions as a unit within the Dick and Mary Lewis Kleberg College of Agriculture and Natural Resources.

SUPPORT US

Three ways to give:

1. Use this QR code.

2. Visit our giving webpage:

https://www.ckwri.tamuk.edu/giving

3. Use the envelope to send a check.

Resilience

South Texas is a fascinating place to study wildlife. No two years are the same, and this last summer was on the upper end of heat and the lower end of spring and summer rainfall. I gauge conditions in and around Kingsville by the water level in a pond behind my house. The last time it went dry was during the drought of 2011. It went dry this summer. The pond is a magnet for birds, and I greatly enjoy unwinding after a day in the office, camera and binoculars in hand, prowling the edge of the pond. As the pond dried up, diamond-backed water snakes and garter snakes joined egrets, herons, stilts, and ibises to gorge on the fish concentrated in the small amount of water left. Then the pond went dry and the life seemed to drain out of the basin.

After 6 weeks of sitting dry, a 3-inch rain filled up the pond. The next day, I noticed schools of minnows darting under the water's surface and 15-inch gar cruising the shallows. Dozens of dragonflies that all but disappeared when the pond was dry, floated overhead.

Resilience is the hallmark of Texas wildlife and rangelands. The instant ecosystem that blossomed in my pond is a perfect example of that resilience. So are pastures ravaged by drought or wildfire that turn lush with the first rainfall. And what better example of resilience is there than quail populations that swing from scarcely a bird in the pasture, to a covey in every motte?
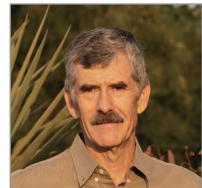
Resilience is also hallmark of Institute graduate students. They learn the facts of ecology and the art of wildlife management, but they also learn how to adapt when satellite transmitters fail, or floods or fires disrupt their study. They struggle to understand complex mathematics, animal physiology, and geographic information systems. They may fail tests and stumble when defending their research. Through this all, they persist, learn, and grow. They come through the hard times of their graduate career strong, resilient, and smiling.
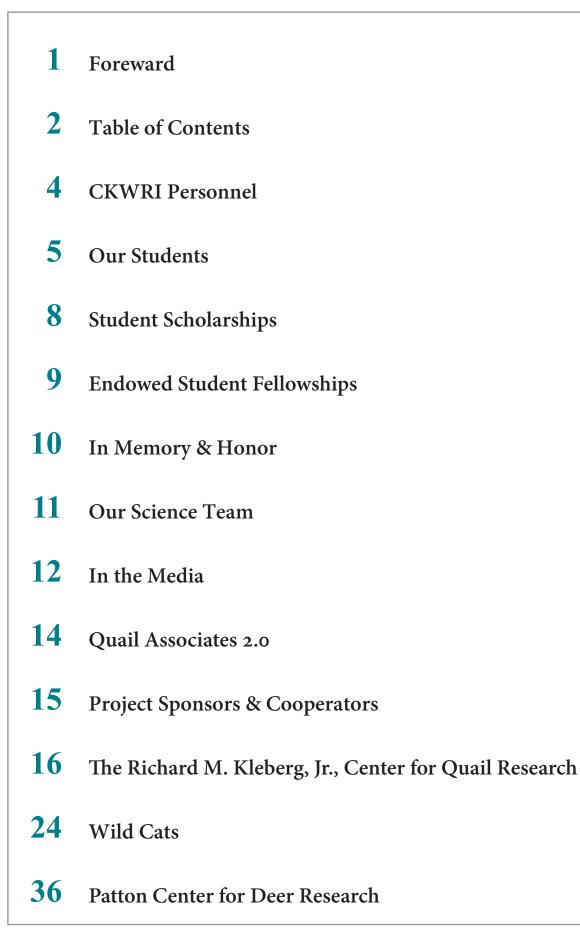
The resilience of Institute faculty is inspiring. These outstanding scientists may fail to be awarded a long-sought grant. They may become frustrated with bureaucracy, and long for the carefree days as a graduate student when they could spend their time in the field instead of the office. There are days when they are drained but they put on a smile, step to the front of the class, and share their knowledge and expertise with a room full of students.

CKWRI scientists and students are outstanding, not because their jobs are easy, but because they overcome the difficult times and persist until they are successful. Articles in this Current Research Report are testament to their tenacity because every student, every project, and every scientist had to be resilient to succeed. Just like the wildlife they study, they find ways to adapt and push through the hard times, then blossom and celebrate when the pieces come together. Enjoy their successes in these pages.

David Hewitt
Leroy G. Denman, Jr. Endowed Director of Wildlife Research

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Scientists and Staff

Mr. Nelson O. Avila, Res. Tech. II
Dr. Bart M. Ballard, Professor
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Dr. Jamie S. Benn, Res. Asst. Professor
Mr. John Boone, Farm Foreman II, Texas Native Seeds–Coastal Prairie
Mr. John R. Bow, Asst. Director, Texas Native Seeds–Central Texas
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Mr. Zachary M. Wardle, Res. Associate
Mr. Tyler C. Wayland, Assoc. Director, Texas Native Seeds–East Texas
Dr. David B. Wester, Professor

Graduate Students

Mr. Cole C. Anderson
Mr. Jose S. Avila-Sanchez
Ms. Kendall L. Bancroft
Mr. Michael R. Barrett
Mr. Alejandro Bazaldua
Ms. Laura C. Beck
Mr. Ethan Bennie
Ms. Tyler A. Bostwick
Ms. Matti R. Bradshaw
Mr. Aidan B. Branney
Mr. Marlin M. Dart II
Mr. Duston R. Duffie
Ms. Georgina R. Eccles
Mr. Calvin C. Ellis
Mr. Juan C. Elissetche
Mr. Forrest C. Fay
Ms. Shanna R. Gleason
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Ms. Katie J. Pennartz
Mr. Daniel J. Ramirez
Mr. E. Drake Rangel
Mr. Harry Rakosky
Ms. Tara L. Rodkey

Mr. Maksim Sergeyev
Mr. Bryan D. Spencer
Ms. Kristyn G. Stewart
Mr. Michael T. Stewart
Ms. Kimberly M. Tanguma
Ms. Katherine A. Travis
Mr. Parker C. Trifiletti
Mr. Zachary M. Wardle
Ms. Emma R. Weber
Mr. Thomas J. Yamashita
Ms. Rebecca R. Zerlin

Where Our Students Come From

CKWRI's world-class program attracts some of the brightest minds from all over the United States and beyond. Our program is unique in that our students have the opportunity to conduct research on private lands. Because of this, our students leave with a greater appreciation for private landowners and their stewardship values.

Washington
Montana

We had over 55 graduate students in our program during the 2022-2023 academic year.

Michigan
New York
Nevada
Iowa
Illinois
Maryland
California
Missouri
Virginia
Arizona
New Mexico
Oklahoma
Tennessee
Alabama
Texas
Mississippi
Georgia
Lousiana
Florida
Mexico

United Kingdom

South Africa

Where Our Students Go

Once they graduate, our students are some of the most sought after in the field of wildlife biology and habitat management. CKWRI graduates are working for:

American Bird Conservancy
CrossTimbers Consulting, Inc.
Deseret Cattle & Timber
Ducks Unlimited
East Foundation
Florida Fish and Wildlife Conservation
Georgia Department of Natural Resources
Idaho Fish and Game
Kansas Wildlife Service
King Ranch, Inc.
Michigan Dept. of Natural Resources
Mississippi Dept. of Wildlife, Fisheries and Parks

Montana Fish, Wildlife, and Parks
National Park Service
The Nature Conservancy
Pheasants Forever
Rocky Mountain Bird Observatory
Stephen F. Austin State University
Sul Ross State University
Texas A&M Agrilife Extension Service
Texas A&M University, College Station
Texas A&M University-Kingsville
Texas Parks and Wildlife Department
USDA - NRCS
U.S. Fish and Wildlife Service

U.S. Forest Service
U.S. Geological Survey (USGS), Patuxent Wildlife Research Center
USGS, National Wildlife Health Center
University of Idaho
University of San Diego
Washington Department of Fisheries & Wildlife
Welder Wildlife Foundation
Wisconsin Department of Natural Resources

CKWRI graduates also work for countless private ranches in management positions throughout the country.

2022-2023 M.S. & Ph.D. Graduates

Aidan B. Branney, M.S.
Thesis: Bobcat Use of Restored and Managed Tracts in Southern Texas

Sarah K. Jacobson, M.S.
Thesis: Habitat Assessment for California, Mountain, and Gambel's Quail in California

Bradley Kye Johnston, M.S.
Thesis: Bobwhite Response to Cattle Grazing on the Sweden Ranch

Lori D. Massey, M.S.
Thesis: Drone Applications for Range and Wildlife Management

David J. Newstead, Ph.D.
Dissertation: Migratory Connectivity Among Redknot Populations

Katie J. Pennartz, M.S.
Thesis: Ecology & Management of Whitebrush (Aloysia gratissima)
with Considerations towards Climate Variability

Maksim Sergeyev, Ph.D.
Dissertation: Fine Scale Habitat Use and Movement of Ocelots and Bobcats

Bryan D. Spencer, M.S.
Thesis: Effects of Cattle Stocking on Nutritional and Reproductive Metrics in Deer

Rebecca R. Zerlin, M.S.
Thesis: The Effects of Prescribed Burning on Butterfly Communities in Coastal Southern Texas

Student Scholarships

Caesar Kleberg Foundation for Wildlife Conservation Fund for Graduate Student Tuition
Every graduate student in our program financially benefits from this fund.

Houston Safari Club Dan L Duncan Scholarship Program
Alejandro Bazaldua, Marlin M. Dart II, Georgina R. Eccles, Calvin C. Ellis, Forrest C. Fay, Shanna R. Gleason, Miranda L. Hopper, Kevin T. Lovasik, Joseph M. McGovern, Dakota R. Moberg, Kimberly M. Tanguma

Quail Coalition Scholarship in Wildlife Management Graduate Scholarships, South Texas Chapter
Cole C. Anderson, Jose S. Avila-Sanchez, Michael R. Barrett, Alejandro Bazaldua, Laura C. Beck, Matti R. Bradshaw, Marlin M. Dart II, Duston R. Duffie, Georgina R. Eccles, Juan C. Elissetche. Forrest C. Fay, Shanna R. Gleason, Joseph A. Hediger, John E. Herschberger, Lindsey K. Howard, Sarah K. Jacobson, Lori D. Massey, Caleb M. McKinney, Dakota R. Moberg, Molly E. O'Brien, Micayla. E, Pearson, Katie J. Pennartz, Tara L. Rodkey, Michael T. Stewart, Kimberly M. Tanguma, Katherine A. Travis

Amanda Whitaker Memorial Graduate Student Scholarship in Wildlife Management, South Texas Chapter of Quail Coalition
Thomas J. Yamashita

Quail Coalition Scholarship in Wildlife Management Undergraduate Scholarships, South Texas Chapter
Joshua D. Allison, Abby M. Balson, Nadia N. Castanon, Jack L. Davison, Shayla M. Haiflich, Jessica J. Johnston, Jessica K. Rogers, Andres N. Rosales

Houston Livestock Show and Rodeo Graduate Scholarship
Lori D. Massey

Houston Livestock Show and Rodeo Graduate Fellow in Wildlife Research
Kaylee L. Lovejoy

Lon and Lee Cartwright Graduate Scholarship in Grass Management
Caleb M. McKinney

Lon and Lee Cartwright Undergraduate Scholarship in Grass Management
Andres N. Rosales

Dr. Charles Seidel Wildlife Photography Scholarship
Jessica J. Johnston, Mikayla Younts

Images for Conservation Fund Scholarship
Samantha J. Gerragauch, Luis Juarez, Ashley Perez, Leslie Raya, Gabriella Ruiz, Deanira Vela

Endowed Scholarships

Robert and Rebecca Palmer Scholarship Fund Graduate Student
Alejandro Bazaldua, Marlin M. Dart II, Georgina R. Eccles, John E. Herschberger, Lindsey K. Howard, Michael T. Stewart

Robert and Rebecca Palmer Scholarship Fund Undergraduate Student
Joshua D. Allison, Nadia N. Castanon, Jessica J. Johnston, Jessica K. Rogers

A. E. Leonard Undergraduate Student Scholarship in Wildlife Conservation
Abby M. Balson, Jack L. Davison, Shayla M. Haiflich

Phillip M. Plant Endowment for Graduate Scholarships in Wildlife
Cole C. Anderson, Jose S. Avila-Sanchez, Duston R. Duffie, Micayla E. Pearson, Katie J. Pennartz, Tara L. Rodkey

Alec D. Ritzell Memorial Fund for Wildlife Research and Education Scholarship
Thomas J. Yamashita

Sam Walton Fellowship in Quail Research
Caleb M. McKinney

Alice Gertrudis King Kleberg Reynolds Endowed Fellowship in Quail Research
Zachary J. Pearson

Elliot B. and Adelle Bottom Fellowship in Quail Research
John E. Herschberger

Walter Fondren, III Fellowship in Shorebird and Wading Bird Research
Jason P. Loghry, Emma R. Weber

Betty and George Coates Fellowship in Habitat Enhancement Research
Aidan B. Branney, Tyler A. Bostwick

Jess Y. Womack, II Fellowship in Wetlands and Wetland Bird Research
Matti R. Bradshaw, Joseph M. McGovern

Boone and Crockett Club Fellowship in Ungulate Research
Calvin C. Ellis

Hixon Fellowships in Deer
Miranda L. Hopper

Hixon Fellowships in Quail
Lindsey K. Howard

Hixon Fellowships in Range Restoration
Katherine A. Travis

Kenneth E. Leonard Fellowship for Livestock-Wildlife Research
Jose S. Avila-Sanchez

Stuart W. Stedman-Faith Ranch Fellowships in Deer Research
Breanna R. Green

Mike and Mary Terry Endowed Fellowship for Habitat Research
Laura C. Beck

Coates-Kelso Graduate Fellowship for Conservation and Management of White-tailed Deer
Kendall L. Bancroft, Bryan D. Spencer

We acknowledge the donors of these student scholarships and fellowships with heartfelt gratitude.

In Memory & Honor

Many people choose to send unsolicited gifts in honor of cherished friends or family.
In FY2023, we have received memorials and gifts to honor...

Camila Alvarez

Leon Bauerle

Albert Biedenharn

*Grady Cage

*Lon and Leigh Cartwright

Charles W. Duncan, Jr.

Celia & Cornelius Dupre'

June & Frank Erwin

Kate Fisher

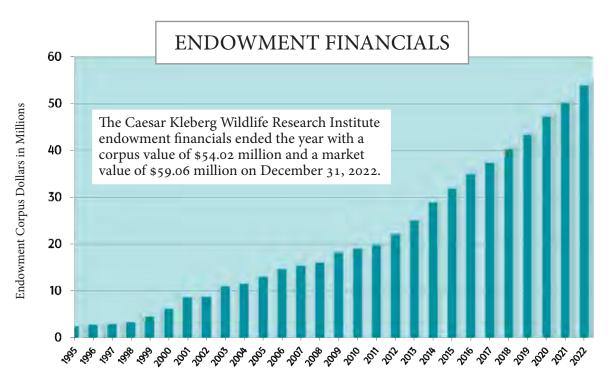*Helen "Helenita" Kleberg Groves

*Rafael A. and Carmen C. Guerra

*Henry Hamman

*John Harris

*Harold Hees

Amy Harry

Baden Harry

*Bruce F. Harrison

Daniel J. Harrison

*Tio and Janell Kleberg

Valgene Lehmann

Bessie Liedtke

Nancy Brown Negley

Gus Reinarz

Alec D. Ritzell

Robert Ross

John David Terry, III

*David Villanueva

Virginia Welder

*C. C. "Charlie" Winn
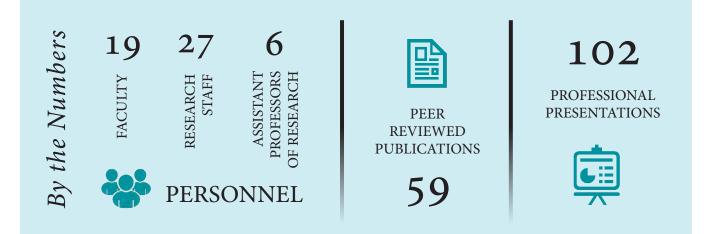
* Also honored in previous years

NEW ENDOWMENTS

Leigh and Lon Cartwright Endowment for Student Scholarships
Hardeman Family Foundation Endowment for Student Scholarships
David G. Hewitt Endowment for Graduate Studies
Hill Country Quail Coalition Endowment for Quail Research
Images for Conservation Fund (ICF) Endowment for Wildlife Photography
John Terry III Memorial Fund for Wildlife Research

Received 9/1/2022-8/31/23

ENDOWMENT FINANCIALS

The Caesar Kleberg Wildlife Research Institute endowment financials ended the year with a corpus value of $54.02 million and a market value of $59.06 million on December 31, 2022.

Endowment Corpus Dollars in Millions

Corpus Growth Reported in December from 1995 to 2022

By the Numbers

19 FACULTY

27 RESEARCH STAFF

6 ASSISTANT PROFESSORS OF RESEARCH

PERSONNEL

PEER REVIEWED PUBLICATIONS
59

102 PROFESSIONAL PRESENTATIONS

AWARDS & ACHIEVEMENTS

Vice President of the Wildlife Society
Dr. Fidel Hernandez was elected Vice President of The Wildlife Society. This is a 4-year position that transitions to President-elect and then President. Fidel's term as President will be 2025-2026.

Junior Faculty Award
Dr. Evan Tanner received the Junior Faculty Research Award for the Dick and Mary Lewis Kleberg College of Agriculture and Natural Resources in the AY 2022-23. This award is presented annually to a junior (non-tenured) faculty that exhibits exemplary work in research.

Buddy Temple Visiting Scholar
Dr. Michael Cherry was named the Buddy Temple Visiting Scholar at Boggy Slough by the T.L.L Temple Foundation. This honor recognizes Mike's contributions to understanding the effects of forest management on wildlife and provides the opportunity to conduct impactful research on the Boggy Slough Conservation Area in East Texas. It's an extra touching honor considering what a loyal supporter Buddy Temple was, and Ellen Temple continues to be, of the Institute.

Regents Professor
On November 10, 2022, the Texas A&M University System Board of Regents named Dr. Bart Ballard a Regents Professor.

A Talk on the Wild Side

www.ckwri.tamuk.edu/media/talk-wild-side-podcast

A Talk on the Wild Side is our bi-weekly podcast, and is supported by the Rotary Club of Corpus Christi Harvey Weil Sportsman Conservationist Award. Drs. Sandra Rideout-Hanzak and Alynn Martin are co-hosts, and Andrew Lowery is our editor. You can find us on any podcast app. Take a listen as we interview experts and enthusiasts about all thing wild in Texas. Be sure to follow us on social media for updates.

Use the QR code to the right to find us on Spotify.

Episodes from the past year:

Even Wildlife Rescue is Bigger in Texas! – with Dr. C. Ullmer, Aug. 29, 2023.

Dinosaurs in Texas? That Tracks! – with Z. Riggs, Aug. 15, 2023.

This Episode is for People Who Love Birds! – with D. Belleny, Aug. 1, 2023.

Sneak Beak into Aplomado Falcons! – with B. Mutch, July 18, 2023.

Oh Captain, My Caption! – with Captain C. Naiser, June 20, 2023.

We Can't Help but Carrion about Scavengers! - with Dr. S. Leivers, June 6, 2023.

Why Did the Ocelot Cross the Road? – with Dr. J. Young, May 23, 2023.

To Err is Human; To Blunder Can Be Funny! – May 9, 2023.

It Takes a Little Mussel to Withstand Extreme Weather! – with A. Tarter, Apr. 25, 2023.

Keeping the Stars at Night Big and Bright! – with S. Hummel, Apr. 11, 2023.

Celebrating Amazing Women in Natural Sciences! Mar. 28, 2023.

Chill Out While We Simplify Climate Complexity! - with Dr. J. Nielsen-Gammon, Mar. 14, 2023

Don't Overextend Yourself! The Extension Specialist is Here! - with Dr. S. Hines, Feb. 28, 2023

Ticks—There's No Such Thing as TMI about TBI! – with Dr. A. Martin, Feb. 14, 2023.

Foraging Texas: Eat the Wild Plants! – with Dr. M. Vorderbruggen, Jan. 31, 2023.

A Plate on the Wild Side! - with Chef J. Griffiths, Jan. 18, 2023

Alligator Gar—Gargantuan Fish! – with Dr. D. Daugherty, Jan. 2, 2023.

CWD in Texas Update – with Dr. H. Reed, Dec. 19, 2022.

Plant Talk with Planthropology! – with Dr. V. Baliga, Dec. 5, 2022.

Stewards of the Wild! – with K. Spurgin, Nov. 22, 2022.

Dear Me! No, Deer U! – with Dr. M. Cherry and Dr. B. Strickland, Nov. 8, 2022.

Vampires We Love, and Why We're Batty about Them! – with Dr. A. Adams, Oct. 26, 2022.

Invasion of the Brown Widows! – with A. Wahlberg, Oct. 12, 2022.

Texas Master Naturalists! – with M.P. Meuth, Sep. 2022.

Ben Masters and Mountain Lions - with B. Masters, Sep. 2022.

Bird Calls Podcast

Episode | Bird Calls, January 10, 2023

Tyler Wayland, the Associate Director of the Texas Native Seeds program in East Texas was a special guest with ornithologist Cliff Shackelford on an episode of Bird Calls. Tyler and Cliff profile the ruby-crowned kinglet.
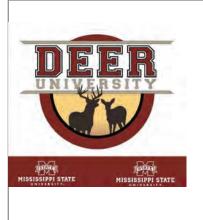
Link: https://www.redriverradio.org/show/bird-calls

Tyler was also interviewed by NRCS and the Texas Longleaf team about restoration and conservation of longleaf pine forests at the links below.

Link: https://www.youtube.com/watch?v=XCNrRhbl1rA (Texas NRCS) Feb 2022

Link: https://www.youtube.com/watch?v=WVO-01zZNjg (Texas Longleaf Team) May 2023

Deer University Podcast

Episode | Buck Breeding Value and Management Implications, July 14, 2023

Dr. Randy DeYoung was a special guest on an episode of Deer University. Randy discussed his many years of work on genetics of deer analyzing maternity and paternity in South Texas deer herds. He discussed results from the buck side of the equation and how they impact management decisions.

Link: https://open.spotify.com/episode/4yyMnv7UWdQar9Mh7dLBJT

Dr. DeYoung was also interviewed on the Texas Standard, a national daily news show about Texas. Randy discussed Chronic Wasting Disease in deer.

Link: https://www.texasstandard.org/wp-content/uploads/2023/04/QA-Brown-DeYoung-on-Chronic-Wasting-Disease-FINAL_01.mp3

Television Interviews

Our Executive Director, Dr. Dave Hewitt, was interviewed on news channels about the $12 million grant to research endangered Ocelots.

Link: https://www.krgv.com/videos/u-s-fish-and-wildlife-service-unveils-program-to-boost-ocelot-population/

Dave also discussed the Institute's programs and projects, and the importance of wildlife conservation as part of an interview series on the Useful Wild Plants website. Catch it on YouTube at the link below:

Link: https://www.youtube.com/watch?v=x2ZS9rtcns0

HISTORY OF QUAIL ASSOCIATES

The *Quail Associates* Program in the Richard M. Kleberg, Jr. Center for Quail Research at the CKWRI was designed and organized by John Kelsey and Fred Bryant in 2001. It was dedicated to providing a landscape look of quail populations and their productivity over the course of ten years (2001-2011). Until this study, it was almost unheard of to have the ability to conduct such a long-range and large-scale study, and the novel findings on genetics, hunting dynamics, and productivity set CKWRI apart. The two overall goals were: (1) create a network of "citizen scientists" who contribute hunter-harvested bobwhite data for annual assessments of quail productivity in South Texas and (2) raise funds to support quail research. The program succeeded at meeting both of these important goals, and it is with great excitement that we are launching *Quail Associates 2.0*.

QUAIL ASSOCIATES 2.0

Like the original program, members of Quail Associates 2.0 will be asked to contribute data including summer roadside counts, hunting success (covey flushes/hour), and productivity (adult/juvenile harvest ratios). Not only will members be acting as citizen scientists, but their financial support will provide important funding for quail research to help predict and shape the future of quail management. CKWRI's Dr. Fidel Hernandez, along with a dedicated research team, will provide participants with exclusive communications updating them on pre-season predictions, a post-season recap, as well as personalized findings specific to their property. The overall findings will be shared with the membership group (with specific ranch information removed).

MEMBERSHIP

Membership benefits will provide: a hunting season forecast based on roadside counts that are submitted by participating ranches, on-the-ground data on how the hunting season progressed in the region (i.e., # of covey finds/hr.) following the end of the season, a personalized ranch report that also provides overall participant findings (you will be the only one who receives information specific to your ranch, assuming you submit data), electronic notifications of new research findings in quail ecology and management, an invitation to an exclusive annual meeting (1/2 day with lunch) where members will learn of the latest research findings and management techniques, and program gifts (two Quail Associates shell bags and hats).

This exclusive group of dedicated quail enthusiasts will be at the forefront of Texas quail research, and membership is not limited to those who are contributing data. For those who want to participate in the next long-range quail research study by providing funding, we welcome you as a member!

Albert and Margaret Alkek Foundation
Arnim Family Foundation
Tommy & Sue Arnim
Bamert Seed Company
Lee & Ramona Bass Foundation
Alston & Holly Beinhorn
Boone & Crockett Club
Borderlands Research Institute, Sul Ross State
    University
The Brown Foundation
Caesar Kleberg Foundation for Wildlife
    Conservation
Canadian Wildlife Service
CF Ranches
ConocoPhillips
Daisy Farms, LLC
Ducks Unlimited, Inc.
Dan L Duncan Family
Mr. Rufus Duncan, Jr.
Joan & Rufus Duncan Memorial Fund
East Foundation
Enbridge Energy Partners L.P.
ExxonMobil Corporation
Alfred S. Gage Foundation
Marie M. & James H. Galloway Foundation
Fred C. Hamilton
Frederic C. Hamilton Foundation
Harris County Flood Control District
Harte Research Institute
Henderson-Wessendorf Foundation
Hildebrand Foundation
Hill Country Quail Coalition
Tim & Karen Hixon Foundation
Ms. Julianna Hawn Holt
Houston Livestock Show & Rodeo
Las Huellas Association of South Texas
Willard & Ruth Johnson Foundation
Joan & Herb C. Kelleher Charitable Foundation
Douglass W. King Seed Company
Caesar Kleberg Partners Program
The Richard M. Kleberg, Jr. Family
Robert J. Kleberg, Jr. & Helen C. Kleberg
    Foundation
Knobloch Family Foundation
Laguna Atascosa National Wildlife Refuge
Lavaca Navidad River Authority
A. E. Leonard Family Giving Council
Louisiana Department of Wildlife & Fisheries
Lubbock Sportsman's Club
Travis & Bettina Mathis
Mule Deer Foundation
National Christian Foundation
National Fish & Wildlife Foundation

National Science Foundation
The Nature Conservancy
New Mexico Department of Game & Fish
Next Decade LNG
Oklahoma Department of Wildlife Conservation
Orsted Energy
Quail Ranch
Railway Ranch
RES Texas Mitigation, LLC
Rio Grande LNG
Rotary Club of Corpus Christi
Safari Club International Foundation
San Pedro Ranch
Sandbrock Ranch
Mr. Rod Sanders
Shield Ranch
Shield-Ayres Foundation
SK Foundation
Mr. Stan Smith
South Texas Chapter of Texas Quail Coalition
Sulphur Bluff Ranch
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Texas A&M AgriLife Research & Extension Center at
    Stephenville
Texas A&M AgriLife Research Station-Beeville
Texas Comptroller Office of Public Accounts
Texas Department of Transportation
Texas Ecological Laboratory
Texas Parks & Wildlife Department
The Raul Tijerina, Jr. Foundation
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USDA National Institute of Food & Agriculture
USDA Natural Resources Conservation Service
USDA NRCS E. "Kika" de la Garza Plant Materials
    Center
USDA NRCS East Texas Plant Materials Center
USDA NRCS James E. "Bud" Smith Plant Materials
    Center
Harvey Weil Sportsman Conservationist Award
Rob & Bessie Welder Wildlife Foundation
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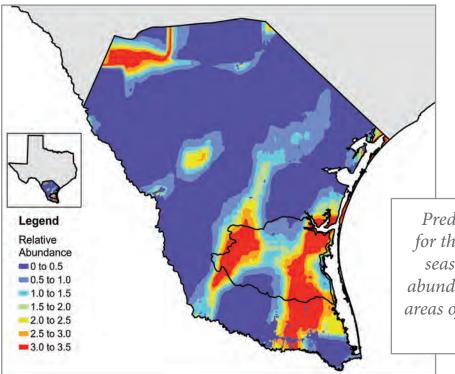
A QUAIL-SEASON FORECASTING TOOL

Alejandro Bazaldua, Fidel Hernández, Aaron M. Foley, and Andrea Montalvo

Northern bobwhites have been declining throughout the U.S. Declining populations are concerning for bobwhite managers because of the species' popularity as a gamebird. Having a reliable method of forecasting the quail-hunting season therefore is important for landowners to appropriately plan harvest.

Current methods of forecasting the quail season are limited because they involve either anecdotal observations (which are subjective) or roadside surveys by Texas Parks and Wildlife Department (which are conducted only once a year). Our objective was to use the Quail Associates 2.0 program to develop a more reliable method to forecast the quail-hunting season in South Texas. We estimated bobwhite abundance by conducting repeated roadside surveys on 13 properties distributed throughout South Texas during AugustSeptember 2022. We also obtained annual rainfall, % bobwhite habitat, and density of energy infrastructure that occurred in the landscape surrounding each route. We then determined the relationship between bobwhite abundance and landscape characteristics and used this relationship to develop a map of predicted bobwhite abundance for the 2022 quail-hunting season (Figure 1).

Our goal is to increase the number of participating properties in the future to obtain a wider distribution of roadside-survey data and further increase the reliability of the predictive map. With an improved bobwhite forecast, ranch managers will be able to make more informed decisions of harvest management.

Legend

Relative Abundance
- 0 to 0.5
- 0.5 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- 2.0 to 2.5
- 2.5 to 3.0
- 3.0 to 3.5

Predicted number of quail/mile for the 2022 South Texas hunting season. Areas of low bobwhite abundance are represented by blue; areas of high relative abundance are represented by red.

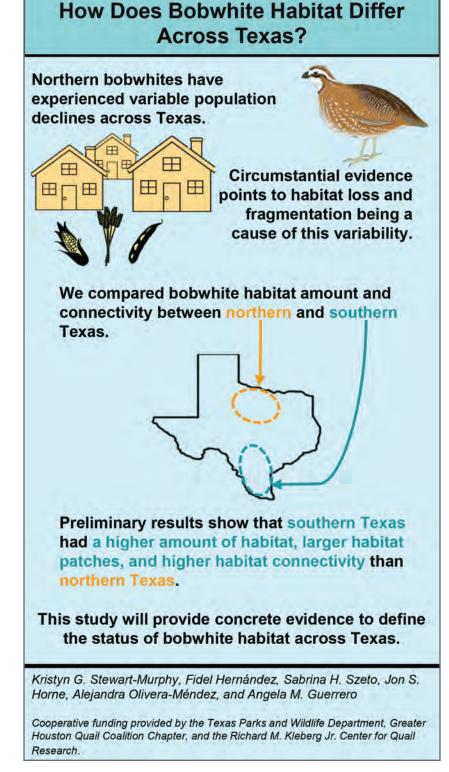## RAINFALL LEGACY EFFECTS IN NORTHERN BOBWHITE

John E. Herschberger, Fidel Hernández, John T. Edwards, and David B. Wester

Northern bobwhite is a game species that is strongly influenced by rain. However, population responses often are less than expected given the amount of rainfall in the year. To better understand the quail-rainfall relationship, we are investigating if rainfall-legacy effects influence populations. Rainfall-legacy effects occur when the influence of past rainfall persists, thereby affecting current conditions, a phenomenon known to occur in grassland plants. The objectives of our study are to quantify the relationship between bobwhite abundance and current and prior-year rainfall.

Our study focuses on both southern and northern Texas. We are using long-term datasets (1978–2022) of bobwhite relative abundance collected through roadside surveys by Texas Parks and Wildlife Department (TPWD) and annual rainfall from a climatological database to evaluate the influence of current and prior-year rainfall on bobwhite abundance.

Our preliminary results suggest a positive influence of current-year rainfall, but weaker influence of prior-year rainfall. Interestingly, the positive influence of current-year rainfall on bobwhite abundance is much weaker than what has been reported in past research. These findings may be explained by possible increases in woody and herbaceous cover along survey routes over time, which may be reducing the probability of detecting bobwhites and therefore introducing "noise" into the bobwhite counts. We will evaluate this hypothesis. Our research will result in a better understanding of the quail-rainfall relationship and lead to important recommendations for improving roadside surveys conducted by TPWD.

How Does Bobwhite Habitat Differ Across Texas?

Northern bobwhites have experienced variable population declines across Texas.

Circumstantial evidence points to habitat loss and fragmentation being a cause of this variability.

We compared bobwhite habitat amount and connectivity between northern and southern Texas.

Preliminary results show that southern Texas had a higher amount of habitat, larger habitat patches, and higher habitat connectivity than northern Texas.

This study will provide concrete evidence to define the status of bobwhite habitat across Texas.

Kristyn G. Stewart-Murphy, Fidel Hernández, Sabrina H. Szeto, Jon S. Horne, Alejandra Olivera-Méndez, and Angela M. Guerrero

RAINFALL EFFECTS ON BOBWHITE REPRODUCTION

Lindsey K. Howard, Fidel Hernández, Clayton D. Hilton, David G. Hewitt, and David B. Wester

Bobwhite populations experience drastic changes in abundance from year to year. It is widely accepted that these fluctuations are related to rainfall, but the exact cause of this relationship is unknown. Birds use a variety of information to time reproduction, including environmental cues (such as weather), and adjust their breeding to local conditions. The rapid change in landscape appearance, from dry brown to lush green after rainfall, may act as an environmental cue that triggers quail breeding. Our objective is to evaluate if vegetation color is a reproductive cue for northern bobwhite in semi-desert environments.

During summer 2022, 20 bobwhite hens were housed in aviary cages with 1 of 4 color treatments: a brown treatment with dry vegetation, a green treatment with lush vegetation, a switch treatment in which vegetation color changed from brown to green, and a control treatment with no vegetation. The birds' reproductive hormone levels and egg-laying rate were monitored throughout the study.

There was no significant difference in egg-laying rate among color treatments. Although the number of eggs laid was consistently higher in the green treatment, low sample sizes and high variability within treatments may have affected our ability to detect a difference. Reproductive hormone measurements are still in progress.

Our results will give a better understanding of what connects quail population dynamics to rainfall, as well as increase general knowledge about bird reproduction in semi-desert environments. This information will inform management in areas of unpredictable rainfall, and will help predict the effects climate change may have on desert birds.

RANGE-WIDE ASSESSMENT

Caleb M. McKinney, Evan P. Tanner, Leonard A. Brennan, Ashley M. Tanner, Humberto L. Perotto-Baldivieso, Fidel Hernández, David B. Wester, David G. Hewitt, Ryan S. Luna, John McLaughlin, and Katherine A. Travis

Avian populations and diversity are declining at an alarming rate globally. This is largely a result of loss and fragmentation of native ecosystems. In particular, Tamaulipan thornscrub in South Texas has declined greatly over recent decades. However, little is known about the effects that loss of thornscrub vegetation has had on bird communities. One strategy for conserving bird communities is to select a focal species to serve as an indicator for that community. Chestnut-bellied scaled quail, a subspecies of scaled quail native to South Texas, has a strong preference for thornscrub environments, and therefore has the potential to be a good indicator for bird communities in this system.

Our goal is to assess breeding bird communities in the thornscrub, and test whether scaled quail are an indicator species for this vegetation community. We began our research in the breeding season (May – June) of 2022 and continued in 2023 at two field sites located on private ranches in Duval and Dimmit Counties. We performed bird point count surveys and scaled quail playback surveys, (pre-recorded scaled quail sounds) to increase detection of this species at 170 locations on each ranch.

Our results will provide information on an understudied bird community and the role habitat loss and fragmentation (including the spread of non-native plants) have on that community. Additionally, determining if scaled quail is an indicator species for this unique community could be beneficial in identifying important areas to target conservation.

CHESTNUT-BELLIED SCALED QUAIL

IN SOUTH TEXAS.

Chestnut-bellied scaled quail, a subspecies of the native scaled quail, have been declining over the past decades. We want to know *why.*

Katherine A. Travis, Caleb M. McKinney, Evan P. Tanner, Ashley M. Unger, Fidel Hernández, Humberto L. Perotto-Baldivieso, Leonard A. Brennan, David G. Hewitt, David B. Wester, Ryan S. Luna, John W. McLaughlin, and R. Dwayne Elmore.

STUDY AREA

To understand the mechanisms of scaled quail decline, we selected two sites: one with a stable population (Dimmit County) and one with a declining population (Duval County).

METHODS

We are tracking quail movements using backpack-style GPS transmitters, which will allow us to better understand how quail are navigating their environment, including vegetation structure, road density, and more.

200 m

PRELIMINARY RESULTS

From February 2022 to June 2023, we fitted 123 individuals with GPS units that took a location every four hours. This resulted in 21,052 locations collected. In addition, we located 6 nests during the 2023 nesting season.

Preliminary analysis suggests strong selection for the Tamaulipan thornscrub vegetation community, and avoidance of mesquite shrubland. Further analysis will reveal more fine-scale relationships.

CALIFORNIA, MOUNTAIN, & GAMBEL'S QUAIL

ASSESSING THREE QUAIL SPECIES IN CALIFORNIA'S CHANGING LANDSCAPE

Sarah K. Jacobson, Leonard A. Brennan, Humberto L. Perotto-Baldivieso, Evan P. Tanner, and Katherine S. Miller

California supports populations of three quail species: the California quail, mountain quail, and Gambel's quail. During the past half-century, the state has experienced extensive land use changes. These changes threaten the loss of habitat for each species from urban development, large-scale agriculture, and changes in forest and rangeland management.

For this project, we used data from the North American Breeding Bird Survey to determine long-term population trends between 1972 and 2017 for the three quail species in California. We then quantified how changes in land use and land cover impacted local quail abundance. We identified areas where quail abundance has declined, increased, or experienced no change and compared road density, human population density, land use, and land cover between these areas.

• On the statewide level, populations of all three species did not experience long-term declines over the 45-year period.

• Locally, areas where California quail declined had higher road and human population densities, and less bare ground and litter cover, than areas where these quail were increasing.

• In areas where mountain quail were declining, percent irrigated land was higher, but road density was lower than in areas where these quail were increasing.

• The area where Gambel's quail declined had higher human population and road densities, and more bare ground cover, than the areas where these quail were increasing.

• Our results indicate that these quail species can persist in a changing landscape if sufficient quality habitat remains available.

Wild Cats

OCELOTS

The ocelot is a federally endangered, medium-sized wild cat with possibly less than 80 individuals remaining in the U.S. There are two populations of the exquisite ocelot in South Texas: the Refuge Population at Laguna Atascosa National Wildlife Refuge (LANWR) in eastern Cameron County and the Ranch Population on the East Foundation's El Sauz Ranch and the Yturria San Francisco Ranch in Willacy and Kenedy Counties. Ocelots rely heavily on native thornscrub, which has been fragmented by agriculture and increasing human development. Understanding the characteristics of vegetation most suitable for ocelots is essential for their conservation. Additionally, understanding differences in habitat selection of ocelots, bobcats and coyotes can provide insight into the coexistence between these 3 carnivores. Researchers in the Feline Research Program at the CKWRI have been studying ocelots and other wild cats to aid in their conservation for over 35 years.

ON THE YTURRIA RANCH IN SOUTHERN TEXAS

Daniel G. Scognamillo, Laura de la Garza, Imer de la Garza, and Michael E. Tewes

We are monitoring the ocelot population on the Yturria Ranch conservation easements with GPS collars and using photographs from trail cameras to identify individuals based on their unique coat patterns. The locations and number of individuals identified will be used in a computer model to estimate ocelot density. During the winter of 2023-2024, we will capture ocelots and fit them with GPS collars to collect information on their movement patterns. During captures we will also collect samples for genetic and reproductive studies.

Gaining knowledge on the movement patterns of ocelots in the restored easements is a critical step for the planning and design of dispersal corridors for this population. Results from this study will support ocelot conservation and restoration efforts in South Texas.
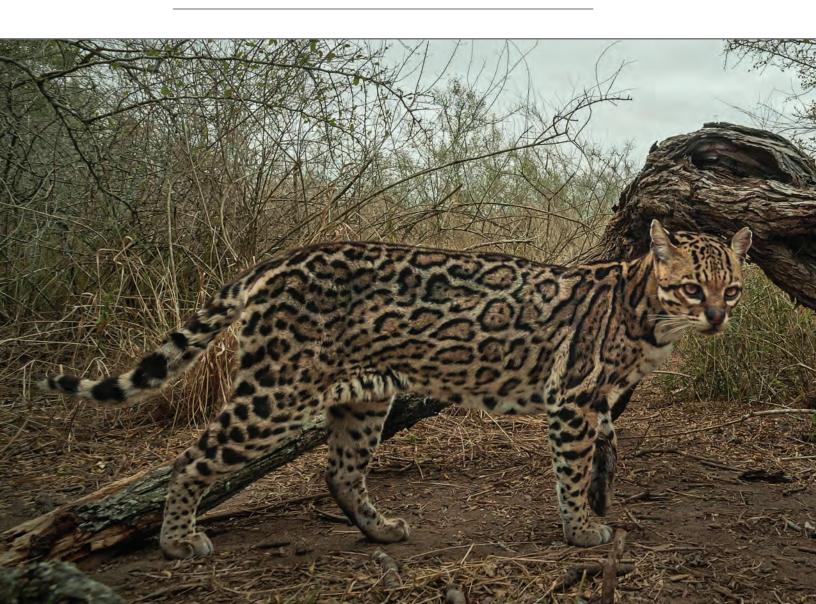
ON THE LAGUNA ATASCOSA REFUGE

Daniel G. Scognamillo, Hunter G. Vasquez, Elizabeth A. Saldo, Sergio J. Vasquez, Brandon N. Jones, Sarah E. Lehnen, Grant M. Harris, and Michael E. Tewes

We are studying the Refuge population at LANWR to add to the existing population database to help ocelot conservation. We are using 30 camera stations in a grid covering 11.5 square miles of prime ocelot habitat to determine ocelot density and abundance. Photographs from these cameras are used to identify individuals based on their unique coat patterns to estimate their density. Our research also focuses on ocelot movements, reproduction, and health. Information is collected from the GPS collars to describe ocelot movement patterns and interactions with wildlife crossings at roads near the refuge. We are also monitoring kitten survival and their movements with trail cameras deployed in areas where females with kittens have been detected.

We have so far captured 5 ocelots and collared them with GPS collars. Data from these collars will be available later in 2023. Our early analysis of camera trapping results has identified 6 ocelots: 3 males and 2 females, and 1 undetermined.

This research contributes to an existing, long-term study of ocelots on LANWR by the refuge staff. The results will support ocelot conservation and restoration efforts at LANWR, and elsewhere in South Texas.

IMPROVING OUTCOMES FOR OCELOT REINTRODUCTION

Tyler A. Bostwick, Ashley M. Reeves, and Lisanne S. Petracca

Fragmentation of native thornscrub in southern Texas because of agriculture and and increasing development has decreased genetic diversity in ocelots. Captive breeding and reintroduction are currently being considered to boost population size and genetic diversity. Our research will (1) create genetic diversity baselines for wild and captive populations, and (2) identify ideal habitat structure to inform thornscrub restoration for ocelot habitat.

For our genetic work, we have 27 blood samples from wild ocelots from 2019 to the present from three locations in South Texas. We also captured a record 12 ocelots on East Foundation's El Sauz Ranch during the 2022-2023 field season. Blood samples from captive ocelots will come from 25 zoos across the country. For our habitat work, we will be using GPS collar data from 36 ocelots from 2011 to 2021, as well as placing new collars on ocelots in the 2023-2024 field season.

Our goal is to give managers the tools they need to maximize the success of ocelot reintroduction. Our genetics work will identify which ocelot pairs would produce greatest genetic diversity in the captive breeding program. Additionally, habitat models will inform managers on how best to restore thornscrub habitat in preparation for ocelot reintroduction. Both research objectives will fill existing data gaps and help recover this endangered species.

OCELOT INTERACTIONS WITH OTHER CARNIVORES

Thomas J. Yamashita, Daniel G. Scognamillo, Zachary M. Wardle, Landon R. Schofield, Jason V. Lombardi, and Michael E. Tewes

We are monitoring populations of ocelots, bobcats, coyotes, badgers, and other mammals using camera traps set on two ranches in the ocelot Ranch Population. We are determining the activity patterns of ocelots and other carnivores. We will assess how vegetation density, climate, and roads affect these relationships. We are using 12 years of camera data from the East Foundation's El Sauz Ranch, and 2 years of camera data from a private ranch in Kenedy County to examine long-term patterns of activity overlap and habitat use.

We have detected ocelots, bobcats, coyotes, and badgers on both ranches. Bobcats and ocelots are primarily active at night. However, bobcats show greater daytime activity than ocelots. Coyotes and badgers are active during the day and night.

This research will give us greater understanding into factors influencing ocelot distribution in South Texas and how other carnivores may influence ocelots. This research demonstrates the importance of private lands for ocelot conservation and will aid with ocelot recovery and translocation efforts.

THERMAL ECOLOGY OF OCELOTS AND BOBCATS

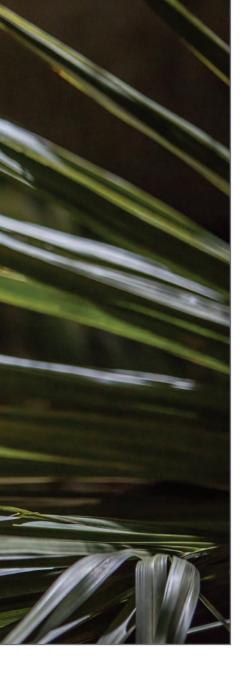Maksim Sergeyev, Evan P. Tanner, Michael J. Cherry, Jason V. Lombardi, Michael E. Tewes, and Tyler A. Campbell

Extreme climatic conditions can alter the activity patterns and habitat selection of a species. This impact can be greater for species that occur at the extremes of their geographic distribution. As two species at the edges of their northern and southern distributions respectively, ocelots and bobcats may face this unique pressure. We aim to answer the question: do ocelots and bobcats select thermal cover by partitioning cover resources, or is this a source of potential competition between the species?

From 2017 to 2021, we monitored 8 ocelots and 13 bobcats in the Ranch Population of ocelots in southern Texas. We compared cover selection to examine the effect of varying temperature on habitat selection. Additionally, we stationed 130 thermal sensors to describe the thermal properties of the various cover types.

To date, we have observed highly consistent selection between species across all temperatures. Ocelots and bobcats selected for shrub cover and vertical canopy cover when cold stressed. When heat stressed, both species avoid bare ground and select for higher vertical canopy cover and are located closer to dense cover. Thermal measurements indicate that forest and shrub cover are significantly cooler than herbaceous or bare ground.

Our results stress the importance of dense shrub cover and forested canopy as thermal refuge for ocelots and bobcats. It appears that abundant vegetation may reduce the effects of competition between species during lower temperatures, and niche partitioning may reduce competition during upper temperature limits.

BOBCAT HABITAT SELECTION IN MANAGED BRUSH

Aidan B. Branney, Zachary M. Wardle, Michael J. Cherry, Humberto L. Perotto-Baldivieso, and Michael E. Tewes

Range management often combines agricultural and wildlife management objectives through the removal of woody plants, leaving strips of brush and open areas. Management is often focused on economically important game species; however, little is known about how this impacts other species such as bobcats. We are investigating how bobcats respond to brush fragmentation through habitat selection.
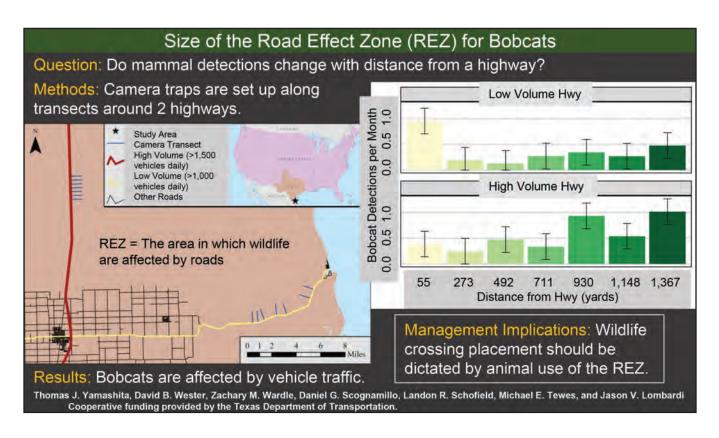
In 2021 and 2022, we GPS-collared 9 bobcats on the Hixon Ranch in La Salle County, Texas. We are comparing woody edge length (yards/2.5 acres) and patch density (number of patches/250 acres) from aerial imagery with bobcat locations to determine bobcat habitat use. To date, bobcats appear to select areas closer to woody vegetation and water bodies and avoid herbaceous cover and high patch density. They also select for greater woody edge density.

These data should provide insights into how strip clearing may help prey communities, which in turn may benefit ocelot use of managed rangelands. This research may be extended to other carnivores in landscapes configured for wildlife, agriculture, and energy infrastructure optimization.

BOBCATS

MONITORING ROAD CROSSINGS FOR WILDLIFE

Thomas J. Yamashita, Daniel G. Scognamillo, Zachary M. Wardle, John H. Young Jr., Michael E. Tewes, and Jason V. Lombardi

Roads can have large impacts on wildlife. These range from habitat fragmentation and vehicle collisions, to disturbance from vehicle noise. Wildlife crossings can help reduce road impacts. Crossings provide safe passage for wildlife below the road surface. An important question is determining crossing effectiveness. This can be done by monitoring crossings and by monitoring how they reduce direct road effects. In South Texas, crossings are being built for ocelots. However, crossings are used by many wildlife, so using only ocelots as the standard may not measure all their values.

We are using camera traps and road mortality surveys to determine crossing effectiveness at crossings on Farm-to-Market 1847 in Cameron County and US 77 in Willacy County. We first established a baseline for mammal detections and road mortality before construction. Then, we will assess how the mammal community changes over time. Finally, we will incorporate important factors such as vehicle noise and traffic, climatic conditions, and road structural characteristics to determine which crossings work best.

We have documented many species at crossings including bobcat, coyote, raccoon, skunk, opossum, deer, nilgai, armadillo, and cottontail rabbit. On road mortality surveys, we have documented these species, as well as ocelot, badger, and long-tailed weasel. Wildlife crossing use is greater at more rural crossings and at night when there are less vehicles on the road.

This research will help the Texas Department of Transportation determine which crossing designs help the most mammal species. This will likely help ocelot survival as well, and support ocelot conservation.

USING LIDAR TO ASSESS HABITAT PARTITIONING

Maksim Sergeyev, Daniel A. Crawford, Joseph D. Holbrook, Jason V. Lombardi, Michael E. Tewes, and Tyler A. Campbell

Understanding the differences in habitat selection of ocelots, bobcats, and coyotes can provide insights into the coexistence between these 3 carnivores. Light detection and ranging (LiDAR) can be used for measuring the sub-canopy structure of vegetation. We used LiDAR data to assess habitat selection by ocelots, bobcats, and coyotes.

We captured and collared 8 ocelots, 13 bobcats, and 5 coyotes from 2017 to 2021 in the Ranch Population of ocelots in southern Texas. We determined selection of vegetation cover for individuals and the population for each species. Ocelots selected vertical canopy cover and dense vegetation of ≤2 yards in height. Bobcats had a broader selection, whereas coyotes selected areas with higher canopies. We observed a high degree of variation among individuals that may help these species coexist. Management for ocelots should focus on dense vegetation and vertical canopy cover.

It seems that habitat partitioning may aid coexistence between these carnivores. By combining accurate LiDAR data with GPS locations, we may provide a more thorough understanding of the habitat use of ocelots, bobcats, and coyotes.

A bobcat uses a newly-constructed wildlife crossing under a highway in southern Texas.

CARNIVORE DYNAMICS ON A MANAGED RANCH

Aidan B. Branney, Michael J. Cherry, Evan P. Tanner, Humberto L. Perotto-Baldivieso, and Michael E. Tewes
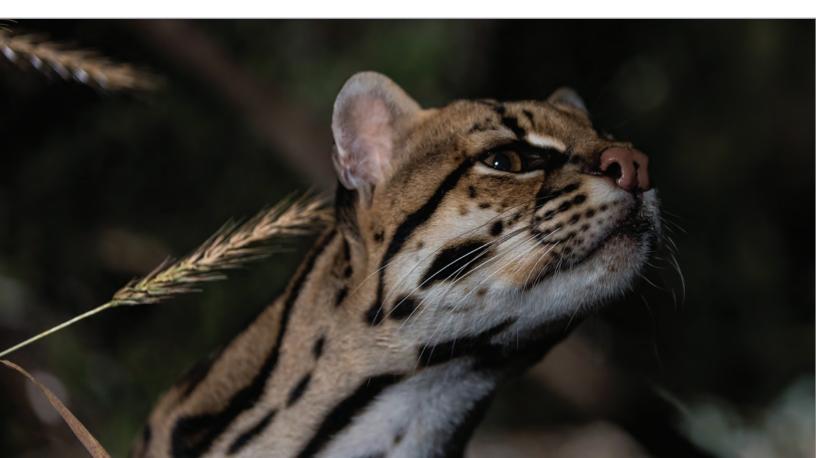
Wildlife communities are influenced by resource availability and potential competition. However, management activities on working lands can influence resource availability, temperatures, and animal interactions. Intensive brush management in South Texas can change the availability of shade, cover, and water. We are evaluating the influence of landscape features on the occurrence and activity patterns of the carnivore community on the Hixon Ranch in La Salle County, Texas.

The Hixon Ranch supports a rich community of carnivore species including bobcat, coyote, raccoon, grey fox, badger, and ringtail. We are using computer models to examine the habitat associations, activity, and carnivore interactions. From May 2021 through May 2022, we conducted a camera trap survey at 53 sites. We measured continuous temperatures at each site and used aerial imagery to form habitat maps.

To date, we have detected 7 species of carnivores, of which 5 species had sufficient data to analyze. The daily average number of coyote photographs is the best predictor for occupancy of bobcats. Bobcat occurrence increases as coyote detection rates increase. This is likely due to high quality habitat and prey abundance. Skunk occupancy was greatest when there was more variance in average temperatures. Thermal variability decreases with increased number of woody patches, so skunks likely prefer areas of more contiguous habitat. Although temperatures affect the detection of carnivores, it appears that landscape attributes also influence detection.

This unique research should help working land managers plan habitat clearing activities. This research also has the potential for use with other carnivores in a managed landscape.

LEOPARDS

POPULATION STUDY IN BOTSWANA

Daniel G. Scognamillo, Christopher E. Comer, and Michael E. Tewes

Leopard population densities are influenced by many variables. These include hunting pressure and the quality and amount of suitable habitat. Understanding leopard distribution and population size is important for the development of accurate hunting quotas.

We are implementing a nationwide leopard survey in Botswana to estimate leopard densities. In coordination with the Botswana Department of Wildlife and National Parks, we have identified 20 sampling sites in 4 different land use areas. These are communal areas, private game ranches, protected areas, and wildlife management areas. At each study site we have set up 104 trail cameras at 52 stations covering an area of about 320 square miles. Individual leopards are identified by their unique coat spotting patterns and their gender.

To date, leopards have been detected at 31 camera stations. From 60 photographs, we have identified 24 different leopards, 15 females (including 2 juveniles) and 9 males (including 1 juvenile). The estimated density of leopards for the study area is 1 leopard/26.1 square miles. This density translates into a population of 56 leopards in the study area.

Results from this research will assist the Botswana Ministry of Environment, Wildlife, and Tourism in the formation of science-based recommendations for leopard management. This study should also help in the development of international sustainable harvest quotas.

USING LIDAR TO DETECT HABITAT USE OF OCELOTS

Jason V. Lombardi, Maksim Sergeyev, Michael E. Tewes, Landon R. Schofield, and R. Neal Wilkins

Reliable estimates of population density and size are crucial to wildlife conservation, especially endangered species. In the United States, ocelots were listed as endangered in 1982. To date, only one population density estimate has been reported in Texas. In this study, we used LiDAR-derived vegetation information and spatial capture-recapture models to determine ocelot encounter rates. We estimated localized population estimates on a private ranch in South Texas.

• From September 2020 to May 2021, we conducted a camera trap study across 42 camera stations on the East Foundation's El Sauz Ranch. Cameras were positioned within a large region of highly suitable woody and herbaceous cover for ocelots.
• We observed a high density of ocelots. The estimated population size was 36 ocelots within the 60 mi^2 habitat area.
• The encounter rate of ocelots increased with greater canopy cover 1-2 yards above the ground and also increased closer to woody cover.
• The use of LiDAR-derived vegetation metrics allowed us to understand where ocelots are likely to be detected. This may aid in current and future population monitoring efforts.
• These population estimates reflect the most recent estimates of the northernmost populations of ocelots in Texas. This study further demonstrates the importance of private working lands for the recovery of ocelots in Texas.

HOW DO COMPETING CARNIVORES SELECT HABITAT?

Maksim Sergeyev, Michael J. Cherry, Evan P. Tanner, Jason V. Lombardi, Michael E. Tewes, and Tyler A. Campbell

Habitat selection by animals is complex and can vary across space and time. The endangered ocelot in Texas shares its range with bobcats and coyotes. We captured and radio collared 8 ocelots, 13 bobcats, and 5 coyotes on the East Foundation's El Sauz Ranch and the Yturria San Francisco Ranch. We compared the location and use of home ranges for these 3 carnivores.
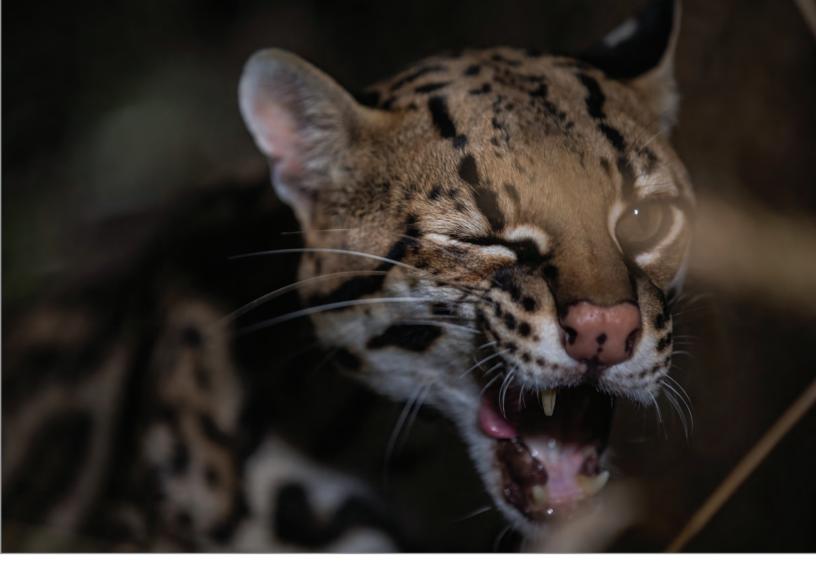
• Bobcats and coyotes preferred mixed landscapes, whereas ocelots were strongly tied to woody cover.
• Ocelots avoided areas used by coyotes and selected more for areas of use by bobcats.
• Results suggest that location of the home range is not affected by presence of competing carnivores; however, at a finer scale, ocelots avoided coyotes but not bobcats.
• Our study emphasizes the importance of woody and leafy cover at the broad scale, and dense vegetation at the finer scale to sustain ocelots.

COEXISTENCE OF OCELOTS, BOBCATS, AND COYOTES

Maksim Sergeyev, Joseph D. Holbrook, Jason V. Lombardi, Michael E. Tewes, and Tyler A. Campbell

It is important to understand competition between similar species for food and habitat in wildlife management. Different use of time and space may help explain how similar species can coexist. We explored the question: does resting, hunting, and exploring behavior permit coexistence of ocelots, bobcats, and coyotes? We monitored 8 ocelots, 13 bobcats, and 5 coyotes with GPS collars in the Ranch Population and modelled their behavior.

- Ocelots and bobcats remained closer to heavy cover when resting and foraging and used open areas more when patrolling territory.
- Coyotes rested in the open and selected for cover when hunting or patrolling.
- Ocelots showed strong nocturnal activity, whereas bobcats seemed to have a similar pattern but with more daytime activity. Coyotes were active during the day and rested at night.
- Differences in time and space between behaviors may help these species share their landscape.
- These methods may be applied to other similar species that overlap in an area.

The Patton Center for Deer Research

DIET SELECTION OF CAPTIVE DEER

Miranda L. Hopper, Breanna R. Green, Joseph A. Hediger, Clayton D. Hilton, David G. Hewitt, and Michael J. Cherry

We evaluated diet selection of captive white-tailed deer at the Alkek Captive Ungulate Facility. We determined preference for diets with varying levels of energy and protein and assessed the influence of preference on the total amount of food eaten by the deer.

From April to September 2022, we measured the amount of food eaten and diet preference of 38 deer who were offered two diet types and allowed to feed freely. The first option was the low energy, high protein diet. It contained 3 kilocalories per gram of digestible energy and 20% crude protein. The second diet was the high energy, low protein diet, which contained 4 kilocalories per gram of digestible energy and 10% crude protein. We found that deer preferred the high energy, low protein diet throughout the study, regardless of age, sex, or pregnancy status. Diet preference did not influence the total amount of food consumed.

Our results reveal the importance of energy in meeting nutritional requirements during pregnancy, antler growth, and juvenile body growth. Deer selection for the high energy, low protein diet demonstrates the importance of energy relative to protein during these periods and suggests energy may be limited in their natural environment.

THERMAL ECOLOGY IN SOUTH TEXAS

Breanna R. Green, Evan P. Tanner, Clayton D. Hilton, and Michael J. Cherry

An important aspect of wildlife ecology is how wildlife change their behavior to cope with periods of high heat while still meeting their daily needs. Equally important is how heat and life-history stages affect the internal temperature of wildlife. In South Texas, where heat stress is common, increases in temperatures due to climate change could reduce the ability of white-tailed deer to function on rangelands.

As deer are an important resource, understanding the extent of heat stress experienced by individuals and how they change their behavior to deal with it will highlight difficulties they may have adapting to changing conditions. With a captive deer herd at the Alkek Ungulate Research Facility, we are measuring the internal temperature of pregnant and non-pregnant deer throughout spring and summer in 2022 and 2023.

In addition, we are stimulating activity to determine how their temperature changes between rest and activity periods, and how that relates to weather, age, weight, and pregnancy status. We are also collecting trail camera data from cameras placed at feeders. These feeders are either under full shade or full sun. The purpose is to determine the temperature that does chose to forage under the shade rather than in full sun. Additionally, we will determine the temperature where deer alter the time of day they come to feed and how pregnancy affects that change.

PREDICTING ANTLER GROWTH DYNAMICS BY AGE

Joseph A. Hediger., Michael T. Moore, Lisanne S. Petracca, Cole C. Anderson, Charlie A. DeYoung, David G. Hewitt, Stuart W. Stedman, Randy W. DeYoung, and Michael J. Cherry

Antler size is a highly desirable trait for hunters and commonly guides harvest recommendations. Therefore, it is essential to understand the dynamics of antler growth and how they change with age. Managers often seek to maximize the availability of large-antlered males by maintaining high numbers of deer in older age classes. However, how antler sizes increase, peak, and decline with age is largely unknown.

To address the knowledge gap, we conducted a 15-year study on the Faith Ranch in South Texas. We captured and marked deer as fawns when age could be identified with certainty and recaptured deer annually using aerial net-gunning to obtain antler size. We measured antler size at capture using the Boone and Crockett Scoring system. We collected a dataset containing annual antler measurements for 471 known-age white-tailed deer. To reduce variation in antler size associated with annual variation in range conditions, we standardized nutrition by providing all deer with supplemental feed and water. We did not expose the population to harvest to avoid biases from hunter selection.

We found antler scores peaked at 7.5 years old, but antler size was not significantly different from adjacent age classes. We observed a substantial decline in older age classes such that 11.5-year-old deer had similar antler sizes as 4.5-year-old deer and were 88% of their peak antler size. Our results can help managers determine the appropriate age to harvest mature bucks given their objectives. We demonstrate maintaining bucks past 7.5 years old is unlikely to produce greater antler scores, and antler scores decline quickly after 9.5 years old.

ESTIMATING BREEDING VALUES FOR ANTLER SIZE

Cole C. Anderson, Randy W. DeYoung, Michael J. Cherry, David G. Hewitt, Charles A. DeYoung, Joseph A. Hediger, Stuart W. Stedman, and Matthew T. Moore

Antler size in white-tailed deer is influenced by age, nutrition, and genetics. Management strategies that focus on age and nutrition are well-established. Less is known about the effects of management on the genetic component of antler size. It is not clear if antler size is a reliable indicator of a male's genetic quality. For example, will a large-antlered male pass this trait along to his sons?

To better understand how genetic traits for antler size are passed to the next generation, we calculated breeding values for wild white-tailed deer, defined as the average antler size of their sons relative to the population average. We compiled antler size measurements of mature males produced in 2 deer management permit (DMP) enclosures on the Faith Ranch during 2007–2022. Each year, a large-antlered male was captured from a 1,100-acre game-fenced pasture and placed in each DMP enclosure with 12-15 wild-caught females. Fawns born in DMP enclosures were tagged during the summer and all deer released back into the game-fenced pasture each autumn. We captured males each winter to track age-specific antler size.

To date, 14 sires produced sons aged 5.5 years old. Although each sire was at least 30 Boone & Crockett inches larger than the population average, all sons produced by 4 of the 14 sires were below average. This suggests that some traits are not passed to offspring, perhaps due to complex gene interactions or environmental influences. Our results will help wildlife managers make informed harvest decisions and help guide regulations focused on antler traits.

USING DRONES TO GENERATE POPULATION ESTIMATES

Lori D. Massey, Jesse Exum, Zach J. Pearson, Jeremy A. Baumgardt, Randy W. DeYoung, Humberto L. Perotto-Baldivieso, and Aaron M. Foley

In South Texas, helicopters are often used to estimate population size of white-tailed deer. However, population estimates using helicopters are often variable and low-level helicopter flights are dangerous. We have been evaluating the use of drones as an alternative method.

Our initial research documented that drones equipped with thermal cameras flown during morning hours can generate consistent population estimates after correcting for visibility. Additionally, drone estimates were comparable with helicopter and trail camera surveys. However, thermal signatures of deer became too blurry when temperatures were over 80°, which often occur in South Texas. The next step was to evaluate nighttime surveys, when temperatures are cooler. Results indicated improved thermal contrast with consistent population estimates.

Drone-based thermal video footage can be used to generate reliable population estimates, however, reviewing footage is time-consuming. To determine whether time spent processing drone video can be reduced, we will evaluate whether population estimates can be generated from photographs instead of video. There are several advantages to using photographs. For instance, artificial intelligence programs can extract photographs that contain thermal images of deer. If successful, this approach can be used to shorten the turn-around time. Second, photographs can view a larger area which will potentially allow us to survey a larger area in a shorter period of time. Improvements in survey methods and processing will make wildlife surveys safer and more cost-effective.

FAWN SURVIVAL IN SOUTH TEXAS

Kevin T. Lovasik, Miranda L. Hopper, Bryan D. Spencer, Randy W. DeYoung, Aaron M. Foley, Alfonso Ortega-Santos, David G. Hewitt, Landon R. Schofield, Tyler A. Campbell, and Michael J. Cherry

The riskiest period of a white-tailed deer's life is the first year. This life stage is when fawns are most vulnerable to predators and experience high levels of mortality. In addition, environmental conditions can influence a young deer's chance at surviving to adulthood. Understanding the rate and reason fawns experience mortality is crucial to making management decisions. Therefore, this study aims to identify survival rates and causes of mortality in relation to environmental variation.

From 2020 to 2023, we captured 63 adult female white-tailed deer on East Foundation's San Antonio Viejo Ranch in South Texas. Pregnant deer were equipped with radio collars and vaginal implant transmitters (VITs). These VITs are expelled just before birth and allow researchers to determine when and where fawns are born. After birth, the fawns are located and equipped with an expandable radio collar designed to grow with the fawn until it falls off or the deer dies. We also captured fawns at approximately 4- and 8-months-old using helicopter net-gunning. We captured a total of 168 fawns. These captures allow us to maintain a larger sample size and monitor deer throughout the first full year of life. When mortalities were detected, the collars were located to determine cause of death using field and genetic evidence.

Currently, we are in the final year of data collection, but early results indicate low survival of white-tailed deer fawns on our study site and identify coyote predation as the greatest cause of mortality. Managers equipped with this knowledge can make better-informed decisions regarding deer populations.

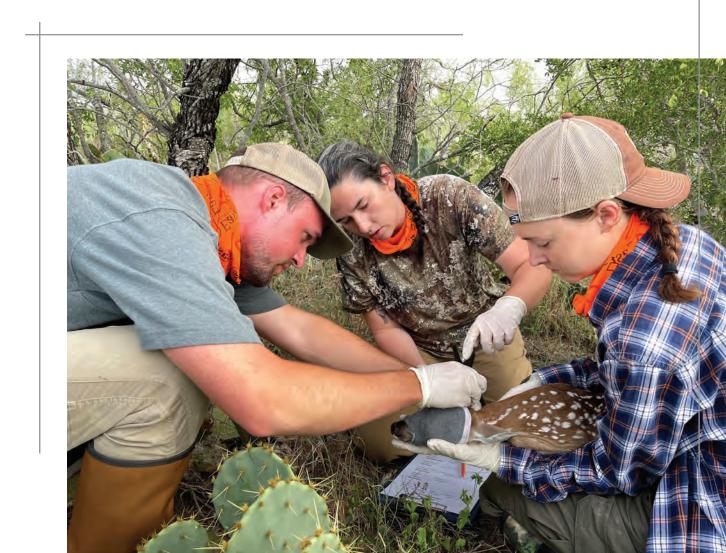# DOE BEHAVIOR IN FAWNING SEASON AFFECTS FAWN SURVIVAL

Miranda L. Hopper, Bryan D. Spencer, Kevin T. Lovasik, Randy W. DeYoung, Aaron M. Foley, J. Alfonso Ortega-Santos, Landon R. Schofield, Tyler A. Campbell, and Michael J. Cherry
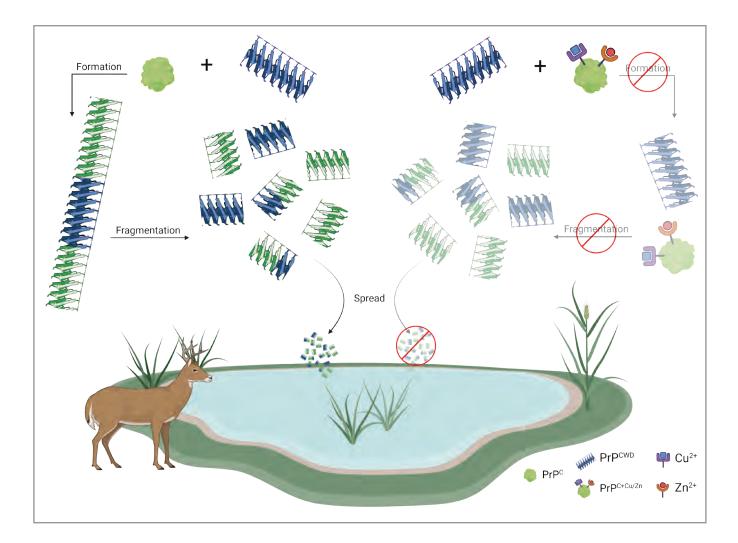
Female white-tailed deer are faced with having to keep their fawns alive while also giving themselves the chance to breed successfully in the future. Because pregnancy can reduce the nutritional condition of mothers, female deer must make decisions to meet their nutritional needs while still giving their fawns the best chance at survival. The decisions the mother makes in the early life of her fawns can potentially influence whether her fawns survive.

We wanted to determine how these decisions made by the mother influence fawn survival. From 2020 to 2023, we captured adult female deer and equipped them with radio collars and vaginal implant transmitters, which allowed us to track birth dates of fawns. In the fawning season, we captured fawns and gave them radio collars which will track survival.

We will use location data from mothers to compare the area where they chose to raise their fawn to other surrounding areas that were available to them. This will reveal what the mothers determine to be suitable for meeting their needs and raising their young. We will use the fawn collar data to determine how the decision made by the mother affected her fawn's survival. This research will help us to understand how the environment influences the mother's decisions and survival of her young.

COPPER AND ZINC: INVESTIGATING A NOVEL APPROACH TO CWD MANAGEMENT

Joseph A. Hediger, Peter A. Larsen, Jason C. Bartz, Randy W. DeYoung, David G. Hewitt, Mitch Lockwood, Alynn M. Martin, J. Hunter Reed, Marc D. Schwabenlander, Tiffany M. Wolf, and Michael J. Cherry

Positive cases of Chronic Wasting Disease (CWD) are spreading rapidly across the U.S., Canada, and Europe. Although a preventative treatment is currently unavailable, the minerals copper and zinc may be capable of binding to CWD molecules and slowing the spread of disease. In a mouse, dietary copper slowed the creation of infectious proteins like the prion that causes CWD. However, we do not know how mineral status influences disease progression in deer. We are working to determine if copper (Cu) and zinc (Zn) in target organs influence the spread of CWD. To do this we harvested 164 mature white-tailed deer spanning a gradient of Cu and Zn levels in Texas. Samples, including liver, brain, intestines, lymph nodes, and tongue, were collected from 1) un-supplemented deer in South Texas, 2) free-ranging deer with access to feed enhanced with Cu and Zn supplementation, and 3) captive deer fed exclusively feed with Cu and Zn supplementation. We will use a technique called prion misfolding cyclic amplification to evaluate the role of Cu and Zn concentrations in brain and lymphoid tissue in reducing CWD. This research has the potential to identify molecules capable of inhibiting the progression of CWD that may serve as a preventative measure to the spread of CWD.

MULE DEER HOME RANGE SHIFTS IN A FRAGMENTED LANDSCAPE

Calvin C. Ellis, Michael J. Cherry, David G. Hewitt, Randy W. DeYoung, Timothy E. Fulbright, Louis S. Harveson, Warren C. Conway, Shawn S. Gray, and Levi J. Heffelfinger

Site fidelity, the tendency of an individual to return to an area, is linked to familiarity of the landscape and increasing survival. In highly mobile animals, site fidelity is often high because familiarity with the landscape and resources is beneficial for survival. While often considered beneficial, recent studies suggest that high site fidelity can negatively impact species in a heavily human-influenced landscape.

In the Texas Panhandle region, mule deer are exposed to human-influence through energy development and row-crop farming. To examine site fidelity in response to human-influence, we are using a 5-year GPS dataset of adult mule deer in the Texas Panhandle. We collected these data across 4 sites with varying amounts of agriculture and energy development. Specifically, we are comparing individual home range overlap between years and seasons. Preliminary results show low site fidelity in Texas mule deer. Overall, females had greater site fidelity than males. Also, site fidelity increased with oil well density and decreased with greater road density. These results will inform us about mule deer site fidelity and their responses to fragmentation, which could aid in population monitoring and management plans. To further understand mule deer in this system, we are investigating attributes of crop fields that influence their use by mule deer. How animals use the landscape and their ability to return to an area is crucial to many species' fitness, and is at risk of being impacted by expanding landscape fragmentation and human influence.

PRONGHORN MOVEMENT AND POPULATION DYNAMICS IN OKLAHOMA

Marlin M. Dart, Evan P. Tanner, Levi J. Heffelfinger, M. Colter Chitwood, Randy W. DeYoung, Derek P. Hahn, Matthew T. Turnley, W. Sue Fairbanks, Robert C. Lonsinger, H. George Wang, and Michael J. Cherry

Pronghorn are an ecologically and culturally important big games species. In Oklahoma they are restricted to the panhandle region, which is characterized by highly variable weather and resource availability and increasing agriculture and energy development. Oklahoma Department of Wildlife Conservation population surveys indicate that pronghorn populations have been in decline across the region. We are collaborating with Oklahoma State University and East Central University to determine the causes of decline. We will estimate and evaluate factors influencing adult and fawn survival and space use of pronghorn across the region.

We captured and collared adult pronghorn during winter and fawns during summer in 2022 and 2023. We monitored fawn survival and determined causes of death when deaths occurred. We also located pronghorn and collected fecal samples to evaluate their diet. Lastly, we conducted predator surveys to evaluate predator density and diet composition. These data will be used to inform pronghorn space use and survival research.

These methods will be repeated for the next three years, but we have already learned that fawn survival for 2022 was 11% with coyote predation being the leading cause of death. Adult survival for 2022 was 67% with hunter harvest and vehicle collisions being the leading causes of death. This research will inform pronghorn management and will allow us to evaluate the causes of the pronghorn population decline in Oklahoma.

ELK

MOVEMENT OF A REINTRODUCED EASTERN ELK HERD

Jamie S. Benn, Braiden A. Quinlan, Jacalyn P. Rosenberger, W. Mark Ford, and Michael J. Cherry

Reintroduction of a wildlife species is a common tool for wildlife management. The effectiveness of these programs requires an understanding of how reintroduced animals sample their surroundings. Movements beyond an animal's home range can be categorized into exploratory movements or dispersals. The frequency and distance of these excursions and habitat use of an animal during excursions are poorly understood for many reintroduced populations. A better understanding of these movements can lead to improved wildlife management, reintroduction programs and disease management efforts.

We evaluated the movements of a reintroduced elk population in the Virginia Elk Management Zone from the first reintroduction in June 2012 through November 2022. We identified home ranges, then categorized excursive movements outside of the home range as exploratory if the elk returned to its home range, or dispersals if they never returned. From a total of 91 elk collared over the 10-year period, we observed 333 excursive movements (327 exploratory, 6 dispersive). Most excursions occurred in May and June and were not influenced by the age or sex of the elk. While on excursions, elk selected to be closer to oak and hardwood habitats and farther from active mines.

These findings can inform management decisions for elk in Virginia as well as for agencies and wildlife managers elsewhere looking to manage and reintroduce a charismatic, large mammal. Continued observation of this population may reveal changes in excursive movements as elk adjust to the recently-instituted yearly hunting season.

WHITE-TAILED DEER

CATTLE GRAZING EFFECTS ON PRODUCTIVITY

Bryan D. Spencer, Miranda L. Hopper, Randy W. DeYoung, Aaron M. Foley, David G. Hewitt, J. Alfonso Ortega-S., Ryan A. Long, Landon Schofield, Tyler A. Campbell, and Michael J. Cherry

In the last 25 years, Texas land use practices have become more multi-purpose oriented, incorporating wildlife management and recreational activities with agricultural practices. The shift to multi-use practices requires an understanding of the relationship between agricultural production and wildlife management to optimize landscape production. We determined the effects of cattle grazing on white-tailed deer traits and what landscape and climatic factors might impact these effects.

• We collected 916 male and 782 female records of white-tailed deer weights, antler measurements, body fat and lactation status. Deer were captured from 4 ranches in South Texas beginning in 2017.
• We linked these data to the stocking practices of these ranches as well as rainfall and sand content of the soil.
• We found that greater stocking rates reduced buck antler size and body mass, and that doe body fat was reduced by greater stocking rates in wetter years and tighter, more productive soils. When conditions were dry or soils were sandy, does had no body fat for cattle to impact.
• Managers should be aware that stocking practices can impact deer population performance, in addition to fawn recruitment and adult survival.

VARIATION IN BODY AND ANTLER SIZE IN SOUTH TEXAS

Aaron M. Foley, Kory Gann, David G. Hewitt, Randy W. DeYoung, Timothy E. Fulbright, J. Alfonso Ortega-S., and Tyler A. Campbell

Body and antler size of white-tailed deer are influenced by the environment. Better environmental conditions lead to increased body and antler size because more resources are available for the animal to invest towards growth. However, environmental conditions and resource availability are variable in semi-arid regions. To get a better understanding of what factors influence body and antler size of white-tailed deer, we captured 4,554 deer between 2011 and 2018 from 7 sites in South Texas.

• Body and antler size declined with increasing percent sand in the soil. For every 7.7% increase in sand, male body length declined by 0.9" and female body length declined by 0.6".
• Rainfall reduced the negative effect of sand but only for measures sensitive to current-year conditions. Antler size declined by 3.9" for every 7.7% increase in sand but increased by 3.1" for every 4.3" of summer rainfall.
• Soil composition and rainfall were the dominant factors influencing body and antler size. Forb biomass, while beneficial for current-year growth and productivity, was too variable to have an effect on skeletal size.
• Deer body and antler size increased as shrub cover increased. Shrubs offer a consistent, year-round source of forage for deer, which allows for extended investment towards growth. Forbs are highly nutritious, but are only available during part of the year.
• Managers interested in increasing size in deer should focus on maintaining or enhancing vegetation diversity to allow for resource availability during both dry and wet years.

MULE DEER

MOVEMENTS OF JUVENILES: IMPLICATIONS FOR CHRONIC WASTING DISEASE

Calvin C. Ellis, Michael J. Cherry, Shawn S. Gray, Randy W. DeYoung, David G. Hewitt, and Levi J. Heffelfinger

Chronic wasting disease (CWD) is a concern for deer management. In Texas, CWD has been detected in over 400 deer statewide. The Panhandle CWD Zone is in the northwest corner of Texas where the Canadian River passes through from New Mexico, an area with limited information on CWD. This river could be a movement corridor for wildlife, connecting regions of known and unknown CWD status. Juvenile deer movement and how individuals use the landscape in unfamiliar areas are both poorly understood. We GPS-collared 30 ≤1.5-year-old mule deer along the Canadian River to study their excursions and compare habitat selection within and outside of their home ranges.
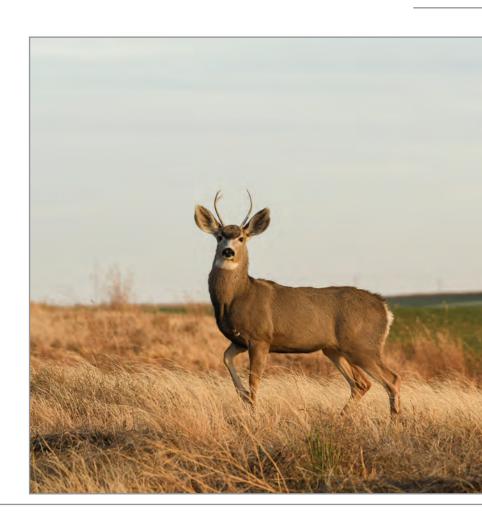
- 20 deer made excursions away from their home range. These 20 individuals made 121 excursions, 115 of which were exploratory (returned to home range) and 6 dispersals (did not return).
- Males accounted for all 6 dispersals, supporting the common belief that young males are most likely to disperse. Females, however, accounted for most of the explorations (60%) and made the longest movements (~82 miles round trip).
- Habitat selection differed between sexes within and outside of home ranges. Particularly, outside of home ranges, females selected for areas farther from water than in the home range.
- Our results indicate that young mule deer are prone to excursions and select different habitat when outside of their early-life home range. These results provide insight into early-life movement of CWD-susceptible species and can aid in CWD management actions.

RESOURCE SELECTION OF ELK IN VIRGINIA DURING CALF REARING

Braiden A. Quinlan, Brett R. Jesmer, Jacalyn P. Rosenberger, W. Mark Ford, and Michael J. Cherry

Calf-rearing is a pivotal time of year for female elk due to the elevated energetic demands of lactation and calf protection. Understanding habitat requirements during this season is important for guiding management actions aimed to support restoration and management of elk populations. Using global positioning system (GPS) location data and habitat types, we quantified habitat selection for 31 adult female elk (cows) during the calf-rearing season (June – August) in southwestern Virginia. We estimated calf-rearing ranges and annual ranges for each elk and compared the selection of habitats therein.

• Compared to the availability of habitat types within the annual range, cows selected lower terrain roughness, developed areas (i.e., infrastructure), and surface coal mines, but avoided pasture and croplands, oak forests, and conifer forests.

• Within calf-rearing ranges, cows selected ridgetops, lower terrain roughness, conifer forests, and surface coal mines while avoiding developed areas, pasture and croplands, oak forests, and mixed hardwood forests.

• Cows consistently did not select for deciduous forests or pasture and croplands, suggesting they are of lower value than other habitat types during the calf-rearing season.

• Additionally, we found that reclaimed surface coal mines provide quality habitat for female elk during the calf-rearing season and continued management of reclaimed mines for reintroduced elk populations is of critical importance.

ELK

Shorebirds & Waterfowl

USE OF COASTAL REFUGES BY OVERWINTERING WATERFOWL

Jordan C. Giese, Rachel R. Fern, Kevin J. Kraai, and Bart M. Ballard

Along the Texas coast, declines in winter waterfowl populations and increases in hunting pressure led to the creation of the coastal refugia program by Texas Parks and Wildlife Department. On properties enrolled in the program, surface water is maintained and hunting is restricted throughout fall and winter. In order to properly assess the program's effectiveness, we are designing a long-term study to estimate how many waterfowl and which species use these areas compared to similar hunted areas.

Audio recording units (ARUs) offer a practical solution for researchers seeking to reduce disturbance of wild birds. During winter and spring 2023, we conducted a pilot study to test the ability of ARUs to detect waterfowl species across different habitats and weather conditions. At 82 unique wetlands, we broadcasted a series of sounds and waterfowl calls at various distances from an ARU while a nearby researcher noted their own ability to detect them. The results from these trials will inform how we distribute ARUs during the next two years of the study. During winters of 2024 and 2025, we will deploy ARUs at several refuge sites and nearby control sites (i.e., hunted wetlands of similar size).

Results of our study will provide information on the effectiveness of the coastal refugia program and guide future placement of refuges along the Texas coast.

HABITAT MANAGEMENT IN THE WESTERN GULF COAST

Georgina R. Eccles, Kevin J. Kraai, Daniel P. Collins, J. Dale James, Jay A. VonBank, Jordan C. Giese, Barry C. Wilson, Clayton D. Hilton, and Bart M. Ballard

Since the 1990's the Gulf Coast Joint Venture has worked to provide foraging habitat for waterfowl species under the Texas Prairie Wetlands Project (TPWP). To date, there is no evidence to show TPWP management is meeting waterfowl's foraging habitat needs. The aim of this research is to investigate the influence of late winter habitat management on female northern pintail spring migration.

Female pintails were captured in late winter along the Texas Coast and fitted with tracking devices. We calculated the proportion of use of the TPWP sites using hourly location data. We also recorded (1) spring migration departure, (2) number of spring migration stopovers, (3) date of arrival on breeding areas, and (4) number of days in migration. Preliminary results show the more time females spent on TPWP sites, the later they left for spring migration; however, they migrated at a faster rate. This shows that TPWP management may positively influence waterfowl by allowing birds to depart wintering areas later and still arrive to breeding areas at the same time as birds that do not use TPWP sites. We plan to calculate the proportion of time feeding for each female to investigate how late winter wetland management influences spring migration performance.

NESTING CONSERVATION ALONG THE TEXAS COAST

Jordan C. Giese, David J. Newstead, David A. Essian, Dale E. Gawlik, and Bart M. Ballard

The coastal bays of Texas provide nesting islands for large gatherings of waterbirds, a group that has declined by 22% since 1970. These islands also provide isolation and protection from potential nest predators. Some species, such as the great egret and tricolored heron, are high priorities for conservation due to recent population decreases and their value as indicators of ecosystem health. There is also a growing concern among resource managers regarding the degradation of coastal islands due to erosion from sea-level rise, storm surges, and wakes from ship traffic. With more than 200 colonial islands along the Texas coast, designation of high-priority areas is necessary for efficient rehabilitation and management of islands.

In partnership with Coastal Bend Bays and Estuaries Program and the Harte Institute for Gulf of Mexico Studies, we completed the first of a five-year study prioritizing colony islands for rehabilitation and management. We captured and fitted great egrets and tricolored herons with tracking devices that will record the bird's location every 15 minutes and show the distance that birds forage from colonies and move among them.

The results of our study will identify priority islands to rehabilitate and will help resource managers sustain breeding populations of waterbirds along the Texas coast.

BREEDING EFFORT AND AUTUMN MIGRATION

Joseph McGovern, Evan P. Tanner, Clayton D. Hilton, and Bart M. Ballard

How well an animal performs during one part of the year can impact their success in other parts of the year. As a result, individuals in a population gain different fitness outcomes based on their previous performance. This is a relatively new concept in wildlife ecology, and there is little information that exists on the impact that breeding effort has on fall migration. For example, one might expect that a migrating bird that spends more time in breeding duties has less time to prepare for fall migration and its survival will be lower.

We placed GPS tracking devices on female northern pintails during the winters of 2020-2023 throughout the southwestern region of the U.S. The tracking devices provide information on the location and behavior of the bird every hour.

Our goal is to study how breeding effort affects a bird's performance during fall migration. We plan to see if there is a relationship between how long a female invests in reproduction with her rate of movement and survival during migration. This research will help us understand the timing of migration and resource needs for successfully breeding female northern pintails. This will allow more focused management towards those birds that produce offspring.

NORTHERN PINTAILS

WINTER LANDSCAPE EFFECTS ON ENERGETICS

Georgina R. Eccles, Kevin J. Kraai, Daniel P. Collins, J. Dale James, Mitch D. Weegman, Clayton D. Hilton, and Bart M. Ballard

Animals spend time and energy looking for food. The habitat animals live in affects where they move to and how long they search for food. Late winter is an important time for waterfowl that migrate because birds that migrate spend the winter preparing for migration. Understanding how the landscape influences energy can help habitat managers plan future projects for their target species. Our goal is to identify how the landscape arrangement affects female northern pintail energy expenditure in late winter.

Northern pintails were captured throughout southwestern and central portions of the United States and fitted with tracking devices. We have complete winter data from 298 females comprising over 160,000 locations. We will use satellite imagery to measure the arrangement of habitat types in the landscape around each location. Our study will help us understand how landscape arrangement affects movements, behavior, and energy expenditure. Results will assist resource managers in the placement of habitat projects to benefit wintering waterfowl.

Female northern pintail spring migration stopovers. Females originated from six different wintering regions: California (purple points), Arizona (yellow), New Mexico (gray), Texas Panhandle (blue), Texas Coast (red), and Louisiana (green). Once females enter the Prairie Pothole Region (pink area), we consider this threshold the end of spring migration and the beginning of the breeding period.

IDENTIFYING IMPORTANT SPRING MIGRATORY STOPOVER SITES

Georgina R. Eccles, Kevin J. Kraai, Daniel P. Collins, J. Dale James, Mitch D. Weegman, Jay A. VonBank, Clayton D. Hilton, and Bart M. Ballard

Migration stopover ecology is the least studied area in bird migration research. Most migratory birds cannot travel between wintering and breeding areas in one non-stop flight. Instead, they need to make stops along the way to rest and refuel. These stopover sites are particularly important because their quality influences whether a bird is able to complete their migratory journey. Our goal for this research is to identify important stopover sites used by female northern pintails along their migratory routes from wintering areas throughout the southern U.S. to breeding areas in the U.S. and Canadian prairies. We attached tracking devices to ~600 female northern pintails captured on wintering areas and obtained locations every hour throughout their spring migration. Tracking devices also have special sensors that allow us to estimate amount of time spent feeding. We plan to calculate amount of time at a stopover site and proportion of time spent feeding to help quantify quality of a site. These findings will help identify important areas for northern pintails during spring migration.

MIGRATION STRATEGIES DURING SPRING

Georgina R. Eccles, Kevin J. Kraai, Daniel P. Collins, Mitch D. Weegman, J. Dale James, Jay A. VonBank, Clayton D. Hilton, and Bart M. Ballard

Tracking available resources, such as food, is thought to be the main driving force in the evolution of migration. Migration strategies broadly fall into energy-saving or time-saving, and not all animals make the same choices when migrating. These differences in animal decisions about migration can affect reproductive success and survival.

Our goal is to investigate the influence of spring migration metrics on breeding effort in female northern pintails. We captured northern pintails during winter across the southern U.S., and we fitted females with tracking devices. We will use several bird-based metrics, such as numbers of stopovers, length of time spent at stopovers, amount of time spent feeding, and date of arrival on breeding areas, etc., to understand their spring migration strategies and relate these metrics to estimates of reproductive success. Results will help us understand when and where habitat management will have the largest impact on pintail populations.

NORTHERN PINTAILS

THERMAL CONSTRAINTS ON MIGRATION

Joseph McGovern, Evan P. Tanner, Clayton D. Hilton, and Bart M. Ballard

As climate patterns shift, warmer temperatures and increased extreme weather events will become more common. Changing climates may cause migratory birds to experience increased stress from novel weather events. Northern pintails arrive very early to breeding grounds and are likely already experiencing temperature limits as they migrate. More thermal stress during migration may negatively impact their ability to reproduce.

We GPS-collared female pintails during the winters of 2020-2023 in Texas, Louisiana, New Mexico, Arizona, and California. These transmitters tell us both where the birds are and what they are doing at an hourly rate.

Our research will first estimate the temperatures that put stress on pintails. We will match this with location and weather data to map the amount of temperature stress on each bird as they migrate to the breeding grounds. We will then measure what effect this stress has on determining when birds arrive to the breeding grounds and the number of eggs they lay. Our research will help manage pintail populations across broad scales with climate change in mind.

DISTRIBUTION IN THREE CRITICAL STOPOVER REGIONS

Tara L. Rodkey, Richard B. Lanctot, and Bart M. Ballard

Grassland birds are increasingly under threat worldwide. Their population declines are driven by habitat loss from development, ecosystem degradation, and climate change. Grassland habitats have experienced much loss compared to other habitats worldwide. The buff-breasted sandpiper is a long-distance migrant who travels from the high Arctic to South America each year and depends on grasslands along the way. It is a species of global conservation concern due to these persistent threats of habitat loss along its migratory pathway.

Three grasslands have been identified as critical stopover regions for this species. These include the Western Gulf Coastal Plain of Texas, Louisiana and Mexico; the Llanos del Orinoco of Colombia and Venezuela; and the Llanos de Moxos of Bolivia. Conservation measures targeted at protecting habitat for this species are expected to also benefit many other grassland birds. Thus, an understanding of which environmental characteristics may be driving habitat suitability in these three migratory stopovers is important to design and implement effective management.

We are using tracking data and observer-based surveys to model buff-breasted sandpiper distribution. This will allow us to estimate the amount of different habitats in each of these three ecoregions. The resulting models can then serve as the first step towards more targeted monitoring efforts or conservation actions by local agencies and organizations.

STOPOVER HABITAT SELECTION ON THE TEXAS GULF COAST

Tara L. Rodkey, Richard B. Lanctot, and Bart M. Ballard

The buff-breasted sandpiper is a migratory grassland-obligate Arctic-breeding shorebird. It stops in the Texas Coastal Plain as it migrates between its wintering areas in the Southern Cone of South America to its breeding areas in the Arctic coastal plains of North America.

• The Texas Gulf Coastal Plain is a critically important stop for this species along its migratory journey, as these sandpipers rest and replenish their fat stores in this region during both their spring and fall migrations.

• Contrary to what we would expect of a grassland species that elsewhere in its range associates with pastureland, in Texas the buff-breasted sandpiper uses mostly sod and cotton fields.

• Its selection for sod and cotton fields is likely because the vegetation on these land-cover types is relatively short at the time this species migrates through the Texas Coastal Plain. Its strong preference for very short vegetation excludes them from most other landcover types.

• Buff-breasted sandpipers avoided woody cover, which likely represents a characteristic of habitats where predators are more common.

• We hope the results of this study bring attention to the threats facing this species, and inform future research and management efforts in the region.

Texas Native Seeds (TNS)

TNS PROGRAM UPDATE

Anthony D. Falk, Colin S. Shackelford, Rider C. Combs, Joshua D. Breeden, John Boone, Nelson O. Avila, Hagen D. Meyer, Jameson S. Crumpler, Tyler C. Wayland, Douglas L. Jobes, and R. John Bow

Texas Native Seeds (TNS) continues to grow and build momentum. This year, we added new evaluation sites and new research projects, increased funding, engaged new seed producers, and re-engaged our advisory board. We continue to build upon our 22 years of developing and promoting locally-adapted native seed.

To better understand how well different plants perform throughout the state, we have drafted agreements, started preparing ground, and building infrastructure at 4 new evaluation sites in environments not previously represented. New locations will include the High Plains of the Panhandle region, southern Blackland Prairie, Gulf Coasts and Prairies, and Pineywoods. Each new location has specific soils and weather that will help give us a better idea which plants perform best throughout the state.

Along with these new evaluation sites, TNS has increased our funding and started new research projects. Through dedicated work, we have identified multiple new funding sources and grown the funding received from many of our long-term supporters. Additionally, we have started 5 new research projects investigating grassland restoration in the Permian Basin, carbon sequestration, and pollinator use of native grasses.

Finally, we have re-engaged our advisory board. The board is currently made up of 9 influential people who are passionate about native grassland restoration throughout the state. We held our first board meeting in fall 2023, and with our board's guidance, we expect great things for our future.

PLANT MATERIALS CENTER COLLABORATIONS

Anthony D. Falk, Shelly D. Chambers, R. Alan Shadow, Brandon Carr, Colin S. Shackelford, Joel L. Douglas, and Charles Kneuper

TNS and the USDA NRCS Plant Materials Centers (PMC) in Knox City, Nacogdoches, and Kingsville are continuing to build upon their 20-year partnership. Current work is focused on developing locally-adapted native plant species through a series of Cooperative Ecosystem Studies Unit projects supported by Texas NRCS. Through these agreements, we are working toward building the supply of native seed to meet potential demand. This involves working hand in hand with seed dealers to ensure commercial availability. Additionally, we will conduct onsite trainings for NRCS field staff to help increase awareness of native plants and their uses.

During the past year, TNS and PMC staff held multiple field days with seed producers to discuss the need for a ready supply of native seed throughout Texas. As a result, there has been a significant increase in the number of requests from commercial seed producers to the PMC and TNS for seed sources developed by both programs. Additionally, all three PMCs have attained grower agreements with new producers. This is expected to increase native seed availability.

To meet increased demand for native seed by commercial growers, both TNS and the PMCs have greatly increased seed production, including an additional 100,000 transplants of various releases throughout the state. These transplants will increase our ability to meet the need of commercial growers for spring 2024.

TXDOT PARTNERSHIP

Anthony D. Falk, Shyla E. Rabe, Colin S. Shackelford, Jameson S. Crumpler, R. John Bow, Douglas L. Jobes, Tyler C. Wayland, and Travis J. Jez

Over the last 22 years, TNS and the Texas Department of Transportation (TxDOT) have enjoyed a very productive partnership that has resulted in the development of 30 native seed varieties. Through this partnership and the tireless effort from commercial seed producers, over 75 native species adapted for Texas are commercially available today.

Both TNS and TxDOT benefit from this partnership. TNS receives funding to collect, research, and select the best native seed populations. TxDOT, in turn, gets a product that it can confidently use to restore native grassland habitat on roadsides throughout the entire state. This also means TxDOT can avoid using non-native species that may spread onto neighboring properties. Both partners also benefit from their relationships with commercial seed producers. By specifying native species, TxDOT creates a demand for the selections made by TNS. This not only helps TNS and TxDOT, but anyone interested in seeding native species.

Through our partnership, we have also researched planting methods to increase pollinator habitat and to establish native roadside vegetation. In the end, what has resulted is a robust native seed market that can provide a large number of native grassland species to consumers throughout the state for use by TxDOT and other right-of-way companies, as well as private and public landowners and managers.

SOUTH TEXAS NATIVES (STN)

STN PROGRAM UPDATE

Joshua D. Breeden, Rider C. Combs, and Anthony D. Falk

STN has placed significant effort into expanding our seed production. The expansion is in response to a growing demand from commercial seed producers for TNS native seed releases. Additionally, we have identified several new species that would make good candidates for future releases which are now being evaluated. Finally, a number of new research seedings are scheduled to be planted this fall to test other upcoming commercial seed varieties.

This year we grew over 8,000 individual plants in our greenhouse which were used to increase our seed production potential by planting 5 new species and expanding 3 others. Along with the new seed production fields, we installed 3 new evaluations. Specific to South Texas is a new evaluation of chili pequin. Collaborating with our Coastal Prairies and Central Texas regions are evalutions of bushy bluestem and brownseed paspalum.

We are also planning on installing a number of new research plantings throughout South Texas. All of these new research plantings are small acreage parcels of large plantings being conducted by landowners. Our goal is to test native seed varieties that will soon be available on new soils and in different climates. These research plantings help demonstrate the ability of these new varieties and help us to provide better seed mix recommendations in the future.

SOLAR DEVELOPMENTS AND GRASSLAND RESTORATION

Micayla E. Pearson, Anthony D. Falk, Eric Heim, and Daniel Willard

Utility-scale solar energy developments are increasing across the United States. These types of projects can create challenges for maintaining native grasslands, which have been steadily decreasing across the U.S. The decrease in native grasslands is affecting countless wildlife and pollinator species.

We began a study evaluating commercially-available native seed mixes, planting techniques, and the timing of planting to identify appropriate methods for restoring native grasslands within utility-scale solar developments. This study is taking place on a 20-acre experimental area within an 1,800-acre mix solar-wind development in Bee County, Texas.

To date we have found that the species in our different seed mixes are performing differently. The low and mid diversity seed mixes which had 4 and 8 species, respectively, ranged between 15-25% cover. This was significantly higher than the high diversity which has 21 species, and non-seeded treatments averaged 5-15% cover in spring 2023. We also found that how each mix was planted and when it was planted had no effect on the seeded species.

It is possible that by adding additional species, the percentage of best-adapted species to the site was reduced, resulting in greater cover in the lower diversity mixes. We are planning to continue to collect data on this site for the next two years to track how the vegetation changes over time.

GRASSLAND RESTORATION FOR TEXAS HORNED LIZARD

Rider C. Combs, Anthony D. Falk, Paul O. Chroniak, Jo Ann Ortiz, and Nikki M. Tanzer

Texas horned lizard is a native species that can be found in desert and semi-desert environments. Currently it is listed as a threatened species in Texas. During spring 2020, Toyota Motor Manufacturing in San Antonio, approached the San Antonio Zoo and TNS about converting a non-native Bermudagrass area to a native grassland. The goal of this project is to establish a native grassland that is suitable habitat for Texas horned lizards. We began with 4 applications of herbicide to the 20-acre area of Bermudagrass. Total cover of Bermudagrass decreased from 90% in spring 2020 to less than 5% that fall. At that time a diverse mix of locally-adapted native grasses and forbs was planted. During spring 2021, Toyota Motor Manufacturing transplanted several native brush species to the grassland restoration area.

We are very pleased with the progress of this conversion. It has created suitable habitat for the Texas Horned Lizard within 75% of the treated area. Currently 90% of the brush species survived transplanting. Bermudagrass cover is maintained at less than 5%, and native plant species make up 60% of the total area, leaving 35% bare ground for feeding. These are ideal conditions for Texas horned lizards to travel throughout the area, hide from predators and feed on insects. Preparations are underway on another 25-acre conversion next to the current grassland restoration.

Drill-seeded research plots under solar -wind development in Bee County, Texas, 4 weeks post planting, September 2022.

COASTAL PRAIRIES NATIVE SEED PROJECT (CPNSP)

CPNSP PROJECT UPDATE

John Boone, Anthony D. Falk, Douglas L. Jobes, and Aaron D. Tjelmeland

Urban growth is an increasing threat in the Coastal Prairies and Marshes ecoregion of Texas, and restoration of degraded or marginal grasslands is crucial. However, many of the seed varieties being used today come from distant plant populations. CPNSP is working to change that by developing new regionally-adapted native seeds.

We are collecting native seeds within an 18-county area in the Coastal Prairies and Marshes ecoregion. Seed from these collections is used to evaluate and select high performing populations. To date we have 8 grass species and 3 flowering species, and the top performing populations of knot-root bristle grass and little bluestem are currently in seed production. Our goal is to develop a diverse mix of native plant seed sources adapted for local use and commercially available. We also provide technical guidance on grassland restoration to landowners and managers, and staff gives educational presentations to the public.

HARRIS COUNTY FLOOD CONTROL DISTRICT

John Boone, Tyler C. Wayland, Anthony D. Falk, Douglas L. Jobes, Kory J. Nickell, and Jeff Jowell

Harris County Flood Control District (HCFD) manages flood risk across 1,777 square miles, including over 2,500 miles of water channels and numerous ponds. Managing these waterways while supporting local ecology is a priority for HCFD. An important part of that includes establishing vegetation to control erosion after construction or maintenance activities. HCFD prioritizes native vegetation in their reclamation practices. However, this is limited by the lack of commercially-available seed sources adapted to the Coastal Prairies region.

CPNSP has completed a three-year evaluation of existing native seed sources at two locations in Harris County. These data will be used to develop seed mixes of high-performing seed sources already commercially available for use by HCFD. Results from this evaluation will also be used to identify priority species for new seed source development. Seed collections of these priority species are already underway with multiple new plant evaluations planned for upcoming growing seasons.

Results from this study will play an important role in providing reliable seed sources for use within the drainages and waterways of HCFCD. This will also help encourage the use of native seeds for restoration and reclamation with other groups, agencies, and landowners of the region.

EAST TEXAS NATIVE SEED PROJECT (ETNSP)

UPDATE ON ETNSP

Nelson O. Avila, Tyler C. Wayland, Keith P. Pawelek, and Anthony D. Falk

The emphasis for ETNSP lies in the quality and quantity of native seed source accessibility for re-establishment of native plants on private and public lands in East Texas. Making seeds available for regionally-adapted native plants for large restoration projects within the region is the main objective.

We have currently made 675 native seed collections representing 71 different species from 59 counties in East Texas. We have three evaluation sites, each representative of 1 of the 3 ecoregions within the project's focal area. There are currently six species under evaluation with more additions this year. Evaluations of silver bluestem and purpletop tridens have been completed and are now in seed production. We are hopeful to make commercial releases of these two species in 2024. This year we have increased seed production of the selected populations of native plants that are suitable for an agronomic production setting. The regionally-adapted seed sources developed by ETNS and project partners will help to increase the number of acres restored to quality habitat throughout East Texas.

ETNSP has also been very active with public outreach in the region. We work with landowners and managers in the region to provide seed mix recommendations, and we have given numerous talks to local organizations and at state and federal meetings. Staff also serves on the longleaf pine re-vegetation project team.

RIVERBY RANCH PROJECT

Nelson O. Avila, Tyler C. Wayland, Jacob S. Sparger, Keith P. Pawelek, Forrest S. Smith, David B. Wester, and Anthony D. Falk

Because of a lack of commercially-available locally-adapted seeds in Northeast Texas, many landowners are forced to use seeds from distant regions that are untested in East Texas. ETNSP partnered with RES, LLC to conduct a multi-year native seed variety adaptation trial on the Riverby Ranch in Fannin County, Texas.

Thirty different commercially-available native seed varieties were tested in both combinations and single species stands. The first planting was installed in October 2019 with a second planting in June 2020. In June 2023, additional forb species were introduced as part of the variety adaptation trial. We have been collecting data on vegetation establishment and performance over three growing seasons. Additional long-term monitoring will take place to document establishment dynamics and evaluate future success.

Studies of this scale, duration, and vigor are an important part of developing seed mixes from existing seed releases. Landowners can move forward on grassland restoration projects with confidence knowing that the seed they are using has proven regional performance. Studies of this nature also show where sources of locally-adapted seed for important plant species are lacking. These data help ETNSP prioritize seed collection efforts and plant evaluation projects for future seed releases specific to East Texas.

EXPANSION OF GRASSLAND UNDERSTORY SPECIES

Nelson O. Avila, Thomas C. Philipps, Robert A. Shadow, Tyler C. Wayland, and Anthony D. Falk

ETNSP is excited to expand our partnership with the US Forest Service and the NRCS East Texas Plant Materials Center. This partnership is focused on developing quality seed sources to support successful grassland understory communities in shortleaf and longleaf pine forests of Texas and Louisiana. Pine forests throughout these regions are adapted to regular low-intensity fires in a grassland understory. This historic understory has largely been lost because of a lack of forest management, including prescribed fire. We are focused on increasing native seed sources for commercial seed dealers to help federal, state, and private landowners conduct native plant restorations across the region. Additionally, we are currently seeking new collections and evaluating a number of other species adapted to southern pine forest understories.

In 2022 we expanded our partnership to include the Kisatchi National Forest in western Louisiana in order to broaden our reach and increase the impact of our work. In our first year of partnering with the Kisatchi National Forest we planted our first trials in the propagation of rivercane. The ultimate goal is to increase the acreage of quality habitat across the region.

PERMIAN BASIN PANHANDLE NATIVE SEED PROJECT (PBPNSP)

PBPNSP UPDATE

Jameson S. Crumpler, Colin S. Shackelford, and Anthony D. Falk

The PBPNSP was started in November 2017. Our mission is to develop commercially-available native seeds for use in the Permian Basin and Panhandle regions. The project also focused on educating landowners and managers in the region on the use of native seeds for restoration and reclamation projects.

Recently, we have been working on new seed collections from both grasses and forbs of interest. Approximately 217 collections of native wildflowers and 312 collections of native grass species have been made. Collections are cataloged and later planted for evaluation at the Railway Ranch near Odessa, in Ector County or the NRCS Knox City Plant Materials Center in Knox County. A search for a new evaluation site in the Panhandle region is ongoing. We hope to have a new evaluation site operational by spring 2024. We are currently evaluating 2 grass species and 1 forb species for use in the region.

To increase public awareness of PBPNS we have been attending field days and giving presentations. We are also actively engaged with several landowners to research methods to establish native grassland communities. Finally, we continue to have multiple opportunities to provide seed mix recommendations to landowners and managers in the Permian Basin, creating positive impact for the native seed market.

MIDLAND NATIVE PLANT DEMONSTRATION GARDEN

Jameson S. Crumpler, Colin Shackelford, Jesse S. Wood, Jason L. Brooks, and Anthony D. Falk

ConocoPhillips has partnered with the PBPNSP to establish and maintain a native plant demonstration garden in the heart of downtown Midland. The goal of this garden is to showcase commercially-available species and future germplasm releases from the Texas Native Seeds Program to oil and gas producers. Many of the largest producers have offices surrounding the garden making it a highly impactful showcase. Also, many of these products are currently used by the industry for restoration and reclamation of abandoned oil and gas sites and rights-of-ways. Allowing people to see how well each product performs will hopefully encourage even more people to use native species.

The demonstration garden was established during spring 2018, and currently contains 6 species of native wildflowers and 21 species of native grasses that are now available or pending release. Each species is displayed in a 10 ft^2 block with a five-foot walking row between blocks. The demonstration garden gives the public a visual example of how each species may appear. This is very important because many people are unaware of the beauty of native species, particularly in the Permian Basin Region.

Educational signage was installed during summer 2019 with language regarding the species present and the partnership between Concho Resources, Inc. (now part of ConocoPhillips) and TNS. Plans for the demonstration garden include removal of poor-performing varieties and the addition of new releases. These updates are planned for spring 2024.

CENTRAL TEXAS NATIVE SEED PROJECT (CTNSP)

CTNSP UPDATE

Hagen D. Meyer, Anthony D. Falk, John R. Bow, and James P. Muir

Locally-adapted native seed sources are being collected, evaluated, and released for commercial seed production in central Texas. Our partnerships with the Texas A&M AgriLife Research Center in Stephenville, the NRCS James E. "Bud" Smith Plant Materials Center in Knox City, and the Sandbrock Ranch in Aubrey have allowed us the space and resources to evaluate native seed sources for the region.

New evaluations of narrowleaf coneflower, sand bluestem, and big bluestem were planted in 2022. New this year is state-wide evaluation of bushy bluestem. Evaluations entering their second year include Canada wildrye and Arizona cottontop.

Seed production of hairy grama, Indiangrass, little bluestem, sand dropseed, seep muhly, sideoats grama, silver bluestem, tall dropseed, and Illinois bundleflower is currently underway in Stephenville. The fall of 2022 was very productive. We harvested 360 lbs of seed for distribution to commercial seed growers. Currently, our releases of Taylor Germplasm sand dropseed and Burnet Germplasm white tridens are on the market.

Along with evaluations and seed production the CTNSP is involved in research. Over the last 5 years we have assisted the Sandbrock Ranch with grassland restoration projects totaling over 350 acres. In April 2023, another 90 acres of pasture was seeded for native restoration. Additionally, several cooperative research projects are underway with Texas A&M AgriLife Research and Tarleton State University. These include evaluations of TNS releases for forage, bioenergy and ornamental purposes.

NATURE-BASED CARBON SOLUTIONS

Anthony D. Falk, Rider Combs, Fidel Hernández, Colin Shackelford, Jameson Crumpler, and Matthew T. Kapelewski

Many companies in the U.S. are looking for ways to offset their carbon footprints by capturing and storing carbon. Grasses take carbon from the atmosphere and store it in their leaves and roots. When roots die, the carbon is transferred to the soil, where it is stored until the soil is disturbed or microorganisms decompose the decaying organic matter.

TNS has partnered with Exxonmobil to test native species' abilities to store carbon in the Permian Basin region. We seeded two seed mixes on 10 sites in the region. Each site represents a commonly-found degraded rangeland with low existing carbon storage in the region. The first seed mix planted contained 9 species with high growth rates; the second mix contained 36 species of grasses plus forbs.

In the future, we will collect plant production data for each seed mix at each site, in order to determine if the high production native grasses or the diverse mix of native species will have higher overall production and therefore greater potential for capture of atmospheric carbon.

TXDOT CCAA MONARCH HABITAT ROADSIDE SURVEYS

Hagen D. Meyer, Rider C. Combs, Samuel J. Glinsky, Travis J. Jez, and Anthony D. Falk

The Texas Department of Transportation (TxDOT) has enrolled 450,000 acres of potential monarch butterfly habitat into a Candidate Conservation Agreement with Assurances (CCAA). The agreement was formed in response to the upcoming 2024 decision on whether or not to list the monarch butterfly as a federally endangered species. The information collected from these roadside habitat surveys will guide monarch habitat development along TxDOT right-of-way properties.

2023 was the third year that TNS and TxDOT partnered to conduct surveys for monarch butterfly habitat. This year the scope of the project expanded from 109 survey plots across the state to 140. Each plot will be surveyed for flowering plant species in the spring. Plots within the monarch butterfly migration pathways in Texas span a vast area between Deaf Smith County in North Texas to Zapata County along the southern border, Loving County on the eastern side and Red River County to the west. Along with the spring plots, 30 survey plots that fell below the ideal monarch butterfly habitat criteria were revisited during fall 2022. Revisiting these plots allowed us to understand the changes in habitat composition between spring and fall.

Expanding the scope of these surveys will help with vegetation management practices for TxDOT along roadways. Additionally, the information gathered in these surveys will help improve our understanding of monarch butterfly habitat by considering seasonal changes in habitat composition.

A black swallowtail caterpillar feeds on prairie bishop in front of an antelope-horns milkweed.

WTNSP UPDATE

Colin S. Shackelford, Louis A. Harveson, and Anthony D. Falk

The development of locally-adapted native plant seed supplies for West Texas is ongoing with significant new accomplishments for 2023. Initial evaluations of 3 new grass species have been completed. Data from these evaluations will be used to develop new releases. An advanced evaluation planting of Arizona cottontop is planned for the 2024 growing season.

New evaluation plantings of sand bluestem and narrow-leaf coneflower were installed in June 2022. Data collection on these plantings will continue before populations are selected for seed production and eventual commercial release. Twenty-seven native plant species have been or are presently undergoing evaluation.

Seed collections are continuing, and thirteen plant species are currently in seed increase including nine grasses and four forb or shrub species. Three seed releases have been completed and are currently in commercial production. Over 1,800 native seed collections have been made.

Eight grassland restoration research plantings have been completed near the project headquarters in Alpine, Texas. A new planting looking at the use of nurse crops was installed spring 2023. Technical guidance on multiple restoration plantings with our partners at the Borderlands Research Institute at Sul Ross State University, as well as for multiple private landowners, has also been conducted.

RESTORATION OF LEHMANN LOVEGRASS

Colin S. Shackelford, Jameson S. Crumpler, Jesse S. Wood, and Anthony D. Falk

WTNSP and PBPNSP in collaboration with ConocoPhillips have begun examining native grassland restoration methods in areas invaded by Lehmann lovegrass. Lehmann lovegrass is a perennial grass native to southern Africa. It was originally planted as a forage grass in sites with sandy soils across West Texas, Arizona, and New Mexico. It is very competitive with our native grasses. Lehmann lovegrass also tends to move well outside the areas where it was planted. It is often the only species found in large areas across West Texas, reducing the amount of native grasslands.

There has been very little research done on the restoration of native grasses in areas of Texas where only Lehmann lovegrass is found. This new project will test combinations of herbicide, discing, and seeding native grasses on sites currently dominated by Lehmann lovegrass. The goal is to develop a potential restoration strategy for Lehmann lovegrass stands. If any restoration strategies show promise, additional research projects will be added with the goal of developing a sound restoration strategy. This project will be an important first step forward in finding a solution to a complex ecological issue imperiling native grassland communities in West Texas.

NATIONAL FISH AND WILDLIFE FOUNDATION

Colin S. Shackelford, Louis A. Harveson, and Anthony D. Falk

WTNSP and PBPNSP began their second project funded by the National Fish and Wildlife Foundation (NFWF). The project is part of NFWF's Pecos Watershed Conservation Initiative, a partnership between NFWF, oil and gas producers in the region, and conservation-centered government agencies.

Funding will support ongoing WTNSP work, including the development of new seed sources for habitat restoration. Along with the installation of new grassland restoration research plantings, funding will also help with farm operations focused on seed production of new plant releases. New seed source research made possible by the project include advanced evaluations of Arizona cottontop and Canada wildrye. New evaluations of sand bluestem and narrowleaf purple coneflower were planted in 2022.

NFWF funding provides partial support for two assistant director positions and a full-time technician employed through our project partner Sul Ross State University in Alpine, Texas. Additionally, 25 acres of new restoration research plantings will be completed through the project. The project will continue through 2024.

Collecting pre-treatment data at ConocoPhillips Quail Ranch near Crane, Texas.

COVER CROPS & NATIVES FOR GUINEAGRASS CONVERSION

Rider C. Combs, Anthony D. Falk, Jimmy C. Rutledge, C. Bart DuPont, and Eric D. Grahmann

Guineagrass is a non-native invasive bunch grass that originated in Africa. It quickly establishes following disturbances like brush clearing in south Texas. Once established, it forms tall dense stands, which suppress the native plants. This is problematic for wildlife that depend on the local native plant community for their habitat. We have completed a 2-year study examining how the use of cover crops might improve competition of native seed establishment following Guineagrass and brush removal.

• Seeding locally-adapted native plants did improve the number of native plants (0.11 – 0.93 plants per square foot) in all treatments compared to not seeding (0.02 plants per square foot) in the short-term.
• Using cover crops did not promote or hinder the establishment of the locally-adapted native species.
• Guineagrass cover returned to a similar cover 2-years post planting.
• No combination of cover crop and locally-adapted native seed mix limited the establishment of Guineagrass where it was well established.

Dense stand of Guineagrass with low growing natives, two years after planting.

Pink pappusgrass and hooded windmillgrass surrounded by a dense stand of Guineagrass two years after planting.

SEEDING RATES OF NATIVES IN PASTURE CONVERSION

Rider C. Combs, Anthony D. Falk, Jimmy C. Rutledge, C. Bart DuPont, and Eric D. Grahmann

Guineagrass is an aggressive non-native bunchgrass that was introduced to southern Texas for cattle forage. Unmanaged stands are dense and out-compete native plant species for resources. In disturbed sites, Guineagrass is quick to establish following brush clearing. This hinders wildlife habitat management and restoration efforts. South Texas Natives (STN) partnered with the La Paloma Ranch to investigate whether increasing seeding rates of certain locally-adapted native plants can outcompete Guineagrass. The goal was to re-establish a native grassland following brush removal in a Guineagrass-dominated pasture.

- Seeding locally-adapted natives increased the number of native plants that occurred in the plots.
- Seed treatments that included an increased rate of slender grama and/or pink pappusgrass had the highest establishment of seeded native species among the different seed mixes.
- Despite increasing the number of native plants in the seeded plots, no specific treatment could outcompete Guineagrass and keep it below 60% cover within the 2-year period.
- Increasing the seeding rate of certain native species from 20 seeds per square foot to 40 seeds per square foot increased establishment, but increasing above 40 seeds per square foot did not have a corresponding increase in number of native species established in the plots.

Habitat Restoration & Management

Regrowth of rangeland plants 20 days after burning.

PRESCRIBED FIRES AND COASTAL PRAIRIE VEGETATION

Forrest C. Fay, Isabella R. Ruiz, Leah I. Ramos, Clarissa Saenz, Sandra Rideout-Hanzak, David B. Wester, and Weimin Xi

Texas' historical prairie communities were shaped by frequent fires. Its removal from these fire-adapted ecosystems has led to significant changes in the plant communities. Texas' coastal prairies and marshes have a heightened importance as crucial habitat to many wildlife species. We must understand how to manage these communities properly and how our land management decisions affect them. Our study aims to determine how different prescribed fire regimes affect nearest-neighbor vegetation relationships and species composition in the coastal prairies.

Our study site is the East Foundation's El Sauz Ranch (Willacy and Kenedy Counties, Texas). We randomly assigned a burn regime of varied season and return interval to 16 burn units (500+ acres each): Summer-short, Summer-long, Winter-short, Winter-long, or Control (no fire). In each burn unit, we established sampling transects which consist of step-point surveys. We record ground cover at each point, the nearest plant species to each point, that plant's nearest neighboring species, and the distance between the two plants. Surveys are conducted pre-burn and repeated every 6 months (up to 24 months) post-burning, with control units being surveyed concurrently. We aim to determine how different fire regimes directly affect species diversity and spatial relationships among neighboring plants in coastal prairies. Our results will help land managers create prescribed burning prescriptions to meet their specific objectives.

Prescribed fire effects on tick abundance in South Texas rangelands

Alynn M. Martin and Sandra Rideout-Hanzak

A. Martin

Question: Do **prescribed fires reduce tick abundance** and tickborne illness risk for humans and animals?

Data: We are collecting ticks in both grasslands and tree mottes in burned and non-burned pastures.

Preliminary Results: Tick abundance is likely **reduced by fire** in grasslands but **may remain high** near poorly burned tree mottes following prescribed burns.

Transect surveys in grasslands

Surveys around tree stands (mottes)

Goal: To understand if prescribed fire is **an effective tool** in controlling tick abundance.

TEXAS TORTOISES AND PRESCRIBED FIRE

Camryn M. Kiel, Toby J. Hibbitts, Forrest C. Fay, Sandra Rideout-Hanzak, David B. Wester, Evan P. Tanner, and Ashley M. Tanner

Prescribed fire has known benefits for improving habitat of many wildlife species, but we don't know a lot about how prescribed fire affects Texas tortoises. We are comparing winter and summer prescribed fire effects on Texas tortoise populations, as well as studying individual's responses to burning in those seasons.

We have attached GPS trackers and temperature dataloggers to Texas tortoises so we can track where they go before, during, and after our burning. Temperature dataloggers will also allow us to see what conditions they are exposed to during burning and what they can survive. Our objective is to answer such questions as: do Texas tortoises survive fire better in the summer or winter? Are tortoises attracted to recently burned areas? Our results will help burners decide when to burn to maximize populations of this state-threatened species.

Cooperative funding provided by the East Foundation. Texas tortoise photo by Fin & Fur Films, fire photo by F. Fay.

ECOLOGY AND MANAGEMENT OF WHITEBRUSH IN TEXAS

Katie J. Pennartz, Evan P. Tanner, Megan C. Clayton, Anthony D. Falk, and Humberto L. Perotto-Baldivieso

Whitebrush is a common shrub species found throughout Central, West, and South Texas rangelands. It is often the target of mechanical and chemical treatments because dense stands reduce the grasses and wildflowers that serve as important wildlife food. New herbicides have been developed to control for this species, though research in field settings is needed to better understand what promotes application success. Furthermore, there is limited knowledge on the basics of whitebrush ecology such as seed production and growth habit.

We are trialing herbicides and collecting seed for greenhouse trials at sites in Frio and Webb Counties, Texas. We have established research plots where whitebrush stands were treated with four herbicides, including a recently-developed product, at varying application rates. Treatments were applied during dormant and growing seasons beginning in fall 2020 and ending in summer 2021. Preliminary results have shown that there are chemical management options capable of offering a very high level of control regardless of season. Greenhouse trials began in spring 2022 to observe germination rates and indirect herbicide effects on seedling growth. Additional laboratory testing showed a wide range of germination potential from 5 – 49%.

Results from this research will allow rangeland managers and scientists to establish informed management options related to the control of this native, yet locally invasive, shrub species.

RESTORING NATIVE GRASSLANDS IN THE EDWARDS PLATEAU

Molly E. O'Brien, Evan P. Tanner, David B. Wester, Anthony D. Falk, and Sandra Rideout-Hanzak

Developing successful restoration techniques for native plant communities in disturbed landscapes is critical for conservation. Restoring native grasslands is desired because grasslands have experienced great declines in their historic distribution. Region-specific restoration techniques exist throughout the Great Plains. However, there has been limited research in the Edwards Plateau Ecological Region of Texas.

We tested combinations of techniques to assess their success for restoring native grassland vegetation in retired agricultural fields in Menard County. Combinations of disking, native seed mix treatments, and herbicide applications were assessed. Plots were monitored where seeded plant species composition and density were measured for two years (2021-2022). Seeded species density was greater in areas seeded with the low diversity seed mix when compared to the high diversity mix. Seeded species density was also higher in areas that received herbicide in combination with a low diversity mix.

Further research will determine which treatments promote species diversity. This study will provide region-specific restoration recommendations for the Edwards Plateau Ecological Region.

DEVELOPING VIRTUAL FENCES FOR LARGE AREAS IN SOUTH TEXAS

Daniel J. Ramirez, Humberto L. Perotto-Baldivieso, Shanna R. Gleason, J. Alfonso Ortega-S., David G. Hewitt, and Jason W. Karl

Farmers and ranchers use technology to move livestock to different pastures. A new way of moving cows can be done through virtual fencing. This means we can create boundaries through electronics rather than building physical fences. Fences can be costly to develop and maintain. They can also cause harm to wildlife and disrupt connectivity.

Current virtual fences have been developed in small areas to move large farm animals, but they cost a lot. Our objective is to provide a low-cost prototype virtual fencing system that is easy to implement. It can be used with no internet connection. Thus, it can be used in places that have no phone service. We plan to create a virtual fence using radio signals for a large pastures with 30-40 cows. The cows will have ear tags that connect to the radio waves to keep them inside the fence. We will monitor cows with GPS collars to assess how they move and behave with the virtual fence.

With the information gathered from this project, we will learn how cows adapt to virtual fences and how they affect the vegetation in the area. Our data will help ranchers and farmers with new ways of managing cattle in large pastures with reduced costs.

VIRTUAL FENCES AND VEGETATION

Shanna R. Gleason, Humberto L. Perotto-Baldivieso, Daniel J. Ramirez, J. Alfonso Ortega, and Jason W. Karl

Ranchers have noticed that rotational grazing systems can help improve habitat for wildlife. However, the cost and labor needed to build and maintain fences is often high. Virtual fencing uses radio signals to restrict movement into an area. It uses sensors that send cues to livestock when getting close to the fence. Virtual fencing can cut the cost and labor of current physical fences. It can make grazing more flexible. Our system will use radio signals between ear tags in cattle and sensors placed around the pasture.

Cattle locations will be paired with vegetation data. We will assess vegetation change using drones. We will collect drone images to see how cattle affects vegetation within the virtual fenced pasture.

The results of this study will provide important material on the value of using this technology at the ranch level. Additionally, it will provide evidence on how cattle use the pasture with virtual fencing.

CAN WE MEASURE WATER AND NUTRIENTS IN GRASSES WITH DRONES?

Kimberly M. Tanguma, Humberto L. Perotto-Baldivieso, Anthony D. Falk, Maria C. Donato-Molina, Doug R. Tolleson, and Shad D. Nelson.

Low levels of soil water increase plant stress, reducing their competitive ability in the range. Limited water within plant species will have a negative effect on plant diversity, animal nutrition, and overall native plant health. These changes can be seen through remote sensing methods.

Our objective is to see how changes in water are captured by remote sensing methods in native grass species. We will use drones and multispectral cameras to assess these changes. We will also use these methods to assess nutrient content of native plants.

Our study will help answer how water moisture content alters range species nutritional content, and will help us improve our use of remote sensing methods to monitor South Texas grasses during the growing season. Our results will help ranchers and farmers find ways to determine optimum water availability and nutrient content in their pastures.

DRONES AND FORAGE PRODUCTION

Lori D. Massey, Humberto L. Perotto-Baldivieso, Jose S. Avila-Sanchez, Evan P. Tanner, and J. Alfonso Ortega S.

Forage production plays a crucial role in feeding livestock, and estimating production aids managers with stocking rates and grazing system decisions. Our goal for this study was to estimate forage production of a pasture using a drone and compare that to the actual forage produced through hay production. Therefore, we flew two hay fields with a drone before they were cut for hay. We marked areas before the drone flight to be collected after the flight was complete. The collected samples were dried and weighed, and paired with the drone imagery to estimate forage production for each field. After the imagery and samples were collected, hay was cut and baled, and we calculated average bale weight and total forage production for each field.

- Field 1 was 30 acres and produced 106 round bales. Average bale weight was 1,430 pounds and total forage produced was 5,250 lbs per acre. The drone estimate for field 1 was 4,700 lbs per acre.
- Field 2 was 3 acres and produced 4.5 round bales. The average bale weight was 1,100 pounds. The total forage produced was 1,980 lbs per acre. The drone estimate for field 2 was 2,140 lbs per acre.
- Each drone estimate was less than 1 bale different per acre from actual hay production for both fields.
- Therefore, drones have the potential to estimate forage production of a pasture.

IDENTIFYING THORNSCRUB SPECIES USING DRONES

Lori D. Massey, Humberto L. Perotto-Baldivieso, Jose S. Avila-Sanchez, Evan P. Tanner, and J. Alfonso Ortega S.

Tamaulipan thornscrub is an important brush community and home to several wildlife species throughout south Texas and northern Mexico. There has been very little research on thornscrub over the last 20 years especially from a remote sensing background. Our goal for this research was to identify different brush species using a drone paired with a multispectral camera. These cameras capture visible color as well as data not visible to the naked eye which provide a unique look at brush species.

We flew a drone over a thornscrub site located on a private ranch in south Texas. We walked the site to mark and identify brush species with a GPS. We then used these points to locate brush species in the drone imagery to classify the entire image.

- We identified 26 shrub species in person and classified 19 shrub species in the image.
- We classified shrub species with accuracies as high as 88%.
- Our dominant species were guajillo and blackbrush.

This research is the first step towards assessing the diversity and potential distribution of Tamaulipan Thornscrub across south Texas. Our study will help set a baseline for mapping these vegetation communities in South Texas.

IS AGRICULTURE HARMFUL TO SPOT-TAILED EARLESS LIZARDS?

Preston Richardson, E. Drake Rangel, Jacob Reyes, Scott E. Henke, David B. Wester, and Cord B. Eversole

Spot-tailed earless lizards (STEL) are a seemingly rare species whose population numbers and distribution have drastically declined. Hence, the species is being considered for federally threatened status. Hypotheses for their decline include invasive flora and fauna, urbanization, and agricultural practices. Our objectives were to determine if the latter resulted in direct or indirect negative impacts. We built a 2-acre enclosure to simulate a crop field; a habitat in which STEL are commonly associated. We placed 20 STEL outfitted with VHF transmitters to monitor their movements. We disked and mowed the enclosure. In addition, we placed 4 groups of 16 STEL (10 juveniles and 6 adults of which half served in the treatment and control groups, respectively) into separate 10-gallon aquaria equipped with heat lamps and UV lights and fed crickets ad libitum. Round-up® (herbicide) and Besiege® (pesticide) were either (1) sprayed directly on STEL within aquaria, or (2) STEL were removed, the chemical treatment was applied to substrate, and STEL were returned after the spray dried. STEL snout-vent length and weight were measured at day 0 and 14.

- Within the 2-acre enclosure, STEL that were above ground would flee the approaching agricultural equipment, while underground STEL would remain as such and the equipment would pass over them.
- Mortality or injury to STEL did not occur in the enclosure.
- Within aquaria, mortality did not differ between treatment and control STEL.
- Snout-vent length growth was unaffected by Round-up®; however, weight gain was less for both juvenile and adult STEL with both direct and indirect spray methods.
- Besiege® affected juvenile and adult STEL growth and weight gain by both spray methods.
- Lizards were monitored an additional 30 days where growth and weight gain between the treatment and control STEL were similar again.

Therefore, it appears that these agriculture practices have mild, indirect negative impacts on STEL.

Biology & Ecology

The figure to the right shows dispersal movements of four juvenile gray hawks in 2019 after they left their nest sites. Blue and green lines show movements of males while orange and red lines are females. None of the four birds limited their movements to the study area of Hidalgo and Cameron Counties.

GRAY HAWKS IN THE LOWER RIO GRANDE VALLEY OF TEXAS

Michael T. Stewart, Ashley M. Tanner, Bart M. Ballard, Jennifer A. Smith, and Brian A. Millsap

Gray hawks, while relatively common within the Mexican and Central American core of their range, have never been a widespread or commonly occurring species in the United States. They have a limited range in Texas, where they are considered threatened, and very little is known about their populations within the state. Identifying gray hawk habitat is especially important for conservation efforts in the Lower Rio Grande Valley (LRGV) of Texas, where over 90% of the native vegetation has been lost.

We began researching gray hawks in the Lower Rio Grande Valley in January 2019. Captured gray hawks received coded aluminum color bands that allow us to recognize individuals, as well as Global Positioning System (GPS) transmitters that allow us to follow their movements and space use over time. These transmitters use the cellular network to collect and transmit location data. Thus far, 58 gray hawks have been fitted with GPS transmitters, and we have collected over 200,000 locations. These data will be used to identify the specific environmental features that characterize current and potential gray hawk habitat in the LRGV.

Data from the GPS transmitters will also be used with data gathered from surveys (where color-banded birds are resighted) to study important population parameters. Using parameters such as survival rates and nesting productivity, we can then assess the population growth rate of gray hawks in southern Texas. The results of our study will help better inform management decisions for this Species of Greatest Conservation Need in Texas.

Photo by M. Stewart.

LANDSCAPE CHANGES AFTER WILDFIRE IN SOUTH TEXAS

Dakota R. Moberg, Humberto L. Perotto-Baldivieso, Evan P. Tanner, Michelle A. Lawing, and Aaron M. Foley

Wildfires are an important natural disturbance in rangelands and can create changes in vegetation cover. New satellite and drone images provide new ways to see how wildfires can affect vegetation cover. In South Texas, the Borrega fire burned over 50,000 acres. It is the largest wildfire to occur in this region in recent years.

Our goal is to understand how the Borrega fire changed vegetation cover at broad scales. We want to identify how vegetation cover recovers from these large wildfires. We will use monthly images from a high-resolution satellite to classify vegetation cover and assess their changes. We will collect GPS points to verify the accuracy of our classifications.

We will be able to see if satellite and drone imagery are useful tools to assess changes in vegetation cover after a fire. Linking these data to field practices could help us show how we can reduce the risk of wildfires similar to the Borrega fire.

MONITORING WILD TURKEYS AFTER WILDFIRE

Kaylee L. Lovejoy, Humberto L. Perotto-Baldivieso, Aaron M. Foley, William P. Kuvlesky, and Jason V. Lombardi

The Rio Grande wild turkey is a key game bird species in the Texas wildlife community. They have an important ecological role with insect and native seed consumption as part of the native food chain. Wild turkeys are of aesthetic and economic value to private landowners, and they are one of the most popular gamebirds in the United States.

In March 2022, a large wildfire spread across Kleberg County and burned >51,500 acres. We are looking at wild turkey numbers on both burned and non-burned areas of the site of the fire. We put trail cameras along transects in burned and non-burned areas during fall 2022. We will collect photos for 4 months every year for 2 years and we will use these photos to analyze occupancy estimates. We will then compare these estimates between burned and non-burned sites for wild turkeys.

Burned areas may have more turkeys than non-burned areas due to new growth of food and cover sources. This information will provide clues on how a large fire can affect wild turkeys and their distribution across the landscape.

EFFECTS OF VEGETATION ON TEMPERATURE AND SOUND TRANSMISSION

Laura C. Beck, Evan P. Tanner, Ashley M. Tanner, Darren S. Proppe, and Samuel D. Fuhlendorf

One of the main factors driving grassland decline in the Great Plains is woody plant encroachment. Direct impacts of woody plant encroachment are well understood, while indirect impacts like changes in temperature and the alteration of how sound travels, due to the changes in vegetation structure, are not. Sound and temperature are intrinsically linked. Changes in temperature modify how sounds travel. Warming conditions could lead to sound transmission being enhanced or degraded. As most animals rely on auditory cues to communicate, this could have large impacts on the biological community. Additionally, the enhancement of human-made noises could mask natural sounds used for communication.

For this study, we will measure how changes in vegetation patterns from woody to grassland areas impact temperature and sound propagation by using a combination of temperature and sound measuring devices. We will quantify different sound types across the landscape, which include: tones (2, 4, 6, 8 kHz) and golden-cheeked warbler vocalizations. This study is being conducted at the Wild Basin Creative Research Center and the Shield Ranch, in the Austin, Texas area. Wild Basin is a protected natural area within an urban setting that receives high amounts of human-made noises. Comparatively, Shield Ranch exists in a more rural environment. Both areas are experiencing woody plant encroachment, while also serving as important wildlife habitat.

Our goal is to not only understand the links between temperature and sounds in the landscape, but also help guide the City of Austin in managing these urban and non-urban native vegetation communities for conservation of critical wildlife species.

Photo by L. Beck.

GENETIC ANALYSIS OF WILD TURKEYS IN OKLAHOMA

Michael R. Barrett, Evan P. Tanner, Randall W. DeYoung, M. Colter Chitwood, R. Dwayne Elmore, Craig A. Davis, Samuel D. Fuhlendorf, Nicole De Filippo, Cody Griffin, and Kent Andersson

Wild turkeys have a rich history and serve as a conservation success story in the United States. However, recent population declines have led to concern regarding the future of this popular game bird. Oklahoma Department of Wildlife Conservation (ODWC) has noted declining numbers of turkeys across their range. Declines may be partially due to changes in genetic structure among populations. Using genetic techniques, we aim to better understand the genetic profile of wild turkeys across the state of Oklahoma.

Beginning in spring 2022, we worked with ODWC, the National Wild Turkey Federation, Oklahoma Tribal Nations, and private citizens to collect samples from hunter-harvested birds. Sampling resumed during the spring 2023 harvest season. A total of 150 samples were collected across 53 Oklahoma counties during the 2023 season. A combined total of approximately 250 tissue samples across 64 counties will provide genetic information from each of these counties. Using genomic analysis, we aim to find current statewide genetic diversity, gene flow, and connectivity. These data will also provide information on hybridization between subspecies of turkey within the state.

Sample collection will continue during the 2024 season to collect samples from underrepresented counties. This research will provide a better understanding of the genetic integrity of current turkey populations. Genetic information will enable ODWC to prioritize management decisions and pinpoint areas for targeted conservation efforts to speed the recovery of turkey populations in Oklahoma.

This figure shows the number of wild turkey genetic samples collected per county via Hunter Harvest 2022-2023.

IS TRANSLOCATION OF TEXAS TORTOISES AN OPTION?

Christin Moeller, Saren Perales, Wraith Rodriguez, Scott E. Henke, Sandra Rideout-Hanzak, David B. Wester, Cord B. Eversole, Jeremy Webb, Paul Crump, and John Young, Jr.

Texas tortoises are a Species of Greatest Conservation Need and a Texas state threatened species. Their populations are at increasing risk of habitat destruction, fragmentation and degradation through the spread of invasive species and development. Translocation of tortoises in danger may be an option; however, two main challenges arise: the threat of transmission of upper respiratory tract disease (URTD) between translocated and recipient populations of Texas tortoises, and the instinctual homing behavior that drives tortoises to return to where they were captured, negating any efforts involved in moving them. We sampled populations of tortoises to be relocated and tortoises from a recipient location for URTD to determine prevalence of disease, and we monitored mortality and movements of the translocated tortoises after being in captivity for 4 months prior to release. Soft releases, placing tortoises in captive pens and monitoring their health and behavior prior to release, was preferred to transporting tortoises to a new location and releasing them immediately to fend for themselves (i.e., hard release). We have tortoises that will remain in captivity for 8 and 12 months to determine if length of "soft release" time reduces homing instinct in tortoises.

Our early results indicate that prevalence of URTD was similar between translocated (56/171; 32.7%) and recipient (8/23; 34.8%) populations. There were low indicators for URTD (1:32 – 1:128) in both populations; thus, it is unlikely translocation would result in an increase of prevalence of disease. Translocated tortoises experienced a 15% mortality rate, which is similar to that of non-translocated tortoises. Mortality factors were predation, URTD, vehicle strikes, fencing entanglement, and unknown causes. Male and female tortoises behaved similarly in their movements within the initial 60 days upon release of captivity. On average, tortoises traveled about 80 feet/day. Tortoises did not appear to display homing behavior, but instead scattered in all directions upon release. Six tortoises (21%) remained within the captive area, even though fences were removed. The study will continue to monitor these tortoises, as well as the tortoises in captivity for 8 and 12 months to determine the viability of translocation as a management option for them.

CLAY LOMAS AND TEXAS TORTOISES

Juan C. Elissetche, Sydney E. Pate, Meghan E. Anderson, Christin Moeller, Sandra Rideout-Hanzak, David B. Wester, Scott E. Henke, Evan P. Tanner, Humberto L. Perotto Baldivieso, Cord B. Eversole, I-Kaui Hung, and Jason Singhurst

Tamaulipan clay lomas are landforms that only occur in the United States in 4 counties along the southern coast of Texas; they can also be found in northern Mexico. Because of their rare presence, there have been few studies of the vegetation and soil composition that make up lomas. Lomas are a result of wind-blown clay sediment from the surrounding lagoons when they are dry, that accumulated over thousands of years on existing vegetation and eventually formed elevated dunes. This accumulation of clay provided the conditions for non-halophilic (salt-loving) vegetation that cannot grow in the surrounding sandy soils.

We are collecting data to allow us to characterize the soils and diverse vegetation found on the lomas. We are also determining their importance to Texas tortoises, a threatened species in Texas. The combination of evergreen and deciduous vegetation provides shelter and food for tortoises throughout the year, and lomas may be a preferred habitat type for Texas tortoises.

The vegetation is important not only to the tortoises but also to the structural integrity of the lomas. The vegetation keeps the soil intact, protecting the loma from natural deterioration such as wind erosion and hurricanes. In addition to vegetation and soil composition, we are interested in the island biogeography of the lomas. The size of the loma and distance between lomas may determine the survivorship and number of tortoises on a loma.

TEXANS' ATTITUDES ABOUT OWNING DANGEROUS ANIMALS

Harry Rakosky and Scott E. Henke

President Biden signed a bill into law in December 2022 entitled "Big Cat Public Safety Act," which made it unlawful for unlicensed people to own, breed, and transport lions, tigers, leopards, cheetahs, jaguars, cougars, and their hybrids. Texas pet law states that exotic animals can be privately owned as long as the owner has a certificate of registration for that animal, which was issued by an animal registration agency. Some Texans believe that certain exotic animals are too dangerous to be allowed as pets. They argue that wild animals belong only in their natural habitats and should never be allowed as pets. Others argue for individual property rights and believe that if a person wants to own a dangerous animal as a pet, then he or she should be allowed to do so. The main goal of our study is to assess the attitude of Texans concerning the right to maintain dangerous wild animals as pets.

To date, we have collected >200 surveys from people living throughout Texas. Only 15% have indicated they personally would keep a dangerous animal as a pet, with small exotic cats, followed by snakes and large reptiles leading the list as desired pets. The vast majority of respondents (88%) believe that dangerous animal ownership should be regulated, and that Texas Parks and Wildlife Department (68% of respondents) should be the likely regulatory authority with the assistance of local veterinarians. A majority (70%) of those wanting a potentially dangerous pet believe that the animal should be contained in a manner to prevent escape. Interestingly, 63% of respondents wanting a potentially dangerous pet are not willing to allow their neighbors to own a dangerous animal. Our study will provide Texas lawmakers with information that can be used to better serve the public concerning exotic pet ownership.

SARS-COV-2 VIRUS IN WILD MAMMALS OF CENTRAL AND SOUTHERN TEXAS

Richard C. Laughlin, Scott E. Henke, Alynn M. Martin, Kyle J. Shaney, and Clayton D. Hilton

The COVID-19 pandemic has infected an estimated 660 million people and led to an estimated 6.6 million deaths worldwide. While the exact origins of the SARS-CoV-2 virus are unknown, data strongly supports a zoonotic origin for the virus. Zoonotic diseases are those that can be spread from animals to humans and vice versa. Coronaviruses have been documented in free-living wildlife and are previously known to have caused serious respiratory disease in humans after jumping from wildlife to intermediate hosts. The SARS-CoV-2 virus has been detected in companion animals (e.g., cats and dogs), numerous animals in human care, agriculture (e.g., mink farms), and wildlife (e.g., white-tailed deer, mule deer, and mink). Texas has recorded the highest number of confirmed animal cases, with all cases occurring in either companion animals or animals in conservancy.

We hypothesize that there are SARS-CoV-2 variants circulating in numerous companion, domestic, and wild animals, and that susceptibility, prevalence, and variant will be highly dependent on the species of animal tested. Therefore, we will survey and sample from mammalian populations in central and southern Texas from a variety of sources and habitats. Data from this project will provide better insight into the pandemic and hopefully provide sentinel species to monitor to reduce the likelihood of future pandemics.

A hoverfly interacts with big bluestem pollen.

NATIVE GRASSES AND POLLINATORS

Ethan Bennie, Joshua D. Allison, Anthony D. Falk, Sandra Rideout-Hanzak, Adam B. Mitchell, and Brian Loflin

Texas rangelands have been invaded by multiple non-native grass species. This invasion reduces plant diversity in rangelands and reduces their value as wildlife habitat. In order to restore native rangelands we must first have a better understanding of the seasonal timing of growth and development of reproductive organs of native grass species, as well as what pollinators they may depend on.

Our study is taking place at the South Texas Natives facility of the Texas Native Seed program in Kingsville, with a sister study taking place at Tarleton State University in Stephenville. We are studying 10 native grass species to determine their growth rates and development and growth stages of their seed structures. We will be comparing our findings to those in North Texas. We are also investigating insect use of these species to determine whether any of them provide supplemental pollen feed for insect pollinators, particularly during the later summer season when wildflowers are not plentiful. Finally, we will be photographing seed structures using a light filter that allows us to see the flowering parts as insects would see them.

We aim to determine basic growth and development of these important native grasses in order to understand better how each species may be used in restoration of native rangelands. Findings about insect pollinators will further our understanding of the ecology of these native plants and their importance in ecosystems.

THE OGALLALA AQUIFER IN TEXAS THROUGH 2100

Edward C. Rhodes, Humberto L. Perotto-Baldivieso, Evan P. Tanner, Jay P. Angerer, and William E. Fox

The Ogallala aquifer is one of the most important pillars of the Texas panhandle economy. There are concerns over the reduction of water levels in this region. These water decreases will have an impact on local economies. Farming is the main source of income in this region. There is a huge economy built around the needs of the farming community. A loss or reduction in cropland productivity would lead to a decline in this economy as well. About 82% of those living in the region are dependent upon the Ogallala aquifer for drinking water. Conserving this resource is critical for social stability.

We are looking at changes in aquifer water in the next 75 years. We will model these changes for different climate change scenarios. We will see how water change may be impacted by humans. We will also compare our model to historical water data and other published models. Our results will be useful in showing the public the value of this resource in the panhandle of Texas.

SPOT-TAILED EARLESS LIZARD (STEL)

POPULATION VIABILITY

Ruby A. Ayala, Cord B. Eversole, Scott E. Henke, E. Drake Rangel, and David B. Wester

Plateau and Tamaulipan spot-tailed earless lizards (STEL) are small, phrynosomatid lizards native to Texas. Their distribution across Texas has been declining believed to be due to habitat loss, agricultural practices, and invasive species. There is a lack of knowledge concerning the population ecology of STEL and the degree of impact that these threats can have on each species. The long-term viability of these populations is in question, and thus, was analyzed with a population viability analysis (PVA) using the program VORTEX to model population-specific information and to test probable life history parameters that can affect the survivability of both STEL species.

- Parameters related to reproduction (i.e., average age at first reproduction) and hatchling and juvenile mortality are the most critical factors affecting each populations' survival.
- A low probability (4%) of extinction exists, barring random catastrophes.
- The increased loss of habitat can speed the process of extinction for STEL.
- Introduction of adult STEL into a population proves to be beneficial to the long-term persistence of STEL, when combined with habitat restoration and increased adult survival management strategies.

Management actions should aim to increase the number of breeding female STEL and reduce mortality across all age classes. Such strategies will likely be more effective at stabilizing populations than programs that focus on captive breeding and reintroduction alone.

A research subject STEL wearing a jacket that held a tracking device is impaled on a mesquite thorn.

PREDATION BY LOGGERHEAD SHRIKE

E. Drake Rangel, Jacob Reyes, Scott E. Henke, Ruby A. Ayala, David B. Wester, and Cord B. Eversole

Spot-tailed earless lizards (STEL) species were once distributed throughout central and southern Texas; however, today, their distribution is patchy across only portions of their previous range. Theories as to why their distributions have shrunk include brush and invasive grass encroachment, agricultural practices, and predation; yet few publications document predation of STEL. We built a 2-acre enclosure in southern Texas and outfitted 30 STEL with VHF transmitters and followed their movements and mortalities from August – October 2022.

- During this time, 25 of 30 STEL (83%) were depredated by loggerhead shrikes, a native songbird.
- We observed shrikes in the area and all 25 STEL were found impaled on mesquite thorns, a known behavior of shrikes.

Interestingly, loggerhead shrikes are uncommon within central Texas during the summer months, which corresponds to where and when the remaining populations of STEL are found. STEL are primarily found in agricultural fields that lack thorn trees and barbed-wire fences which shrikes could utilize for their unique predation tactic. More research is needed to determine the extent to which shrikes could be significant factors in the distributional decline of STEL.

APPROACH TOLERANCES AND ESCAPE DISTANCES

E. Drake Rangel, Christin Moeller, Luke Willard, Scott E. Henke, David B. Wester, Cord B. Eversole, and Ruby A. Ayala

Plateau and Tamaulipan spot-tailed earless lizards (STEL) are native to central and southern Texas, but both species have experienced population declines in recent decades, which has made them species of conservation concern. Currently, both species are being considered for federally threatened status by the U.S. Fish and Wildlife Service. Therefore, baseline information of population abundance and distribution is needed to determine if population declines and range reductions are occurring. We noted that STEL fled upon approach during surveys. This wariness, coupled with their cryptic coloration and behavior of spending a portion of each day buried, creates difficulties in assessing baseline data. Therefore, our objectives were to determine the approachability of each STEL species to walking and driving surveys and determine the distances they fled when approached too closely. If STEL are wary to the point of rendering them undetectable during surveys, it could lead to incorrect conclusions concerning their abundance and distribution, which could affect their status for being listed as threatened.

- Both STEL species were more cautious of approaching humans than approaching vehicles.
- Both species allowed an approaching vehicle to get within 6 feet before a flight response initiated.
- Tamaulipan STEL were more wary than Plateau STEL; Plateau STEL allowed humans to get nearly half as close as Tamaulipan STEL.
- Tamaulipan STEL ran 3X farther from approaching humans than Plateau STEL.

We recommend standardizing survey methodology so abundance of STEL can be compared between locations with populations. We recommend driving surveys as the best method that offers closest proximity to STELs for positive identification.

CAN eDNA BE USED TO DETECT PRESENCE OF STEL?

E. Drake Rangel, Christin Moeller, Jacob Reyes, Ruby Ayala, Scott E. Henke, David B. Wester, and Cord B. Eversole

A challenge of wildlife management is knowing what species are present in habitats. However, with advancements of DNA sequencing, surveying for an organism's DNA is now possible. Organisms constantly shed skin cells, mucus, or feces into their environments, from which the DNA can be identified. Our objective was to use DNA technology to determine the presence of STEL, a species that is being considered for federally threatened status by the United States Fish and Wildlife Service. To determine the efficacy of this method, we placed individual STEL in aquaria with 3 inches of soil for 1 week, after which we collected soil samples to analyze for DNA left by STEL. In addition, we collected soil samples where STEL do not exist. Soil samples were randomized and DNA analyzed in a blind study where personnel did not know which samples were which. We had 18 STEL samples and 9 control samples with no STEL .

• Two control samples failed during analysis, which provided 25 total soil samples.
• Analysis correctly identified 8/18 (44%) of samples as positive for STEL DNA.
• All control samples (7/7; 100%) were correctly identified as negative for STEL DNA.
• Ten soil samples (56%) were considered false negative samples, while 0% were considered false positive samples by DNA analysis.

Although DNA technology is a promising technique, the method is still in its infancy and cannot be considered reliable yet. It could be that STEL do not shed sufficient DNA into their environments on a consistent basis. Perhaps in the future, the technology will be refined to determine STEL presence, even if DNA shedding is minimal.

REESTABLISHMENT AND INCREASE OF HOME RANGE AFTER TRACKING EFFORTS

E. Drake Rangel, Jacob Reyes, Scott E. Henke, David B. Wester, and Cord B. Eversole

Spot-tailed earless lizards (STEL) are an elusive and seemingly rare species that were recently elevated from subspecies to full species status. Recent research indicated that STEL home ranges were 5 – 15 acres, about 4X larger than similar species in the same genus. In our observations of STEL, we noted that individuals fled from humans but did not appear to return to their previous site of observation. Therefore, we outfitted 30 STEL with VHF transmitters to track their daily movements for 1 week. Then in a cross-over design, we pursued half the STEL to locations approximately 100 yards from their original observation site while maintaining a distance from the other half. We continued to monitor movements, and after another week, we pursued the second group to a new location while maintaining a distance from the first STEL group.

• We found that non-harassed STEL maintained 0.2-acre home ranges, but if harassed, they would escape to a new site and re-establish a home range similar to the size of their previous home range without returning to original home range sites.
• Only 1 STEL appeared to attempt to return to its original site, but was preyed upon as a result.
• Our results indicate that if all the area is included, both old and new home ranges and the area between the two, then STEL home range size becomes 5.6X larger as a result of intensive or aggressive tracking by researchers.

Inflated or biased estimates of home range can result in misinterpretations that have potential to misguide management or conservation strategies. This should be considered by future researchers when conducting home range studies of STEL.

DEMOGRAPHICS IN SOUTHERN TEXAS

Christin Moeller, Saren Perales, Wraith Rodriguez, Juan Elissetche, Scott E. Henke, Sandra Rideout-Hanzak, Jeremy Webb, Cord B. Eversole, and David B. Wester

The Texas tortoise is one of six species of tortoises that are native to North America. Historically, the geographic distribution of Texas tortoises was located across the southern portion of Texas, south of an imaginary line from Del Rio to San Antonio to Victoria. Their historical range extends into Mexico southward from the Rio Grande through eastern Coahuila and Nuevo Leon into San Luis Potosi. However, today their abundance has declined and their distribution within their historical range has become sporadic. Past densities of Texas tortoises averaged ~6.5 tortoises/acre, but more recent studies estimate densities at 1 tortoises/10 acres. Past data for Texas tortoises suggest that tortoises are born at a 50:50 sex ratio, reach breeding age at 15 years, lay 1-2 clutches per year with an average of 3 eggs per clutch, and have a longevity of up to 60 years. We assessed a Texas tortoise population of 171 individuals that occurred on a clay loma habitat in southern Texas to determine its status compared to historic data known about the demography of Texas tortoises.

- There were slightly more females than males (100 females:71 males).
- Age structure was heavily skewed toward adults, with no hatchlings (0%), 6 juveniles (4%), 17 young adults (10%), and 148 older adults (86%).
- Tortoise density was 1.7 tortoises/acre.
- Reproduction was virtually nonexistent within this population.

Lack of reproduction and/or lack of recruitment of young to breeding age appears to be the key as to why populations are declining.

POTENTIAL EFFECTS OF COPROPHAGY

Saren Perales, Christin Moeller, Scott E. Henke, Sandra Rideout-Hanzak, David B. Wester, and Cord B. Eversole

Coprophagy, or eating feces, is a known behavior of Texas tortoises; however, the extent of this behavior has not been documented. It is largely unknown whether Texas tortoises display preferences for their own scat, other tortoises' scat, or even the scat of other species. We studied this behavior by placing 10 Texas tortoises individually in a 10 square yard pen, and providing various scat types in a cafeteria-style experiment. Scat choice included the tortoises' own scat, which was collected during the days prior to the experiment, scat from other Texas tortoises, and scat from raccoons, coyotes, and nilgai. These species were selected because they were the most prevalent scat on the landscape associated with Texas tortoises. Quantity of scat consumed by tortoises was measured every 12 hours during a 48-hr period. Similar quantity of each scat was placed in containers that were exposed to the environment and used as controls for potential shrink:swell due to heat or humidity.

- Seven of the 10 tortoises ate at least one scat type and one tortoise consumed some of each type.
- Texas tortoises displayed individual preference for scat type but did not display a generalized preference for scat type.
- Five tortoises consumed raccoon scat, which creates potential mortality and risk factors associated with *Baylisascariasis*, a parasitic infection found in raccoon feces that can cause neurological disorders.

Coprophagy in Texas tortoises can be considered an ecological trap because this innate behavior may be a reason why they have become a threatened species.

HABITAT PREFERENCES IN SOUTHERN TEXAS

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Texas tortoise populations were once distributed throughout southern Texas with densities as high as 6.5 tortoises/acre. More recent studies have estimated densities at 0.1 tortoise/acre, and their distribution has become sporadic throughout their historic range. Populations of Texas tortoises are thought to be restricted to thornscrub and coastal prairie habitats. Older studies (~50 years) found Texas tortoises in clay loma habitat along the southern coast of Texas and in the lower Rio Grande Valley; however, the importance of such habitat to Texas tortoises remains unclear. Therefore, we conducted a habitat availability and use analysis for Texas tortoises in southern Texas. We collected 174 tortoises within a 270-ha area.

• Of the 8 habitats identified within our study area, Texas tortoises only used the grassland loma in greater proportion than it was available, with 120 tortoises (80.5%) located within that habitat.
• Tortoises used evergreen loma and salt prairie habitats in proportion to their availability, and wetlands, open water, coastal flats, dredge spoils, and thornscrub habitats much less than the availability of those habitats.
• Density of Texas tortoises within the grassland loma was 1.6 tortoises/acre, which is a 15-fold increase from the 0.1 tortoise/acre estimate.

Our results suggest that thornscrub is not a preferred habitat by Texas tortoises and clay loma habitats should be protected as critical habitat for this state-threatened reptile.

BODY WEIGHT OF SMALL ANIMALS ACROSS A GRADIENT OF PLANT INVASION

Duston R. Duffie, Andrew J. Mullaney, Scott E. Henke, and Cord B. Eversole

Historically open rangelands of southern Texas have been invaded by non-native grasses and native, woody shrubs. Small vertebrates play vital roles in ecosystems as primary and secondary consumers; however, little is known about their responses to invasive vegetation. We surveyed small mammal, reptile, and amphibian communities at the Welder Wildlife Refuge in San Patricio County, Texas. In late 2019, we established six plots: two consisted of native vegetation, two of invasive vegetation, and two were intermediate. By August 2022, we recorded 419 captures of 30 reptile species and 2,331 captures of 11 small mammal species. To evaluate effects of invasive vegetation on these communities, we compared body weight of speciess between each plot.

• Of our three most commonly captured small mammal species, only one, hispid cotton rat, was heavier in invaded and intermediate plots.
• Of our five most common snakes, only western diamondback rattlesnake, was heavier in the invaded plots.
• Other species showed no responses to level of invasion.

Invaded and intermediate plots consisted of woody shrubs that may provide more cover and food for certain small mammals resulting in heavier individuals. Rattlesnakes prey on small mammals, so larger prey likely results in larger snakes. These plant communities can be advantageous to certain small vertebrates.

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