2025

Game Bird Research Report

BORDERLANDS RESEARCH ◆ INSTITUTE

CONSERVING THE LAST FRONTIER

OUR MISSION:

Conserving the natural resources of the Chihuahuan Desert Borderlands through research, education, and outreach.

Since 2007, the Borderlands Research Institute has encouraged effective land stewardship of the ruggedly beautiful terrain of the Chihuahuan Desert. By providing land managers with the most current scientific information, the Borderlands Research Institute is helping to conserve one of the most biologically diverse regions of the world.

Housed at Sul Ross State University, the Borderlands Research Institute builds on a long-lasting partnership with private landowners, the university's natural resource program, cooperating state, federal, and non-governmental organizations, and other stakeholders. Faculty scientists and the graduate students they mentor are conducting groundbreaking research on every aspect of the desert landscape and the wildlife it supports.

ENDOWED POSITIONS

Kelly R. Thompson
Professorship of Quail Research

John B. Poindexter
Endowed Fellowship in Quail Research

Technology is changing at a rate most of us can't keep up with. That also holds true in the field of wildlife research, where recent advances in technology provide mechanisms that allow us to ask unique and cutting-edge questions about quail ecology and behavior.

In our 2025 Game Bird Report, you'll find three articles focused on our quail research program that have leveraged technological advances to ask innovative questions regarding impacts of feral hogs on Montezuma quail, state-of-the-art monitoring systems to ascertain scaled quail movements and survival, and gauging impacts of the oil and gas industry on scaled quail movements.

These studies are supported by private gifts and grants from individuals, nonprofits, and corporations that, like you, cherish the gamebirds of West Texas. On behalf of our advisory board, faculty, staff and students, thank you for your continued support of all our programs at the Borderlands Research Institute!

Louis A. Harveson, PhD
Dan Allen Hughes, Jr., Endowed Director

The Trans-Pecos is a unique landscape and is the only place in the state where we can find all four Texas quail species. As such, much of our research focuses on quail that inhabit our arid landscapes—the Montezuma quail, Gambel's quail and the scaled quail. Over the past few years, two of these quail species have received the majority of our focus, specifically the Montezuma quail and the scaled quail.

We currently have students working on study sites across the Trans-Pecos. Through partnerships with private landowners, agency personnel, ConocoPhillips, The Nature Conservancy, and Quail Coalition chapters, we seek to answer a wide range of questions pertaining to quail population dynamics, habitat selection, and survival across seasons. These projects would not be possible without the support of our constituents and contributions from other individuals. We sincerely appreciate your support of our Game Bird Research Program and the opportunity to study these iconic species in the Chihuahuan Desert.

Ryan S. Luna, PhD
Kelly R. Thompson Professor of Quail Research

BORDERLANDS RESEARCH ◆ INSTITUTE

CONSERVING THE LAST FRONTIER

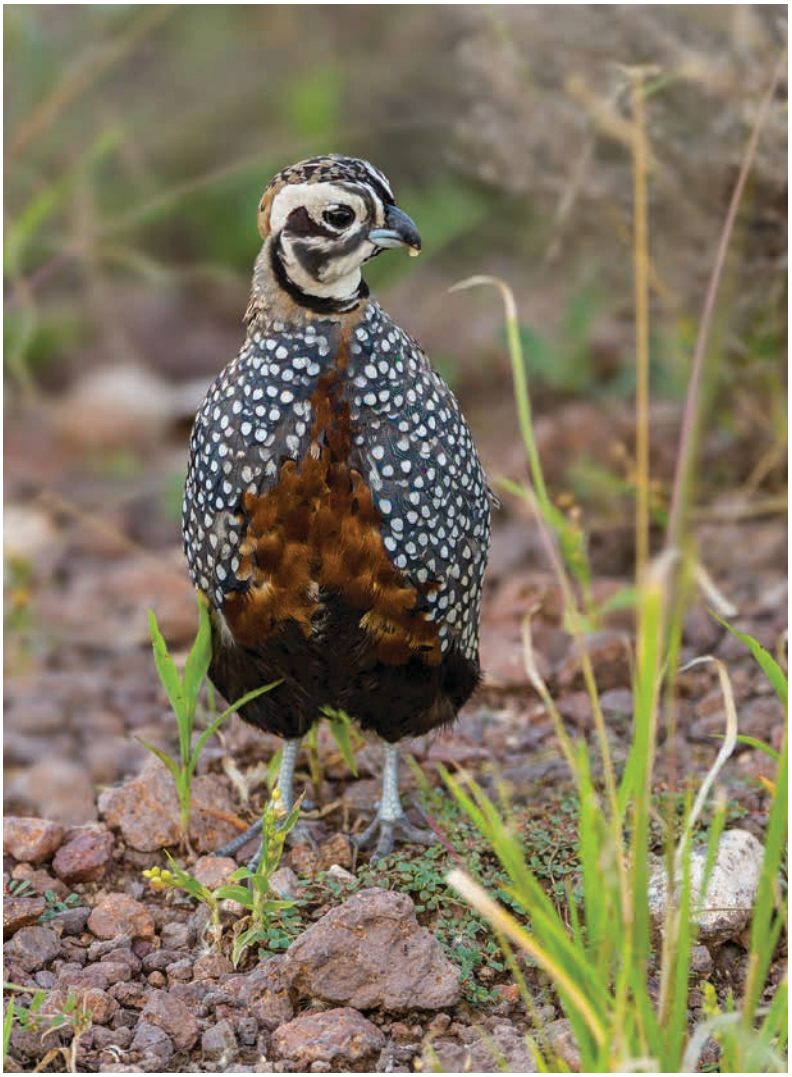
2025 Game Bird Research Report

CONTENTS

MONTEZUMA QUAIL:

Factors influencing Montezuma quail populations in the Trans-Pecos region of Texas

Maya A. Vaughn, Justin T. French, Fidel Hernandez (TAMUK/CKWRI), and Ryan S. Luna



A male Montezuma quail in the Davis Mountains. Photo courtesy of Michael L. Gray.

Montezuma quail is a cryptic quail species inhabiting the piñon-juniper woodlands of the southwestern United States and much of Mexico. They are challenging to trap and study; thus, little is known about their ecology and population demographic rates. The limited studies on the Texas populations indicate their restricted range and overall population declines are attributed to habitat degradation, overgrazing and drought. Because there is little information on this species, there are unstudied factors that could be affecting West Texas populations, such as the influence of extreme weather events and new invasive competitors, like feral pigs.

To better understand how feral pigs affect Montezuma quail populations, we investigated the overlap of Montezuma quail habitat and feral pig presence, indicated by feral pig rooting behavior, tracks and scat. Through rooting, feral pigs disturb the soil. This potentially reduces plant cover, alters soil composition, causes nutrient loss, and alters vegetation communities. This could minimize forage resources and the ground cover that Montezuma quail utilize for nesting, temperature regulation, and predator avoidance. We enumerated the presence of feral pigs according to indicator type (Figure 1) in the Davis Mountains Preserve, owned by The Nature Conservancy. Then, we extrapolated their presence across the entire Davis Mountains range. We then used a Montezuma quail habitat model from a previous study to estimate the overlap between feral pig presence and the Montezuma quail habitat. We estimated a 58% overlap of predicted feral pig presence and predicted Montezuma quail habitat within the Davis Mountains Preserve. When we extrapolated our overlap model to the entirety of the Davis Mountains region, we estimated a 51% overlap (Figure 2). Feral pig presence didn't completely overlap with the predicted Montezuma quail habitat, but the overlapped areas occurred in the preferred habitat of the Montezuma quail. These are areas that Montezuma quail need when their populations

are low and resources are scarce. Our results indicate feral pigs are positioned to potentially impact Montezuma quail resources and habitats, and further research should be conducted to directly evaluate that potential.

Extreme climatic events may also take a toll on Montezuma quail populations. The Davis Mountains contain some of the most contiguous habitat for these birds in Texas, and their populations are significant there. As such, they can be a source population for the range expansion of the species under good conditions; however, these populations may be vulnerable to habitat loss and adverse climatic conditions. In addition to direct impacts, extreme climatic events, such as droughts, extreme precipitation and temperatures, snowstorms, and wildfires, influence local environmental factors through time, affecting both flora and fauna. There are several anecdotal reports on the sudden apparent decline of Montezuma quail in Texas, New Mexico, and Arizona following extreme climatic events, such as high levels of overwinter precipitation or droughts. Understanding these climatic events better is crucial as they can impact vulnerable populations, like Montezuma quail in West Texas. Our model used population simulations, indicating that Montezuma quail populations can rapidly decline if subjected to several years of adverse climatic conditions. These simulations showed that several years of poor climatic conditions decreased the survival and recruitment of the species, leading to higher chances of local extirpation.

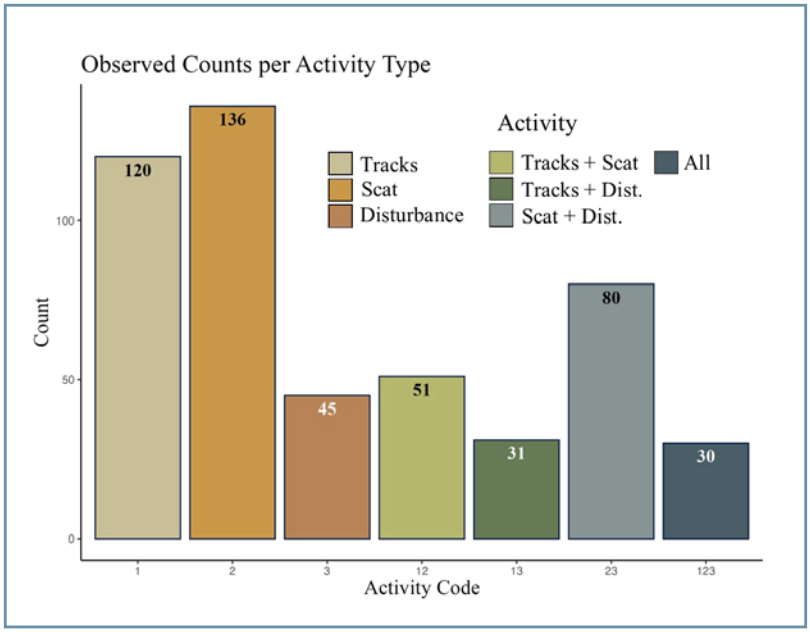


Figure 1. Observed counts of feral pig activities, recorded in the Davis Mountains Preserve.

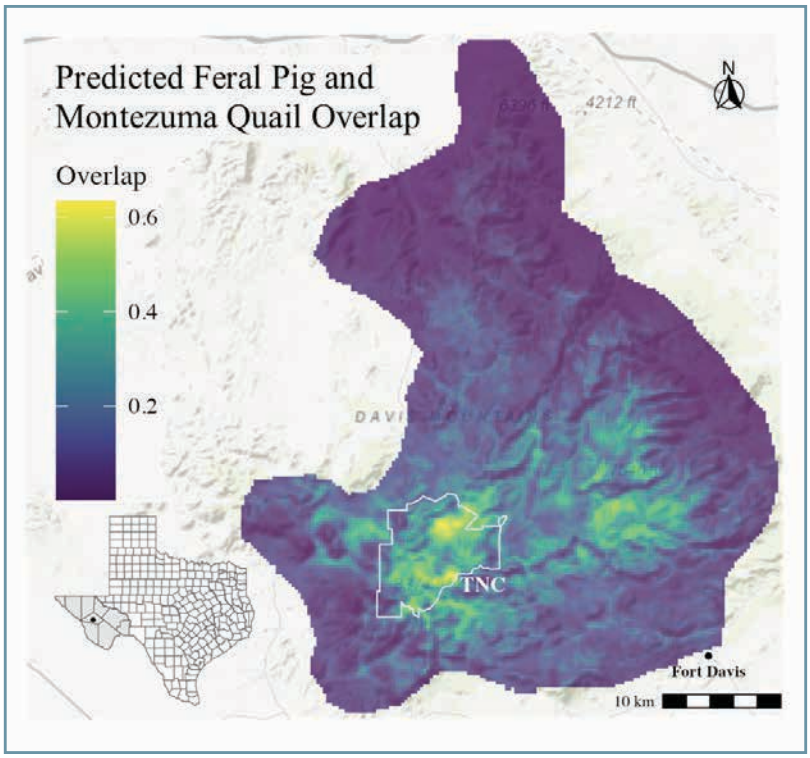


Figure 2. Overlap between Montezuma quail habitat and feral pig presence in the Davis Mountains.

These birds are assumed to be relatively robust to regular droughts and environmental changes; however, Montezuma quail populations might be vulnerable to back-to-back extreme weather events and more aggressive, generalist competitors like feral pigs. These two sources could alter Montezuma quail habitat and could change, or reduce, choice resources. More fine-scale research is required to better understand how Montezuma quail are affected by these components. Further research should investigate Montezuma quail demographics and population dynamics to provide a firm baseline understanding of the species and long-term data analysis on climatic fluctuations.

SCALED QUAIL, WINTER SURVIVAL:

Winter habitat selection, movement behavior, and survival of scaled quail in Trans-Pecos, Texas

Caleb Hughes, Carlos E. Gonzalez, Justin T. French, Louis A. Harveson, and Ryan S. Luna

Scaled quail huddled under a cholla on a snowy winter day. Photo courtesy of LD McCleary.

Scaled quail have experienced declines across their range due to several factors, primarily including habitat degradation. As habitat quality decreases, resources for food and cover are reduced from the historical availability of the grassland-shrub habitats scaled quail occupy. This lowers the resources produced following rainfall and affects their carryover into periods of reduced resources, such as winter.

Chihuahuan Desert winters are characterized by low moisture, reduced plant growth, and periodic winter storms. This presents scaled quail with less food and cover amidst occasional extreme temperatures, increasing predation, starvation, and exposure risks. Habitat degradation likely exacerbates these risks beyond scaled quail's adaptive tolerance, turning winter into a period of conservation concern. Unfortunately, little is known about how scaled quail respond to this challenging time of year in the Chihuahuan Desert.

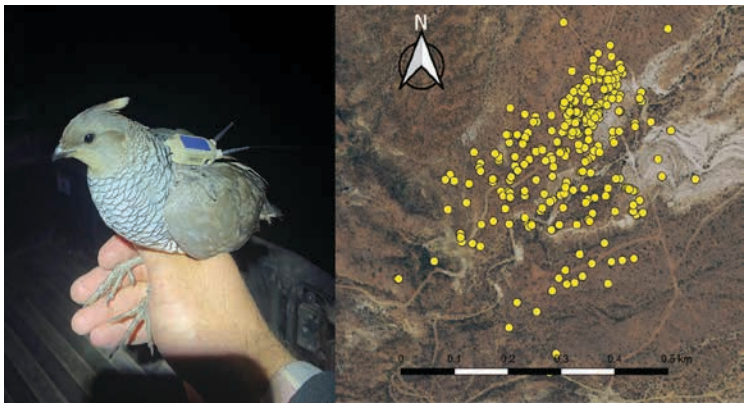
We studied habitat selection and survival of scaled quail during the winter of 2022-23 in the Trans-Pecos to observe their response to winter conditions. At Nine Point Mesa Ranch in south-central Brewster County, Texas, we monitored a subset of the population to gain information from different coveys. Using walk-in funnel traps, we captured and deployed Global Positioning System (GPS) backpacks on 37 scaled quail to collect location data and monitor survival. We monitored survival from November to April and collected 26,936 GPS locations. Each location was paired with relevant habitat variables to examine how scaled quail avoid or select for various landscape attributes.

Our habitat selection analysis revealed scaled quail selected for proximity to supplemental feeders, low-to-moderate vegetation greenness, and concave landscape features such as creek beds and small drainages. While temperature had no detectable impact on their movements, being near a feeder elicited reduced

movement effort. We observed a winter survival rate of 47% and did not see steep declines in survival following winter storms (Figure 1). Our survival estimate is notably higher than overwinter survival rates in literature for bobwhite and Montezuma quail. Still, it is lower than the survival rates of scaled quail during other seasons of the year.

Scaled quail's positive relationship to feeders is consistent with previous studies. Reduced movement near feeders could suggest that supplemental feed helps relax the significant energy expenditure of locating food when resources are scarce. Their use of concave topography suggests that terrain features that concentrate runoff water are desirable during winter. Higher soil moisture at these sites following rainfall often promotes greater vegetation growth than at surrounding sites, supporting the carryover of food and cover into winter and the composition of vegetation and bare ground that scaled quail prefer. However, their high selection strength for these habitats in our study suggests they are not highly available. If habitat availability is low during winter, habitat degradation across the scaled quail's range could create extremely limiting environments for scaled quail during this season.

The response of scaled quail to Trans-Pecos winters merits further research attention. These results show they can face low habitat availability in winter and may suffer higher mortality in winter than in other times, particularly when exaggerative factors such as drought or extreme winter storms are present. As juvenile recruitment and energy storage for reproduction occur in winter, these challenges can strongly influence population persistence. Scaled quail managers may consider supplemental feeding to help alleviate the energy demands they experience in winter. Additionally, factoring in local watershed features when choosing sites and methods for habitat improvement can enhance output by leveraging their higher soil moisture. This can help facilitate habitats that support scaled quail during this challenging time of year.



A scaled quail fitted with a backpack-style GPS transmitter is shown next to the collected data points. This transmitter was programmed to record its location every two hours during the daytime.

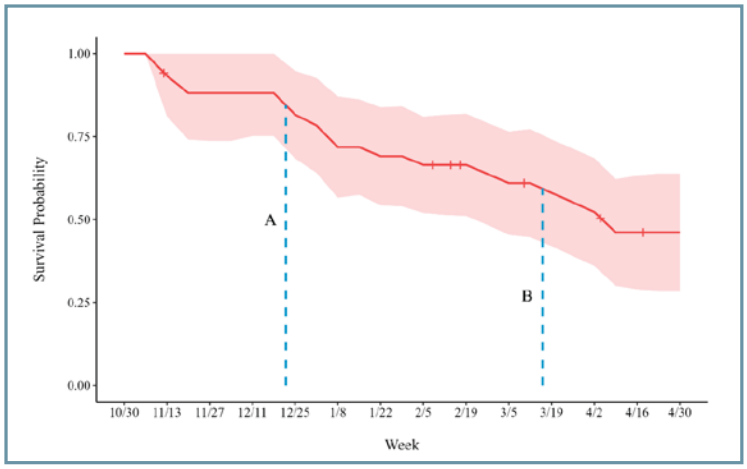


Figure 1: A Kaplan-Meier survival curve showing weekly survival estimates of scaled quail from 30 October 2022 to 30 April 2023 surrounded by a 95% confidence ribbon. The blue dashed lines represent the dates of two winter weather events: a hard freeze in December 2022 (A) and a snowfall event in March 2023 (B).

Small watershed features can provide food and cover for scaled quail in winter due to runoff received during monsoon rains. Here a straw wattle is laid in a channel next to a reseeded plot, slowing runoff to boost the prospects of native vegetation for scaled quail. Photo courtesy of Caleb Hughes/BRI.

SCALED QUAIL, OIL & GAS DEVELOPMENT:

Scaled quail habitat selection on an active oil & gas field

Brooke A. Bowman, Evan P. Tanner (TAMUK/CKWRI), Carlos E. Gonzalez, Jesse Wood (ConocoPhillips), and Ryan S. Luna

Scaled quail caught during a night capture to collect GPS data from attached logger devices. Recapturing tagged individuals when they are roosting is easier than when they are active during the day.

Land use change to energy development will likely become a significant factor in biodiversity loss as increased energy demands further fragment habitat. Oil and gas development is currently the largest contributor to energy development globally. Recent technological advancements, such as horizontal drilling coupled with hydraulic fracturing, have made extraction of shale resources more economically practical. This has significantly increased unconventional drilling practices in the United States since the early 2000s. This increase in oil and gas infrastructure raises questions about its effect on surrounding landscapes and its inhabitants.

Scaled quail relationships to oil and gas development remains understudied. Their role as prey species and seed dispersers in the ecosystem, their contribution to conservation revenue through game bird hunting, and the declining state of their populations highlight the importance of advancing this area of research. In West Texas, scaled quail's range completely overlaps with the continuously developing Permian Basin. Historically, scaled quail populations in West Texas were more widely distributed, but their populations have declined since the early 1960s. This is likely due to a combination of land use changes that results in desertification and woody brush encroachment, rangeland deterioration from overgrazing, frequent drought conditions, and disease. West Texas landscapes where scaled quail reside have transformed from grassland savannas interspersed with shrubs to

In the Permian Basin of West Texas, scaled quail share their home with oil and gas development. Here one perches in front of a pumpjack. Photo by Jason Brooks, a ConocoPhillips wildlife biologist.

shrubland savannas dominated by woody species such as mesquite, tarbush, whitethorn acacia, and creosote bush, among many others. A healthy shrub canopy, in conjunction with an intact native herbaceous understory, is important for scaled quail.

Quail management practices in the Permian Basin of West Texas are often borrowed from research conducted in the Trans-Pecos and Rolling Plains ecoregions; however, the Permian Basin is unique in its vegetation communities, soil types, and the intense energy development that spans the region. Thus, it is important to research this specific landscape to determine if oil and gas development affects scaled quail habitat selection.

This study was completed on two ranches owned and managed by ConocoPhillips in Upton County, TX. Scaled quail were trapped across a 47-km^2 control site with a well pad density of approximately 0.5 pads/km^2 and a 40-km^2 developed site with a well pad density of approximately 5 pads/ km^2 from 2021-2022. Backpack-style global positioning system (GPS) loggers were deployed on selected individuals, which recorded latitude and longitude coordinates every four hours. This data helped us identify habitat selection patterns in this unique scaled quail population.

We found that scaled quail habitat selection is affected by distance to well pads, distance to supplemental quail feeders, and monthly vegetation greenness. The parameter that affected their selection the most was vegetation greenness. Scaled quail were more likely to use habitat with a higher greenness value than habitat with a lower greenness value during all months of the year. In addition, quail were more likely to choose habitat closer to quail feeders than farther away from quail feeders. We also found that well pad densities did not affect quail habitat selection. However, their niche expands considerably during the winter months of the non-breeding, covey season. This suggests that scaled quail reduced competition within the species by expanding their niche breadth when resources decreased.

CURRENT STUDENTS AND ONGOING PROJECTS

EMILIE BROCHON

Using passive acoustic monitoring to estimate Montezuma quail density in the Trans-Pecos

One area of Montezuma quail research that is largely lacking is a methodology to determine current population estimates. Determining populations of Montezuma quail has been difficult due to their cryptic behaviors and tendency to crouch and freeze when disturbed. Passive acoustic monitoring (PAM) is now available to help overcome some of these past issues. Passive acoustic monitoring allows for unattended and non-invasive monitoring through recording vocalizations of the local taxa. By using PAM techniques coupled with autonomous recording units, this study is collecting field data that can be used to estimate the occupancy and population abundance of Montezuma quail.

Emilie's love for wildlife developed at an early age while growing up along the Mississippi River. Almost immediately after high school graduation, she left home and served nine years in the Marine Corps, where she gained resilience, a strong work ethic, and professionalism. Afterwards, she earned a BS in Biology from the University of Texas at San Antonio. During her undergraduate years, she discovered the significance of hunting as a conservation tool while deepening her passion for protecting wild places and wild things. She is excited to be studying at Borderlands Research Institute, where she is gaining valuable knowledge and skills for a successful career in wildlife management.

HAYLEY SHULTZ

Fine-scale habitat use and survival of scaled quail associated with seasons

Scaled quail is an important wildlife species throughout the Trans-Pecos. However, little is known about how seasonal changes affect fine-scale habitat use and survival. For this project, we are equipping scaled quail with satellite backpack transmitters to determine fine-scale habitat selection and survival during the breeding season. The backpacks are scheduled to record a location every four hours throughout the day. Location and survival data from this study will yield information on what habitat attributes are being selected for on the landscape and what management strategies may assist in creating a better nesting substrate.

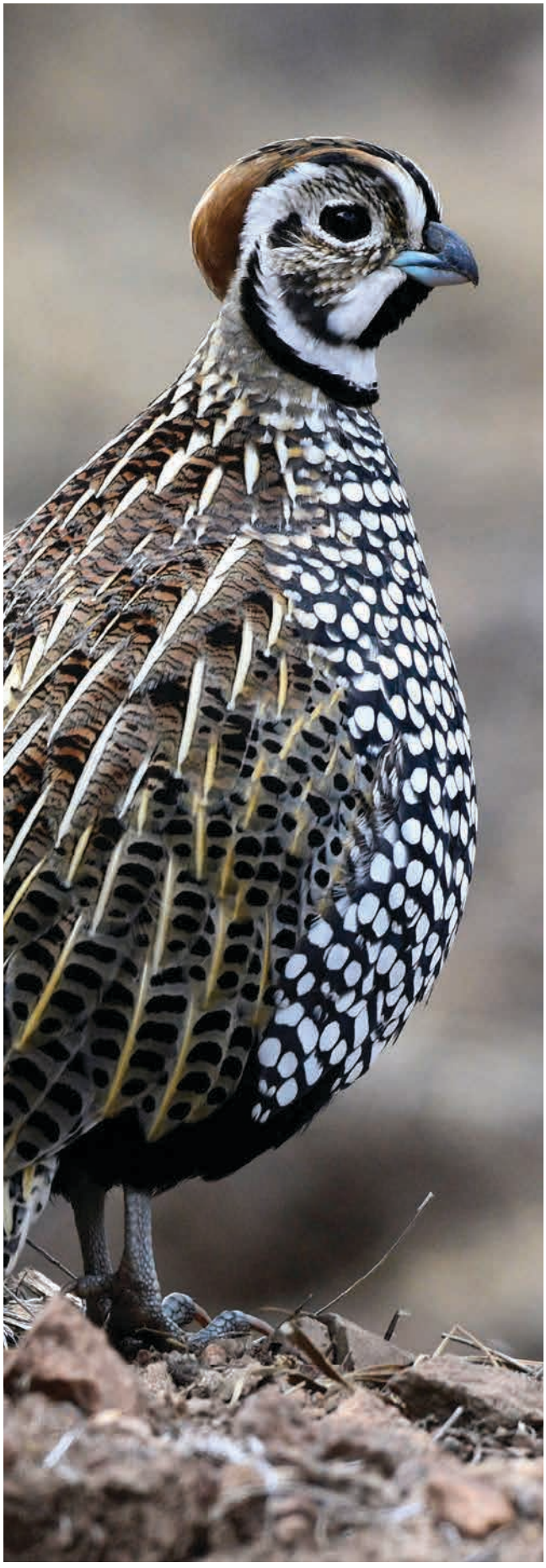
Hayley always knew she wanted to work with animals but didn't know how until she was an undergrad at Texas Tech University and started exploring their Natural Resources Management program. Immediately, she got involved with deer captures, mist netting, and vegetation surveys and fell in love with the work and West Texas itself, and she is now a graduate student at Sul Ross State University. Hayley has lived most of her life on the East Coast, and it took a while to acclimate to the dry heat and culture, but she couldn't imagine being anywhere else for graduate school.

DAVID TØNNESSEN

Using passive acoustic techniques to monitor a sensitive game bird species (Montezuma quail)

Passive acoustic monitoring has been touted as an efficient and cost-effective method of monitoring wildlife. Effectively surveying for members of Galliformes requires different methods than for songbirds, and due to its secretive nature and little existing literature, no standardized survey protocol has been applied for Montezuma quail. In this study, David is testing the efficacy of using passive acoustics to estimate densities, comparing results with in-person flush surveys. We use BirdNET detection software to calculate Montezuma quail densities and inspect the phenology of vocal activity over wet and dry periods. This is the first project using passive acoustic techniques to estimate populations of a game bird species.

Born into a large family that eventually settled in Colorado, David has been fascinated by nature ever since he can remember and found birds as a way to focus his analytical mind. He found out about this Master's program while guiding at a birding festival in Del Rio, and is grateful to pursue his goals at the Borderlands Research Institute. He is passionate about spreading a love of nature, education, and conservation research.



Montezuma quail photo by David Tønnessen/BRI

BORDERLANDS
RESEARCH ◆ INSTITUTE

CONSERVING THE LAST FRONTIER

Front and back cover photos courtesy of Michael L. Gray.
BRI staff editors include Julie Rumbelow, Bill Adams, and Lydia Saldaña

The Borderlands Research Institute at Sul Ross State University depends on private donations to fund much of our work. We are immensely grateful to the many partners who make our work possible.

Borderlands Research Foundation
ConocoPhillips
Houston Livestock Show and Rodeo
Houston Quail Coalition
John B. Poindexter
John B. Poindexter and Friends
Nancy M. Law
Nine Point Mesa Ranch
John L. Nau, III
Park Cities Quail Coalition
Permian Basin Quail Coalition
Quail Coalition
San Antonio Livestock Exposition
Texas Parks and Wildlife Foundation
The Nature Conservancy
Wayne and JoAnn Moore Charitable Foundation

Follow our activities on our website and on social media:

bri.sulross.edu

@borderlandsresearchinstitute

@borderlandsresearchinstitute

SR | SUL ROSS
THE FRONTIER UNIVERSITY of Texas