2022

Big Game 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 Range and Wildlife Program and cooperating state, federal, and non-governmental organizations. Faculty scientists and the graduate students they mentor are conducting groundbreaking research on every aspect of the desert landscape and the wildlife it supports.

BIG GAME RESEARCH TEAM

Justin T. French, Ph.D.
Research Scientist, Big Game Ecology and Management

Carlos "Lalo" Gonzalez, Ph.D.
Nau Endowed Professor of Habitat Research and Management

Louis A. Harveson, Ph.D.
Dan Allen Hughes, Jr., Endowed Director, Borderlands Research Institute
Associate Provost of Research and Development,
Sul Ross State University

ENDOWMENTS

Victoria and Parker Johnson
Endowed Fellowship in Big Game Research

When it comes to big game, West Texas is the best of Texas!

Nowhere else can you find such a diversity of horns, antlers, and hooves. Pronghorn, desert bighorn sheep, and mule deer are iconic species that typify the diversity of habitats that occur across the Chihuahuan Desert Borderlands. They also serve as the proverbial canary in the coal mine.

Our big game research program works side-by-side with Texas Parks and Wildlife Department, conservation partners, and private landowners to address the unique issues each species faces, including active restoration and recovery, habitat enhancements, predator-prey dynamics, disease management, and issues surrounding burgeoning invasive species populations. As with all our research programs, we strive to make a difference in advancing conservation solutions that have meaningful impacts.

We hope you enjoy our 2022 Big Game Research Report and thank you for your unwavering support of the Borderlands Research Institute!

Louis A. Harveson, Ph.D.
Dan Allen Hughes, Jr., Endowed Director

Our research seeks to identify solutions to big game management issues backed by an ever-increasing body of solid science.

The Trans-Pecos borderlands are home to every big game species in Texas. These iconic species are central to the culture and economy of the region, attracting tourists and hunters alike. However, each of these species faces a suite of management issues and, for a few, their future is uncertain.

We work side-by-side with agency personnel to investigate pressing questions in big game management. We then pass this knowledge to the next generation of managers by providing students with opportunities to get their hands dirty working on real management and conservation issues.

None of this would be possible without the cooperation, support, and partnerships we enjoy with private landowners, conservation partners, academic colleagues, and our generous donors. Thank you all for your continued support of big game research in the Trans-Pecos!

Justin T. French, Ph.D.
Big Game Specialist and Research Scientist

BORDERLANDS RESEARCH ◆ INSTITUTE

CONSERVING THE LAST FRONTIER

2022 Big Game Research Report

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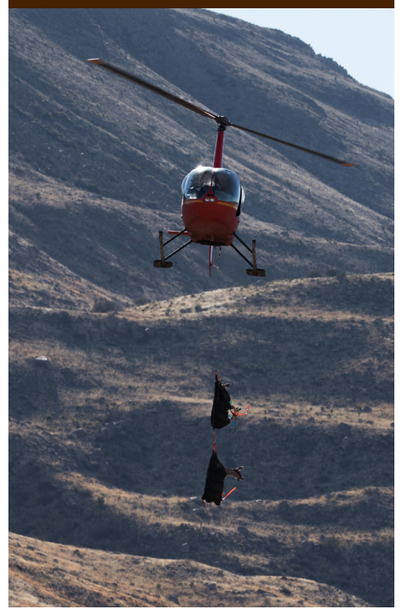


DESERT BIGHORN SHEEP AND AOUDAD:

Space Use of Desert Bighorn Sheep and Aoudad

Jose L. Etchart, Carlos E. Gonzalez, James W. Cain (NMSU), Louis A. Harveson, and Froylan Hernandez (TPWD)

Nonnative aoudad (pronounced AW-dad), pictured here and at bottom on page 5, often occupy similar habitat as desert bighorn sheep, a reintroduced native species in Texas (page 5, top).

The introduction of aoudad in the Trans-Pecos over the past seven decades has provided an economic stimulus to landowners through hunting, leading to a large, well-established population. Aoudad have shown remarkable ability to establish, spread, and extend their distribution. Unfortunately, the presence of aoudad in the Trans-Pecos may threaten the success of desert bighorn sheep restoration. Aoudad occupy similar habitat to desert bighorn sheep, reproduce more quickly, and are both larger and more aggressive.

As aoudad populations continue to grow, it is increasingly important to understand the scale of their movement across the landscape. Wider-ranging species exhibit higher connectivity among populations, making them more resilient. However, movement is energetically costly and risky, so individuals must make tradeoffs to balance access to resources with risk and energy expenditure. When there is more competition for resources, the rewards are more likely to outweigh the risks of larger movements. Thus, the relative range size of similar species using the same habitat can shed light on how they interact in such landscapes.

In September 2015, the Borderlands Research Institute captured and collared female aoudad in the Sierra Vieja Mountains as a companion study to a translocation of desert bighorn sheep in that mountain range. At the time of these efforts, collared desert bighorn sheep were also monitored, providing the opportunity to evaluate seasonal ranges of desert bighorn sheep and aoudad in a co-occupied area. GPS locations from the collars were used to estimate seasonal desert bighorn sheep and aoudad ranges. Anecdotal evidence suggests that aoudad are rapid colonizers of vacant habitats, leading to resilient populations. Thus, we anticipated seasonal ranges for aoudad would be more extensive compared to desert bighorn sheep.

However, aoudad seasonal ranges were consistently one-half to two-thirds that of desert bighorn sheep, suggesting the latter needed larger ranges to find the resources they required (Figure 1). Previous work in the Trans-Pecos showed that desert bighorn sheep ranges are small in higher quality habitats, such as the Sierra Diablo Mountains, but increase when they must move between multiple habitat patches to find resources. Despite the high quality of the Sierra Vieja Mountains, we observed desert bighorn sheep moving between patches of habitat more than we initially expected, leading to large range sizes. The presence of aoudad and consequent competition for space and resources may force desert bighorn sheep into larger ranges in the Sierra Vieja Mountains. However, it is also possible that desert bighorn sheep frequently move between these areas simply because habitat is patchily distributed.

Further work is needed to determine whether aoudad competitively displace desert bighorn sheep. However, in the absence of such information managers must make conservative decisions to ensure desert bighorn sheep persistence, particularly given the similar physiology, niche, and habitat distribution they share with aoudad.

Our work suggests connectivity among habitat patches is important for bighorn persistence in the face of potential competition with aoudad. If patches are too widely distributed, or the quality of resources within them is too low, the benefits of those habitats will not outweigh the costs of moving between them, leading to poor population performance. Depending on the population densities of both exotic and native species, competition and subsequent exclusion could lead to higher rates of dispersal between habitat patches in desert bighorn sheep. Differences in seasonal range sizes could suggest aoudad experience less competition than desert bighorn sheep, or are superior competitors to them.

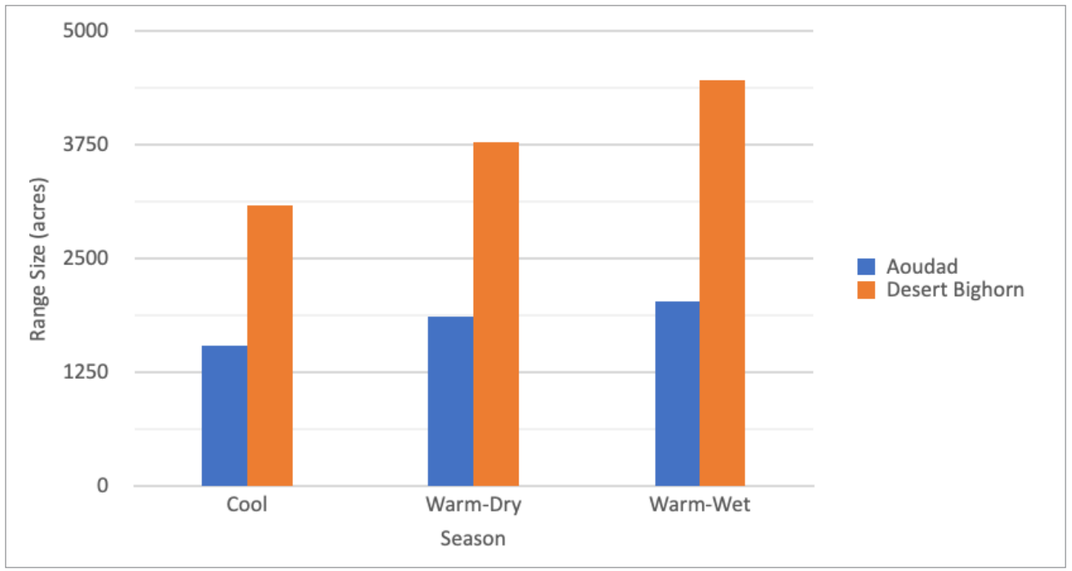


Figure 1: Mean seasonal ranges of aoudad and desert bighorn sheep in the cool season of 2015–2016, and the warm-dry and warm-wet seasons of 2016.

MULE DEER:

Antler Progression of Desert Mule Deer

Justin T. French, Carlos E. Gonzalez, Thomas S. Janke, Juan J. Celaya, and Louis A. Harveson

What are reliable criteria for selective harvest of mule deer bucks? Should we focus on antler characteristics at older age classes (above), or do yearling spikes (below) have lower potential? To answer these questions, we captured fawn and yearling mule deer bucks via helicopter (opposite, right), providing a sample of 55 known-age bucks. We monitored these bucks' antler scores throughout their lives to identify what, if any, criteria reliably predict future Boone and Crockett scores.

Trophy management for mule deer often focuses on selective harvest, or culling, to enhance herd antler quality. Managers use a variety of criteria based on early-age antler characteristics to predict which bucks will or will not grow to be trophies later in life. By removing low-quality deer early in life, managers seek to increase breeding opportunities and access to resources for larger antlered bucks. However, the efficacy of culling programs is questionable and there are few robust evaluations of criterion reliability.

Interest in mule deer management is increasing, but there is little information available to managers on how individual bucks' antler sizes change through time, which we term antler progression. This phenomenon is widely studied in closely related white-tailed deer and is debated just as widely. Much of this debate stems from the difficulty of interpreting cohort-based studies, which compare antler characteristics of age classes in snapshots, rather than tracking the antler performance of individual deer through time. We had the unique opportunity to track antler characteristics of 55 known-age mule deer bucks throughout their lives on the Apache Ranch, near Van Horn, Texas. This allowed us to directly examine and compare antler progression of these bucks through time, rather than in snapshots, providing one of the first clear looks at this process in mule deer.

We captured bucks as fawns or yearlings, which we confirmed based on tooth eruption and replacement. While aging deer based on tooth wear patterns is unreliable, the replacement of 'milk teeth' and the emergence of the rear-most molars are reliable indicators of fawns and yearlings. We then ear-tagged

each known-age deer with a unique color and number combination for future identification in game camera images. We then estimated the Boone and Crockett score of each buck each year from multiple images captured at feeding stations for the next nine years.

The average mule deer buck reached a peak Boone and Crockett score of 149" at 5.5 years old (*Figure* 2). Peak scores varied from 4.5 to 7.5 years old. Based on our models, we found that culling spike and 3-point yearlings would remove a below-average buck just 46% of the time, slightly less reliable than flipping a coin. The absence of G4 tines (*Figure* 3) in 4.5-year-olds may reliably distinguish below-average bucks, but as only four bucks met this criteria, it should be considered with caution. Thus, reliable culling criteria remain elusive.

Further, the use of such criteria also assumes that mule deer can be reliably aged on-the-hoof, which we consider unlikely. Using images of known-age bucks, we evaluated how reliably trained biologists and managers could age them visually. We asked them to do this on a short timeframe (30 seconds per deer) with limited information (one or two images of the deer), as similar as we could make the process to encountering a buck in the field. We found that deer could only be aged to the year correctly 24.7% of the time. Classifying bucks as immature or mature improved reliability to 72.9%, but more than 1 in 4 bucks were still classified incorrectly. Interestingly, this was true regardless of age class; 2.5 and 6.5+ year-old deer were misclassified just as often as 3.5–5.5-year-old deer. While certainly not the final word about on-the-hoof aging, these results demonstrate that doing so is difficult and uncertainty in aging estimates has the potential to greatly undermine selective harvest programs. Overall the criteria we evaluated were unreliable on their own and perhaps more difficult to apply reliably, undermining the efficacy of culling programs.

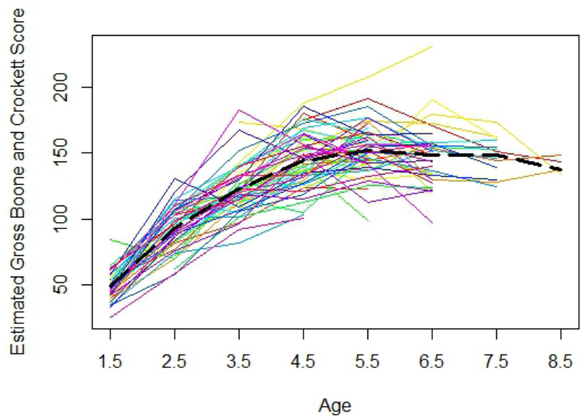


Figure 2: Antler progression curves of 55 known-age mule deer bucks on the Apache Ranch. The average is represented with a black dashed line. On average, mule deer bucks reached a peak score of 149" Boone and Crockett at 5.5 years old, although there was considerable variation.

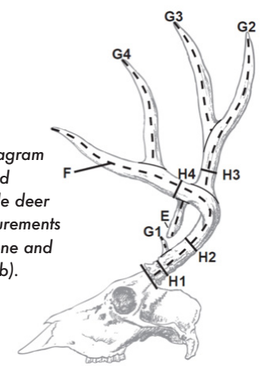


Figure 3: Diagram of Boone and Crockett mule deer antler measurements (source: Boone and Crockett Club).

DESERT BIGHORN SHEEP:

Social Integration and Survival of Translocated Desert Bighorn Sheep

Taylor S. Daily, Carlos E. Gonzalez, Justin T. French, Louis A. Harveson, Warren C. Conway (TTU), and Froylan Hernandez (TPWD)

Desert bighorn sheep have made a comeback in Texas, thanks to translocation efforts over the last several decades.

Historically, desert bighorn sheep were prevalent throughout the Trans-Pecos region of Texas. However, they were extirpated by the 1960s due to unregulated hunting, habitat loss, predation, and disease transmission from livestock. Intensive restocking and translocation efforts began in the 1950s, and desert bighorn sheep have now been restored to the Trans-Pecos. Translocation is the most widely used tool to restore ungulate populations, but the influence of translocation procedures on restoration outcomes is poorly understood. Hard- and soft-release methods are common in desert bighorn sheep restoration, but there is little information on their impact on survival and integration into recipient populations.

Hard-release is the immediate release of translocated individuals into recipient habitat. On the other hand, soft-release methods involve holding individuals in a large enclosure within recipient habitat for several weeks. Holding animals in this semi-protected state is thought to allow them to learn about their new habitat in relative security prior to release, leading to higher survival afterwards. However, social integration with resident individuals also benefits translocated animals by learning from residents' experience. Social bonds formed during the acclimation period of soft-release may hinder this process, potentially offsetting the benefit of such methods.

In the winter of 2017–18, we GPS collared 30 resident (8 M, 22 F) and 70 translocated desert bighorn sheep (36 M, 34 F) released at Black Gap Wildlife Management Area. Of the 70 translocated, 28 (12 M, 16 F) were hard-released and 42 (24 M, 18 F) were soft-released. We held soft-released desert bighorn sheep in a 500-acre enclosure for three weeks before release, while hard-released individuals were released immediately on arrival.

We compared social integration, habitat use and configuration, and survival between resident, hard-, and soft-released desert bighorn sheep. Social herding behavior was correlated with landscape metrics (R = 0.411,

P = 0.001), and release method explained the most variance for social herding behavior (R2 = 0.222, P = 0.001). Resident desert bighorn sheep had the greatest overall 2-year survival estimate (S = 0.87; Figure 4), followed by hard-released (S = 0.78), and then soft-released (S = 0.62).

Soft-released individuals had lower survival and were less likely to integrate with resident desert bighorn sheep. It appears that hard-released desert bighorn sheep were more likely to integrate into resident social groups and used habitat more similarly to them as a result. Higher survival among hard-released desert bighorn sheep suggests they may learn to use available habitat effectively from resident individuals, whereas soft-released sheep did not.

These results highlight the importance of post-translocation social integration to persistence of introduced desert bighorn sheep, and the effects of release methods on this process. While many argue soft-release methods permit animals to acclimate to their new environment, our results indicate they actually hindered acclimation by preventing social integration with resident individuals and learning from them.

Soft-release methods may still prove advantageous when restocking vacant mountain ranges, as translocated desert bighorn sheep could not learn from established residents. In this case, acclimating in a semi-protected environment may afford an advantage over hard-release. Alternatively, it is possible that hard-released desert bighorn sheep did not learn from resident sheep, but integrated with groups they found while searching for habitat they already considered suitable. Future translocation efforts to unoccupied ranges should consider comparing survival and habitat use outcomes to evaluate which of these alternatives is more likely.

In all, translocated desert bighorn sheep were more likely to integrate with resident herds and survive when hard-released. We advise avoiding soft-release methods when resident sheep are present to prevent maladaptive social organization and habitat use.

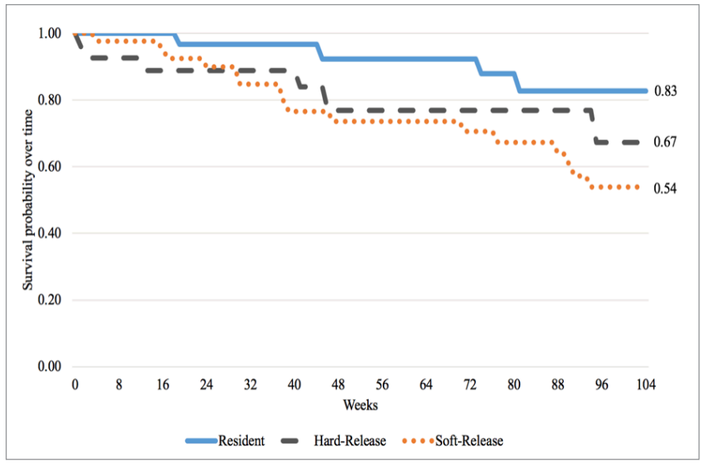


Figure 4. Kaplan-Meier survival estimator curve based on weekly intervals for desert bighorn sheep at Black Gap Wildlife Management Area, Texas, USA, December 2017–December 2019.

PRONGHORN:

Trans-Pecos Pronghorn Restoration: A Successful Decade

Justin T. French, Carlos E. Gonzalez, Louis A. Harveson, and Shawn S. Gray (TPWD)

Pronghorn benefit from the wide open spaces on the Marfa Plateau.

In 2011, Trans-Pecos pronghorn populations hit an all-time low following a precipitous decline. Shrub encroachment, habitat fragmentation, parasites, and historic drought brought them from a peak of 14,000 individuals in the mid-1980s to just 2,700 in 2011.

At that low point, concerned landowners partnered with the Texas Parks and Wildlife Department and the Borderlands Research Institute to investigate and reverse the decline. Over the intervening decade, there were 775 pronghorn translocated from the Panhandle to the Trans-Pecos in six translocations, 1,000 modifications to restrictive fences across pronghorn habitat, and numerous habitat improvement projects. Pronghorn populations have responded to the active management and have rebounded to approximately 4,500 individuals.

Monitoring and research have been integral to these efforts, producing seven completed master's theses, six scientific and technical publications, and numerous public presentations. Each research project was born from a restoration question, directly refining and guiding these efforts.

For example, we have learned much about the influences of habitat connectivity and fencing on the success of pronghorn populations. Much of the best pronghorn habitats in the Trans-Pecos were effectively islands due to impassible fences, with little or no pronghorn movement between pastures. GPS data from translocated individuals on the Marfa Plateau demonstrated the profound effects of fence modifications on habitat connectivity. Translocated pronghorn in 2011 found a landscape full of barriers (Figure 5), but extensive fence modifications allowed pronghorn to move throughout the entire plateau by 2017 (Figure 6). Pronghorn rely on highly nutritious, but equally ephemeral, forbs to sustain themselves. Patchy rainfall makes the distribution of these forbs variable on the landscape and, without well-connected habitat, pronghorn nutrition suffers. In dry years, high parasite loads can compound this stress as pronghorn congregate on limited resources. This proximity increases the transmission rate of intestinal parasites, greatly increasing nutrient demand.

Pronghorn are relatively unique among ungulates in that they do not store appreciable fat reserves, tying their nutrition closely to seasonal variation in habitat conditions. We found that pronghorn experience the most nutritional stress in the winter, when the demand for calories is high but availability is low. Our research showed that up to 47% of their diet may be composed of a single high-calorie forage during this time, such as Texas filaree in the Marathon Basin or shrubby milkwort on the Marfa Plateau. Field sampling revealed only trace abundance of these species in either site, meaning pronghorn were searching for them intensively and burning calories in the process. Further research showed that grazing practices exert complex effects on forb abundance and quality, and that grazing systems incorporating rest periods enhanced the abundance of high-quality forbs. In combination, we learned that fencing and grazing practices can be leveraged to improve the nutrition and success of these populations.

We have also learned better ways of conducting pronghorn translocations. Pronghorn are notoriously highly stressed when handled, leading to elevated rates of capture-related mortality. Our mortality rates are among the lowest recorded for pronghorn, due to minimization of helicopter chase times, careful monitoring of body temperature while handling, the use of anti-inflammatory drugs to manage the physiological effects of stress, and careful attention to the design of transport trailers. This combination of techniques has led to minimizing capture-related mortality rates.

These advances have directly aided the restoration of Trans-Pecos pronghorn, but there is still much to be done. We continue to investigate management practices to enhance the quality and connectivity of pronghorn habitat, ensure survival and social integration of translocated individuals, monitor habitat quality, better understand their nutritional and habitat requirements, and ultimately answer the question "How do we restore and sustain pronghorn in the Trans-Pecos?"

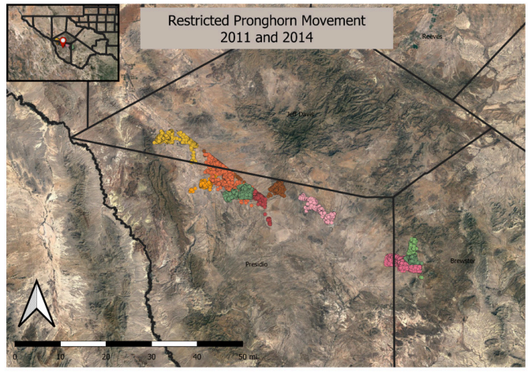


Figure 5: Movements of pronghorn early in the restoration effort (2011 and 2014) on the Marfa Plateau. Restrictive fencing constrained these animals' ranges, limiting their access to resources.

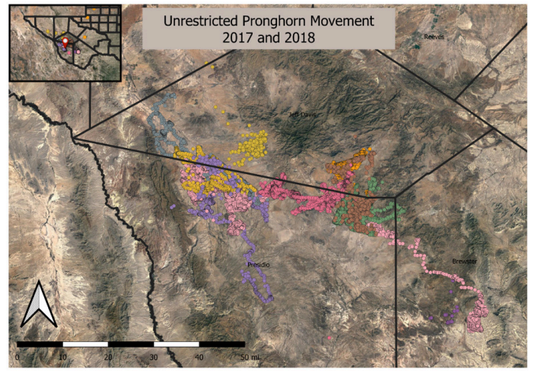


Figure 6: Movements of pronghorn later in the restoration effort (2017 and 2018) on the Marfa Plateau. Modification of previously restrictive fences allowed these pronghorn to roam at will, granting access to more resources.

DESERT BIGHORN, AOUDAD, AND MULE DEER:

Interactions Among Desert Bighorn Sheep, Aoudad, and Mule Deer

Daniel Wilcox, Justin T. French, Carlos E. Gonzalez, Louis A. Harveson, Shawn S. Gray (TPWD), and Froylan Hernandez (TPWD)

Shown left to right: desert bighorn sheep, aoudad, and mule deer.

Aoudad are a wild sheep native to northern Africa but have become a popular big game species in the Trans-Pecos, and their populations have exploded nearly as quickly as their popularity. Both desert bighorn sheep and mule deer populations declined in the Trans-Pecos in the early 20th century. Early intervention and natural resilience led to mule deer recovery, but desert bighorn sheep went extinct in the region by the mid-1960s. Fortunately, subsequent reintroduction, habitat improvement, and herd management efforts returned desert bighorn sheep to historic population levels in the Trans-Pecos by the 1990s, representing a resounding conservation success.

Desert bighorn sheep, mule deer, and aoudad share many similarities. All three are large, browsing ungulates, though desert bighorn sheep and aoudad can also graze during lean habitat conditions. All three species occupy rugged terrain, though mule deer occupy low mountains and foothills while bighorn prefer high elevations. Aoudad, on the other hand, are known to use both. Aoudad are also more gregarious than mule deer and hardier than desert bighorn sheep. These similarities and advantages suggest that aoudad could compete with native species and likely outcompete them.

In 2018, Texas Parks and Wildlife Department partnered with Borderlands Research Institute to study interactions between desert bighorn sheep, aoudad, and mule deer occupying the Van Horn Mountains in the western Trans-Pecos. We did this by comparing each species' niche, which is simply the range of ways they can use the landscape successfully. When two species' niches overlap, they are likely to compete when resources are limited, a common occurrence in the desert. The niche is also closely tied with terms like generalist and specialist; generalists have broad niches, allowing them to use a wide range of conditions, while the opposite is true for specialists.

We saw that desert bighorn sheep and aoudad had small but overlapping niches. On the other hand, mule deer had a broad niche that was mostly separated from the other two species. This suggests that aoudad were likely to compete with desert bighorn sheep, but not with mule deer, under the limited conditions we observed. These results are also consistent with what we know about desert bighorn sheep and mule deer behavior; desert bighorn sheep are specialists with a small niche, while mule deer are generalists with a broad one.

Aoudad are commonly considered a generalist species, but their niche suggests they are a specialist. However, the aoudad population we studied was relatively small due to active control measures by the landowner before our study. With fewer mouths to feed, individuals within a population experience less competition with each other and can use the best available resources. Ultimately, this suggests that the aoudad population we observed is small enough that they are not competing amongst themselves and can "act like" a specialist.

While aoudad may not feel the effects of competition, it is likely that desert bighorn sheep will. We found that the two are most likely to co-occur in the best desert bighorn sheep habitats (Figure 7). Further, these habitats are small and relatively isolated in the Van Horn Mountains and adjacent areas. Under stressful conditions such as drought, small habitat patches cannot support many animals and competition is likely to be intense for prime areas.

Despite the small niche overlap we observed with aoudad, mule deer are not out of the woods when it comes to competition. As the aoudad population grows, their niche will expand. When this happens, we expect their niche to broaden, and possibly overlap the mule deer niche considerably more than we observed, leading to potential competition. Recognizing these realities, it is crucial to investigate how competition can be appropriately managed to ensure the persistence of natives alongside their new neighbors.

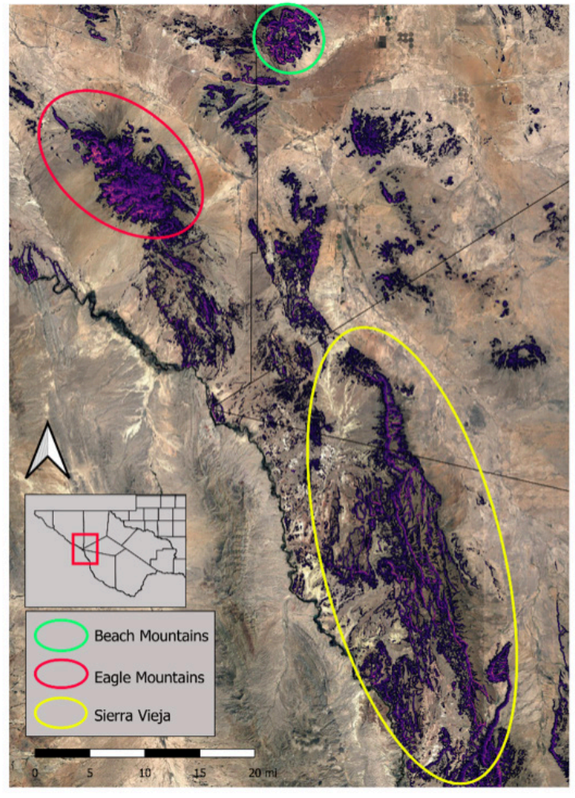


Figure 7: Co-occurrence distribution of aoudad and desert bighorn sheep. Brighter colors indicate a higher probability of aoudad and desert bighorn sheep encountering each other at that location. We see hot-spots in the areas of highest desert bighorn sheep habitat quality in the Beach, Eagle, and Sierra Vieja mountains.

CURRENT STUDENTS AND ONGOING PROJECTS

OLIVIA GRAY

Seasonality of Resource Use Among Desert Bighorn, Aoudad, and Mule Deer

Aoudad, desert bighorn sheep and mule deer likely compete for resources. However, aoudad and native species may respond to these pressures by altering finer scale behaviors to minimize competitive effects. For example, ungulates may partition resources by changing forage preferences, and they may partition resource use to different times of day. Olivia is investigating how desert bighorn sheep, mule deer, and aoudad adjust resource use in the Trans-Pecos. By comparing their diets on a seasonal basis, her work identifies when competition for food may occur. She is also comparing how cycles in their resource use change through time, identifying how the three species might share them.

Olivia was raised in San Antonio but spent a lot of time camping and hiking in West Texas. Her love for the outdoors and conservation led her to pursue a degree in Natural Resources Management from Texas Tech University. While at Texas Tech, she was involved in the student chapter of The Wildlife Society, where she volunteered on many research projects, including studies on mule deer, lesser prairie chickens, coyotes, nilgai, raptors, and passerines. Olivia's experiences during her undergraduate studies led her to gain a deeper appreciation for research, and she is now pursuing a Master of Science degree at Sul Ross State University.

PRESTON McKEE

Habitat Selection and Movement Behavior of Mule Deer and Desert Bighorn Sheep in an Extreme Habitat

As drought becomes more intense and frequent, it is important for managers to understand how ungulates respond to extreme conditions. The Black Gap Wildlife Management Area features some of the most arid and variable climate in the mule deer and desert bighorn sheep range. By studying the habitat selection and movement behavior of these species in this area, we can understand how they cope with these harsh conditions. Preston's research aims to do just that. He is using GPS collar data from mule deer and desert bighorn sheep at Black Gap to model their habitat selection and movement behaviors and how they may change seasonally.

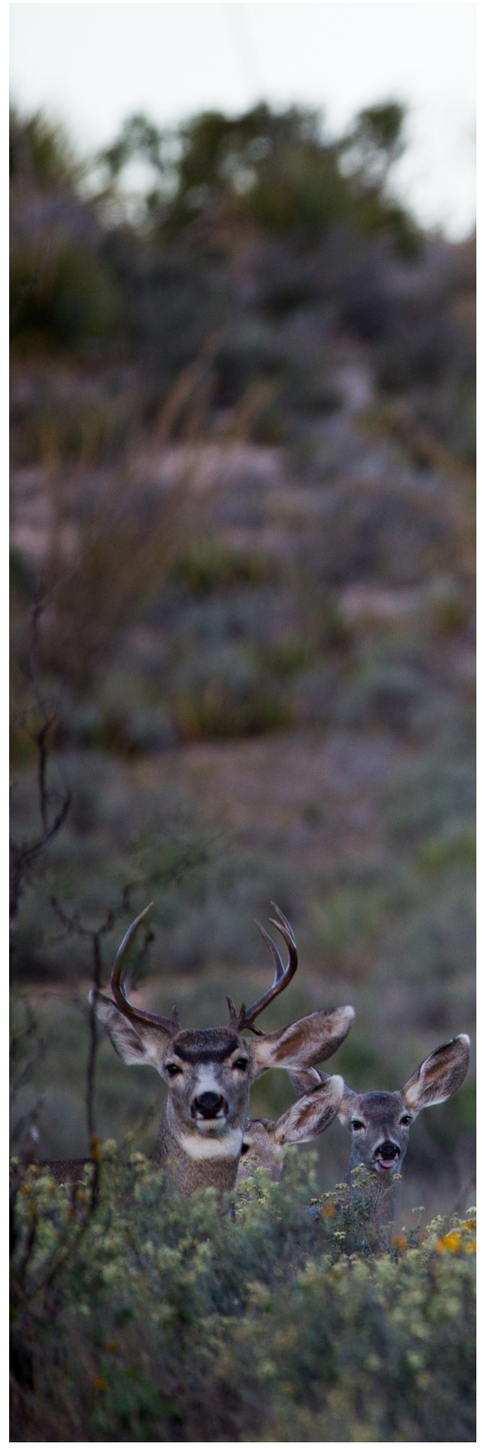
Preston is from the tiny town of Hope in southeastern New Mexico, where his love for wildlife began. He grew up in a hunting family, which spawned his passion for the outdoors. This passion grew into a career path leading Preston to pursue a degree in wildlife management at Sul Ross State University. Involvement in the student chapter of The Wildlife Society and opportunities to learn in the outdoor classroom of the greater Big Bend region contributed to an appreciation for wildlife management, conservation, and research. His interest in big game animals led him to pursue a Master of Science degree, studying mule deer and desert bighorn sheep.

ERIN O'CONNELL

Acclimation and Habitat Selection of Translocated Pronghorn in an Energy-Dominated Landscape

Translocation is one of the most common tools to reverse ungulate population declines. However, the response of released animals to their new habitat has profound impacts on translocation success. Erin's research focuses on how pronghorn acclimate to new habitats following translocation. By comparing the behavior of translocated pronghorn to that of residents, she is able to understand how long it takes translocated pronghorn to acclimate to their new habitat, whether they learn to use this habitat similarly to residents, and how memory of past habitat influences these behaviors. She is also investigating how energy development may influence these processes.

Born and raised in North Carolina, Erin developed a passion for science and the outdoors from spending summers outside at her grandparents' farm in West Virginia. Currently pursuing a Master of Science degree at Sul Ross, she has undergrad experience in both marine and terrestrial research. She graduated from Wofford College in South Carolina with a bachelor's degree in Biology in 2020. Erin spent the summers of 2019 and 2020 capturing and tracking bats throughout West Virginia, Pennsylvania, and Kentucky, researching population estimates and spread of white-nose syndrome. She is interested in disease ecology, microbiology, and quantitative ecology.



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All photos courtesy of Ben Masters, with the exception of P4, P12, and P11 bottom (BRI staff, faculty, and students), and P10 (Paul Slocumb). BRI staff editors include Julie Rumbelow, Shawna Graves, and Lydia Saldaña.

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