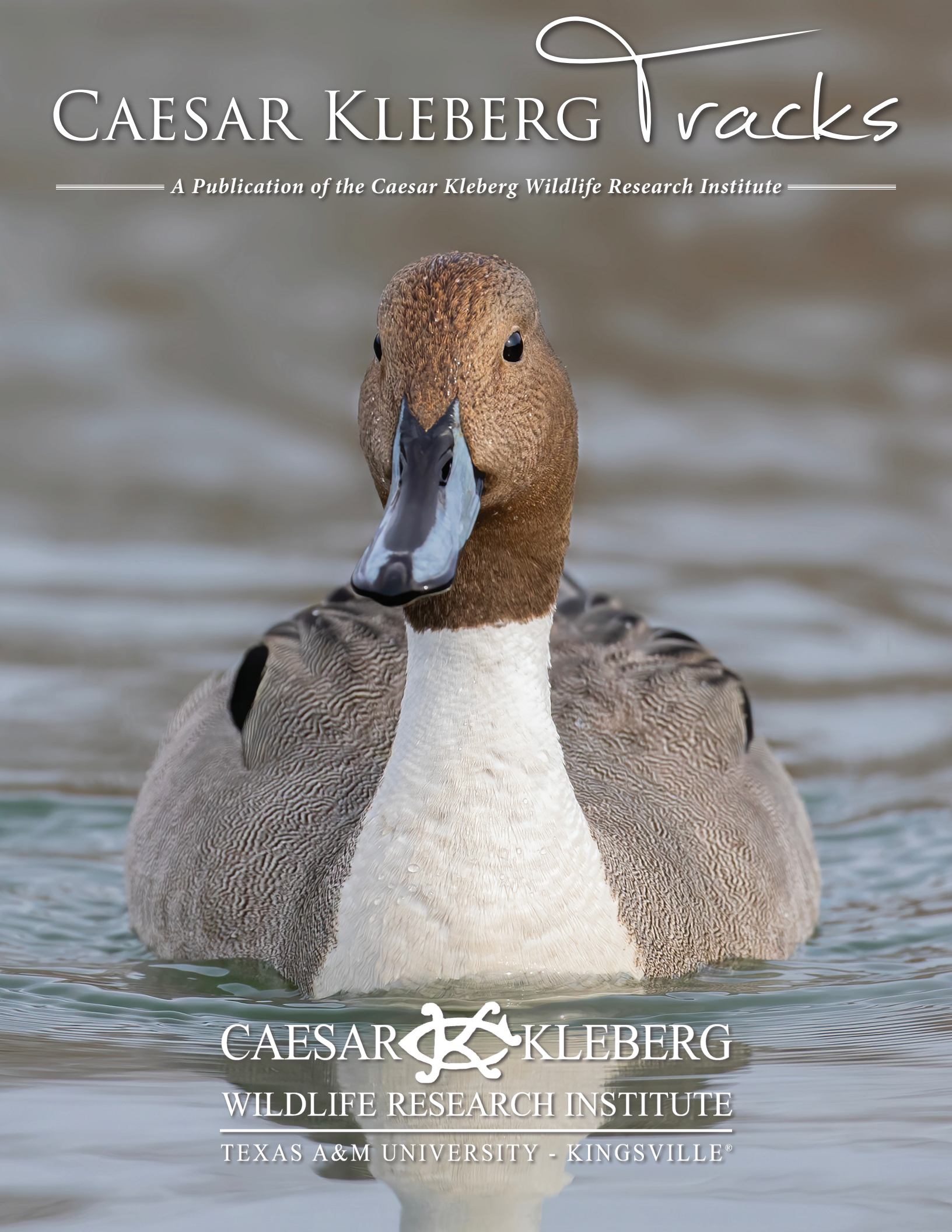
Caesar Kleberg Tracks

A Publication of the Caesar Kleberg Wildlife Research Institute



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

Caesar Kleberg Tracks

Volume 9 | Issue 1 | Spring 2024

In This Issue

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 Texas wildlife.

Visit our Website

www.ckwri.tamuk.edu

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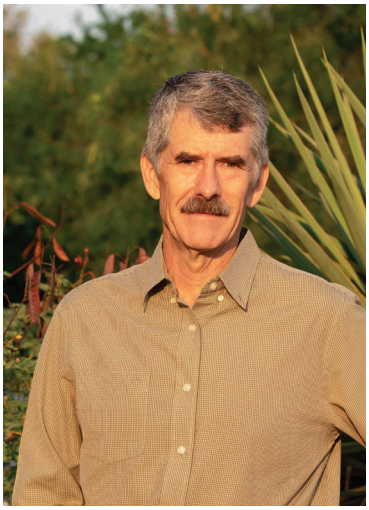
FROM THE DIRECTOR



Summer is here and although there is plenty to keep a land steward busy, an afternoon stroll across the pasture is not usually how one chooses to spend their time. When we do spend time outside during summer, wildlife sightings are less common than during cooler months. Wildlife may be less visible now, but there is a miracle happening behind the cloak of summer heat and haze. That miracle is the annual pulse of reproduction that is critical to maintaining wildlife populations and which provides game for us to pursue.

As a biologist, I understand the importance of reproduction to wildlife populations. Animals die of many causes, and some disperse from their birth area. I understand that wildlife populations could not maintain themselves without new individuals. What I failed to fully appreciate until recently is how tenuous this annual infusion of new animals is.

My epiphany happened earlier this summer while watching and photographing purple martins in my backyard. Like many bird species, purple martin chicks are featherless and helpless when they hatch. Both parents work hard, bringing an amazing variety of insects to their young. With up to 6 young in a nest, the parents are very busy. They are greeted by gaping mouths of hungry chicks every time they return to the nest. Into these mouths the parents stuff bugs ranging in size from mosquitoes to dragonflies. The chicks somehow swallow even the biggest bugs. The parents' hard work pays off and the chicks grow quickly.

After about 4 weeks, the chicks are nearly adult sized and fully feathered. A crucial stage is reached when they fledge, or leave the relative safety of their nest. These chicks are like teenagers entering a world they know little about with a body they are still learning how to use. As I watched the recently fledged chicks sit on the ground or flutter a few feet over it, I thought, "How in the world will any of these chicks survive". They could easily succumb to starvation, dehydration, heat, predators, or simple accidents. The parents somehow keep track of their multiple chicks and continued to feed them, but there is only so much they can do.

Obviously, a sufficient number of chicks become adults to maintain the population of purple martins. All species must get enough young through the early stages of life to balance death losses, but many young do not make it. On average, only 15% of white-tailed deer fawns conceived reach their first birthday. Quail chicks are notorious for dying at an even higher rate. In some places, the deck is stacked against reproduction and the species is no longer found there. Not producing sufficient young in some areas is one cause of the contraction of the bobwhite's range and the reason ocelot populations continue to struggle.

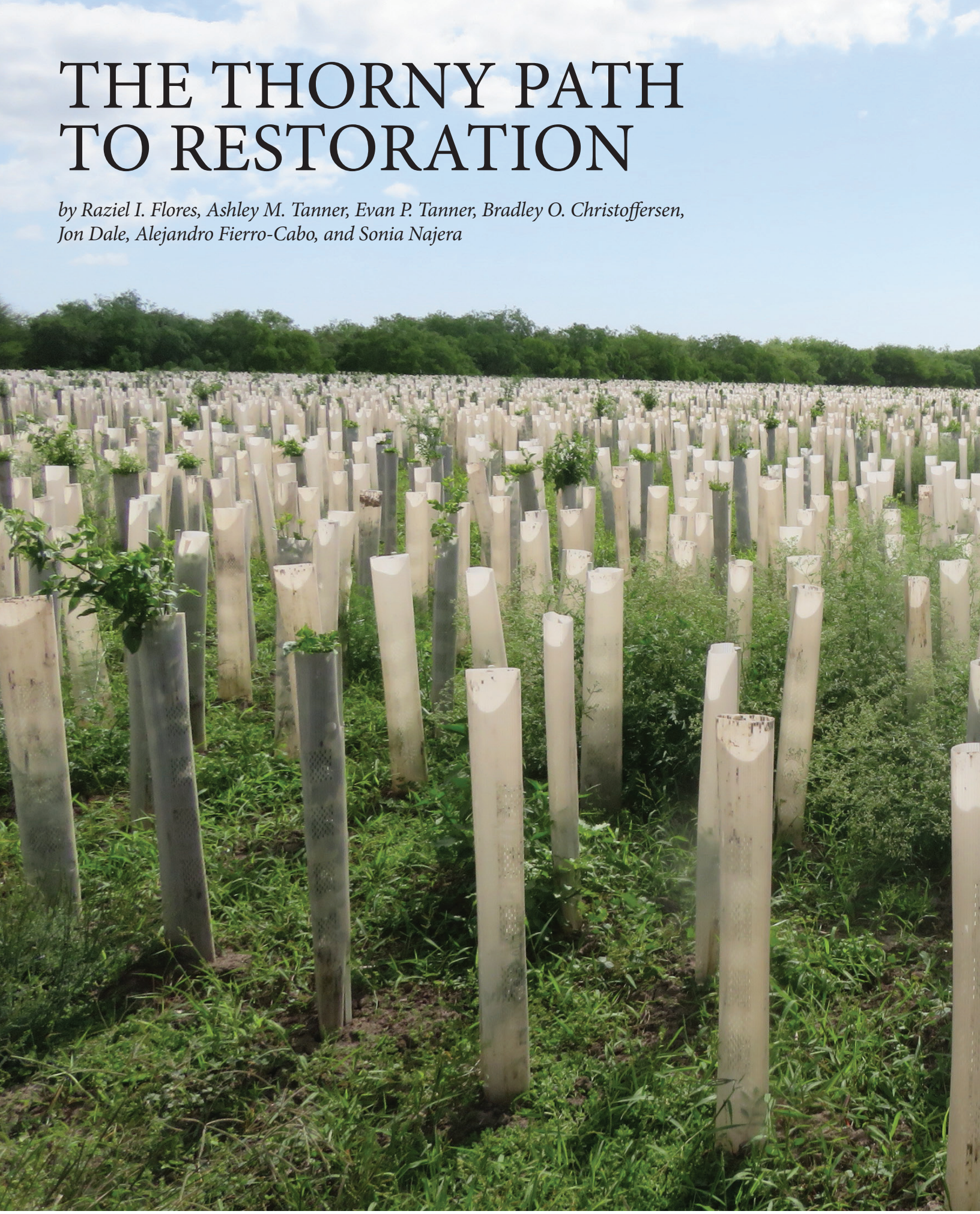
So, what is the lesson? I learned two things. The first is the importance of setting the table for success. Landowners need to be empowered to provide the best habitat possible to support reproduction of all wildlife. That is what Caesar Kleberg Wildlife Research Institute seeks to do through our research and graduate-student training. The other lesson is to marvel at the tenacity of parents to raise their offspring and the resolve of offspring to survive. Each young animal is fighting the odds, but by being resolute, resilient, and lucky, some survive. It is a lesson each of us concerned about the natural world can take to heart.

All the best,

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

THE THORNY PATH TO RESTORATION

by Raziel I. Flores, Ashley M. Tanner, Evan P. Tanner, Bradley O. Christoffersen, Jon Dale, Alejandro Fierro-Cabo, and Sonia Najera



The Lower Rio Grande Valley of South Texas is a biodiversity hotspot that has attracts wildlife enthusiasts from around the world. The region is well known for having the highest avian species richness in the country with approximately 500 total species, nearly 400 of which are documented annually, and over 150 of which breed annually in the Lower Rio Grande Valley (hereafter LRGV). An additional 44 species of mammals, 115 species of reptiles and amphibians, and approximately 300 species of butterflies inhabit the ecosystems within the LRGV, including numerous threatened and endangered species, such as the ocelot. There are a combination of factors that support such patterns of biodiversity, but one of the principal components is the dense and diverse vegetation. A thorough understanding of habitat characteristics associated with this ecosystem will help develop appropriate approaches towards conserving and restoring these areas in a rapidly growing urban landscape.

South Texas is located in a transition zone between the neotropics, temperate North America, and the Chihuahuan Desert. The relatively flat topography and crossroads with two major avian migration flyways facilitate seed dispersal and allow convergence of adjacent climates and floras. These environmental characteristics have posed challenges for botanists to classify the vegetation and has led to multiple nomenclatures. Although the most common reference is "Tamaulipan thornscrub", the vegetation of South Texas has also been referred to as "Tamaulipan thornforest", "South Texas brush country", "xerophytic shrubland", "Rio Grande Plains", "mesquite-grasslands", among others; all of which have been used interchangeably and inconsistently in conversations regarding management, conservation, and restoration.

Figure 1. Seedlings of native woody plants were recently planted for reforestation at Laguna Atascosa National Wildlife Refuge, Texas. Photo credit: Raziel Flores

Figure 2. Native thornscrub plant communities can be found across private ranches in South Texas. Photo taken in Starr County, Texas. Photo credit: Raziel Flores

Regardless of the name, the vegetation is consistently described as "short," "dense," "thorny," and occasionally even "mean"; however, attempts to provide further detail quickly become an abstract concept as a result of the wide range of growth patterns found in many South Texas plants. A single species can exhibit tree-like and shrub-like growth forms between communities and within communities, making it unclear whether to classify the structure as a forest or shrubland community. Various species also display unpredictable abundance patterns that can rapidly transition from being locally absent to dominant, such as the sporadic mottes formed from root sprouts of the coma tree. The vegetation of South Texas does not fit into a perfect box because plant communities are as diverse as the wildlife species that inhabit them and these communities transition through space and time in a seemingly infinite arrangement of species, habitat associations, and structure.

Like most habitable land in the world, the vegetation and biodiversity of the LRGV has been severely affected by anthropogenic land use, the main threats being habitat degradation and loss. Extensive land clearing occurred in the early 1900's, particularly after the creation of several new irrigation districts in the 1920's. A shift in agricultural practices transitioned small farms to large commercial agriculture in the 1950's, further accelerating land clearing. Human population growth has also adversely impacted the landscape, and urban landscapes currently dominate many parts of the LRGV and will continue to do so for the foreseeable future. From the mid-1930's to 1983, the net loss of native woodland cover in Cameron County was estimated at 91%, with approximately 75% of the original vegetation being replaced with agriculture. It is estimated that since the 1920's, more than 95% of the original native brushland and 99% of the riparian vegetation has been cleared for agricultural and urban development. Many of the native plant communities in the LRGV have become extirpated and the remaining ones stand as unique relics that are disconnected from an increasingly fragmented landscape.

Given this extensive loss, restoration efforts have been a key component of strategies to halt and

Figure 3. Old growth thornforests stand as unique relics, disconnected from an increasingly fragmented landscape. Photo taken in Cameron County, Texas. Photo credit: Hernan Colmenero

reverse habitat degradation in South Texas. The first documented habitat restoration in the LRGV was conducted at one of the Las Palomas Wildlife Management Areas by Texas Parks and Wildlife Department in the late 1950's, with the goal of creating habitat and hunting opportunities for the previously declining white-winged dove. Restoration efforts led by the U.S. Fish and Wildlife Service began in the early 1980's and continue to date. These practices usually involve acquiring cropland and revegetating it with native trees and shrubs. Several challenges have surfaced since the onset of the restoration process, such as seedling availability, seedling mortality, and invasive grass encroachment. Setting target goals of what constitutes success in a highly diverse ecosystem is a challenge in of itself, yet the results of these restoration efforts are generally interpreted as having mixed success. Nonetheless, there is consensus that supporting an increasing degree of biodiversity and habitat connectivity is a hallmark of successful ecological restoration.

The Caesar Kleberg Wildlife Research Institute, The University of Texas Rio Grande Valley, The Nature Conservancy, and American Forests have partnered with the U.S. Fish and Wildlife Service to enhance thornforest restoration efforts in the LRGV. Our goal is to learn from previous attempts and continue to improve restoration approaches. A framework will be implemented to identify target locations and inform spatial planning for future restoration using habitat connectivity models and information on the habitat requirements and movement characteristics of endangered species (i.e., ocelots). In addition, information determining restoration success at various stages of restoration practices (i.e., time since restoration planting) will be developed using "old growth" reference sites. Improved propagation practices, such as timing of seed collection, storage, germination, and growth will also be established. Finally, restoration monitoring will be conducted to help understand factors influencing plant survival and identify post-planting strategies to improve success. Though the restoration of native plant communities to their exact former state may not be feasible, restoring these plant communities to states that still sustain important ecological processes, self-regenerating capabilities, and resiliency is still possible. The late ecologist Tony Bradshaw described ecological restoration as "the acid test of our ecological understanding" and it's time to put our knowledge to the test for the Lower Rio Grande Valley.

Figure 4. Old growth stands of thornforest play a critical role in understanding what target goals should be established when determining the success of restoration efforts. Photo taken in Cameron County, Texas. Photo credit: Hernan Colmenero

WEATHER OR NOT:

Tracking Northern Pintails through Adverse Weather during Spring Migration

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

Each spring, millions of birds set off on incredible migratory journeys, flying thousands of miles from their winter quarters to raise young in northern breeding areas. Making this journey has many benefits for migratory birds, allowing them to take advantage of a flush of resources on breeding areas. It also allows them to avoid extreme weather in the places they've left for the season, such as the summer heat in southern Texas.

Figure 1: Northern pintails feeding and swimming at the Santa Ana National Wildlife Refuge in Alamo, TX. Photo by Kyndra Chastain.

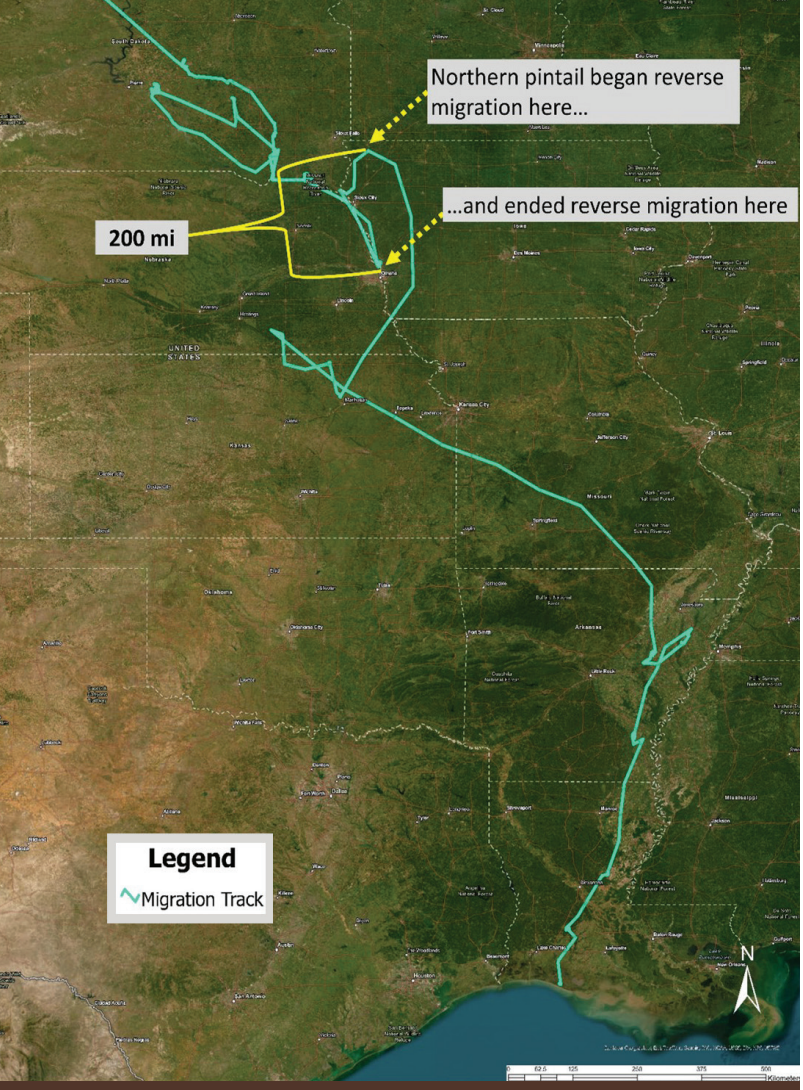


Figure 2: The GPS track of a female northern pintail, captured in Louisiana, showing a nearly 200-mile reverse migration during Spring 2023, likely during a late snowstorm (start, stop and distance marked by yellow arrows/brackets). Map by Joseph McGovern. Map background from ESRI, Redlands, CA.

However, migration requires a lot of energy. Although some birds have been documented flying thousands of miles without stopping, most take periodic breaks in areas known as stopovers, where they can rest and refuel. Most dabbling ducks (i.e., ducks that feed by tipping in shallow water as in *Figure 1*) need bodies of water where they can safely rest while they feed on aquatic plants and insects. Stopover sites for dabbling ducks include, but are not limited to, wetlands, farm ponds, rivers, and lakes.

An understanding of stopover ecology is vital to the conservation of migratory birds. However, we know relatively little about the role stopover sites play in providing protection from challenging weather conditions. Adverse weather conditions often pose unique challenges during an already-challenging period of a migratory bird's life. For instance, how might a bird respond when a late blizzard or cold front occurs during spring migration, providing inclement weather and strong headwinds at a stopover site? Two options are typically available; first, they can fly back south to an area with better weather conditions, a pattern known as reverse migration (*Figure 2*), or second, they find a way to seek shelter and ride out the storm. Both of these scenarios come with disadvantages. Birds either move back south and expend energy flying or stay at the stopover and expend energy attempting to stay warm. These decisions to move or stay can impact the timing of arrival to breeding areas as well as the amount of energy reserves the bird has upon arrival; both of which are known to influence their success during nesting.

Few studies have looked at how waterfowl respond to short-term, rapid changes in temperature and wind, particularly during migration. To address this, we seek to better understand the behaviors of the northern pintail in response to adverse weather conditions during migration. The northern pintail is an ideal species to investigate such a question because it migrates much earlier than many other dabbling duck species, sometimes nesting as soon as the snow melts in the northern prairies. This may mean that they are able to deal with colder temperatures better than species that migrate later, like blue-winged teal. However, this also means they are often exposed to colder conditions during much of their migration. Pintail populations have also been in decline in North America, in contrast to most other dabbling duck species, and it's not entirely known why this is the case. Understanding the challenges faced by the northern pintail during migration, and how they navigate and overcome these obstacles, will be essential to providing effective management prescriptions during this critical period of their annual cycle.

Along with numerous state, federal, and private collaborators, researchers with the Waterfowl and Wetland Bird Program at CKWRI captured over 600 female northern pintails on wintering areas in Texas, Louisiana, Arizona, New Mexico, and California and fitted them with state-of-the-art GPS tracking devices. These devices tracked the birds from wintering areas, throughout spring migration, and to breeding areas by communicating with the cell phone network. We are currently using movement information provided by the tracking devices to understand how northern pintails respond to on-the-ground weather conditions at stopover sites.

The ability to measure on-the-ground weather conditions (i.e., the conditions a bird will actually experience), known as microclimate, will help us better understand northern pintail responses to adverse weather events. Vegetation structure, among other stopover characteristics, cause temperatures to vary greatly over small areas throughout the day (*Figure 3*). Because of this, the temperatures reported on a weather app are not really what a pintail out in a wetland has to contend with. Measuring microclimate weather conditions will give us a much more accurate picture of how pintails navigate adverse weather during migration periods.

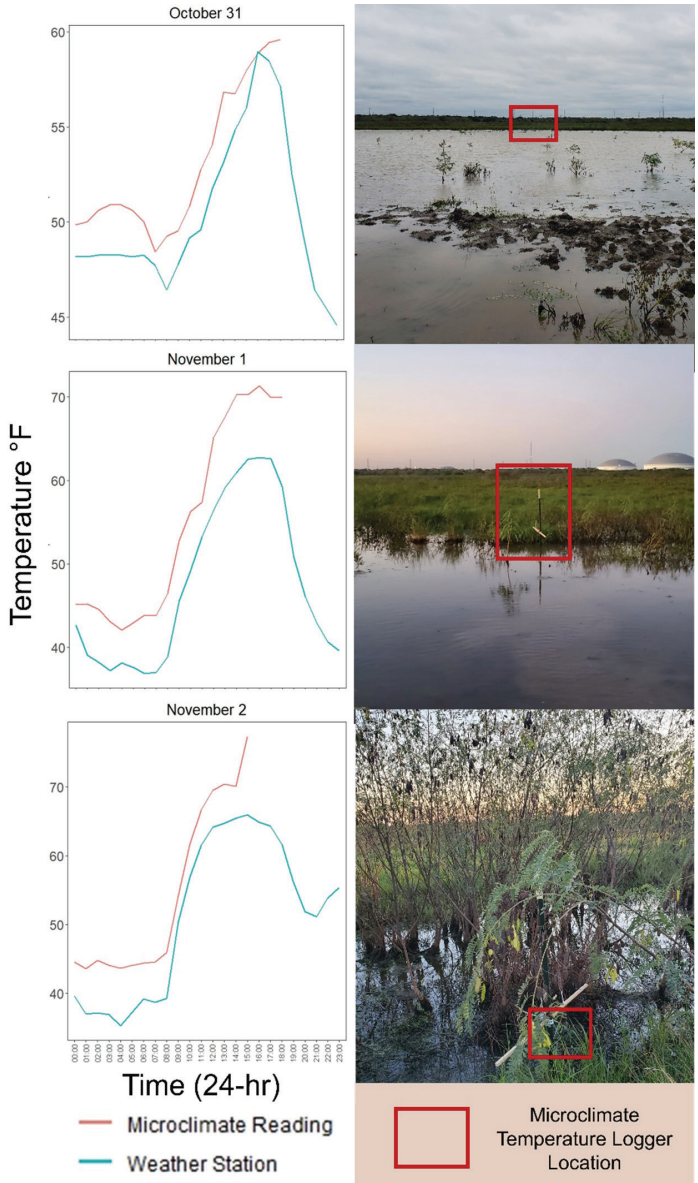


Figure 3. The above graphs show the differences between the wetland microclimate readings and weather station measurements, within 24-hour periods, over the span of 3 days. Precise microclimate temperatures were measured using a device called a thermocouple (locations shown in red boxes) on October 31st-Nov 2nd, at Justin Hurst WMA in Freeport, TX. Weather station data was taken from Angleton/Lake Jackson, Brazoria County Airport (NWS/FAA) via Texas MesoNet. Images and graphs by Joseph McGovern.

CKWRI graduate student Joseph McGovern (right) and Lang Alford (left; TPWD) releasing a female northern pintail, February 17, 2023, Mad Island WMA, TX, USA. Photo by Bart Ballard.

Though northern pintail responses to extreme weather during migration are currently unknown, what we do know is that extreme weather is becoming more common during this important period for this species. Changing weather patterns, particularly increased extreme weather events, pose a major challenge when managing for migratory species. Northern pintails may be able to adjust their movements to changing weather patterns if stopovers can continue to offer them refuge from adverse weather. By measuring how these stopovers create refuge from extreme weather, we can better manage for northern pintails against this increasingly common threat to their existence.

Photo by Brian Loflin

QUAIL ASSOCIATES 2.0:
A New Twist to A Past Program

by Alejandro Bazaldua and Fidel Hernández

Many of you likely have heard the term Quail Associates sometime during the past two decades. It was a program created in 2000 by Dr. Fred Bryant, then Director of the Caesar Kleberg Wildlife Research Institute (CKWRI), with a vision to conduct impactful research on South Texas quail populations that engaged landowners. When Dr. Lenny Brennan joined the Institute in 2001, he assumed the helm of the program and initiated data collection on South Texas quail over the next ten years (2001–2011). Landowners in the program sent in data on harvest, age ratios, and body weights, among other things, from across South Texas. Through these and other data collected by numerous graduate students, we learned many exciting things about quail. For example, we learned how adequate bunchgrass cover was correlated with quail productivity, with properties containing higher bunchgrass cover having greater productivity. We also learned that large, contiguous tracts of habitat in South Texas were key for maintaining the genetic diversity of quail in the region. The program concluded in 2012 and remained "in the books" for the next ten years until 2022, when we began discussions about re-initiating the program to address timely new questions. So, in 2023, Quail Associates 2.0 was born.

The structure, organization, and intent of Quail Associates 2.0 (QA 2.0) is still the same as the original program: to conduct meaningful research on South Texas quail that engages and benefits landowners and managers. The data being collected by landowners, however, has changed slightly for QA 2.0 in order to address new questions and lines of inquiry. For example, a common question landowners ask each year is, "What kind of quail population will we have this season?". It is a question that is difficult to answer for a region as large as South Texas. However, through roadside surveys conducted by landowners and managers in QA 2.0, along with data that we collect on landscape variables (e.g., rainfall, habitat, and energy infrastructure), we are able to develop a quail forecast for each year by relating landscape variables to quail abundance to develop a predictive map of abundance (*Figure 1*).

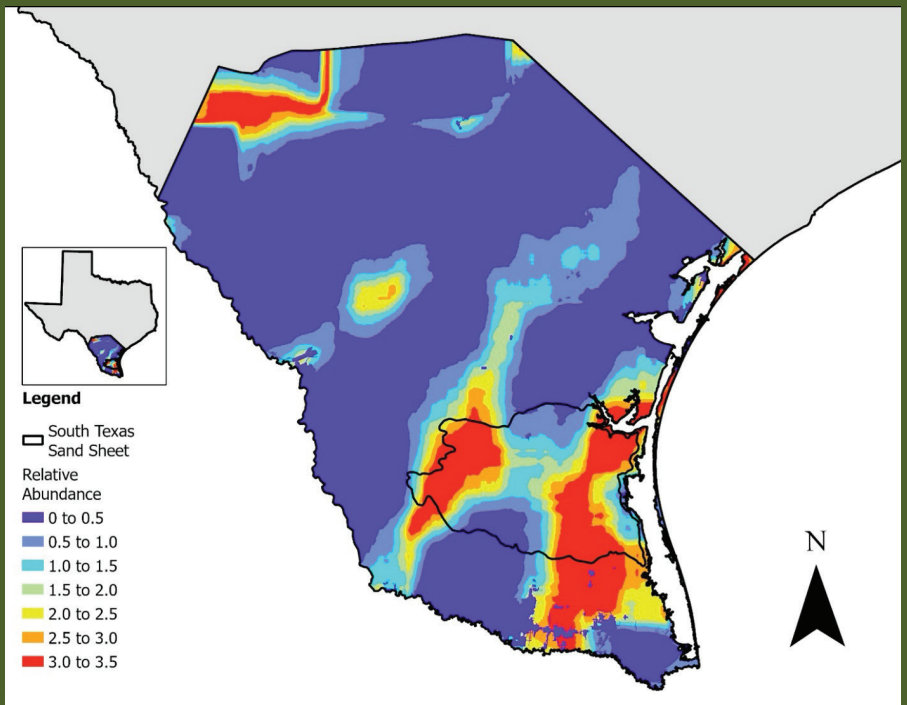


Figure 1. Example of a map of predicted bobwhite relative abundance for South Texas, August–September 2022.

Recent advances in technology and availability of remotely-sensed data also are permitting the exploration of landscape questions through QA 2.0 that in years past were not possible. The study of habitat-quail relationships provides a good example of a utilizing a new approach. Historically, habitat-quail relationships were developed by going into the field and manually collecting data. For example, if one was interested in determining the amount of woody cover that quail required, you would go into the field to a sampling point, lay a tape measure out to say 50 yards, and record how much of that tape measure was covered by brush. By dividing the length of the tape measure covered by brush by the total length of the transect, one could calculate percent woody cover. One would then move to another sampling point within the same site and repeat the process. By comparing percent woody cover between points where quail were found (such as covey flushes) to points in the surrounding landscape, you could identify the bounds of habitat-suitability of woody cover for quail. This on-the-ground approach was effective and led to a key understanding of the habitat requirements of quail. Unfortunately, the approach was limited because it was very time consuming. In addition, logistical considerations limited the number of points that could be sampled not only within a site, but also the total number of different sites that could be sampled in a study. Consequently, collecting habitat data by direct sampling over was limited to small areas, and sampling of an entire ecoregion was impossible due to logistical constraints. But this all changed with the availability of remotely-sensed data and the use of geographic information systems (GIS).

Remotely-sensed imagery provides estimates of ecological variables (e.g., meteorological data, land-cover classification, biomass, and vegetation cover) that are sourced from satellite images. Advancements in cloud storage and cloud computing power allow for easy storage and retrieval of remotely-sensed data. From these data, users are able to collect estimates of critical variables such as biomass production or precipitation for an area of interest. The Rangeland Analysis Platform (RAP) is an example of satellite imagery, reclassified to estimate aboveground biomass production for annual and perennial herbaceous vegetation. Additionally, RAP estimates vegetation cover for six plant categories (annual forb and grass cover, perennial forb and grass cover, shrub cover, tree cover, litter, and bare ground). Estimates from RAP can be used not only to detect long-term trends in biomass production or changes in vegetation cover in an area of interest, but also to develop wildlife-habitat relationships. That is, whereas before direct sampling did not permit sampling of habitat at a landscape scale because of logistical constraints, platforms today such as RAP allow for the collection of vegetation data at large scales that can be remotely extracted and related to species location or abundance data.

We wondered, "Could remotely-sensed data be used to reliably develop bobwhite-habitat relationships at large scales?". We began exploring this using data from QA 2.0. For this research, our objective was to quantify the relationship between remotely-sensed habitat data (e.g., litter cover, herbaceous biomass, woody cover) and bobwhite relative abundance collected by Quail Associates.

This particular aspect of QA 2.0 involved 13 ranches conducting 28 total road-side surveys throughout South Texas. Routes were 10–20 miles, and roadside surveys were repeated at least 4 times during August–September 2022. From these data, we calculated average bobwhite relative abundance (no. of quail/mile) for each of the 28 routes. We then georeferenced the routes, buffered them to about 440 yd on both sides, and extracted habitat data from RAP. Habitat data included percent cover (annual forb and grass, perennial forb and grass, litter, bare ground, shrub, and tree). We then quantified the relationship between the landscape data and bobwhite relative abundance. In line with ecological expectations, we documented that bobwhite relative abundance increased as the amount of perennial forb and grass cover increased (*Figure 2A*). Similarly, we also documented that bobwhite relative abundance decreased with increasing litter cover (*Figure 2B*). Both of these findings align with the known habitat-quail relationships that were developed using on-the-ground

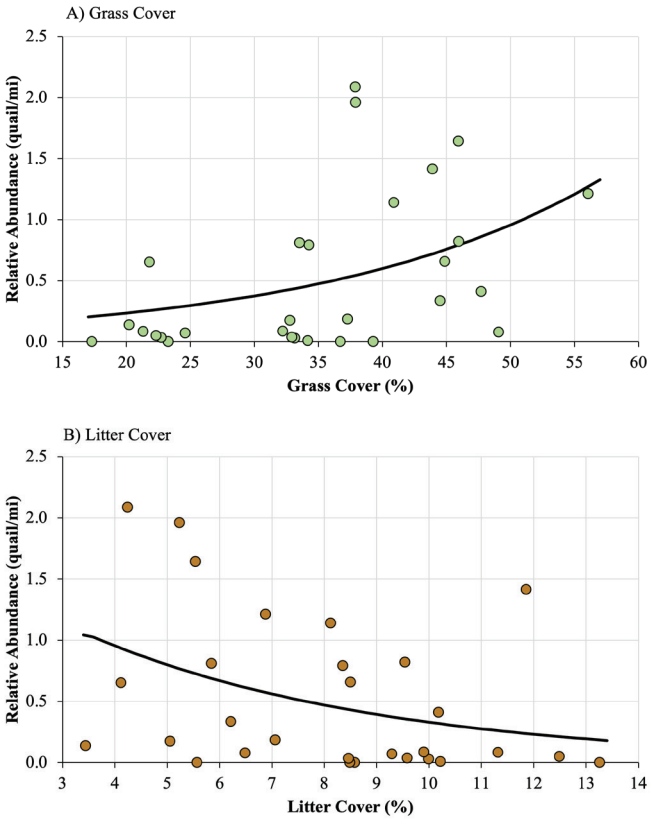


Figure 2. Relationship between bobwhite relative abundance (quail/mi) and A) annual and perennial grass cover, and B) litter cover, South Texas, 2022.

sampling from past studies. Thus, it seems that remotely-sensed data may represent a reliable and efficient means to build habitat-quail relationships over large space and time scales.

Our goal is to continue refining these relationships (as well as those with other habitat variables) using future data from QA 2.0. As we refine these habitat-quail relationships with longer-term data, these relationships will permit us not only to quantify the amount of quail habitat on properties using remotely-sensed data, but also to estimate the relative bobwhite abundance that should be on a property based on its habitat characteristics. They also will permit us to identify what areas of the property are in need of habitat management and how relative abundance is predicted to change in response to such management.

This is an exciting time for CKWRI and Quail Associates 2.0. If you are interested in learning more about the program and joining as a Quail Associate, please visit www.ckwri.tamuk.edu.

DONOR SPOTLIGHT: *Steve Lindley*

by Lorie A. Woodward

Steve Lindley's passion for the outdoors was ignited by the staccato explosion of birds on the wing.

"I grew up hunting dove, blue quail—anything that flew," said Lindley, a native of Midland who has lived in Houston since the mid-1970s.

"When I was very young, my dad took me with him on dove shoots and later when I got old enough he included me in blue quail hunts, and I guessed he seemed to enjoy hunting with me because he kept inviting me to come along."

In the inhospitable terrain of the Permian Basin, the Lindleys and their friends relied on jeeps, instead of dogs, to pursue blue quail, which are notorious for running. The hunting parties would drive two vehicles side by side across the prairie until a covey flushed.

Then, one vehicle would head to where the covey went down, while the other circled in front of the covey to block it. Gun and shooting safety was the top priority because of the nature of the "circle" hunt with hunters potentially being in front of the shooters, so the rule was to only shoot when the flushed bird got "outside the circle."

Steve Lindley and son, Matthew

“I started hunting with my dad and then migrated to hunting with my friends,” Lindley said. “We hunted weekends or after school. Whether it was chasing blues or sitting at a tank shooting dove, it was always fun to be outside and to socialize with friends.”

If it wasn’t hunting season, Lindley and friends might occupy themselves by "chasing the weather." Lindley, who got his driver’s license when he was 15, recalled evenings spent with friends in the car at the edge of town just watching the thunderstorms roll across the seemingly endless West Texas sky.

“To this day, I love being outdoors and enjoying the majesty of nature,” Lindley said.

The yearbook at Midland High was named CATOICO, a local acronym that covered the region’s economic bases: cattle, oil, and dryland cotton. Lindley’s family was in the drilling fluid business, so the energy industry was in his blood when he left Midland for SMU.

After graduation, he accepted a job at First City National Bank in Houston. Once Lindley completed the bank’s management training program, he went to work in the Petroleum & Minerals Group. He stayed with that group for six years until his uncle asked him to return to the family business, which had expanded to encompass drilling fluid products, production chemicals and rental drilling equipment.

During this time, Lindley’s uncle, David Johnson, who was an avid hunter and fisherman, had work roots in South Texas. Johnson was also a close friend of Henry Hamman. The duo began including Lindley on their hunting and fishing excursions. Many of those adventures took them to the Gulf Coast for angling or waterfowl hunting or to South Texas in pursuit of quail.

“If you love quail hunting, you just naturally migrate to South Texas which offers the best wild quail hunting in the country,” said Lindley, noting he also has had the opportunity to hunt some of the superlative quail leases on King Ranch and other large ranches in South Texas.

Both Johnson and Hamman supported the Caesar Kleberg Wildlife Research Institute. They introduced Lindley to its mission and many of its other active supporters. CKWRI was a natural fit for Lindley as well.

“Since I enjoy wildlife and the outdoors,” Lindley said, “what CKWRI does inspires me.”

As a quail enthusiast and chairman of Quail Associates 2.0, research that keeps wild quail on the landscape excites him. He also closely follows developments in the Native Seed program and its efforts to re-establish native forbs and grasses across Texas, which are foundational to prime wildlife habitat. Although he claims “not to be well-versed” in the ocelot reintroduction work, the groundbreaking science and the possibility of re-establishing one of Texas’ rarest animals on private land also intrigues him.

While CKWRI’s commitment to cutting-edge research is important to Lindley, it’s the faculty and staff’s dedication to developing the next generation of well-educated, passionate conservationists that resonates most strongly with him.

Steve Lindley's daughter, Jenna, and Mike Sandifer

"They are training these young people to be good stewards of the natural resources that God gave us," Lindley said.

"Having a very understanding wife, I've been fortunate to see a lot of wild and wonderful places around the world—and I feel like it's up to us to preserve the outdoors, so youth can experience these great creations in ways large and small, and in turn be inspired to maintain and conserve nature. Hopefully, I have instilled some of my love for nature and the outdoors in my children."

In his lifetime, he has seen once common species become rare. As a child, he and his friends enjoyed an abundance of horned toads. They would wait near sprawling red ant beds and catch horned toads that came to dine on the insect buffet. For a few days, the horned toad would enjoy the luxuries of a sand-filled shoebox condominium. Then, the youngsters would release them back into the wild.

Lindley remembered being filled with wonder as he pondered the relationship between the horned toads and the red ants. It prompted him to study the life history of horned toads and the unseen world of red ants.

"I became fascinated by things that many people never take the time to look at or try to understand," Lindley said. "I love that CKWRI keeps that fascination and curiosity about the natural world alive in future generations, whether it's red ants, hummingbirds, wildflowers, or game birds and game animals."

He continued, "We can't afford to lose that knowledge of the natural world—and the more people we have who are actively involved in studying in the wildlife arena and our natural resources, the better off we all will be. I hope CKWRI's research continues forever because the bigger and more populated the world gets, the greater the need for people who will help conserve and maintain our wild things and wild places."

Steve quail hunting with his dad in South Texas

CKWRI Establishes
The Henry Hamman Program for Hill Country Conservation and Management

CKWRI was fortunate to have Henry Hamman serve on our Advisory Board for 20 years and lead the Institute as Chairman for 8 years. CKWRI has earned a reputation as an authority on a variety of wildlife and conservation topics in South Texas, and we are excited to be expanding our research to the Hill Country. Because Henry was dedicated to habitat restoration and truly understood the importance of a healthy and balanced ecosystem, we are honored to name our newest research program *The Henry Hamman Program for Hill Country Conservation and Management*. The overall goal is to produce management guidance and best practices that will be applicable to the entire region.

Inaugural Projects

Juniper Management in the Upper Frio River Basin: This project will summarize past research that has been done on juniper management in the Hill Country. We will use juniper management projects implemented over the last 30 years to understand the outcome of various treatments and then produce a management bulletin for Hill Country Landowners.

Large Mammal Monitoring and Management: White-tailed deer and exotics are important species in the Hill Country. Understanding their impacts and managing their populations begins with reliable population estimates and knowledge of their habitat use and interactions. We will use camera surveys to provide this information and translate what we learn into management actions.

How You Can Help

Our biggest need at this stage of program development is operating funds. Support for specific projects will be welcome once the program's infrastructure is in place. Operating funds can be provided through gift designations through the following giving programs (complete benefits of each opportunity can be found on our website):

- **Named Endowment**: *Opportunities starting at $100,000.*
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SUPPLEMENTAL FEED PROGRAMS FOR WHITE-TAILED DEER:

Understanding the Effects of Timing, Type, and Temperature on the Benefits of a Feed Program

by Lorie A. Woodward

Many ranches realize the benefits of supplemental feed programs for improving deer nutrition and productivity. Research has confirmed the observations of many managers that supplemental feed can increase antler sizes, body weights, and fawn recruitment. This effect is driven by maximizing the nutritional condition and allowing deer to allocate additional resources to body growth, antler development, and maternal investment during pregnancy and fawn-rearing. Yet, how to maximize these benefits while balancing a budget with a large feed bill remains a challenge for many managers. Knowing when to feed, what to feed, and how much is enough are open and important questions. Understanding the constraints that limit feed consumption and the expected benefits may lead to more effective use of supplemental feed for achieving deer management objectives.

Many landowners report reduced use of feed during the heat of the summer. On one hand, this is surprising as does experience the peak reproductive demands

during the first weeks of nursing, which occurs during the summer. Similarly, males are investing in antler growth and experience high nutritional demands. Antler size can affect breeding opportunities by influencing dominance hierarchies in bachelor groups and may be a key trait driving female mate-selection; therefore obtaining nutrition during this time has direct implications for their reproductive potential. During the summer, yearlings experience high nutritional demands for body growth as they seek to maximize their size to increase their reproductive potential and minimize the risk from predators. So why does feed consumption drop during the summer when nutritional demands are so high? Recent research conducted by Miranda Hopper and colleagues at the Albert and Margaret Alkek Captive Ungulate Facility at the Caesar Kleberg Wildlife Research Institute (CKWRI) suggests the answer may be that it is too hot. Ms. Hopper, the Hixon Fellow for Deer Research at the Patton Center for Deer Research at CKWRI, conducted a series of experiments offering feed with varying amounts of digestible energy and crude protein. Her study showed deer strongly preferred a high energy – low protein diet. She also showed that as temperatures increased, deer selected a lower protein diet. The reason for this selection despite high demands for protein was revealed using novel technology that logged internal body temperature every minute. The internal body temperature of deer increased with the consumption of protein. Simply put, deer decrease the use of protein because consuming protein increases body temperature - a cost deer cannot pay during Texas summers.

At the steak house this is called the meat-sweats. In the biomedical literature this phenomenon is known as diet-induce thermogenesis, which describes the process where digestion creates heat. The amount of heat depends on the diet. Some items like proteins generate more heat during digestion than other dietary components. When deer are presented with a high protein feed they balance their diet by eating plants with a low protein contain. Research from CKWRI has demonstrated that deer presented with supplemental feed by-pass high quality plants for roughage that will effectively balance their diet to more ideal nutrient levels. For example, if deer are presented a pelletized feed with a 20% protein formula and they want a 12% protein level for their total diet, they must save enough rumen capacity for roughage that will reduce protein level down in the total diet. Due to the high costs of thermoregulation and the fact that digestion of protein generates more heat than other dietary components, protein may be limiting the consumption of feed. This would minimize the ability for deer to obtain other important nutrients and minerals that are included in many feeds. Whether offering a lower protein feed during the periods of heat stress results in increased fed use and better deer nutrition is an important next step for research.

Cottonseed meal is a by-product of cotton that is used for an alternative supplemental feed because it is rich in digestible energy and protein, is less expensive and does not degrade in moist conditions as readily as other supplements. Cottonseed is also less attractive to monogastric competitors for supplemental feed (i.e., raccoons, pigs, javelina, rodents) because it contains a polyphenolic pigment called gossypol. Gossypol can be toxic if consumed at high doses and unlike ruminants such as deer, monogastric species lack the foregut microorganisms that detoxify the plant compound. Therefore, cottonseed is an attractive alternative supplemental feed that can be more cost effective than other products. However, in ruminant livestock, reproductive effects of gossypol toxicity include reduced libido with decreased sperm counts and sperm motility,

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as well as sperm abnormalities. Reproductive effects in female livestock include irregular cycling, disruption of pregnancy, and direct embryo toxicosis. Other effects of gossypol toxicity in livestock include respiratory distress, impaired body weight gain, anorexia, weakness, and apathy. The effects of gossypol toxicity on reproduction, nutritional condition, and health in deer are unknown. Importantly, it is unknown how cottonseed and pelleted feed compare in terms of supporting the productivity of deer populations. To address this question CKWRI has launched a project comparing recruitment rates and nutritional condition of deer with access to pelletized feed, cottonseed, or both.

We are also investigating the importance of feeding deer continuously throughout the year relative to feed programs that do not provide pelletized feed during the hunting season. Nutritional condition of ruminant livestock at ovulation can be an important predictor of offspring quality and quantity. Removing supplemental feed and potentially putting does in a negative energy balance before ovulation could affect their offspring. For example, litter size is determined at ovulation and the 'decision' to support 1, 2, or 3 fawns is likely driven by the female's conditions at ovulation. There may also be effects on offspring quality. There is evidence from anecdotal observations and research that suggests offspring quality is higher during better years. This 'silver spoon' effect is caused by enhanced maternal investment when resources are more abundant during good years. The level of maternal investment is likely determined by factors such as the deer's current nutritional condition and environmental cues. Fetal programming is a process whereby a mother's nutrition and physiology during pregnancy has long-lasting effects on offspring. In livestock, fetal programming can affect offspring survival, muscle and fat development, organ morphology, immune function, reproductive potential, and growth rates. This is likely also true for wild ruminants, such as deer. If so, it would be important for does to be in peak condition and experiencing environmental cues of stable resource availability during ovulation and gestation. Removing feed from female deer during the hunting season which coincides with ovulation and early gestation may have unexpected effects on offspring quality.

Supplemental feed is an important and common tool in deer management, but there are many important questions that need to be addressed to maximize the efficacy of feed programs. Nutritional demands vary through the season in different ways for bucks, does, and fawns. A deeper understanding of the unique requirements of bucks, does, and fawns during different seasons would allow for more effective feed programs. Supplemental feed may also play an important role in wildlife disease. For example, deer with access to supplemental feed are in better nutritional condition and have fewer mineral deficiencies. This would support immune function, and result in a healthier deer herd. However, many diseases can be transmitted by sharing feed and water or by social interactions that increase when deer are congregated near feeders. Supplemental feed has been a cornerstone of Texas deer management and undoubtedly can improve the nutrition and productivity of a deer herd. However, many questions remain for maximizing the benefits of a feed program. At CKWRI, we are pursuing research that will support landowners by understanding this important management tool on deer physiology and nutrition.

ALUMNI Spotlight

Lianne KOCZUR

CKWRI Class of 2017,
Science & Conservation Director,
Alabama Audubon
Birmingham, AL

What is your background with the Institute?

I was a graduate student at CKWRI during 2012-2017 and earned both my M.S. and Ph.D during that time. I worked with Dr. Bart Ballard to study American Oystercatchers and Reddish Egrets, so I became very knowledgeable and passionate about waterbird ecology. My M.S. project was focused on examining the reproductive success of American Oystercatchers along the central Texas coast. During that time, I learned so much about oystercatchers and nest survival analyses, and I also got really good at driving and trailering a boat! For my Ph.D, we fitted adult Reddish Egrets with satellite transmitters and tracked their movements. We found that the Reddish Egrets breeding in the Laguna Madre were partially migratory; some of them went to Mexico and Central America for the winter and some stayed in Texas.

What are you doing now?

I have been the Science & Conservation Director at Alabama Audubon for the last five years. I oversee our statewide science and conservation programs, which include bird-window collision monitoring, songbird and shorebird banding projects, bird surveys, and a coastal bird stewardship program. It was a full circle moment for me when I banded my first Alabama oystercatcher! It's not all field work these days though, I do my fair share of report and grant writing, recruiting and maintaining volunteers, and of course lots of zoom meetings! I also supervise our coastal staff, which has been a highlight of my job these last few years.

How does your time at CKWRI continue to affect you today?

My time at CKWRI continues to affect me in so many ways. I learned so much about wildlife and birds there that I took with me to my current job. I also learned what it means to be a great mentor because I had such a great mentor in Dr. Ballard. I finally started gaining confidence in my ability as a researcher and writer because of him. I'm very grateful to have volunteered with David Newstead trapping and banding shorebirds; I learned so much from him and gained a lot of field experience. I had a wonderful network of colleagues during my time at CKWRI, many of whom I still get to work with today. And I made some lifelong friends. It has been really amazing to see how our careers have taken shape and how we've grown. I'm very thankful for my time at CKWRI!

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