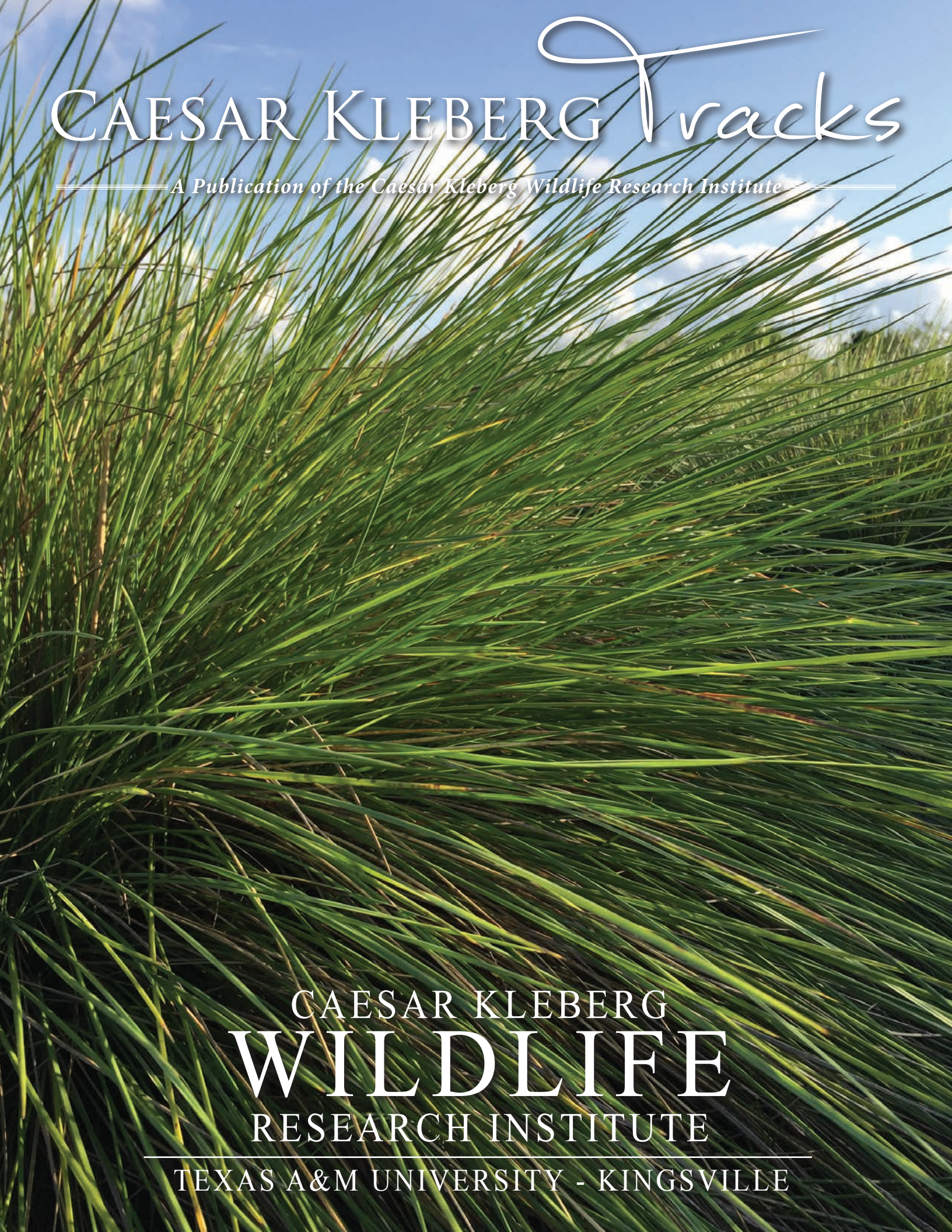

Caesar Kleberg Tracks

A Publication of the Caesar Kleberg Wildlife Research Institute

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TEXAS A&M UNIVERSITY - KINGSVILLE

Caesar Kleberg Tracks

Volume 3 Issue 1 *Summer 2018*

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Learn More About CKWRI

The Caesar Kleberg Wildlife Research Institute at Texas A&M University-Kingsville is a Master's and Ph.D. Program and 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, its mission is to provide science-based information for enhancing the conservation and management of wildlife in South Texas and related environments.

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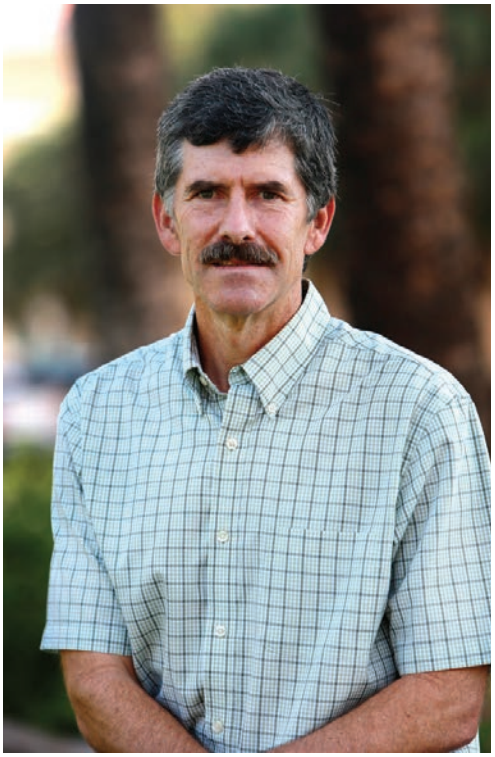
Cover Photo by Silverio Avila

From the Director

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



Dear Friends of CKWRI,

Inspiration. Inspiration is one of the reasons people love wildlife and wild places. Outdoor experiences inspire people to crawl out of bed early to set up waterfowl decoys, sit in a deer blind, or photograph coyotes in the golden morning light. Being outdoors inspires people to train and maintain dogs, sit on a bulldozer in the heat of summer, and invest treasure in land, leases, and equipment.

Tracks Magazine was inspired by your love of wildlife and the outdoors. The magazine is one way CKWRI's scientists share their research findings and ideas with you. In this issue you will learn about the expanding reach of the Texas Natives Seeds Program and using prescribed fire to manage gulf cordgrass. There are results from drone and deer research and an announcement of a new quail book with a description of the process necessary to produce a book about wildlife and its management, an activity in which CKWRI scientists invest a lot of time.

The research projects we conduct at the CKWRI are often inspired by observations and experiences of those of you who spend time outdoors. We value the time we spend afield with you and appreciate you sharing your ideas.

The research reported in Tracks not only requires inspiration in the form of ideas from Texas' wildlife managers and landowners but also financial resources from a vast number of supporters and partners. Some supporters are inspired to send a one-time donation, others are sustaining contributors or participate annually through our Partners program. Still others directly support research projects or choose to contribute in perpetuity by endowing a program, fellowship, lectureship, or operating fund. And many others are inspired to give back to wildlife conservation by supporting one of the Institute's many partners.

People are inspired by wildlife and wild places. This inspiration is primal, bubbling up from somewhere down deep within us. This inspiration fuel's peoples interest in hunting, fishing, hiking, bird watching, outdoor photography, and other activities that give us a reason to conserve wildlife. Your passion for the outdoors and wildlife in turn inspires us at the CKWRI to continue our work on behalf of wildlife conservation.

We appreciate your interest and support.

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

LEARN MORE

Read more about our conservation partner, The South Texas Chapter of Quail Coalition, on page 11.

Improving livestock distribution and utilization in gulf cordgrass with prescribed burning

by Tori Haynes, Silverio Avila-S., Poncho Ortega, David Wester and Sandra Rideout-Hanzak

Stretching along the gulf coast of South Texas, the Gulf Coast Prairies and Marshes ecoregion produces a fairly continuous supply of grasses, and provides food and cover for both wildlife and livestock. Its potential for cattle ranching was evident to settlers who described it as an ocean of grasses decorated with wildflowers. Early settlers also reported frequent large-scale fires. Most were started by Native Americans who used fire to attract wildlife to prime feeding areas, reduce pests, and create easier travel routes among other things, but lightning strikes and spontaneous combustions also contributed to fire occurrence.

The extensive grazing that accompanied settlers reduced both the likelihood and sizes of these fires because, no matter the ignition source, occurrence of fire depends on accumulation of fine fuels—grasses in South Texas. Fire suppression efforts were increased with increasing settlement, and prairies protected from periodic fires began experiencing brush encroachment, invasion by non-native species, slower nutrient cycling, and loss of biodiversity. In its absence the value of fire became more evident.

Gulf cordgrass, also known as "sacahuista," is a highly-productive perennial bunchgrass that covers thousands of acres in the region. Gulf cordgrass can maintain green tissue year-round, and is well-adapted to the salinity of the coastal soils. However, livestock do not graze mature gulf cordgrass if other forages are available because it has firm coarse blades armed with sharp tips.

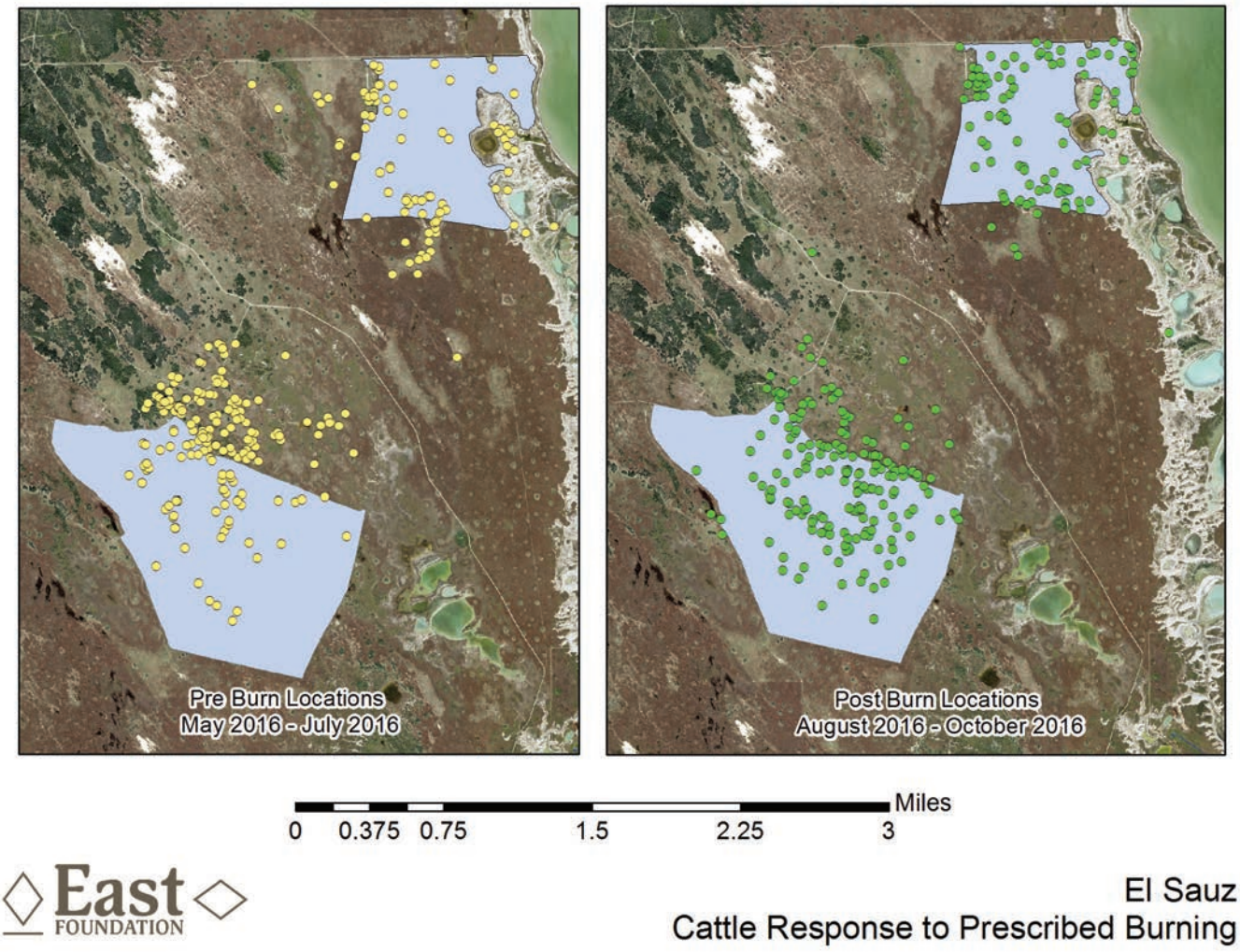
Gulf cordgrass - photo by Silverio Avila

Land managers know fire is a useful tool for rejuvenating mature stands of gulf cordgrass. However, we often don't agree on the appropriate season for burning it. Conducting a burn during late summer has been suggested by some as the best timing because of the critical need for green forage during the winter, while others have recommended burning during spring when soil moisture is sufficient for forage regrowth.

We embarked on a project comparing effects of prescribed burning in summer or winter in gulf cordgrass. One objective was to determine the best time to burn to improve livestock distribution and utilization in cordgrass. We created 10 plots at least 500 acres each on the East Foundation's El Sauz ranch near Port Mansfield, Texas. The ranch is approximately 27,000 acres, and has very little interior fencing. Plots were randomly assigned either winter burn, summer burn, or control (no burn). Within winter and summer burning groups, two were burned in the first year of our study while two were burned during the second year.

Before burning, we collared 30 adult cows ranging from 4 to 6 in body condition scores. Collars were programmed to collect GPS locations every 13 hours, eventually providing locations at all hours of the day. The lack of interior fencing allowed cattle to move freely about the ranch before and after our burning treatments in a patch burn-grazing scheme. We compared locations of collared cattle before and after burning in both seasons, utilization of forage in burned and non-

Figure 1



burned areas, and forage quality after burning.

Before our burning treatments in either season, cattle were using the burn patches very little. Using collar locations from all times of day only 13% of locations were inside a burn patch during the 3 months prior to burning. That increased to 49% of collar locations within the burned patches after burning, and season of burning made no difference here. Figure 1 shows two summer burn plots and the collar locations of four cows before and after those burning treatments; you can see an increase in locations inside the patches after burning.

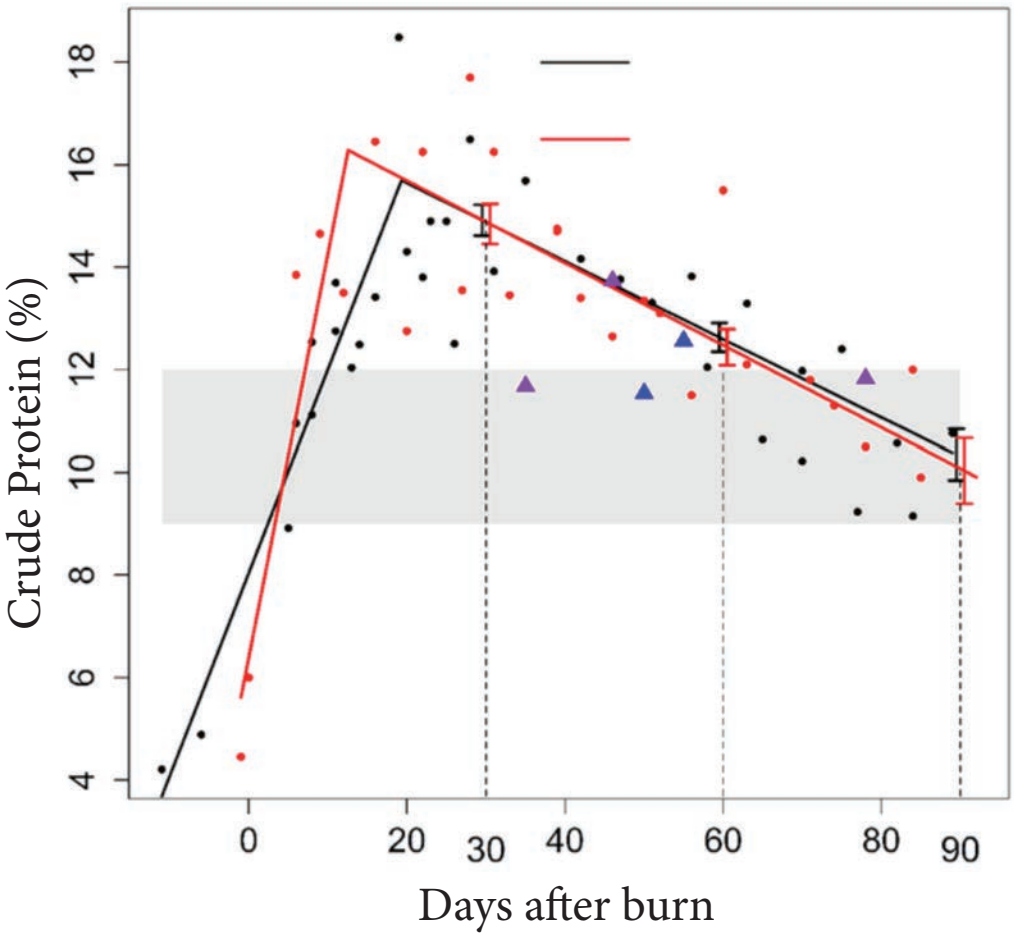
We saw the opposite effect in the non-burned patches. While there was still no difference between season of burning, 87% of cattle locations occurred in the non-burned areas before our burning treatments while only 51% of locations occurred in non-burned patches after other patches received a burning treatment.

When we limited the dataset to include only those collar locations recorded during the morning and evening prime grazing hours there was still no difference between burning during summer and winter. The collar locations inside burned patches increased from 17% before burning to 41% after burning. We can see regardless of time of day the burning patches have a strong magnet effect on the cattle.

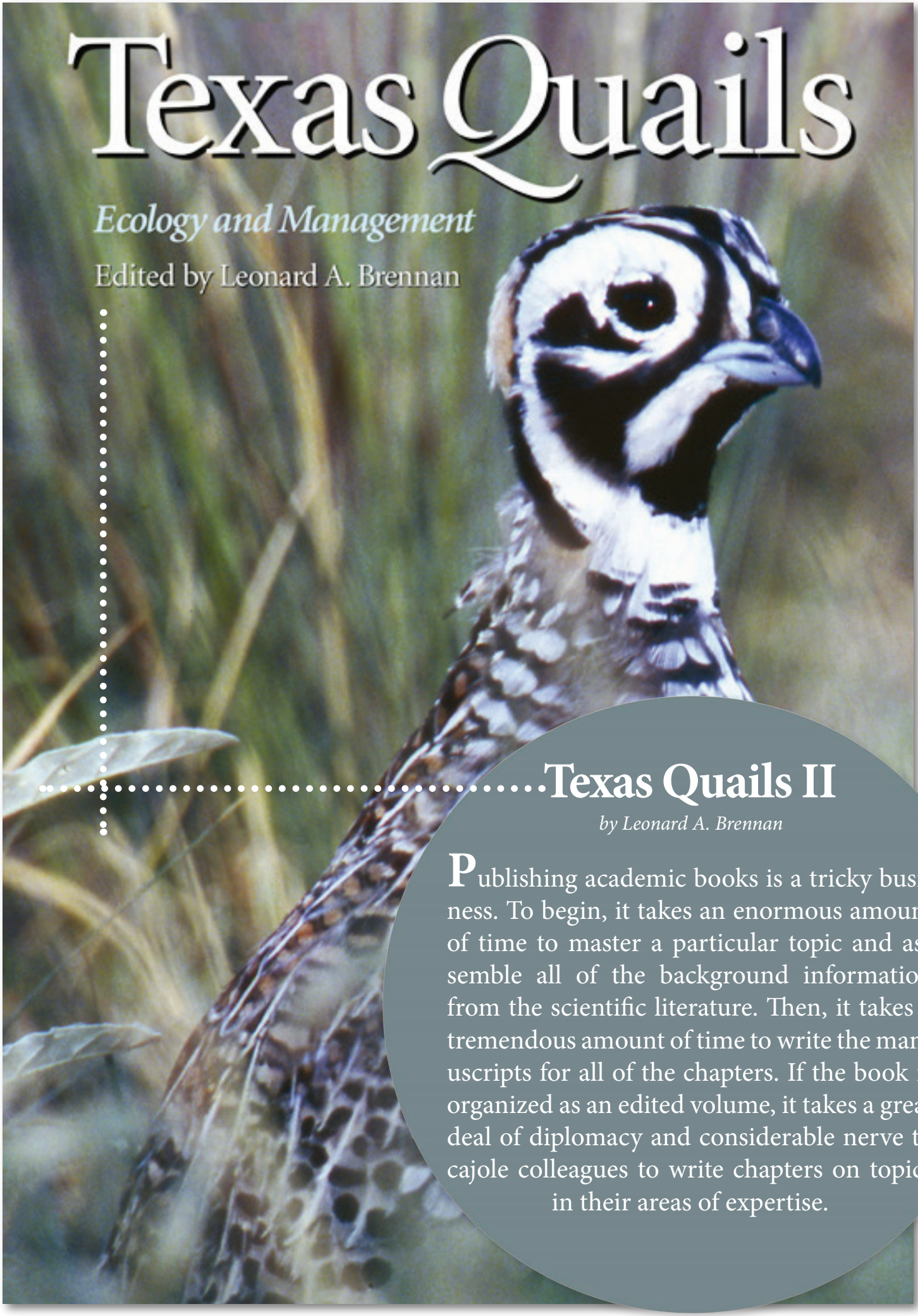
These results can be explained by our analysis of gulf cordgrass quality before and after burning. Prior to burning treatments, crude protein in gulf cordgrass ranged from 4 to 6% in both winter and summer burn patches. Immediately after burning, crude protein increased sharply, and was nearly 15% at 30 days. It remained higher than pre-burn levels, and as high or higher than the maintenance levels of 9 to 12% for lactating cows for 90 days. See Figure 2. Fiber content was reduced during the 90 days following burning, which also enhances overall forage quality.

There was also a difference in utilization of gulf cordgrass between non-burned and burned patches. During the 3 months after burning the average utilization inside burned patches was 69%, and it was only 10% in non-burned patches. Again season of burning made no difference in these results. The ranch received ample rain during the course of this study, and we determined that with favorable growing conditions, 2.5 acres of gulf cordgrass could support 1 animal unit for 90 days following either season of burn.

Figure 2



Our study tells us that whether we burn during summer or winter, we will significantly increase the forage quality and utilization of gulf cordgrass by cattle for at least 90 days. This is important to understand because it allows us the flexibility of using fire when it's most convenient on a case by case basis. We can base the decision on having sufficient soil moisture, having enough hands available to safely conduct the burn, or having agreeable weather patterns. However, repeated burning of different patches during winter and summer seasons, holding season constant in a patch over multiple years, will lead to vegetative differences between patches and greater variety in wildlife habitat.



Texas Quails II

by Leonard A. Brennan

Publishing academic books is a tricky business. To begin, it takes an enormous amount of time to master a particular topic and assemble all of the background information from the scientific literature. Then, it takes a tremendous amount of time to write the manuscripts for all of the chapters. If the book is organized as an edited volume, it takes a great deal of diplomacy and considerable nerve to cajole colleagues to write chapters on topics in their areas of expertise.

When the manuscript text, tables, and figures for a book project are complete, all of this material gets sent to the publisher who then has a couple of people review the manuscript and make constructive comments to improve it. After revision, the manuscript text, tables, and figures then go back to the publisher for production of the actual book. The pages are typeset and page proofs are sent to the author or editor for final checks and corrections.

Compared to writing a novel or a memoir, the process of producing an academic book can take a much longer period of time, often up to two or three years, and sometimes longer. What this means is that when an academic book is published, it is invariably at least a couple of years out of date because a considerable amount of new literature has appeared in peer-reviewed journals during the time the book was being written, edited and printed. Such newly-published scientific findings are not included in the completed book simply because of timing.

The book Texas Quails: Ecology and Management was published by Texas A&M University Press in 2007. A brief inspection of the more than 1,000 literature citations in Texas Quails shows that there are only a few of these cited papers dated 2004 and none later than that. Thus, Texas Quails was already about three years out of date on the day that it was published! At the time of this writing (2018), the material in Texas Quails is now at least 14 years behind the peer-reviewed scientific literature on quail biology and management. Much of this new peer-reviewed literature on quail biology and management has been based on research in Texas, and a great deal of this scientific literature has been conducted by scientists and graduate students at the Caesar Kleberg Wildlife Research Institute (CKWRI).

What all this means is that during the next couple of years it will be time to compile a second edition of Texas Quails: Ecology and Management. Quail researchers in Texas and elsewhere have made tremendous progress on numerous fronts during the past 15 years. Incorporating this new quail research material into Texas Quails II will provide biologists, land managers, ranchers, hunters, and other stakeholders with access to the material in more than a hundred new peer-reviewed journal articles that would otherwise remain buried in disjointed obscurity in university libraries or on the internet.

Progress in Our Lifetime

Progress in advancing knowledge through scientific research typically proceeds by small increments, rather than large, headline-generating breakthroughs. Research on quail is no different. The majority of quail research during the past 15 years has been incremental, but there have also been a few important breakthroughs, especially in the areas of molecular genetics, thermal ecology, and the influence of invasive grasses. All of the findings described below have occurred since Texas Quails was published in 2007.

Molecular Genetics.—The first landscape-scale assessment of the molecular genetic structure of northern bobwhite populations was done by Erin Wehland for her M.S. thesis in 2006, and was supervised by Dr. Randy DeYoung. Based on samples collected from across South Texas, we hypothesized that bobwhites would show clear differentiation in the genetic structure among populations from different areas. We were wrong. We were completely wrong, in fact. Contrary to our hypothesis that there would be strong evidence for genetic differences among areas, bobwhites showed little or no genetic differentiation in population structure across South Texas, even with a high level of genetic diversity present. Follow-on studies with samples from across even larger areas extending from South Texas into the upper Midwestern U.S. by CKWRI graduate students Damon Williford and Katherine Miller further supported this pattern. The take-home message from this research is that some unknown portion(s) of bobwhite populations (with the exception of bobwhites in Cuba that were most likely brought there

by people) are far better at dispersing from where they were hatched than we ever imagined. These results have made us completely rethink the scale on which habitat for bobwhites, and by extension other species of quails, should be maintained and managed.

Thermal Ecology.—When he was a professor at CKWRI, Fred Guthery was the first bobwhite researcher to formalize study of the thermal ecology of bobwhites and put this topic in a management context. First, in a paper from the National Quail Symposium Proceedings, Guthery and his coauthors clearly showed that large areas of grassland habitat could not only be uninhabitable for many hours in a day, they also showed that such areas were lethal to bobwhites during daily periods of peak heat. After he moved to Oklahoma State University, Guthery's landmark Wildlife Monograph on the Thermal Ecology of Bobwhites in North Texas showed how the ecology of heat directly influenced ways that bobwhites used habitat space through time during the summer. Additional studies by Tim Fulbright and his graduate students Holley Kline, Ben Olsen, and Brandon Palmer at CKWRI have confirmed Guthery's thermal ecology findings for quail in South Texas and have provided new insight into the vegetation characteristics of thermal refugia.

Invasive Exotic Grasses. —One of the first studies of how invasive grasses impact bobwhite populations was conducted at the Chaparral Wildlife Management Area by CKWRI graduate student Aron Flanders and supervised by CKWRI professors Bill Kuvlesky, Fidel Hernández, and Tim Fulbright. Focusing on the impacts of invasive exotic grasses on bobwhite abundance, Flanders documented that bobwhite abundance was 50% greater in pastures that were dominated by native rangeland vegetation, compared to those pastures where Lehman lovegrass and buffelgrass (both are invasive exotic grasses not native to Texas) were prevalent. Flanders further documented that the potential factors behind the low numbers of bobwhites in exotic grass pastures were most likely related to the fact that both arthropods and native forbs (both of which provide key foods for bobwhites) were only half as abundant in the exotic pastures compared to the native rangeland pastures. Thus, when pastures become dominated by exotic grasses, the carrying capacity of those pastures with respect to supporting bobwhites, is reduced by at least half.

Other Points of Progress. —What has been accomplished by the quail researchers at CKWRI during the past 15 years or so is truly impressive. Whether the points mentioned in the bulleted list below qualify as breakthroughs is a matter of opinion. What is true, in my view, is that they represent serious elements of incremental progress from the scientific study of wild quail. Consider, for example the following research results:

- Helicopters are an efficient and practical method for estimating bobwhite density, that when used within a distance sampling platform which has resulted in the first-ever reliable estimates of bobwhite population density in rangeland vegetation.

- Based on analyses of empirical demographic data using population modeling, we now have an objective basis for recommending northern bobwhite harvest prescriptions. We are now in the process of testing these harvest prescriptions.

- Bobwhites use areas of woody cover that are much denser than originally thought, and this woody cover may be a key factor that helps them to survive through drought.

- Cumulative rainfall from 1 April through 31 August explains more than 90% of the variation in annual bobwhite production of young birds.

- Feeding a protein-based ration has no effect on the annual production or size of the home ranges of bobwhites in the wild.

- Removal of nest predators during the breeding season potentially does little to compensate for the effects of heat or drought; maintaining suitable habitat has a much greater influence than predator control.

- Scaled quail are apparently much more sensitive to the presence of even small patches of exotic grasses than we previously thought, because these grasses produce strong barriers to their movements.

- The relatively low prevalence (7-9%) of eye worms in South Texas bobwhites indicates this parasite is probably not causing additive mortality to populations in this part of the state.

All of these findings, whether breakthrough or incremental, represent scientific progress, not just in our lifetime, but over a relatively short period of about a decade and a half. Quail science, like any other branch of science, is never complete or finished. There will always be new questions to ask, or hypotheses to test. Nevertheless, it is rewarding to see such a panoply of research results that are directly applicable to developing a scientific basis for sustaining populations of wild quails in Texas and elsewhere. Texas Quails II will be the next academic book of record for communicating these quail-science results to the larger world.

Photo by Zach Pearson

Conservation Partner Highlight

The South Texas Chapter of Quail Coalition raises money through an annual banquet and auction. Because of the generosity of individuals, groups, and businesses who donate to the auction and the people who attend the event and bid on items, the South Texas Chapter of Quail Coalition has given over $1.2 million to quail conservation projects, conservation education, and scholarships over the past 8 years. If quail and the expansive quail habitat of South Texas inspires you, consider attending the next banquet on August 25, 2018!

Visit www.southtexasquailcoalition.org to learn more.

Looking at vegetation from the skies

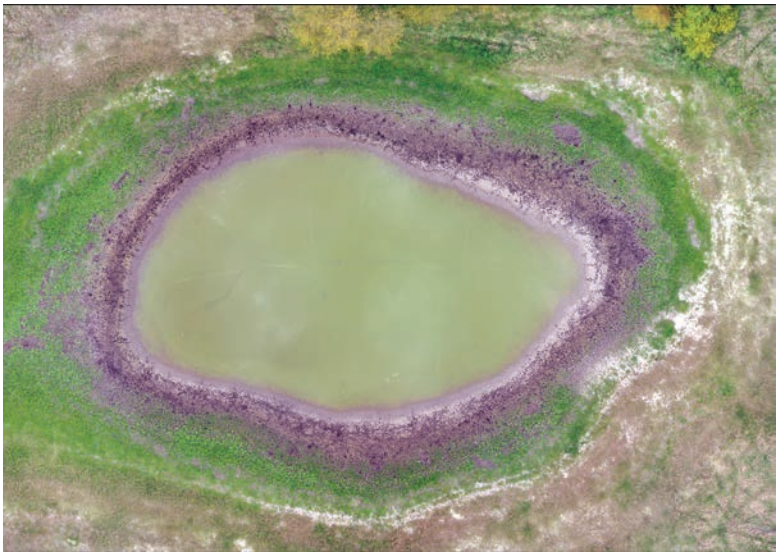
by Humberto L. Perotto-Baldivieso, J. Alfonso Ortega-S., David B. Wester, Karelys Labrador, Jose Mata, Mikayla House

Remote sensing platforms have significantly improved in the last 15 years. The rise of high-resolution commercial satellites coupled with technological advances in spatial and temporal resolution are providing a wealth of information for natural resource managers. In the last couple of years, new satellites have started delivering medium resolution monitoring of the planet on a daily basis and as a result we have new and more detailed insights into fine temporal changes of our landscapes. Parallel to satellites, the development of unmanned aerial systems (UAS) has revolutionized how we can acquire, process, and analyze spatial data. These two platforms combined can deliver very high spatial and temporal resolution that can help us understand the fine scale spatial and temporal dynamics of vegetation.

At The Geospatial Technologies Laboratory at CKWRI, we are using both daily satellite imagery and UAS technology to study vegetation communities and their spatial and temporal dynamics in South Texas. One of our first goals is to develop models that can help us quantify the amount of standing forage biomass in a pasture. Field-based data collection (e.g., hand-clipping biomass from sampling quadrats) produces reliable and essential information that is used to set and adjust stocking rates, but is time-consuming and expensive to acquire; additionally, this method depends on using appropriate sampling units so that pasture-based estimates are reliable. We are developing remotely-sensed estimates of forage biomass that will be accurate and economical. Recently, we conducted a pilot study assessing the feasibility of using UAS technology to estimate biomass in South Texas rangelands. We used a DJI Phantom UAS to capture, process and analyze imagery from a pasture in South Texas. We obtained a digital surface model and an orthorectified image both with a resolution of 2 cm (4/5 in) and a 3D model that allowed us to estimate forage production. Our initial results are very exciting and promising.

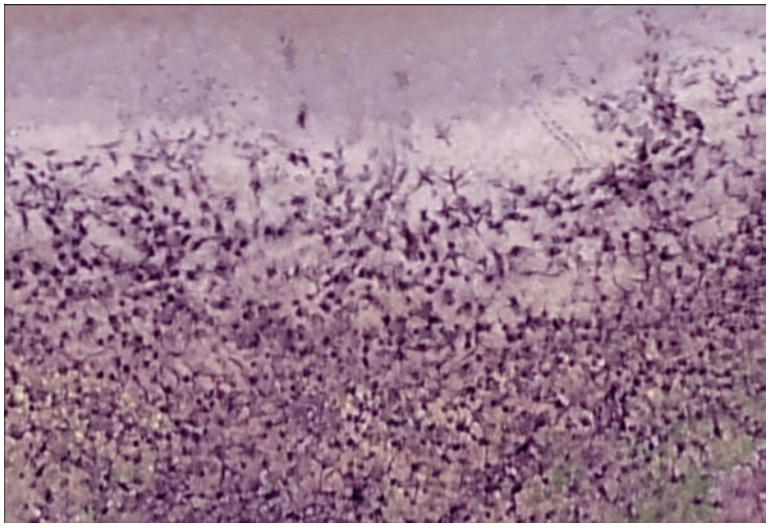
We are developing a refinement in data capture, data analysis that can be combined with field samples to provide better estimates. More importantly, we will be able to estimate the biomass by vegetation community

Woody Cover Vegetation



Pond in the TAMUK South Pasture

3D model of a pasture



Wildlife tracks of animals visiting a water source

and therefore provide the amount and potential quantity of the forage available in the 10-acre plots. Once we build these models we will be able to integrate them to daily imagery and generate high spatial and temporal resolution of forage production at the ranch scale.

Another key question in wildlife habitat management is how wildlife species utilize woody cover. Woody cover is important habitat for feline species and provides cover for other wildlife species such as quail and deer. Recent research has shown that thermal refuge from heat is also very important to wildlife species. Quantifying the amount of woody cover over large scales can significantly improve our ability to assess habitat for wildlife, particularly in southern Texas by incorporating woody cover into wildlife habitat. We are planning to set up permanent plots at the Tio & Janell Kleberg Wildlife Research Park and South Pasture. We will fly each area 4 times a year at an altitude of 100 ft with a double grid pattern using a Phantom 4 Pro and we will process the imagery to obtain a ½" resolution image for each site. We will identify woody material (e.g., leaves, branches and twigs) to estimate woody cover. We will validate our models in the field by obtaining field data with densitometers. Once we are able to assess woody cover, we will develop the vegetation indices using daily satellite imagery and we will develop spatial models to quantify woody cover across large areas in south Texas.

Landscape Ecology at CKWRI

The Landscape Ecology Program is focused on multidisciplinary research aimed at understanding the spatial patterns that drive ecological processes on South Texas rangelands. These processes include animal movement, the effect of land use and land change on wildlife species, and the expansion of invasive species on native rangeland, amongst others. To answer some of these questions, the use of geographic information systems, global positioning systems, remote sensing, and landscape ecology tools which are becoming an essential part of the natural resources professionals' toolbox.

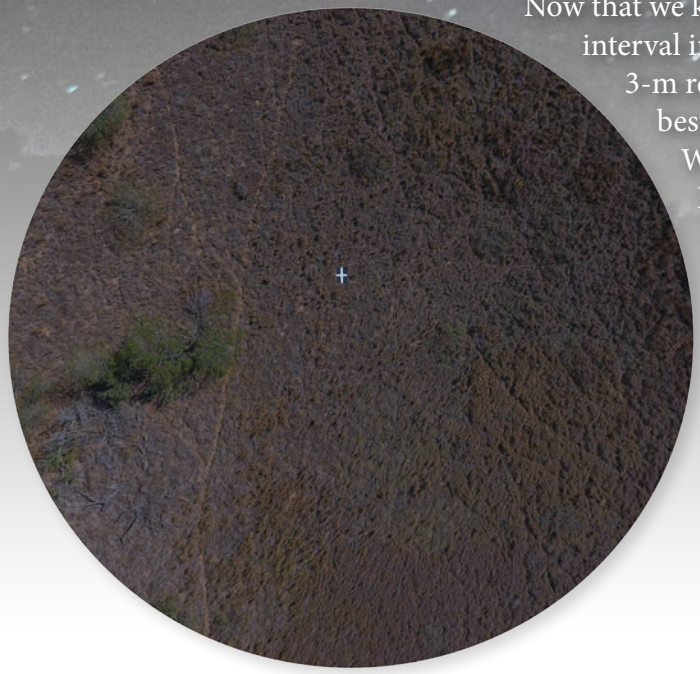
Graduate students mapping tanglehead in the field

Scan the QR code to read the full article highlighted on the following page entitled *Quantifying the spatial and temporal distribution of tanglehead (Heteropogon contortus) on South Texas rangelands.*

Monitoring tanglehead from space

by Humberto L. Perotto-Baldivieso, Jose M. Mata, Fidel Hernández, Eric D. Grahmann, Sandra Rideout-Hanzak, John T. Edwards, Michael T. Page and Taylor M. Shedd

Tanglehead is a native grass to southwestern US rangelands but in the last 15 years its prevalence increased rapidly acting as an invasive. Large areas of monotypic stands have emerged in Jim Hogg, Duval, Brooks, and Kleberg Counties. Using imagery from the National Agriculture Imagery Program, we were able to identify and successfully map tanglehead in 5 sites across these counties. Our image classifications resulted in accuracies greater than 85%. We also assessed the occurrence of tanglehead cover by soil textural classes and found that tanglehead occurred in sandy, loamy sand, and sandy loam soils. Overall, cover of tanglehead increased from 7.1% in 2008 to 17.8% in 2014. Remote sensing combined with spatial analysis and landscape metrics was the key in analyzing dynamics and spread of tanglehead between 2008 and 2014.



Now that we know we can identify tanglehead with a 1-m resolution and 2-year interval imagery, we are looking forward to expanding our research to use 3-m resolution of daily satellite imagery. This will allow us to identify the best time of the year for classifying tanglehead using remote sensing. We could then use this information with large-scale platforms, such as LANDSAT, to develop regional assessments of changes in land cover and expansion of tanglehead. Our findings show the value of analyzing spatial and temporal dynamics of tanglehead with remote sensing techniques. These tools will help us assess the effects of tanglehead on wildlife habitat, livestock operations, and restoration strategies.

Left is an image from a drone of an area invaded with tanglehead. The spatial resolution of the image is 1.8 cm (3/4 in per pixel).

ONLINE

For more information on this study, please visit: https://ecologicalprocesses.springeropen.com/articles/10.1186/s13717-018-0113-0

Texas Native Seeds Program expands further in pursuit of statewide impact

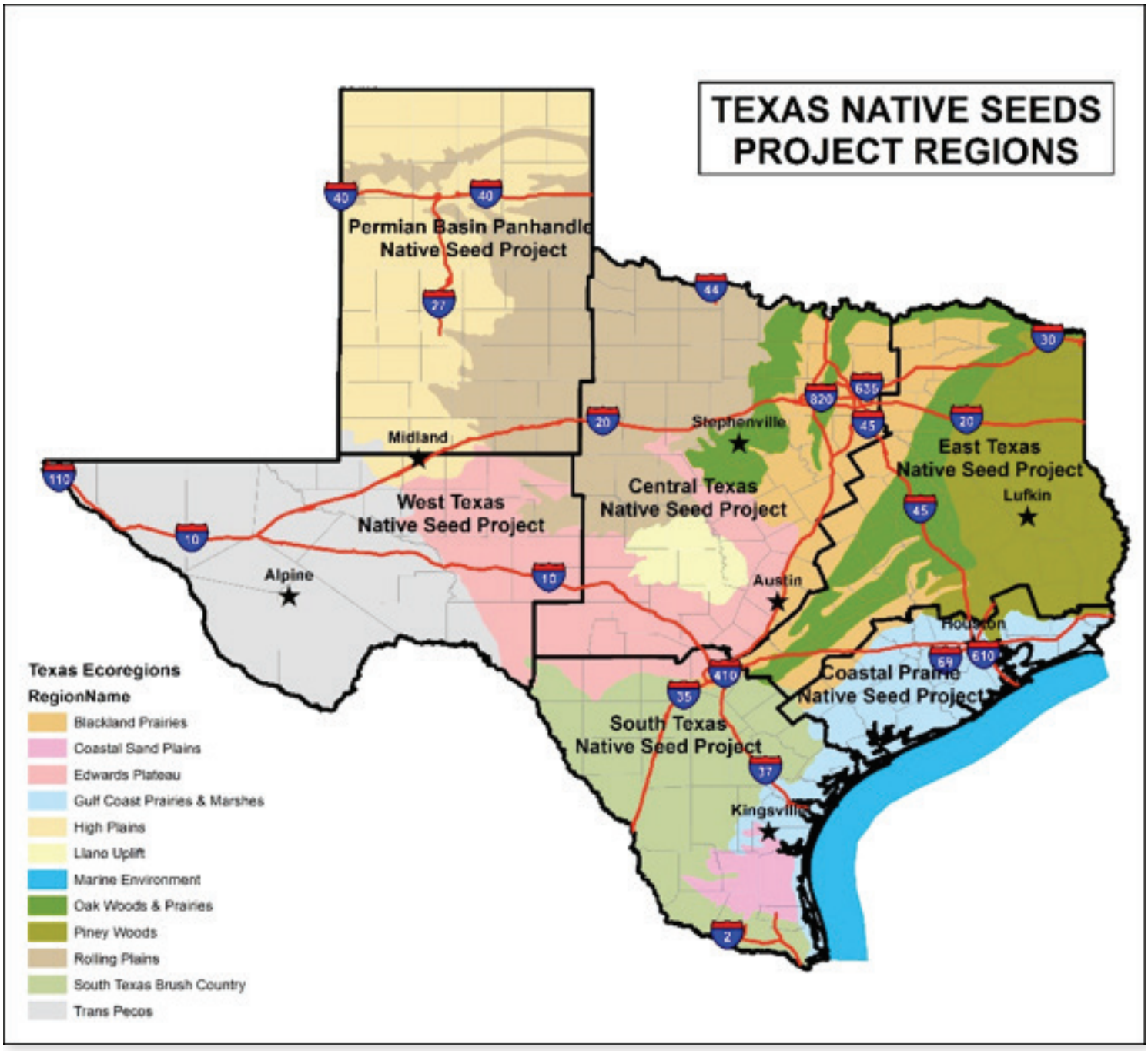
by Forrest S. Smith-Dan L Duncan Endowed Director, Texas Native Seeds Program

Two early supporters of South Texas Natives (STN) were Buddy and Ellen Temple. Their generous funding, and restoration efforts at the Temple Ranch were important for advancing STN's mission. As passionate as they were about our South Texas efforts, Buddy and Ellen longed for a similar project in their home region of East Texas. As of this spring, East Texas Natives Project (ETN) has been launched thanks to a major contribution by Ellen in Buddy's honor. Several other contributors have joined in support of ETN. Additionally we have been working to put the Coastal Prairies region of Southeast Texas. These new projects have made the Texas Native Seeds Program (TNS) a true statewide effort.

History of Expansion of the STN Model

We began expanding the geographic impact of our native seed work in 2010. The catalyst was the Texas Department of Transportation (TxDOT). As an agency working throughout Texas, TxDOT needed native seeds and restoration methods across the state. As a result, TNS was born, with a mission of providing all of Texas with locally-adapted native seeds for restoration, and promoting the restoration of native plants throughout the state both on TxDOT's right of ways, and on adjacent private lands. The Texas Transportation Commission and Vegetation Management Director Dennis Markwardt have been tremendous advocates for this leadership by TxDOT.

Based on the sage advice of STN Advisory Group co-chair, Katharine Armstrong Love, we initially took on the challenge of a statewide program by adding just 2 regions of where needs were greatest, and where we had partners to help. This included Central Texas, in cooperation with Dr. Jim Muir at Texas A&M AgriLife Research Station in Stephenville; and in West Texas, with Dr. Louis Harveson and Borderlands Research Institute at Sul Ross State University joining forces as cooperators. Paramount to this expansion was TxDOT's support and long-term funding commitment enabling the expansion. In addition, resources provid-



Map of project regions of the Texas Native Seeds Program.

ed TNS by the Dan L Duncan Family endowment had a tremendous impact enabling this growth.

As we have grown, the participation and involvement of the USDA NRCS James E. "Bud" Smith Plant Materials Center in Knox City led by Brandon Carr has been crucial. The Texas Plant Materials Specialist, Rob Ziehr, and NRCS State Conservationist, Salvador Salinas have also been integral supporters of the TNS growth. We are also thankful for the support of Douglass King and Bamert Seed Companies whose work in seed production for these new regions has been critical.

On-the ground efforts in Central and West Texas began in 2011. In similar timing as the STN project, we released our first native seed selection for these new regions, Guadalupe Germplasm white tridens, in 2017. Production of this seed release was licensed to King and Bamert seed companies, and the species is already being supplied commercially. This spring, we distributed two important native grass releases for West Texas, Santiago Germplasm silver bluestem and Permian Germplasm whiplash pappusgrass, for production. Releases of purple threeawn, little barley, and slim tridens will begin being produced in 2018, followed by West

Texas selections of sideoats grama and Central Texas selections of sand dropseed and hooded windmillgrass next spring. TNS operations in West Texas are led by Colin Shackelford, who has been at the helm of work there since 2011, and in Central Texas by Randy Bow, who has worked with us since 2016. Both programs are starting to hit on all cylinders under their leadership.

Future releases for Central Texas will include selections of little bluestem, meadow dropseed, silver bluestem, tall grama, hairy grama, and seep muhly; and for West Texas releases will include galletagrass, blue grama, sand dropseed, Greggs mistflower, Tahoka daisy, and skeleton leaf goldeneye. Recently, Central Texas efforts have been expanded with support from Rod Sanders and the Horizon Foundation. Rod's Sandbrock Ranch will become a much needed research location in this region of high demand for native seeds.

Filling in the map West and North, and expanding East

In 2017, we were able to expand our efforts further in West Texas to include the Permian Basin region and adjacent Panhandle. This growth was made possible through the generous support of CKWRI Advisory Board Member Tim Leach and Concho Resources, the Midland Based oil and gas company he founded. In response to restoration needs in this region as a result of energy exploration, in November we hired Sam Lutfy as Assistant Director in Midland. Sam is working to engage energy companies and landowners to put great effort toward native plant restoration. We are extremely excited about the opportunity to partner with Concho and other energy operators in this region.

Also in 2017, with Ellen's pledge of support we began organizing East Texas efforts. After several meetings with regional conservationist that drew standing-room only crowds, we began successfully raising funds to start operations. TxDOT and Texas NRCS have each provided substantial support to ETN, as have several private donors and the U.S. Forest Service. In February, we hired former STN technician Tyler Wayland as ETN Assistant Director. Tyler is working closely with NRCS Nacogdoches Plant Materials Center led by Alan Shadow. This spring we began region-wide seed collection in the region.

Tyler Wayland, East Texas Assistant Director, collecting native seeds.

Simultaneously in 2017, we began advancing a goal to expand the STN model along the Gulf Coast to improve seed supply for the Coastal Prairie region. To do so, we have partnered with Jim Willis and Gary Stephens of Wildlife Habitat Federation, of Cat Spring, TX, and Sonia Najera and Aaron Tjelmeland of The Nature Conservancy. Both groups have already made advances toward restoration seed supply in the region, and we hope to add to those efforts. This spring we are planting two evaluation projects - little bluestem and knotroot bristlegrass. Start-up funding for the Coastal Prairie region effort has been provided by private landowners, NRCS, TxDOT, and the Harvey Weil Trust. We are seeking additional resources for the Coastal Prairie Project, and if successful, we hope to station a regional assistant director in Houston to coordinate these efforts in 2018.

In addition to our five regional projects across Texas, STN in South Texas remains the bellwether for regional native seed development and restoration programs. Under the experienced direction of TNS Associate Director Keith Pawelek, and Research Coordinator Tony Falk, restoration results and seed availability for South Texas are hallmarks. Our successes in South Texas are thanks to long-standing support from a number of private donors, including the Bass, Robert and Helen Kleberg, Richard M. Kleberg, Sr., Temple, Kelleher, Leonard, and Cato Families. We are also blessed to have the cooperation of NRCS's Kika de la Garza Plant Materials Center led by John Reilley, TxDOT, Texas

Large scale native plant restoration seeding on a power line right of way in the South Texas Sand sheet.

Sandbrock planting (large scale planting)

Seed increase Stephenville from October.

Parks and Wildlife Department, and Rio Farms. Our home base for STN, and TNS administration-TAMUK and the CKWRI, provide valuable leadership and support, especially, Shyla Rabe our TNS Administrative Coordinator.

Once recent seed mix recommendations topped 1,000 acres in project size, numerous projects of several hundred acres in South Texas have been facilitated because of the work of STN. We believe the restoration results being achieved are among the best anywhere, with seed mixes of 30+ species now able to be planted, and consistent restoration results well documented across the region. STN has and will continue to make a significant impact on South Texas restoration.

The road ahead

Demand for native seeds in Texas continues to increase, while supply and diversity of species available to consumers remains a limiting factor to successful restoration in many regions of the state. Several factors influence this growth in demand.

First, awareness of the success of the STN model of seed source development, and resulting availability of a wide diversity of high quality native seeds with demonstrated ability for successful restoration has changed perceptions of what may be possible through native plant seeding. Second, growing societal appreciation of the importance of native plant communities for wildlife, conservation, and environmental health underlies demand for native seeds, and support for TNS. This was exemplified recently by the explosive interest of the public and agencies in monarch butterfly habitat restoration. But, such efforts are limited in success and scale because commercial supply of native seed is lacking. STN has been working to develop additional pollinator plant seed sources, and commercialized a native selection of milkweed with King Seed Company in the last year. This release, named Mariposa Germplasm zizotes milkweed, is the nation's first formally released and commercialized native milkweed seed source. Pollinator- and monarch-habitat seed source development is just one of many examples of the TNS Program's wide appeal, and relevance.

Finally, a trend toward greater use of native plants for restoration in the transportation and energy industries has helped carry our work ahead. In 2014, TxDOT

specified many STN releases and other native seeds for two-thirds of Texas, resulting in greater demand. We have had considerable success advising landowners on native seed specification, and partnering energy companies to use native seeds on pipeline and transmission right of ways. Results possible from these partnerships were showcased in 2017 by a project with King Ranch, other Kenedy County private landowners, and Enbridge on the Valley Crossing Pipeline. As a result of this partnership, 46 miles of the Valley Crossing Pipeline were reseeded using a native seed mix designed to provide benefit for migrating monarchs. As more and more energy producers integrate native seed use into their operations, we will see continued increases in demand.

The Texas Native Seeds Program has proudly expanded its impact and scope of work to all of Texas in the last year.

We are committed to delivering the native seeds and knowledge necessary for restoration in Texas to reach every corner of the state in the years ahead.

We are extremely thankful for the support, cooperation, and trust of the thousands of landowners, many state and federal agencies, and our long list of donors and advisors for making this work possible. TNS is poised for many more successes to come, and we look forward to sharing them with you. Please don't hesitate to contact us if we can be of help with your next native plant restoration effort!

Doing restoration research trials in the Permian Basin.

Native pollinator habitat planting in the Rio Grande Valley of South Texas.

Preparing a native plant evaluation site in the Coastal Prairie region.

TNS Staff and Contact Information

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The Texas Native Seeds Program

Texas Native Seeds is a research and development program, augmenting and providing products to the commercial seed industry. TNS works to develop native seeds that can be produced commercially, in volumes needed by restoration professionals in order to have ecosystems level impacts on native plant and wildlife conservation. TNS is a visionary effort to do something now, while substantial native plant populations still exist and provide a reservoir for collection, evaluation, and development of tomorrow's seed sources today.

DID YOU KNOW

South Texas Natives, Valley Crossing Pipeline, Douglass King Seed Company and landowners have worked together to design the best possible commercial native seed mix to restore native plant communities to the Valley Crossing Pipeline right-of-way in Kenedy County. An emphasis for this seed mix has been inclusion of important native pollinator plants in order to provide needed nectar sources for the monarch butterfly during their spring and autumn migration through the area.

Student Highlight

Brandon Palmer, Master of Science
Hometown: Rochester, Michigan
Project: *Effects of Habitat Restoration and Thermal Environments on Northern Bobwhite Habitat Use*

Brandon is from Rochester, Michigan. He knew from an early age that he wanted to study conservation and the great outdoors. He graduated with a bachelor of science in Fisheries and Wildlife from Michigan State University. Brandon is currently a master student with CKWRI and is studying the effects of habitat restoration and thermal environments on Northern Bobwhite habitat use.

Student Highlight

Gael Sanchez, Master of Science
Hometown: Albuquerque, New Mexico
Project: *Landscape Genetic Analysis of Mule Deer to Guide the Management of Chronic Wasting Disease in Texas*

Gael received her bachelors of Conservation Ecology from New Mexico State University. She became a part of CKWRI in the Spring of 2016 to pursue a master's studying Mule Deer genetics and the spread of Chronic Wasting Disease. She chose CKWRI to be part of the incredible community of wildlife research that this Institute is known for both nationally and internationally.

Training the Next Generation: Hands-On Learning for the Future of Wildlife Conservation

by Randy W. DeYoung

Students are more than boots on the ground for the research performed by the Caesar Kleberg Wildlife Research Institute. In the era of online degrees, there is simply no substitute for the hands-on experience gained from field research. Applied research is especially difficult in our environment. One must work long hours in unpredictable and often unpleasant weather, surrounded by snakes, ticks, chiggers, mosquitoes, Africanized bees, and other nasties. The vegetation is poisonous or covered with thorns. One must surmount flat tires, broken equipment, oilfield traffic, and ornery livestock, and somehow stay on schedule despite droughts, hurricanes, and wildfires. One must respect the property and the wishes of the private land stewards who allow us access to conduct the research. For graduate students, the journey is punctuated by tedious laboratory work and GIS or statistical analyses, followed by preparation and defense of a highly technical thesis or dissertation. Finally, graduate students are expected to prepare one or more scientific and popular articles about their work. Clearly, all of this requires a passionate and detail-oriented person with a strong work ethic.

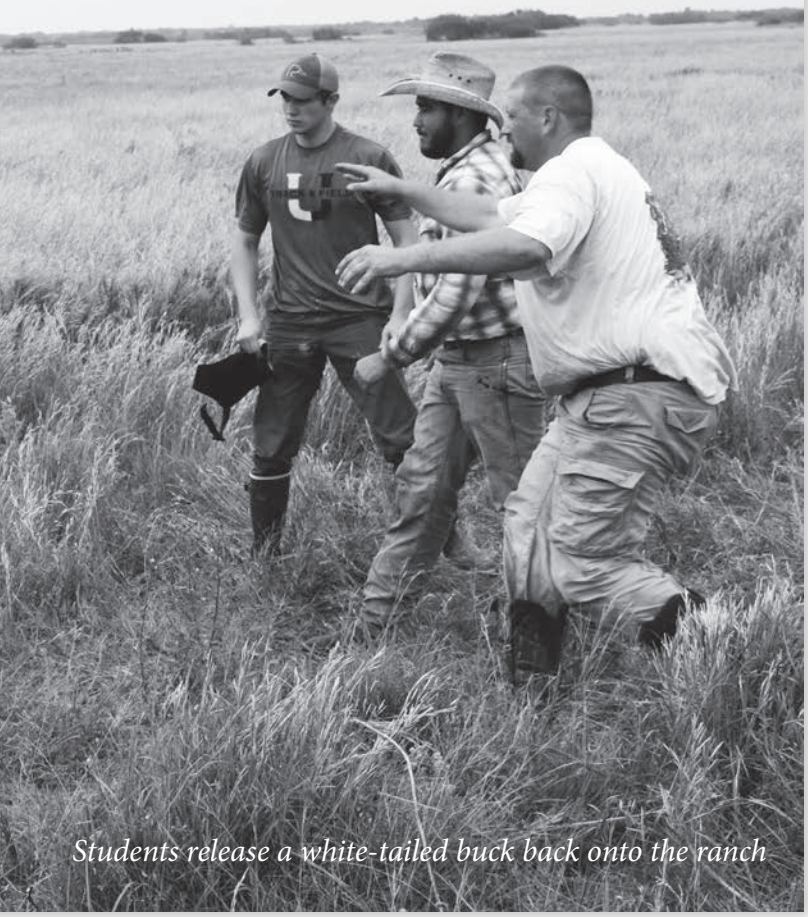
How can students learn and demonstrate the qualities expected of a professional biologist? Much of the learning is hands-on, in the field. We strive to involve undergraduates in our research when possible. Our ultimate goal is for aspiring biologists to gain the much-needed experience to pursue a job or the demands of graduate school. With the support of the East Foundation, the Caesar Kleberg Wildlife Research Institute has touched the lives of many current and future wildlife biologists. One recent study, termed the 'deer capture project,' has been especially impactful. Despite a rather unassuming title, the deer capture project has impacted hundreds of aspiring wildlife biologists during the past 7 years.

Formed in 2007 from the estate of Robert C. East, the East Foundation mission is to support wildlife conservation and other public benefits of ranching and private land stewardship. Research, education, and outreach are the pillars of a three-legged stool for the Foundation, where each has equal priority to the East Foundation's mission. Therefore, the ideal research study would combine each of the three pillars. From a research standpoint, the most insightful studies are long-term, so that we can observe how our south Texas

Neal Wilkins, CEO of the East Foundation, gives students an orientation to the San Antonio Viejo Ranch

Sampling saliva from a doe captured on the East El Sauz ranch for a study of stress hormones.

Student volunteers pose for a photo after a day of capturing deer on the East El Sauz ranch.



Students release a white-tailed buck back onto the ranch

environment affects the animals and plants under different conditions. 'Long-term' may mean at least five, and ideally ten years or more. Some research activities provide the perfect outdoor laboratory for hands-on learning, especially research that involves the capture and handling of white-tailed deer. This is because deer captures require a large team of volunteers to transport and restrain deer, record physical and antler measurements, sample blood, hair, and tissue, and release the deer unharmed. There are many diverse 'jobs' – opportunities for hands-on learning –during captures, some of which require little skill, others that can be learned in a few hours' time.

This background set the stage for a great partnership: a long-term study that requires a large pool of volunteers a few times of year, with diverse opportunities to handle animals and participate in research for a range of skill levels – a perfect match for the goals and expertise of the East Foundation and the Caesar Kleberg Wildlife Research Institute. The deer capture project began in the fall of 2011. During four consecutive weekends, the team of scientists from the Institute and Foundation capture deer on four south Texas properties owned and operated as cattle ranches by the East Foundation. We recruit undergraduate student volunteers from wildlife programs, including Texas A&M-Kingsville, Texas A&M-College Station, Sul Ross, Tarleton State, Texas State, and Stephen F. Austin. Each year during 2011–2017, we involved about 75 undergraduates, who captured and sampled over 400 wild deer; in the seven years of the project, nearly 500 student volunteers and over 2,800 captures. The data have formed the basis for a doctoral dissertation, a master's thesis, and numerous presentations to both lay and scientific audiences. We have quantified the influence of soil type on body mass and antler size, the influence of rainfall and age on fawn recruitment, the effect of drought and lactation on stress hormones, and investigated the genetic similarity within and among populations. All students learn about the results of the research and thereby deer ecology in South Texas. They are also able to interact with and learn from the East Foundation and the Caesar Kleberg Wildlife Research Institute staff and faculty. It is harder to quantify the influence on student education, but the experience has opened the door to a valuable learning opportunity, an investment in the future of conservation that we believe will be repaid many times over.

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