

2023

Habitat Research Report



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.

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ENDOWMENTS



John L. Nau, III Nau Endowed Professor of Habitat Research and Management



One of the mantras we take pride in at the Borderlands Research Institute is providing students with hands-on opportunities in natural resource conservation.

In a state that is 95% privately owned, we rely heavily on our landowner partners to facilitate student training on their properties.

Over the last ten years, Nine Point Mesa Ranch has turned into a "BRI training site"

for our students. The outdoor laboratory has been the backdrop for research focused on desert bighorn sheep restoration, mule deer movements, scaled quail research, and now a variety of habitat-centric projects including soil mycorrhizae, hydrology, invasive grasses, brush management, arthropods, scaled quail, and mule deer antler development. In addition to the thesis projects, Nine Point Mesa has hosted hundreds of undergraduates as technicians and volunteers, or during countless field trips. We are honored to work on Nine Point Mesa and all the private properties across West Texas to train the next generation of conservationists!

Louis A. Harveson, Ph.D.

Dan Allen Hughes, Jr., Endowed Director



Our Habitat Research and Management Program emphasizes pragmatic management of natural resources through sound science.

The Chihuahuan Desert contains various geologic and soil types and significant climatic variations, yielding diverse vegetation communities. These vegetation communities are critical for private landowners concerned with the sustainability of livestock, wildlife,

watersheds, and riparian areas. However, for many reasons, the present vegetation community may not meet a landowner's needs. Therefore, we work with landowners to develop a habitat program that fits the needs of working private lands. Our research aims to encourage the development of strategies to decrease soil erosion, increase water harvest, reduce undesirable plant species, and sustain livestock and wildlife. We accomplish this by engaging students in the applied field experience of rangeland management while working directly with faculty. All this would not be possible without the continued support from landowners and conservation partners. We sincerely appreciate your contributions toward habitat conservation in the Trans-Pecos.

Carlos "Lalo" Gonzalez, Ph.D.

Nau Endowed Professor of Habitat Research and Management

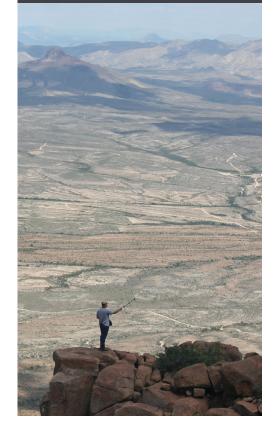
BORDERLANDS RESEARCH • INSTITUTE

CONSERVING THE LAST FRONTIER

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STEWARDSHIP SERVICES:

Center for Land Stewardship and Stakeholder Engagement

Billy Tarrant, Jason Crosby



Field days provide landowners and land managers the opportunity to see first-hand the the results of habitat restoration techniques, such as these brush weirs which help slow runoff water and restore riparian functionality.

The principal goal of the Center for Land Stewardship and Stakeholder Engagement is to facilitate effective conservation in Far West Texas by providing technical resources for landowners, energy developers, community members, and conservation partners. From a habitat management perspective, this is accomplished by delivering science-based technical guidance to area land stewards to assist them in their conservation goals. The Center also facilitates cost share programs to lessen the financial burden of implementing habitat enhancement practices.

Since its inception in 2021, the Center for Land Stewardship and Stakeholder Engagement has launched various new initiatives as noted below.

Our Partners for Habitat Program is funded through the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program. It provides cost share opportunities for habitat enhancement projects that illustrate a benefit to federal trust species, including migratory birds, threatened and endangered species, and other species of concern.

The Greater Big Bend Conservation Partnership is a U.S. Department of Agriculture Natural Resources Conservation Service Regional Conservation Partnership Program grant. It funds the implementation of landscape-scale conservation initiatives in Brewster, Jeff Davis, and Presidio counties. The Partnership is coordinated through the Center for Land Stewardship and Stakeholder Engagement in cooperation with Texas Agricultural Land Trust, Rio Grande Joint Venture, and Trans-Pecos Grazing Lands Coalition.

The Alamito Creek Conservation Initiative is funded through Dixon Water Foundation and Horizon Foundation. This innovative conservation partnership with Rio Grande Joint Venture uses available funding to implement riparian and grassland restoration techniques along Alamito Creek and several of its tributaries.

The Trans-Pecos Grasslands and Riparian Conservation Initiative is another strategic partnership between Borderlands Research Institute, Rio Grande Joint Venture, and Texas Parks and Wildlife Department. This multimillion dollar grant from Texas Parks and Wildlife Department utilizes federal Pittman-Robertson funds to conduct strategic brush removal, restrictive fence replacement, and riparian restoration in key areas of the Trans-Pecos.

We also continue to utilize support from the National Fish and Wildlife Foundation's Pecos Watershed Conservation Initiative to fund grassland restoration activities on private lands in the region.

The recently funded *Trans-Pecos Grazing Lands Conservation Partnership* aims to increase technical assistance and education to private landowners and operators in the region, focusing on grazing lands. We partnered with the Trans-Pecos Grazing Lands Coalition to obtain this notable grant through the NRCS Grazing Lands Conservation Initiative.

Through these initiatives and with our landowner and conservation partnerships, we have treated over 5,600 acres in Presidio County and over 3,000 acres in Brewster County. Almost all initiatives incorporate a valuable monitoring component that allows our researchers to better understand the effectiveness of applied management techniques. Many of these efforts have a substantial education and outreach component, which helps our staff share critical results with Trans-Pecos land stewards and conservation partners. And finally, almost all of these initiatives incorporate other prominent conservation organizations as partners, building on the concept that the Center for Land Stewardship and Stakeholder Engagement serves as a convener of conservation partners across the region.

NATIVE SEEDS:

West Texas Native Seeds Project

Colin S. Shackelford (CKWRI), Billy Tarrant, Louis A. Harveson, and Carlos E. Gonzalez



Installing seed increase plantings at our West Texas research farm.



Transplants for new plant evaluations being prepared at our greenhouse at Sul Ross State University.

West Texas Native Seeds was established as a partnership between the Caesar Kleberg Wildlife Research Institute and the Borderlands Research Institute. Our mission is to develop ecotypic native seed sources and grassland restoration methodologies for wildlife habitat improvement, energy development reclamation, and right-of-way management in West Texas. A limiting variable for successful habitat restoration in West Texas is the lack of commercially available locally adapted native seeds. We work to change that and make grassland restoration possible across the region.

To date, we have completed 26 plant species evaluations, leading to six native germplasm seed releases available on the commercial market. These include Brewster Germplasm sideoats grama, Santiago Germplasm silver bluestem, Permian Germplasm whiplash pappusgrass, Guadalupe Germplasm white tridens, Cibolo Germplasm little barley, and Menard Germplasm purple threeawn. Currently, 11 plant species are in the last step before commercial release. Plans are in place for new sand dropseed and cowpen daisy releases to the commercial seed trade.

We have made over 2,000 native seed collections across West Texas, which enable new plant evaluations. There are currently four ongoing plant evaluations, with plans for new evaluations each growing season. New farm facilities being developed on the Sul Ross State University campus will facilitate these evaluations and allow us to scale up seed production.



Seed increase plantings of cowpen daisy at our West Texas research farm.

Over ten restoration research and demonstration plantings have been completed across West Texas. These plantings allow us to test seed performance, the impact of cover crops on planting success, novel planting methodologies, and develop methods to restore grassland communities impacted by exotic species. More research plantings are planned as we develop new seed releases and landowner partnerships.

West Texas Native Seeds also facilitates grassland restoration through consultations with regional landowners and project managers. We can help develop seed mixes and planting methodologies specific to a project or site. West Texas landowners who have a grassland restoration project in mind are invited to contact us for technical guidance.

FORBS, PRONGHORN, AND CATTLE:

Effects of cattle grazing systems on forb biomass and nutrition in pronghorn habitat in Trans-Pecos, Texas

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



Cattle grazing on the Dixon Water Foundation's Mimms Unit during the monsoon season.

Pronghorn are adapted to diverse vegetation communities among the desert ecosystems they occupy. Despite the high vegetation diversity present in our desert landscapes, their dietary preferences are strict. Pronghorn are herbivore specialists that prefer high-energy forbs, and their health and survival depend on the nutritional value of available forage, which varies seasonally. Ensuring pronghorn dietary choices are met can aid conservation efforts. Therefore, we took on the task to assess how livestock grazing practices might aid pronghorn food availability.

Grazing by large herbivores influences vegetation diversity, quantity, and quality. A literature review suggests that the unique grazing activities of bison were fundamental for grassland plant and herbivore species diversity. However, after European settlement in the Trans-Pecos area of the Chihuahuan Desert, the dominant grazer's ecological role shifted to the introduced domestic cow. Thus, the influences of bison on vegetation through their unrestricted movement changed to the deliberate placement of cattle and fences. Although the spatial and environmental effects of bison grazing cannot be replicated, cattle may serve as a suitable alternative.

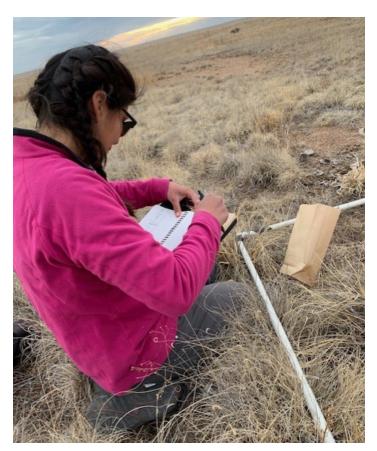
Previous research regarding the impact on plant communities by cattle grazing revealed inconsistent results across ecosystems. This led us to investigate the effect of cattle grazing systems on forb abundance and quality to assess approaches for improving pronghorn habitat. The objectives were to compare forb production and nutritional quality among continuous, rotational, and deferred cattle grazing systems during one winter season.

Our results suggest that cattle grazing systems had little influence on forb quantity and nutrition during the winter.

Possible reasons that forb biomass and nutrition values were similar could be due to plants having similar responses to weather conditions, leaf maintenance, and physical state following grazing regardless of the grazing system. Results of previous research show slightly higher differences in forb biomass and nutrition during the warm growing season favoring the rotational system. It is possible that the forb species detected during the winter could be less reliant on precipitation during the Trans-Pecos monsoons or more droughtresistant than those not detected. Due to low forb detection, our analysis may not have been able to capture other variables like precipitation, soil properties, and access to sunlight. Precipitation influences plant production in arid ecosystems and is highly variable within and between years. Our study was conducted during drought conditions. Thus, it is possible that the forb biomass and quality did not indicate their values in average precipitation years.

Determining the correct stocking rate is the most valuable component in cattle grazing systems. The stocking rate controls the pace at which herbage is removed by grazers and is defined as the area of land allotted to an animal unit for the duration of the grazing period. Forage is the supply, and cattle are the energy demand. Supply and demand should be balanced using the stocking rate as a fundamental tool. Temporal relationships among stocking rate and environmental variables vary. Their interplay complicates assessing time scales and vegetation changes. Our results likely highlighted a relatively small section of the full magnitude of successional stages relative to grazing.

Understanding the dynamics of vegetation communities is a necessary management component for sustainable animal production and plant integrity in arid rangelands. Our research shows that grazing systems have little effect on



Graduate student researcher Leanna Morin collects plant samples to compare nutritional quality between plots with different grazing systems.



Pronghorn, a species adapted to open grasslands, share much of the same habitat with cattle.

forb communities during winter in drought conditions. There is little information about arid ecosystem dynamics through long temporal scales, but coupled with previous research in the Trans-Pecos, research can help illuminate grazing effects. We conclude that cattle grazing in arid regions under proper management does not cause harm to the forb community and requires adaptation and attentiveness to climatic variation to maintain sustainability and conservation of rangelands.

GRASSLAND BIRDS:

Impacts of woody plant control on nonbreeding bird communities in Trans-Pecos, Texas

Emily Card, Mieke Titulaer, Carlos E. Gonzalez, Justin T. French, and Louis A. Harveson



The grasshopper sparrow is a grassland specialist that has lost nearly 68% of its population over the past half-century. Grasshopper sparrows were observed in higher abundances in herbicide-treated plots three sampling seasons after the initial herbicide application.

Grasslands are one of North America's most imperiled ecosystems. Populations of grassland birds have declined at higher rates than any other group of birds in North America. One of the most significant threats to grassland bird habitat is the intrusion of woody plants into grass-dominated ecosystems. Woody plant encroachment is characterized by increased dominance, density, and cover of trees, bushes, or shrubs. Previous research demonstrated that shrublands treated with herbicide experience an increase in grass production as the woody cover is reduced. To better understand how grassland bird populations respond to the removal of woody plants, we completed nonbreeding bird and vegetation surveys on three ranches in the Trans-Pecos region of Texas during the winters of 2019-2022. One study site was partially treated with an herbicide to remove woody plants in 2019. The research objectives of this project were to 1) evaluate how woody plant removal influences the presence and abundance of grassland bird species, and 2) monitor nonbreeding bird community structure and composition in grassland, untreated

shrubland, and herbicide-treated shrubland sites across a four-year sampling period.

We found that nonbreeding bird communities are largely shaped by the presence and distribution of woody plants. Grassland-obligate species comprised the greatest proportion of birds detected during surveys in areas containing grassland habitat with low shrub densities. Conversely, shrub-associated birds dominated the communities observed in areas with more woody cover. Results revealed that the herbicide-treated areas possessed a nonbreeding avian community characteristic of a savanna ecosystem (i.e., containing a mix of grasslandobligate, grassland-facultative, and shrub-associated species) by the end of the project's sampling period. We found that the abundances of several grassland-obligate species were notably higher in this area in 2022 than in the previous survey years. The community composition in treated plots differed from those observed in the grassland and untreated shrubland strata. These findings indicate that the herbicide application did not completely restore the treated habitat to historical grassland conditions by the end of the project's sampling period, as we originally predicted.

The strong influence of shrub cover and height on nonbreeding avian community structure indicates that our results are consistent with the habitat heterogeneity hypothesis, which postulates that species diversity increases as the number of habitats in a landscape increases. Within our study system, the



Graduate assistant Emily Card conducts a non-breeding bird and vegetation survey to evaluate the impacts of herbicide treatments on wintering bird communities.

early phases of shrub encroachment enhanced the horizontal and vertical vegetation structures, resulting in a wider variety of available resources and niche spaces for wildlife to use. Local species richness is expected to increase as generalists and shrub-associated bird species occupy these new habitats and join the community of grassland-obligate birds. We found that avian species strongly associated with grasslands were absent from habitat containing high shrub densities.

It may also be advantageous to identify and assess relationships between grassland birds and herbaceous plant species. There is much to learn about species-specific preferences for food resources. Explaining these relationships can provide a better understanding of how grassland birds track limiting resources.

Our results highlight the importance of removing shrub structures from the landscape to create suitable habitat for imperiled grassland bird populations in the Chihuahuan Desert. In addition, our findings confirm that herbicide can be a valuable tool for restoring semi-arid grassland habitat for some grassland-obligate species. When utilized alone, herbicide may not fully recover habitat conditions. Grassland birds that spend the winter in the Chihuahuan Desert are experiencing the highest rates of annual loss compared to other bird assemblages in North America. By identifying the habitat characteristics that primarily influence nonbreeding bird community composition and utilizing effective management techniques, biologists and land managers can set achievable conservation goals that benefit grassland bird species of concern.

CURRENT STUDENTS AND ONGOING PROJECTS

GRAY HANCOCK



Gray was born and raised in Nacogdoches, Texas. He grew up hunting, hiking, fishing, and exploring the lakes and wooded areas near his family farm, which developed his passion for conservation and the outdoors. As a kid, his family would visit the

Trans-Pecos area of Texas to hike, swim, and explore Big Bend National Park. It was during these trips that Gray experienced the allure of West Texas. This led him to obtain a bachelor's in Natural Resource Management from Sul Ross State University. He is excited to continue his education by pursuing a Master of Science in Range and Wildlife Management, focusing on hydrology and remote sensing.

ANDRÉS SOLORIO PULIDO



Andrés was raised in Villa Manuel, a rural town in Tamaulipas, Mexico. His family owned some land dedicated to agriculture, where he found a passion for being in the field and engaging in outdoor activities. As a teenager, he volunteered at Mexico's National Institute for Forestry, Agriculture and Livestock Research, and staff there encouraged him to get a

bachelor's in Forestry at the Autonomous University of Nuevo Leon. After gradutation, he worked in the corporate world focused on ecosystem restoration, habitat management, and environmental protection. Now, he is excited and grateful to be part of the Borderlands Research Institute team, where he is gaining more experience working with range and wildlife management activities.

Developing monitoring methods to assess the effectiveness of hydrology improvements to retain topsoil using unmanned aerial vehicles

Water is a precious resource in the arid environment of the Trans-Pecos. Understanding how water can be manipulated using process-based restoration strategies to slow erosion and retain topsoil is vital in restoring habitat. This study focuses on developing an accurate monitoring process using unmanned aerial vehicles, such as drones, for examining soil retention. Using remote sensing technology will aid in analyzing the effectiveness of using structures to retain topsoil.

Native vegetation restoration in areas invaded by Lehmann's lovegrass

Habitat is a critical factor for wildlife conservation. For example, scaled quail are an important game species for the Trans-Pecos, but invasive grass species such as Lehmann's lovegrass have been deteriorating quail habitat by creating monocultures and decreasing native grassland species. Lehmann's lovegrass was introduced to West Texas in the 1940s to protect the eroded soils in the region. However, Lehmann's lovegrass has modified the Chihuahuan Desert ecosystem. Because of this, we are comparing three treatments in a Lehmann's lovegrass invaded area to increase the diversity of native vegetation. Our results will provide fundamental scientific information to advise habitat restoration efforts and improve native vegetation for scaled quail.

JASON CROSBY



Jason spent his childhood roaming the Sumter National Forest in South Carolina's Appalachian Piedmont, learning to love and appreciate the natural world. He is driven by two lifelong principles: learning and service. After retiring from a

25-year career in the United States Army, he moved to Alpine and enrolled at Sul Ross State University to continue his pursuit of those tenets, earning a bachelor's degree in Natural Resource Management with a concentration in Range Management. He is honored and excited to continue his growth in the field of rangeland management as part of the team at Borderlands Research Institute.

TY GOODWIN



Ty grew up in
Gatesville, Texas, and
decided to attend
school at Sul Ross
State University after
falling in love with the
area on a summer
motorcycle trip with
his grandfather. After
graduating from
high school in 2020
with eight years of
plant identification
experience,
Ty decided to

study Natural Resource Management with a Range concentration. Ty graduated with a bachelor's degree in 2023 and pursued a master's degree at Sul Ross State University weeks after graduation. As an undergrad, he was heavily involved with the Borderlands Undergraduate Mentorship Program and is excited about his thesis research on livestock grazing and restoration ecology.

Comparing rangeland monitoring methods for grassland restoration

Rangelands comprise nearly half of the earth's land surface and provide critical ecosystem services. However, habitat fragmentation and overgrazing have transformed some rangelands into brush-dominated landscapes. Detecting change from restoration is essential to determining its efficacy. Jason's project will compare monitoring methods using remotely sensed spectral data and manual surveys to evaluate the rate of change for brush cover and herbaceous production after restoration efforts. This will determine the scales at which remotely sensed data can capture change in brush communities compared to manual monitoring. Identifying which methods are most efficient at assessing rates of change in these landscapes will assist stakeholders in the planning of grassland restoration efforts.

Livestock grazing systems within a desert ecosystem: ecological implications

Rangelands contribute significant percentages of ecosystem services worldwide, such as water retention, water purification, food services, and carbon sequestration. Humans have historically used rangelands as a nutritional source through livestock production. However, grasslands have lost ecosystem health and function due to overgrazing and poor land stewardship. Ty's project will examine how long-term grazing regimes affect environmental variables such as soil moisture, forage diversity, cover, and annual forage production in a Chihuahuan Desert grassland.



Photos courtesy of Ben Masters (front and back cover) and BRI staff, faculty, and students.

BRI staff editors include Julie Rumbelow, Shawna Graves 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 our many partners who make our work possible.

Apache Corporation
Bird Conservancy of the Rockies
Caesar Kleberg Wildlife Research Institute at
Texas A&M University-Kingsville
ConocoPhillips
Cynthia and George Mitchell Foundation
Dixon Water Foundation
The Horizon Foundation
Houston Livestock Show and Rodeo
The Meadows Foundation
National Fish and Wildlife Foundation
The Nature Conservancy
The Nau Foundation
Pam and Will Harte
Permian Basin Area Foundation

Lana and Robert Potts
Potts and Sibley Foundation
Quivira Coalition
Rio Grande Joint Venture
San Antonio Livestock Exposition
Stanley Smith and Railway Ranch, Inc.
Still Water Foundation
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Texas Department of Transportation
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