

# CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

2026



Terlingua Ranch Lodge  
Brewster County, Texas  
May 17–19, 2026



Sponsored by the Texas State University System, the TSUS Foundation,  
and the Texas State University Department of Biology

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Terlingua Ranch Lodge  
Brewster County, Texas  
May 17–19, 2026

## **Sunday, May 17**

- 5:30 pm Informal social for meeting participants on the patio by the café
- 6:30 pm Dinner for meeting registrants at the Bad Rabbit Café (meal available for attendees who did not preregister, \$30.00)

## **Monday, May 18**

- 8:00 am Paleontology and geology of the Cretaceous Aguja Formation (meet on the patio outside the café)
- 8:30 am Field trip to Paisano Mine (meet in the parking lot outside the bunkhouse)
- 9:00 am Christmas Mountains Field Research Station tours (shuttles departing from the parking lot outside the bunkhouse)
- 1:45 pm Paper session (in the bunkhouse beneath the Bad Rabbit Café)
- 6:30 pm Dinner for meeting registrants at the Bad Rabbit Café (meal available for attendees who did not preregister, \$30.00)

## **Tuesday, May 19**

- 8:30 am Field trip to Christmas Mountains overlook (meet in the parking lot outside the bunkhouse)
- 9:00 am Christmas Mountains Field Research Station tours (shuttles departing from the parking lot outside the bunkhouse)
- 2:00 pm Afternoon paper session (in the bunkhouse beneath the Bad Rabbit Café)
- 6:30 pm Dinner for meeting registrants at the Bad Rabbit Café (meal available for attendees who did not preregister, \$30.00)

## Field Trips

### **Paleontology and Geology of the Alto Shale Member of the Aguja Formation (Cretaceous) Exposed East of the Terlingua Ranch Lodge**

Trip leaders: Thomas Shiller, Sue Mulroney and Adam Myers

Monday morning at 8:00 – meet on the patio outside the Bad Rabbit Café

In 1939, a team of paleontologists from the American Museum of Natural History traveled to the region now known as Terlingua Ranch. During their visit, Dr. Erich M. Schlaikjer and William O. Sweet collected vertebrate fossil remains from the Cretaceous Aguja Formation near Smallpox Well. These included the left mandible, limb bones (one later found to be the radius of a duck-billed dinosaur), and other fragments from a small horned dinosaur, and a *Deinosuchus* tooth. The collection localities lie just to the east of the Terlingua Ranch lodge, adjacent to property owned by Adam Myers and Susan Mulroney. Broad exposures of the Alto Shale member (formerly the upper shale member) of the Aguja Formation on the Myers/Mulroney property preserve a variety of vertebrate fossils (dinosaurs, turtles, and crocodylians) as well as fossil wood. A walk through the property will provide an opportunity to step back in time and observe rocks that formed when the landscape was strikingly different and discover the remains of plants and animals that lived over 65 million years ago. Attendees at the 2025 symposium discovered an in-place, well-preserved dinosaur bone on the property, later excavated and found to be a complete hadrosaur (duck-billed dinosaur) scapula.

### **Paisano Mine**

Trip leader: Dave Lemke

Monday morning at 8:30 – meet in the parking lot outside the bunkhouse

Fluorspar or fluorite is an important industrial mineral used in the manufacture of steel, aluminum, glass, and fluorocarbons. It occurs at several localities in the Trans-Pecos and Llano regions of Texas. Trans-Pecos deposits are commonly associated with Tertiary volcanics and Cretaceous limestones. Occurrences of fluorspar have been found in the Quitman and Eagle Mountains of Hudspeth County, the Chinati Mountains of Presidio County, the Franklin Mountains of El Paso County, and the Christmas Mountains and other areas of Brewster County. None of the deposits in Texas are currently being produced.

The Paisano fluorite mine, covering an area of 310 hectares (766 acres) is located on the north side of the Christmas Mountains. This mining site was first discovered in 1971 and has been exploited through both surface and underground mining methods. The primary mining technique employed was open pit mining. By 1982, the mine had a capacity to extract 9 metric tons of ore per day, but the availability of lower cost fluorite from Mexico led to the closing of the mine in the mid-1980s.

We will carpool to a parking area near the mine site, which is then reached by a half-mile hike over a gravel road. This is a moderately easy hike, although since we are in the desert, plan to carry at least a liter of water with you

### **Christmas Mountains Overlook**

Trip leaders: Dave Lemke

Tuesday morning at 8:30 – meet in the parking lot outside the bunkhouse

Participants will carpool up the summit road to a scenic overlook at the road's end. We will make several stops along the way to take in views of the Rosillos Mountains and desert flats to the east and the Chisos Mountains to the southeast. The overlook, at an elevation of approximately 1640 m (5370 ft), provides stunning views of the region to the south and west, and participants will have the option of making the short but rugged hike to the summit at 1746 m (5728 ft).

Please note that the summit road requires short wheelbase, high-clearance vehicles with good tires and, consequently, the number of participants on this trip will be limited by the number of vehicles we have at our disposal.

### **Christmas Mountains Field Research Station Tour**

Trip leaders: John Hayek and Ashley Spicer-Runnels

Monday and Tuesday 9:00 to noon – meet in the parking lot outside the bunkhouse for a SRSC shuttle departure approx. every 30 minutes (parking is limited at the field station)

Join us for the first public tour of the Christmas Mountains Field Research Station, a newly developed facility designed to support field-based teaching, research, and immersive learning experiences across disciplines. Participants will be transported by shuttle from the bunkhouse to the field station, where we will tour the main building and surrounding spaces. The visit will include an overview of the station's design, functionality, and intended use, along with a discussion of how the facility will support academic programming, research initiatives, and future collaborations across the Texas State University System. This tour offers a unique opportunity to experience the facility firsthand and to learn more about the vision for the Christmas Mountains as a destination for discovery, creativity, and interdisciplinary engagement.

# 2026 CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

## Monday May 18

- 1:45 Welcome and Introduction  
David E. Lemke, Texas State University
- 2:00 Being BearWise: Living with black bears in Trans-Pecos, Texas  
Rachael Connally, Texas Parks and Wildlife Department
- 2:15 Things your mother never told you . . . about bat echolocation  
Lindsey Bredemeyer, Tierra Grande Master Naturalists
- 2:30 Shifts in breeding phenology for Cassin's Sparrow (*Peucaea cassinii*) over four decades  
John Schnase\*, Mark Carroll, Paul Montesano, and Virginia Seamster, NASA Goddard Space Flight Center and New Mexico Department of Game and Fish
- 2:45 Break**
- 3:00 Assessing fine scale spatial arrangement of vegetation under continuous and rotational grazing using unmanned aerial systems  
Christian A. Lewis\*, S. Antonio Cantu, J. Silverio Avila, Carlos E. Gonzalez, Sul Ross State University
- 3:15 Do grasses of central Texas use water stored in limestone?  
Eli Hartung\* and Susan Schwinning, Texas State University
- 3:30 Ongoing bryophyte survey efforts in the Davis Mountains Preserve and Chinati Mountains State Natural Area of Trans-Pecos Texas  
Clifton Albrecht\* and Dale Kruse, Sul Ross State University and Texas A&M University
- 3:45 Break**
- 4:00 The botanical contributions of S.W. Stanfield  
David E. Lemke, Texas State University
- 4:15 Archives of the Big Bend: Interdisciplinary research and resources across West Texas  
Victoria Contreras, Sul Ross State University
- 4:30 DFCs, MAGs, GMAs: Alphabet soup for groundwater management in far West Texas  
Kevin Urbanczyk, Sul Ross State University

## Tuesday May 19

- 2:00 Background color matching enforces rare phenotype of Trans-Pecos ratsnake (*Bogertophis subocularis*) in the Big Bend region of Texas  
Thornton Larson\*, Dusty Rhoads and Dean Williams, Sul Ross State University, University of North Texas and Texas Christian University
- 2:15 The effects of soil substrate on kangaroo rat forelimb morphology  
Kennedy B. Wood\* and Leila Siciliano-Martina, Texas State University
- 2:30 UAV and GPS applications for understanding scaled quail habitat in the Chihuahuan Desert  
Luke D. Christensen\*, Carlos E. Gonzalez J. Silverio Avila S. and Antonio Cantú, Sul Ross State University
- 2:45 Break**
- 3:00 Structural geology of the Upper Cretaceous Boquillas Formation in Javelina Draw, Big Bend National Park, Texas  
Amanda Piper\* and Jesse Kelsch, Sul Ross State University
- 3:15 Life in the Eocene of West Texas: A fossil site from the Pruett Formation, Brewster County  
Austin Drews\* and Thomas Shiller, Sul Ross State University
- 3:30 Ancient squash in the American Southwest: An SEM-based comparative guide for identifying archaeological *Cucurbita*  
Diana Flores\* and Clifton Albrecht, Sul Ross State University
- 3:45 Break**
- 4:00 Black bears on the move: Insight Into black bear recolonization efforts in the southwestern U.S.  
Jake B. Gowdy\*, Jesse D. Ellgren, Caitlin M. Camp Pappas, Matthew O. Hewitt, Amanda M. Veals Dutt, Justin T. French and Louis A. Harveson, Sul Ross State University
- 4:15 Alamito Creek conservation initiative – Working with landowners to implement riparian habitat restoration in the Alamito Creek watershed  
Jared Schniers and Nick Loveland, Sul Ross State University and Rio Grande Joint Venture
- 4:30 Evaluating the integration of economic development and environmental sustainability in the Downtown Austin Plan  
Rumana Naznin, St. Edward's University

## ABSTRACTS

### Monday Afternoon

#### **Being BearWise: Living with black bears in Trans-Pecos, Texas**

Rachael Connally – Texas Parks and Wildlife Department, Alpine, TX

Black bears (*Ursus americanus*) were extirpated from the Trans-Pecos region of Texas by the 1950s but began naturally recolonizing the region from northern Mexico in the 1980s. This recolonization has led to increasing incidents of human-bear conflict. Texas Parks and Wildlife Department staff have worked with several other state and national wildlife management groups and agencies to develop best practices for reducing human-bear conflict while living and recreating in regions occupied by black bears. BearWise is a program of the Association of Fish & Wildlife Agencies and is managed by a team of North American bear biologists and communications professionals. BearWise is a trusted resource for sound information and smart solutions that help homeowners, businesses, and communities coexist with bears. We share the BearWise principles and describe ways to use them around your home, ranch, and rental property. We discuss the importance of and methods for securing attractants in preventing human-black bear conflict. Since 2018, Texas Parks and Wildlife Department staff have been testing the use of electricity to deter bears from feeders and as a proxy for other attractants in the Trans-Pecos region. We discuss the efficacy of using electricity in securing various black bear attractants in the Trans-Pecos region and other arid landscapes. We conclude with suggestions for reporting black bear sightings as wildlife managers continue to monitor the species' movement across its recolonized range in Texas.

#### **Things your mother never told you . . . about bat echolocation**

Lindsey Bredemeyer – Tierra Grande Texas Master Naturalists, Alpine, TX

Acoustic detection and species identification of bats has become the default method with modern digital systems. What is seldom discussed is the discovery of the ultrasonic voice of bats, a discovery that was in conflict with the prevailing opinion for centuries. How the relationship of a Harvard physics professor, two zoology students and a farm boy from Webberville Texas first heard the voice of bats, revolutionized radio, spearheaded the understanding of animal intelligence and initiated the gift of hearing for over a million functionally deaf individuals. And as a continuing influence, one of the related devices is imbedded in your daily life.

#### **Shifts in breeding phenology for Cassin's Sparrow (*Peucaea cassinii*) over four decades**

John Schnase<sup>1\*</sup>, Mark Carroll<sup>1</sup>, Paul Montesano<sup>1</sup>, and Virginia Seamster<sup>2</sup>—<sup>1</sup>NASA Goddard Space Flight Center and <sup>2</sup>New Mexico Department of Game and Fish

Cassin's Sparrow (*Peucaea cassinii*) is an elusive resident of the southwestern United States, southern Great Plains, and northern Mexico. Despite long-standing interest, its breeding phenology is not well established. In this study, we used 40 years of eBird occurrence records to quantify the breeding phenology for Cassin's Sparrow. We determined the timing of key phases of the breeding cycle based on the distinctive skylarking behavior of male Cassin's Sparrows and examined how

these phases have shifted over time, with particular attention to regional variation. Our results reveal a complex east-to-west seasonal progression of breeding activity across the species' U.S. range, consistent with patterns reported in the historical literature. We also identified a potential source of monitoring error in the North American Breeding Bird Survey that could lead to inaccurate population trend estimates for the species in areas where the timing of the survey differs from breeding season activity peaks. This could bring into question conservation status assessments for Cassin's Sparrow that are based on those estimates. Finally, we found regional differences in phenological trends over the past four decades. This is meaningful, because it suggests that local populations may be responding differently to changing climatic conditions. Our findings underscore the complexity of the breeding ecology of Cassin's Sparrow and have broader implications for the monitoring and conservation of aridland birds.

### **Assessing fine scale spatial arrangement of vegetation under continuous and rotational grazing using unmanned aerial systems**

Christian A. Lewis\*, S. Antonio Cantu, J. Silverio Avila and Carlos E. Gonzalez – Borderlands Research Institute, Sul Ross State University, Alpine, TX

Livestock grazing is a tool in habitat management used to modify habitat and forage resources in rangelands. Constraints on efficient and accurate sampling methods have limited our understanding of how and why vegetation communities respond spatially to grazing regimes that differ in the frequency and intensity of disturbance. We are using aerial imaging via drones, which have proven helpful to increase efficiency of sampling, to compare the fine scale vertical and horizontal arrangement of vegetation communities in two pastures under continuous and rotational grazing regimes. We hypothesize that heterogeneity in pastures under continuous grazing will be greater than in rotational pastures or pastures that have been excluded from grazing. We predict that increased uniform pressure from rotational grazing may decrease heterogeneity in vegetation spatial arrangement and increase homogeneity in vegetation height. The results from this study will enhance our understanding of the relationships of vegetation response to disturbance and grazing pressure. This will help land stewards make economically and environmentally responsible decisions when adjusting grazing practices or transitioning between grazing regimes, in support of their land stewardship efforts to serve both domestic livestock and native wildlife.

### **Do grasses of central Texas use water stored in limestone?**

Eli Hartung and Susan Schwinning – Department of Biology, Texas State University, San Marcos, TX

In limestone karst, significant amounts of water are stored in the rock matrix, both in weathered bedrock and in limestone rock fragments embedded in soil. Research showed that trees use bedrock water during the dry season to mitigate the impact of drought and saplings may use limestone fragments in the same way. However, whether herbaceous plants in karst areas similarly benefit from limestone fragments remains unknown. The goal of this project was to determine if grasses of the Edwards Plateau of Texas use water stored in limestone fragments during intermittent drought to maintain photosynthesis, delay leaf senescence and ultimately produce as much biomass as a plant in pure soil with higher total storage capacity. We addressed this question in a series of greenhouse experiments using *Muhlenbergia reverchonii* (seep muhly), a limestone endemic. Plants were grown in pots containing 1) 30% limestone rock, representative of Edwards Plateau soils, 2) 30% inert rock as a control, and 3) an equal volume of pure soil under intermittently well-watered and drought

conditions. We found that plants increased root production in response to limestone rock, but not in crushed limestone, inert rock medium or soil. Plants on limestone also survived and delayed gas exchange decline for the longest time during drought. This study provides the first direct evidence of rock water supporting herbaceous plant growth during intermitted drought conditions and furthermore suggests that trait plasticity contributes to this ability.

### **Ongoing bryophyte survey efforts in the Davis Mountains Preserve and Chinati Mountains State Natural Area of Trans-Pecos Texas**

Clifton F. Albrecht<sup>1</sup> and Dale Kruse<sup>2</sup> – <sup>1</sup>Department of Natural Sciences, Sul Ross State University, Alpine, TX and <sup>2</sup>S.M. Tracy Herbarium, Texas A&M University, College Station, TX

Survey efforts presented here represent preliminary work to document and voucher the bryophyte floras of the Chinati Mountains State Natural Area and the Davis Mountains Preserve, two sites in Trans-Pecos Texas with markedly different survey histories. The bryophyte flora of the Davis Mountains Preserve, as well as the Davis Mountains more broadly, is relatively well characterized. As such, work at that site largely consists of re-collection of previously documented species to expand bryophyte holdings at the A. Michael Powell herbarium, support identification training for students, and to validate and refine existing records. In contrast, the bryophyte flora of the Chinati Mountains State Natural Area, as well as the Chinati Mountains more broadly, is essentially completely undocumented, and surveys there aim to address a significant blank spot in the botanical map of Texas. In addition to documenting species presence, collection sites at both locations are distributed systematically across available ranges of elevation, aspect, and geologic substrate to enable assessment of species' niche breadths and environmental preferences with respect to these factors. Fieldwork began in October 2025 and includes one foray to the Chinati Mountains State Natural Area and multiple to the Davis Mountains Preserve; identification and sampling are ongoing, and this presentation reflects ongoing effort rather than a completed study. Ultimately, the preliminary survey efforts presented here are expected to be expanded into one or several graduate theses over a period of two to five years.

### **The botanical contributions of S.W. Stanfield**

David E. Lemke – Department of Biology, Texas State University, San Marcos, TX

The collection of an unusual plant specimen along the Blanco River in Hays County, Texas, some years ago provided the impetus for an investigation into the scientific contributions of the first botanist to be employed at what is now Texas State University in San Marcos. Silas Walter Stanfield was born in Bexar County, Texas, in September 1856. He was educated at Southwestern University and the University of Chicago and was among the first group of faculty to be employed when Southwest Texas State Normal School opened to its first class of students in 1903. Over the course of his career, Stanfield collected hundreds of plant specimens that were deposited in the herbaria of the New York Botanical Garden and the Academy of Natural Sciences of Philadelphia, and the digitization of these collections has facilitated an investigation of his work. This talk will discuss Stanfield's largely unacknowledged early contributions to the botany of Texas, including his meeting with the eminent Dutch botanist and geneticist Hugo de Vries.

## **Archives of the Big Bend: Interdisciplinary research and resources across West Texas**

Victoria Contreras – Archives of the Big Bend, Sul Ross State University, Alpine, TX

Despite early descriptions of desolation and “empty wastelands,” West Texas has always been rich in culture and resources that continue to flourish to this day. Thankfully, local communities, organizations, and institutions have identified the value of our region’s intellectual and creative outputs and have had the foresight to collect and preserve regional collections. This presentation will discuss some of these fascinating collections, the repositories keeping them “alive,” and how these archival materials are transcending time and space to serve modern researchers across academic fields. It will also touch on Big Bend-related collections housed outside of our immediate region, recent archival research projects, and existing opportunities for new or revived regional research.

## **DFCs, MAGs, GMAs: Alphabet soup for groundwater management in far West Texas**

Kevin Urbanczyk – Meadows Research Institute for West Texas Water, Sul Ross State University, Alpine, TX

As part of a state mandate to establish Desired Future Conditions (DFCs), the groundwater conservation districts in Groundwater Management Area 4 (GMA 4; Culberson, Jeff Davis, Presidio, and Brewster counties) have conducted analyses of available groundwater level data. The process involved compiling existing datasets and evaluating temporal trends, including simple linear regressions for wells with sufficient records. The data described here focus on the West Texas Bolsons (WTB) and the Igneous aquifers, which are identified as relevant aquifers by the Texas Water Development Board (TWDB). Although DFCs are adopted at the GMA level, the analyses were performed at the county scale to support development of aquifer-specific DFCs. Trends were projected over a 50-year planning horizon consistent with statutory requirements. Based on these analyses, GMA 4 proposed the following DFC drawdown values: WTB—Culberson: 78 feet; Jeff Davis: 31 feet; Presidio: 20 feet; Igneous—Brewster: 52 feet; Jeff Davis: 24 feet; Presidio: 17 feet. These DFCs are provided to the TWDB, which is responsible for estimating Modeled Available Groundwater (MAG) values using groundwater availability models (GAMs) where applicable. In this planning cycle, however, existing models for these aquifers are limited or not well suited to represent local hydrogeologic conditions. As a result, the TWDB, in coordination with GMA 4, may rely on alternative approaches to estimate MAG, including evaluation of aquifer stratigraphy, estimates of saturated thickness, and other simplified analytical methods. This is expected to be particularly challenging for the structurally complex Igneous aquifer system.

## Tuesday Afternoon

### **Background color matching enforces rare phenotype of Trans-Pecos ratsnake (*Bogertophis subocularis*) in the Big Bend region of Texas**

Thornton Larson<sup>1</sup>, Dusty Rhoads<sup>2</sup> and Dean Williams<sup>3</sup> – <sup>1</sup>Department of Natural Sciences, Sul Ross State University, Alpine, TX, <sup>2</sup>Department of History, University of North Texas, Denton, TX, and <sup>3</sup>Department of Biology, Texas Christian University, Ft. Worth, TX

Understanding the mechanisms that enforce different phenotypes to exist in natural populations is difficult to study, particularly for non-model organisms. Phenotypic variants often persist within a population where the trait lends an advantage across a mosaic landscape through background matching leading to lower rates of predation, or perhaps prey capture through ambush tactics. The “Blonde” color phenotype of *Bogertophis subocularis* (Trans-Pecos ratsnake) is most prevalent within a small range west of Big Bend National Park. The geology in this region is a particular yellow limestone that is also rare across the range of the Trans-Pecos ratsnake. We have tested background color matching both where “Blondes” are found and where they are not found for both “Blondes” and the normal H-pattern. The color matching uncovers both why the “Blonde” phenotype continues to be successful, even within the small range it occurs in as well as why it is limited to that region and not found beyond the yellow Boquillas limestone habitat.

### **The effects of soil substrate on kangaroo rat forelimb morphology**

Kennedy B. Wood and Leila Siciliano-Martina – Department of Biology, Texas State University, San Marcos, TX

Kangaroo rats (*Dipodomys* spp.) are granivorous, nocturnal rodents that live in arid environments of North America. Classified as semi-fossorial scratch-diggers, kangaroo rats spend most of their life underground and use their forelimbs, claws, and fingers to burrow and move soil. The ability to excavate burrows requires strong biomechanical processes such as mechanical loading, generation of force, and resistance to opposing forces, which may be associated with specialized forelimb morphology. Different kangaroo rat species may occupy unique habitats and soil environments that may require different forelimb specializations. For example, specializations of the metacarpals and phalanges assist in providing stability and adding supporting power, which may be beneficial particularly in dense substrates. We are collecting linear measurements from the metacarpals and phalanges of four kangaroo rat species to test whether finger morphology differs among species and whether these differences are associated with their substrate environments. Given the relationship between substrate and forelimbs, we expect species that burrow in dense, compact substrate to have thicker, shorter metacarpals and phalanges than species that burrow in loose, friable substrate. This research will provide insight into how substrate conditions shape forelimb morphology in semi-fossorial mammals and vital knowledge for conservation efforts to determine the optimal habitat for different kangaroo rat species.

## **UAV and GPS applications for understanding scaled quail habitat in the Chihuahuan Desert**

Luke D. Christensen\*, Carlos E. Gonzalez J. Silverio Avila S. and Antonio Cantú – Borderlands Research Institute, Sul Ross State University, Alpine, TX

Little is known of scaled quail (*Callipepla squamata*), fine-scale habitat use across seasons. Traditional habitat mapping techniques often rely on coarse imagery datasets and consequently overlook localized microhabitats, fine-scale landscape features, utilized by scaled quail. Effective property-scale management requires the acknowledgement of microhabitats such as clumps of critical vegetation like western mesquite that provide seed forage and native grasses that offer lateral cover, along with their spatial distribution. Seasonally, aspect, elevation, and availability of different cover types may influence habitat utilization by scaled quail. Using GPS data from radio collared individuals, UAV imagery, and in-situ verification, we will identify scaled quail habitat characteristics associated with seasonal variation at Nine-Point Mesa Ranch. Understanding the roosting behavior of scaled quail is essential for properly managing habitat and protecting habitat feature utilized and favored across various seasons. This study will investigate how roosting site characteristics vary across spring, summer, fall, and winter. Diel habitat preferences such as midday loafing cover can be inferred along with evening roosting preferences. In regard to diel and seasonal habitat preferences, we hypothesize scaled quail will select denser, sun-exposed vegetation at higher elevations during cold months and lower-elevation sites with more shade in warmer months. Roosting in sunlit or sheltered locations in winter may improve warmth, while shaded or low areas may help avoid summer heat stress. Spatial analysis will assess shifts in scaled quail habitat use and thermal buffering behavior.

## **Structural geology of the Upper Cretaceous Boquillas Formation in Javelina Draw, Big Bend National Park, Texas**

Amanda Piper\* and Jesse Kelsch – Department of Natural Sciences, Sul Ross State University, Alpine, TX

The Big Bend region of west Texas was subjected to a series of tectonic events that influenced the trend of exposed geologic structures. Most structures visible today in Big Bend National Park (BBNP) exhibit trends reflective of the most recent tectonic events, including the Cretaceous-Paleogene Laramide orogeny and Late Cenozoic Rio Grande rift extension. Javelina Draw, located on the western flank of the Sierra del Carmen, exposes meso-scale folding likely reflective of the shortening event associated with the Laramide orogeny. The folds exposed within Javelina Draw in BBNP contain abundant fractures and slip surfaces that may record the kinematic history of the structure.

This study integrates field-based research, structural analysis, and high-resolution digital outcrop modeling (DOM) to analyze fractures within the folds exposed at Javelina Draw. Methods for this study rely on joint and fracture analysis to constrain the regional tectonic history and strain-orientation of the fold, in addition to strength analysis to compare variable fracture occurrences to rock strength. Kinematic indicators such as slickenline data from slip surfaces will assist in developing an interpretation of the strain history of the fold structure. Rock-strength variability across the fold structures will be analyzed to determine axes of strain during Laramide deformation to further understand the regional deformation histories of BBNP. Additionally, outcrop strength testing will supplement the DOM to characterize how fracture patterns may influence rock strength. Although the region has been mapped previously, a detailed structural analysis of the fold structures in Javelina Draw has not been published at this time.

## **Life in the Eocene of West Texas: A fossil site from the Pruett Formation, Brewster County**

Austin Drews\* and Thomas Shiller – Department of Natural Sciences, Sul Ross State University, Alpine, TX

A fossil site was discovered by the second author in 2024 in the Pruett Formation, exposed on the O2 Ranch in Brewster County, Texas. Part of the Buck Hill volcanic series, the Pruett Formation is composed largely of volcanic tuffaceous sediment deposited between approximately 38.6 and 35.4 million years ago (Late Eocene). A nearly complete hindlimb, numerous abraded vertebrae, and ribs of a large ungulate mammal are exposed on the surface, spanning an area of roughly 100 m<sup>2</sup>. The bones are well preserved, permineralized, and stained by the surrounding purple-gray tuff. Several elements preserve surficial gnaw marks consistent with rodent activity, indicating exposure prior to burial. Additional remains of smaller-bodied mammals of uncertain taxonomic affinity have also been recovered from the site. Nearby fossil localities of similar age have yielded a diversity of vertebrate fossils. However, the Pruett Formation remains understudied and poorly described. Continued mapping, excavation, and analysis of this site will help to develop a better understanding of Eocene paleoenvironments in the Trans-Pecos region of Texas.

## **Ancient squash in the American Southwest: A SEM-based comparative guide for identifying archaeological *Cucurbita***

Diana Flores\* and Clifton Albrecht – Department of Natural Sciences, Sul Ross State University, Alpine, TX

The genus *Cucurbita* (squashes, gourds, pumpkins) includes some of the earliest domesticated plant taxa in the Americas and has played an important role in Indigenous agriculture. Ancient remains of *Cucurbita* are commonly recovered from rock shelters and similar archaeological sites in southwestern North America. However, these remains are often fragmentary, making taxon-level identification using traditional macromorphological criteria difficult or impossible. Here, we present a comparative guide to seed coat and fruit rind micromorphology covering modern domesticated and wild *Cucurbita* taxa, developed to support identification of fragmentary archaeological remains. This project uses electron microscopy to document diagnostic differences between taxa in micromorphological features, such as the depth and arrangement of distinct layers of the seed coat and fruit rind, and the size and shape of individual cells, that can be used to distinguish *Cucurbita* taxa when macroscopic traits are absent. This guide is intended as a practical tool for identifying fragmentary archaeological remains and will support future research on the domestication and dispersal of *Cucurbita* taxa in southwestern North America. It represents a preliminary research effort on *Cucurbita* which will be expanded in the future to incorporate radiocarbon dating and genetic analyses to deepen understanding of the evolutionary history and domestication of *Cucurbita* in North America.

## **Black bears on the move: Insight Into black bear recolonization efforts in the southwestern U.S.**

Jake B. Gowdy\*, Jesse D. Ellgren, Caitlin M. Camp Pappas, Matthew O. Hewitt, Amanda M. Veals Dutt, Justin T. French and Louis A. Harveson – Borderlands Research Institute, Sul Ross State University, Alpine, TX

Black bears (*Ursus americanus*) were extirpated from the Trans-Pecos region of Texas in the late 1950s, primarily due to early predator control efforts and increases in anthropogenic infrastructure. The designation of black bears as threatened at the state level in Texas and as endangered in Mexico, coupled with the close proximity of Big Bend National Park to remnant black bear populations in northern Mexico, facilitated recolonization of the species back into the state in the late 1980s. Bears have since continued to expand into the greater Trans-Pecos and Transboundary regions of southwest Texas, with sightings as far north as Fort Davis, TX and as far east as Uvalde, TX. The Borderlands Research Institute currently has active projects collecting data on general black bear ecology, as well as the impacts of recent border infrastructure on black bear population connectivity and gene flow through multiple graduate level research projects. The institute is actively working on estimating black bear population density through non-invasive hair snare collection, building a denning habitat suitability model to understand black bear denning mechanisms in the desert, modeling how black bear (and other large-bodied mammals) occupancy is affected by border infrastructure, and assessing the impacts of border infrastructure on black bear international connectivity. These studies will help inform wildlife managers and the general public on current black bear management needs in a rapidly changing landscape.

## **Alamito Creek conservation initiative – Working with landowners to implement riparian habitat restoration in the Alamito Creek watershed**

Jared Schniers<sup>1</sup> and Nick Loveland<sup>2</sup> – <sup>1</sup>Borderlands Research Institute, Sul Ross State University, Alpine, TX and <sup>2</sup>Rio Grande Joint Venture, Alpine, TX

The Alamito Creek Conservation Initiative (ACCI) is a collaborative partnership among the Borderlands Research Institute (BRI), Rio Grande Joint Venture (RGJV), and the Dixon Water Foundation (DWF). ACCI is a landscape-level conservation program focused on enhancing riparian and watershed health within the Alamito Creek watershed. ACCI works directly with willing landowners to plan and carry out voluntary, incentive-based habitat restoration and enhancement projects. Funded through a mix of private foundation support and existing cost-share programs, ACCI aims to improve the ecological function of this arid, historically dynamic stream system. ACCI aims to enhance riparian function, increase watershed resilience, and support the recovery of diverse grassland and riparian plant communities. Restoration efforts under ACCI emphasize process- and nature-based approaches designed to mimic natural hydrologic and geomorphic processes. Instream structures are installed in deeply incised drainages where accelerated runoff and sediment loss have reduced the hydrologic function. Natural infrastructure is designed to promote natural process recovery within a degraded riverscape by slowing water velocities, capturing and storing sediment, increasing water retention within the riparian aquifer, and improving both riparian and instream habitat. Complementary upland treatments, such as selective removal of invasive shrubs and placement of medialunas, aim to slow overland flow, promote sediment deposition, and facilitate vegetative recovery on the uplands. Over time, these improvements will contribute to healthier hydrologic function within the broader Alamito Creek system. Monitoring, strategic planning, adaptive management, and broader outreach will help expand our efforts throughout the watershed. Ultimately,

ACCI exemplifies a cooperative, landowner-oriented approach to conserving and revitalizing riparian ecosystems in dryland watersheds subject to erosion, aquifer depletion, and vegetation loss.

### **Evaluating the integration of economic development and environmental sustainability in the Downtown Austin Plan**

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Urban centers play a critical role in advancing sustainable development while balancing economic growth and environmental resilience. This study evaluates the Downtown Austin Plan (DAP) as a framework for integrating economic development with environmental sustainability in a rapidly growing urban environment. The research examines key strategies implemented between 2013 and 2024, focusing on business growth, infrastructure investment, green building practices, and climate-resilient planning initiatives. Using a combination of document analysis, policy review, and comparative assessment, the study identifies how economic objectives, such as job creation, commercial expansion, and investment attraction, interact with environmental priorities including green infrastructure, water conservation, and emissions reduction. Findings highlight significant synergies, particularly in mixed-use development, sustainable building standards, and smart urban systems, which support both economic vitality and environmental performance. However, the study also identifies critical trade-offs, including pressures on green space preservation, increased urban density, and affordability challenges associated with sustainable development. The research demonstrates how urban planning frameworks can evolve to better align economic and environmental goals through data-driven decision-making and integrated policy approaches. This work contributes to broader discussions on sustainable urban systems and provides insights applicable to climate-resilient infrastructure planning in both urban and semi-arid environments. The findings are relevant to policymakers, planners, and researchers seeking to develop balanced strategies for sustainable growth in rapidly urbanizing regions.

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P.O. Box 638  
Terlingua Ranch, TX 79852  
(432) 371-3146

[www.terlinguaranch.com](http://www.terlinguaranch.com)

Office open 9:00 am to 5:00 pm

- Room service. If you need additional towels or linens, please come to the Front Desk.
- Check-out time is 11:00 am. If you wish to extend your stay, please notify the Front Desk prior to checkout.
- The Bad Rabbit Café is open from 7:00 am to 8:00 pm daily.
- Security and Assistance: For after-hours emergencies, a 911 phone is located on the patio next to the pool. For non-life-threatening emergencies after hours, call 432-244-8905. For local EMS and Fire, call 432-371-2536.
- Pets must be on a leash in common areas and are not allowed in the pool area.
- Pool hours are 10:00 am to 10:00 pm. The bath house is open 24 hours, seven days a week.
- Laundry is open 2:00 pm to 10:00 pm.
- Water is scarce – please conserve.
- A burn ban is currently in effect for Brewster County with warm temperatures and dry, windy conditions. Please confine outdoor cooking to the use of propane stoves. See the Front Desk for more information regarding burn bans.
- Smoking is allowed outdoors only. Please dispose of cigarettes in butt cans located throughout the Lodge.
- Please obey posted speed limits.



Air Strip

# Welcome to Terlingua Ranch Lodge

8:00am to 7:00pm Every Day

PO Box 638

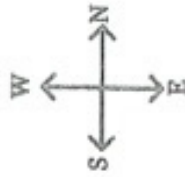
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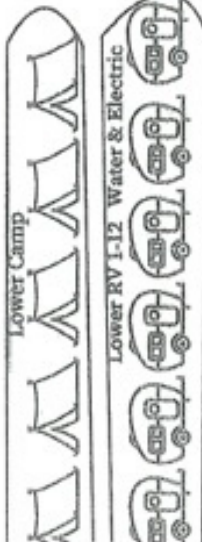
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BAD RABBIT CAFE



Dump Station



Bunk House



Up the hill  
NO RVs or Trailers



Up the hill  
RVs & Trailers

Up the hill  
9% Grade



LAUNDRY

Horse Corral  
Stalls



Air Pump



Main Ranch Road  
16 Miles to HWY 118



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Make plans to join us next year

# CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

## 2027

Terlingua Ranch Lodge

May 16–18, 2027

**Front cover illustration:** The recently completed Texas State University System Christmas Mountains Field Research Station is a newly developed facility designed to support field-based teaching, research, and immersive learning experiences and future collaborations across the Texas State University System. Tours of the facility will be offered during this year's symposium. Original photo taken by Jim Spofford at Terlingua Ranch.