CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

2019

Terlingua Ranch Headquarters
Brewster County, Texas
May 20–22, 2019

CHRISTMAS
MOUNTAINS
THE TEXAS STATE UNIVERSITY SYSTEM

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

2019 CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

Terlingua Ranch Headquarters
Brewster County, Texas
May 20th–22nd, 2019

Monday, May 20th

5:00 pm	Informal social for meeting participants on the patio by the café
6:00 pm	Dinner for meeting registrants at the Bad Rabbit Café (buffet available for attendees who did not preregister, $12.50)

Tuesday, May 21st

8:30 am	Field trip to Christmas Mountains overlook (meet in the parking lot outside the bunkhouse)
8:30 am	Geology stroll (meet on the patio outside the café)
1:00 pm	Paper session (in the bunkhouse beneath the Bad Rabbit Café)
6:00 pm	Dinner for meeting registrants at the Bad Rabbit Café (buffet available for attendees who did not preregister, $18.50)

Wednesday, May 22nd

8:30 am	Field trip to Christmas Mountains overlook (meet in the parking lot outside the bunkhouse)
8:30 am	Paleontology and Geology of the Cretaceous Upper Aguja Formation (meet on the patio outside the café)
1:00 pm	Afternoon paper session (in the bunkhouse beneath the Bad Rabbit Café)
6:00 pm	Dinner for meeting registrants at the Bad Rabbit Café (buffet available for attendees who did not preregister, $18.50)

FIELD TRIPS

Christmas Mountains Overlook
Trip leader: Dave Lemke
Tuesday morning at 8:30 – meet in the parking lot outside the bunkhouse

Participants will carpool up the Old Mine Road to a scenic overlook at the road's end. We will make several stops along the way to examine the geology and vegetation of the area and 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 Old Mine Road requires high-clearance vehicles and, consequently, the number of participants on this trip will, of necessity, be limited by the number of vehicles we have at our disposal.

Geology Stroll
Trip leader: Jim Chude
Tuesday morning at 8:30 – meet on the patio outside the Bad Rabbit Café

Join Jim Chude for a short hike to the overlook east of the headquarters area where he will provide an introduction to some of the major sedimentary rock formations and igneous intrusions that characterize the geology of the Christmas Mountains area. The hike will involve a short, mostly uphill trek over a gravel road and dirt path, as well as the possibility of some scrambling over open, rocky areas. 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 leader: Dave Lemke
Wednesday morning at 8:30 – meet in the parking lot outside the bunkhouse

Participants will carpool up the Old Mine Road to a scenic overlook at the road's end. We will make several stops along the way to examine the geology and vegetation of the area and 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 Old Mine Road requires high-clearance vehicles and, consequently, the number of participants on this trip will, of necessity, be limited by the number of vehicles we have at our disposal.

Paleontology and Geology of the Cretaceous Upper Aguja Formation
Trip leaders: Thomas Shiller, Sue Mulroney and Adam Myers
Wednesday morning at 8:30 – 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, museum personnel 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 (formerly referred to as *Phobosuchus*). 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 upper shale member of the Aguja Formation on the Myers/Mulroney property preserve a variety of vertebrate fossils (dinosaurs, turtles, and crocodilians) 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.

2019 CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

Tuesday, May 21

1:00 Welcome and Introductions

1:15 An introduction to the Christmas Mountains – a site for education and research
David E. Lemke, Texas State University

1:30 Dos Rios landscape conservation design
Philip Boyd, Sul Ross State University

1:45 Sul Ross State University's paradigm shift to sustainability
Bibiana Gutierrez, Betsy Evans, Theron Francis, Liam Duggan, and Cody Kalinowski, Sul Ross State University

2:00 Arachnids of the northern Chihuahuan Desert
Christopher M. Ritzi, Sul Ross State University

2:15 Break

2:30 Survey and documentation of animal activity in the southeastern quadrant of the Christmas Mountains complex, Brewster County, Texas
Thad Bagwell, Texas State University

2:45 Morphological analysis of the Rio Grande Monkeyface, *Quadrula couchiana* (Mollusca: Bivalvia), using photogrammetry
Mary P. Jones, Miami University , Ned E. Strenth, Angelo State University , Robert G. Howells, BioStudies, and David J. Berg, Miami University

3:00 The genus *Echinocereus* (Cactaceae) in the vicinity of the Christmas Mountains, Brewster County, Texas
James F. Weedin, Sul Ross State University

3:15 Fossil woods of the Aguja Formation on Terlingua Ranch, Brewster County, Texas
David E. Lemke and Alaa Ibrahim, Texas State University

3:30 Break

3:45 A proposed geology guide to the Christmas Mountains summit road
Elizabeth A. Measures, Sul Ross State University

4:00 Respect Big Bend Initiative
Billy Tarrant and Philip Boyd, Sul Ross State University

Wednesday, May 22

1:00 Natural resource studies at Big Bend Ranch State Park
Amber Harrison, Texas Parks and Wildlife Department

1:15 Ancient (Eocene-Oligocene) lake limestones in Big Bend Ranch State Park and Dalquest desert research site, Texas: continuing studies
David M. Rohr, Sul Ross State University, Blaine R. Hall, Texas Parks and Wildlife Department, Stephanie N. Elmore, Corbin T. Carsrud, and Elizabeth A. Measures, Sul Ross State University

1:30 Geomorphic change detection analysis of upper Terlingua Creek
Kevin Urbanczyk, David Hallum and Jesus Hermosillo, Sul Ross State University

1:45 A characterization of clay minerals in Rio Grande suspended sediment and relationship to source
J.W. Roberson, Kevin Urbanczyk, and Elizabeth Measures and, Sul Ross State University, and James Ward, Balmorrhea, TX

2:00 Break

2:15 Animal adaptations to the Chihuahuan Desert
Francis Horne, Texas State University

2:30 Survey and natural history of bee fly parasitoids (Diptera: Bombyliidae) of Hymenoptera within Brewster and Jeff Davis counties, Texas
Lauren G. Garrett and Christopher M. Ritzi, Sul Ross State University

2:45 Movement patterns of the native *Procambarus clarkii* (Crustaceae: Decapoda) in west-central Texas
Michael Lucero, West Virginia Division of Natural Resources and Ned E. Strenth, Angelo State University

3:00 Investigations of the mycoflora inhabiting the bark of *Juniperus ashei* (Cupressaceae) in central Texas
Jessica Bernardin, Trina Guerra, David Rodriguez, Dittmar Hahn and David E. Lemke, Texas State University

3:15 Break

3:30 How old is old? Radiometric dating in the Big Bend of Texas
Tim Gibbs, Texas Parks and Wildlife Department

3:45 Utilization of vegetation by people of the past in the Chihuahuan Desert
Mark Leamons, Texas State University

ABSTRACTS

Tuesday Afternoon

Introduction to the Christmas Mountains – a site for education and research

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

This presentation will provide a brief overview of the geology, ecology, and history of the Christmas Mountains property from its inclusion as part of the massive G4 Ranch in the nineteenth century to its recent transfer to the Texas State University System. Geologically, the approximately 4000 hectare property is characterized largely by marine sedimentary rocks of Cretaceous age that have been intruded by much younger (44–40 million year old) igneous rocks forming a complex caldera system. At present, the area supports a well-developed desert grassland ecosystem comprising several distinct plant community types and may represent one of the best-preserved examples of Chihuahuan Desert grassland in the State. Over the past several years the property has been used as a field site by a number of college and university classes, as well as a research site for both students and faculty. Plans by the Texas State University System to enhance the utility of the site for education, outreach, and research will be presented and discussed.

Dos Rios landscape conservation design

Philip Boyd, Borderlands Research Institute, Sul Ross State University, Alpine, TX

In the fall of 2017, the Borderlands Research Institute at Sul Ross State University was awarded a grant to coordinate the Dos Rios Landscape Conservation Design (LCD). The LCD process is a partner-driven, collaborative, cross-jurisdictional planning process that results in strategic and spatial products to achieve common landscape-scale goals and resiliency in cultural and natural resource conservation. The Dos Rios LCD project area encompasses the southern edge of the Trans-Pecos region of Texas, along the Rio Grande/Rio Bravo, including protected lands in the United States and Mexico, and the Rio Conchos watershed in Mexico. These two regions were combined into one study area as the Rio Conchos serves as a largest tributary for the Rio Grande/Rio Bravo, which itself is a significant shared resource between the two countries. The Dos Rios LCD project area was selected due to its large tracts of unfragmented land, long history of private and public land stewardship, and shared natural and cultural resources that are threatened by growing economies, development, historical mismanagement, exploitation, and increased frequency of drought. Since February 2018, the Borderlands Research Institute has coordinated the Dos Rios LCD project as a member of the Dos Rio Conservation Cooperative. The Dos Rios Conservation Cooperative includes members from various state and non-governmental agencies including Rio Grande Joint Venture, World Wildlife Fund, Texas Parks and Wildlife Department, Comisión Nacional de Áreas Naturales Protegidas, and the Rio Grande Research Center. Through regular team meetings, review of previous conservation assessments, and partner engagement, the process has helped drive collaboration, spatially identify areas of concentrated conservation challenges, and provide management strategy resources to partners in the arid region.

Sul Ross State University's paradigm shift to sustainability

Bibiana Gutierrez[1], Betsy Evans[2], Theron Francis[3], Liam Duggan[4], and Cody Kalinowski[4], [1]Department of Behavioral and Social Sciences, [2]Wildenthal Memorial Library, [3]Department of Languages and Literature, and [4]Department of Natural Resource Management, Sul Ross State University, Alpine, TX

This presentation uses the transtheoretical model of change to identify strategies for catalyzing attitude and behavior change related to sustainability in the Big Bend region of Texas. Faced with many false starts and barriers to success, a grassroots effort arising out of the Sul Ross State University (SRSU) Sustainability Council used resources from the Association for the Advancement for Sustainability in Higher Education in a mixed-methods approach to launch a pilot survey on campus knowledge and attitudes about sustainability. This data serves as a foundation for defining populations and their stages in the transtheoretical model of change in order to develop more effective strategies to catalyze SRSU and the Big Bend community to change. The results of a fall 2018 SRSU survey revealed a high interest within the SRSU community in sustainability; however, it also showed frustration with the lack of progress integrating sustainability into the university's operations and academic programs. In an April 2019 university town hall, a sustainability plan was called for, which would consider xeriscaping on the grounds and alternatives for funding–such as grants and a student green fee. The transtheoretical model will serve as a guide in conducting yearly SRSU sustainability surveys to track progress and adjust strategies accordingly in order to steer and maintain the momentum of this sustainability movement, as well as integration with others efforts in the Big Bend.

Arachnids of the northern Chihuahuan Desert

Christopher M. Ritzi, Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX

Arachnids tend to be an overlooked facet of animal biodiversity in the world around us. This is no different in the northern Chihuahuan Desert, where hot, dry conditions actually make the various arachnid forms an amazingly diverse and successful taxonomic group. In order to get a better appreciation of the diversity of the types of Arachnida present in the Chihuahuan Desert region, a summer field class was conducted by Sul Ross State University to investigate and collect an assortment of the arachnids present. From these collections, specimens were documented from the following orders: Araneae, Amblypygi, Uropygi, Acari, Opiliones, Scorpiones, Pseudoscorpiones, and Sulifugae, thus representing all but three of the known orders of the arachnids. Common methods for the collection and recovery of these arthropods included hand and kill jar collection, traps, Burlese funnels, ectoparasitic removals from hosts, blacklight surveys, and nighttime inspection of various habitats, including riparian areas and rock cuts. The variety of arachnids recovered will be discussed, including basic information about their natural history. In addition, the variety of families recovered from certain orders will be expanded upon, illustrating the need for more survey work to better document the arachnid diversity in the region.

Survey and documentation of animal activity in the southeastern quadrant of the Christmas Mountains complex, Brewster County, Texas

Thad Bagwell, Department of Information Technology, Texas State University, San Marcos, TX

In an attempt to document animal species and population density in the southeastern area of the Christmas Mountains complex and to complement previous studies, five automated trail cameras were deployed in

August 2018 southeast of the old mine road into the Hidden Valley draw. During the August timeframe, the area was experiencing a summer "monsoon" and was blanketed with heavy rain, high winds, and hail making tracks difficult to detect even in sandy locations. The cameras were progressively mounted on both sides of the ravine facing south, east, and west. The cameras were left unattended until servicing was done the following December. None of the cameras detected any activity and three of the cameras were then redeployed. Two were relocated within the Hidden Valley area, while the other was deployed on the northern side of the old mine road in a draw running northeast toward the ranch headquarters. The cameras were recovered in early April 2019. The camera located on the northern side of the road did show positive results. Captured were images of a pair of mountain lions, deer, and one small unidentified mammal. Given this activity, we hope to redeploy cameras in additional locations northeast of the successful location. It is suggested that deployment of one or two remote, stationary, instrumented platforms would be beneficial for long-term monitoring of wildlife and environmental conditions within the complex. These platforms are currently being built and are designed to be scalable to support additional instrumentation over a design life of approximately ten years. Based on Linux and powered by a solar-replenished 250W battery pack, the stations will provide temperature, wind direction, velocity, solar intensity, and serve as a stationary camera platform. Data is to be stored on solid state media and can be sent via a digital communications link to a research center. Real-time webcam interface is provided for those interested in incorporating weather and imaging data on institutional webpages.

Morphological analysis of the Rio Grande Monkeyface, *Quadrula couchiana* (Mollusca: Bivalvia), using photogrammetry

Mary P. Jones[1], Ned E. Strenth[2], Robert G. Howells[3] and David J. Berg[1], [1]Department of Biology, Miami University, Oxford, OH; [2]Department of Biology, Angelo State University, San Angelo, TX; [3]BioStudies, Kerrville, TX

The Rio Grande Monkeyface, *Quadrula couchiana*, is a relatively small freshwater unionid bivalve endemic to the Rio Grande drainage of Texas and northern Mexico. There is little known about this species and it is presumed extinct. However, recent field work in northern Mexico has yielded valves and potential habitat in which live individuals may still exist. This has prompted an examination of current museum collections. The purpose of this study was to compare museum specimens identified as Rio Grande Monkeyface to similarly shaped species such as the Golden Orb (*Cyclonaias aurea*), Mapleleaf (*Quadrula quadrula*), and Southern Mapleleaf (*Q. apiculata*), and to determine the range of morphological variation within and among these species. Photogrammetry was used to build three-dimensional digital models for geometric morphometric comparisons. The computer software Metashape was used to align and stitch multiple photos of each specimen to build a fine-scale resolution digital model. The digital models were then statistically compared using a multivariate analysis and PCA using Procrustes distances. Preliminary results indicate that some of the current museum records of *Q. couchiana* are misidentified. Plastic replica models were produced using 3D printing and will be donated to institutional malacological collections. These models will provide a useful tool for teaching and training workers on key valve features used for identification.

The genus *Echinocereus* (Cactaceae) in the vicinity of the Christmas Mountains, Brewster County, Texas

James F. Weedin, Research Associate, A. M. Powell Herbarium, Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX

The genus *Echinocereus* (Cactaceae) in Trans-Pecos Texas features distinctive species defined by stem, flower and fruit differences. There are at least twelve species and 21 taxa of *Echinocereus* in the region. Both diploid and polyploid species are present. The most distinctive members of the genus include the claret-cups (*E. coccineus*), Texas rainbows (*E. dasyacanthus*) and strawberry cacti (*E. stramineus*). This presentation will highlight the echinoceri in the vicinity of the Christmas Mountains but will also include a discussion of those in other parts of the Trans-Pecos. Geoedaphic aspects for several taxa will mentioned.

Fossil woods of the Aguja Formation on Terlingua Ranch, Brewster County, Texas

David E. Lemke and Alaa Ibrahim, Department of Biology, Texas State University, San Marcos, TX

Terlingua Ranch, in southern Brewster County, Texas, is a nearly 100,000 hectare property located between Big Bend National Park on the east, Big Bend Ranch State Park on the west, and the entrance to the Christmas Mountains. The southeastern portion of the ranch contains an abundance of fossilized conifer wood specimens occurring as logs ranging from 1.6 m in diameter and 15 m in length to much smaller logs and pieces of float. Most of these fossils occur in strata belonging to the Upper Cretaceous (Campanian) Aguja Formation (83–72 Ma). Anatomical details of the fossil conifer specimens from Terlingua Ranch were analyzed by comparing wood anatomical features of the fossil material with a database compiled by examining the structure of extant conifer woods and through the use of published keys for fossil conifer wood identification. Three different fossil wood types were identified from the Aguja Formation at Terlingua Ranch: a cupressoid/ podocarpoid wood type, a *Cupressinoxylon* wood type, and the first definitive report of a *Taxodioxylon* wood type from the southern portion of the western interior. These results are compared to other studies of fossilized woods from the Upper Cretaceous of the Western Interior of North America.

A proposed geology guide to the Christmas Mountains summit road

Elizabeth A. Measures, Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX

The gravel road in the southeast part of the Texas State University System's Christmas Mountains property is the best-known road on the property. The road has been called the "summit road." It climbs from an elevation of approximately 4000 feet at the property boundary to approximately 5500 feet at a parking area close to the highest point in the Christmas Mountains. The summit road transects the Cretaceous and Cenozoic rocks of the Christmas Mountains laccocaldera and offers an excellent opportunity to examine the geology of the property. The basic geology can be determined using a topographic map and a geologic map. The lower half of the road contains exposures of the Boquillas Formation and underlying Buda Limestone. There are also exposures of concordant, younger intrusive igneous rocks within these formations. The intrusives were emplaced during the formation of the laccocaldera. As the road climbs, discordant igneous dikes are obvious as they cross-cut the thin bedded sedimentary units. Sedimentary lithologies adjacent to the intrusions have been contact metamorphosed. The oldest Cretaceous rocks, the Santa Elena Limestone, as well as some of the youngest extrusive volcanics, are exposed in the upper half of the road. There are also numerous structural features that can be observed along the road. There are two places along the road that could be considered

scenic overlooks. In the lower half of the road, a wide switchback provides a panoramic view to the north and east. At the end of the road, a parking area provides a panoramic view to the south and west. A detailed geologic guide of the geology along the road is under construction. At present a digital image of a portion of the road is being annotated with a written narrative and photos of the geology. Once the entire length of the road has been annotated, it will be determined how best to make this available. The virtual guide could be made into a printed pamphlet but permission would be needed to place markers along the road.

Respect Big Bend Initiative

Billy Tarrant and Philip Boyd, Borderlands Research Institute, Sul Ross State University, Alpine, TX

The greater Big Bend region is world-renowned for its expansive landscapes, ranching heritage, dark skies, wildlife diversity, and iconic communities. Currently the region is experiencing unprecedented pressures, as it has been discovered as prime real estate for energy development. Projections for the greater Big Bend region are staggering, with an estimated 75 trillion cubic feet of gas, 3 billion barrels of oil, $1 billion invested in solar, and 450 square miles in wind energy. A coalition of land managers, conservationists, energy leaders, and communication specialists has assembled to address the energy sprawl in the greater Big Bend region. Using the moniker "Respect Big Bend," coalition partners include the Borderlands Research Institute, Bureau of Economic Geology, Cynthia and George Mitchell Foundation, Texas Agricultural Land Trust, Hudson Pacific, Kay Bailey Hutchison Energy Center, The Nature Conservancy, and others. Respect Big Bend was organized and is supported financially by the Cynthia and George Mitchell Foundation—a Texas foundation that seeks innovative, sustainable solutions for human and environmental problems. The mission of Respect Big Bend is "to inspire and empower stakeholders to conserve the unique resources and protect iconic communities of the greater Big Bend region of Texas while developing energy responsibly." The initiative is not an anti-energy development effort, but rather an effort to help foster thoughtful energy development that minimizes impacts to the fragile environment, communities, and culture of the Big Bend Region. An important part of establishing a strategy for responsible development in this region of the state is to engage local stakeholders and determine the landscape values they cherish and would like to see for future generations. Outreach efforts will include community seminars, landowner workshops, and coordination with conservation partners. Additionally, the Stakeholder Advisory Group is a select assemblage of respected individuals who assist in this process by working together to identify priorities to shape a shared vision of how the greater Big Bend region will look moving forward. This group includes landowners, mineral owners, energy industry and service providers, community members, and conservation partners.

Wednesday Afternoon

Natural resource studies at Big Bend Ranch State Park

Amber Harrison, Texas Parks and Wildlife Department, Big Bend Ranch State Park, TX

This presentation will highlight several research projects that have been undertaken or are ongoing at Big Bend Ranch State Park (BBRSP). Big Bend Ranch State Park, administered by Texas Parks and Wildlife Department, comprises roughly 315,000 acres of Chihuahuan Desert wilderness. It is home to a diverse range of plants and animals and is known for its complex geology, abundant springs and Rio Grande River corridor – all of which offer endless possibilities for scientific exploration. Researchers from all over the world have conducted scientific studies at BBRSP in fields from geology to range ecology. Such systematic studies further

our knowledge of the natural environment of the Big Bend and the park, specifically. The goal of this presentation is to bring attention to the resources at BBRSP and inspire continued research and collaboration among students, faculty and other private and public organizations.

Ancient (Eocene-Oligocene) lake limestones in Big Bend Ranch State Park and Dalquest Desert Research Site, Texas: continuing studies

David M. Rohr[1], Blaine R. Hall[2], Stephanie N. Elmore[1], Corbin T. Carsrud[1], and Elizabeth A. Measures[1]. [1]Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX and [2]Texas Parks and Wildlife Department (retired), Fort Davis, TX

Limestone units occur within the strata of the Eocene-Oligocene (36–30 Ma) Solitario conglomerate. Previous studies were of thin (<3 m) limestone beds interpreted to have formed in spring-fed shallow, playa lakes containing stromatolites and oncoids, some of which preserve calcified microbial filaments. Additional outcrops of lacustrine limestone are part of an ongoing study in the area. Unusual circular travertine structures occur in Big Bend Ranch State Park (BBRSP), and thick limestone (>70 m) is exposed on the Dalquest Desert Research Site (DDRS). The two areas are separated by the Tascotal Mesa fault. The circular travertine structures are up to 60 cm in diameter and are nearly vertical. Modern tufas in Pyramid Lake, Nevada, are similar and are described as tubular structures forming tufa mounds thought to have been created when springs discharged from the bottom of the lake. Thin beds of limestone on BBRSP and DDRS are typically well laminated and stromatolitic, but one area on DDRS about 2 km^2 exposes thicker and more massive beds. The thicker beds are peloidal grainstone and are interpreted to have been deposited in a deeper portion of the lake. No fossils other than stromatolites and coated plant stems have been found yet. The cause of the thick limestone is not restriction by lava flows, but it may be fault bounded. The limestone is interpreted to have formed as temporary playa lakes in an interior arid basin. The unit appears to have originated as a porous tufa, and many of the voids were later filled by calcite cement. The lack of insolubles indicates a lack of clastic input from runoff, where springs and groundwater seepage zones provided a significant portion of the inflow into the lake. The lake limestone probably represents a short-term change in climate. A more humid interval raised the levels of the water table and led to the development of a spring-fed playa in a broad basin. When the climate dried, the water table dropped and subaerial conditions and clastic deposition resumed.

Geomorphic change detection analysis of upper Terlingua Creek

Kevin Urbanczyk, David Hallam and Jesus Hermosillo, Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX

Terlingua Creek is a tributary to the Rio Grande with a 335,000 hectare drainage area that includes parts of Presidio and Brewster counties, Texas. This area has experienced loss of alluvial aquifers due to land use practices that resulted in overall loss of riparian vegetation. This loss of alluvial aquifers is problematic both as it contributes to the degradation of the habitat in the immediate area and as it results in the contribution of excess sediment to the Rio Grande. Our specific research location is a ~300 meter section along the main channel of the creek in the upper portion of the drainage. It represents a 21,400 hectare catchment area (the Hackberry Draw-Terlingua Creek HUC12 drainage). Recent efforts to restore riparian vegetation have been initiated here. The vegetation restoration has involved the planting of a sequence of native willow poles in a diamond pattern in the channel with the goal of decreasing flood water velocity and encouraging sediment deposition. The technique has been partially successful with the survival of some of the willow diamonds. Our project was designed to document the impact of the restoration project by monitoring changes in the

topography and geomorphology of the channel using modern survey techniques. Initially, we conducted relatively high resolution (0.5 m point spacing) annual surveys from 2011 to 2014 using RTK GPS. In 2019 we conducted a TLS LiDAR survey (0.025 m point spacing) of the same area. Digital elevation models were created from the field data and we then used a geomorphic change detection tool in ArcMap to assess the annual topographic change. In the 2011 to 2014 time period, we observed a 96 m^3 annual increase, followed by a 192 m^3 decrease, followed by a 513 m^3 increase. In the 2014 to 2019 time frame, we found a 214 m^3 overall increase. Our data indicate an overall net increase of 631 m^3 in the 300 meter section, some of which may be the result of the trapping of sediment by the vegetation restoration activities.

A characterization of clay minerals in Rio Grande suspended sediment and relationship to source

J.W. Roberson[1], Kevin Urbanczyk[1], Elizabeth Measures[1] and James Ward[2], [1]Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX and [2]Balmorhea, TX

The Big Bend region has a varied geologic history involving, but not limited to, volcanism related to compressional Laramide and extensional Basin and Range regimes, shallow sea carbonate deposition, and terrigenous sediment deposits transported by overland streams, groundwater flow, and fresh water lacustrine environments. These past processes directly influence the presence of common and unique clay mineral species, which this study is investigating. Characterization of the clay mineral species present in specific samples of Rio Grande suspended sediments should inform researchers measuring sediment load transportation of the likelihood of clay mineralogy negatively impacting the accuracy of acoustic-doppler profiler instruments used to take sediment load measurements. A subsequent relationship to a source will assist in understanding which mineral sources are weathered into which clay mineral species and regional location those sources have had the most impact in the Big Bend Region. An oriented aggregate preparation method is utilized for analyzing suspended sediment and bulk sediment samples for clay mineral presence. Preliminary analysis has shown the presence of illite, montmorillonite, interlayered illite/smectite, kaolinite, and chlorite in Rio Grande suspended sediments. More investigation is currently underway to create relationships to source and note the presence of other clay mineral species in Rio Grande suspended sediments.

Animal adaptations to the Chihuahuan Desert

Francis Horne, Department of Biology, Texas State University, San Marcos, TX

The Chihuahuan Desert of the Big Bend region of west Texas and Mexico is a hostile environment for animals and plants alike with infrequent rainfall, associated food shortages, and temperature extremes. Water availability and extreme temperatures create survival problems directly, and impact food availability indirectly. For four or five months of the year, daily desert temperatures in the Chihuahuan Desert may actually exceed thermoneutrality ranges where tissues normally function. Combined with the scarcity of life-sustaining water and food, survival can be extremely tenuous. Behavioral, biochemical, and physiological mechanisms have evolved to cope with environmental matters of temperature extremes, food shortages, and water issues. Among hundreds of desert species, remarkable behavioral and structural adaptations for avoiding excess heat and shortages of food and water have evolved, many of them quite ingenious. Discussion of how both animals and plants acquire, conserve, recycle, and actually manufacture water and food under hostile temperatures is the crux of this presentation.

Survey and natural history of bee fly parasitoids (Diptera: Bombyliidae) of Hymenoptera within Brewster and Jeff Davis counties, Texas

Lauren G. Garrett and Christopher M. Ritzi, Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX

Bee flies (Diptera: Bombyliidae) are pollinators as adults and larval parasitoids of various insect groups, including bees and wasps. Despite over half of all Texas bee fly genera exploiting hymenopterans, the prevalence, range, and specific life histories of these species are heavily lacking or non-existent in description. With increasing concerns for pollinators and native bee populations, expanding the current knowledge of bee fly life cycles and host usage may help illuminate some complex ecological interactions and fluctuations within these insect communities. This study was conducted to determine the prevalence and diversity of bee flies exploiting hymenopterans within Brewster and Jeff Davis counties. Trap-nests, sand pits, and a novel pan trapping method were employed between late March and early November 2018 in three geographically distinct study areas: Chihuahuan Desert Research Institute (grasslands), Davis Mountains Preserve (sky island), and Terlingua Ranch (desert scrub). Pan trap assays collected bombyliids of subfamilies Anthracinae, Bombyliinae, Phthiriinae, and Usiinae, while members of subfamily Toxophorinae were solely retrieved from trap-nests. Bee flies were captured from the pan trap assays at all three study areas, however trap-nest collections only yielded bombyliids from the grassland sites.

Movement patterns of the native *Procambarus clarkii* (Crustaceae: Decapoda) in west-central Texas

Michael Lucero[1] and Ned Strenth[2], [1]West Virginia Division of Natural Resources and [2]Department of Biology, Angelo State University, San Angelo, TX

This study was undertaken to determine movement patterns and burrow occupancy of the red swamp crayfish, *Procambarus clarkii*, at Anson Springs in Tom Green County, Texas. The study represents the first use of radio telemetry within the native range of *P. clarkii*. Eight specimens (three males and five females) were fitted with radio transmitters and their locations were tracked in-stream six times a day, from August 10–24, 2017. Results suggest that reproductive males undertake fewer movements than females during the day and night. Also, the majority of movements for both males and females occur after 1800 hrs. Burrow occupancy suggests that males are more often found in bank burrows while both males and females are less often observed under boulders.

Investigations of the mycoflora inhabiting the bark of *Juniperus ashei* (Cupressaceae) in central Texas

Jessica Bernardin, Trina Guerra, David Rodriguez, Dittmar Hahn and David E. Lemke, Department of Biology, Texas State University, San Marcos, TX

Juniperus ashei (Cupressaceae) is a common evergreen tree in central Texas with a range extending from Arkansas to northern Mexico. A notable feature of these trees are conspicuous white patches that occur on the bark of the trunk and branches that have been identified as a parasitic fungus, *Robergea albicedrae* (Ascomycota). This fungus, along with others that inhabit the bark of *J. ashei*, remains understudied and ambiguous in terms of the overall mycoflora occurring on juniper bark. The purpose of this study is to identify culturing techniques and media types suitable to grow *R. albicedrae* in vitro, to isolate and culture other fungal species that grow on the bark of *J. ashei*, and to sequence *R. albicedrae* and the other mycoflora constituents.

How old is old? Radiometric dating in the Big Bend of Texas

Tim Gibbs, Texas Parks and Wildlife Department, Big Bend Ranch State Park, TX

American archeologists frequently describe their findings in context of the past 14,000+ years of human occupation, but how do they reach these conclusions using such rarified data? This talk will provide a brief overview of, and evidence for, the occupational chronology of the Big Bend and our ongoing efforts to refine our limited understanding of these temporal frameworks.

Utilization of vegetation by people of the past in the Chihuahuan Desert

Mark Leamons, Office of Human Resources, Texas State University, San Marcos, TX (retired)

The Christmas Mountains lie within the Chihuahuan Desert region of North America and receive, on average, only 12 in of precipitation per year, with annual amount varying between 2 and 40 in, most coming in the summer monsoons. A brief survey of plants on the hill slopes of Christmas Mountain and the Hidden Valley area was conducted. The two areas have slightly different ecosystems providing greater diversity of plants. Researchers believe that up to 80 percent of all plants in the Chihuahuan Desert were utilized by ancient inhabitants, natives and pioneers. There were no retail stores, grocery stores or pharmacies. How did these people utilize the plant resources that were available in order to survive in the Chihuahuan Desert?

Welcome to Terlingua Ranch Lodge

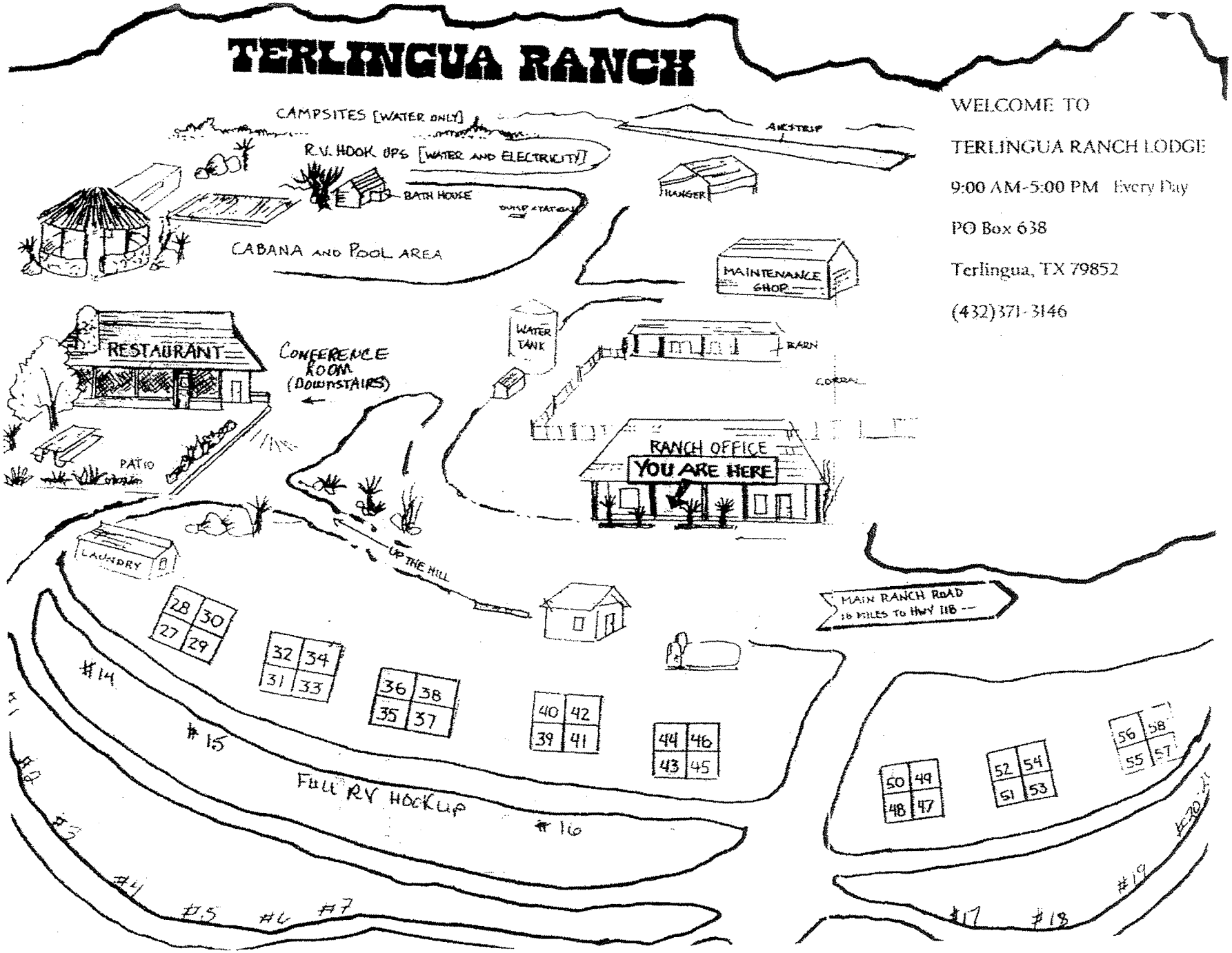
16000 Terlingua Ranch Road
P.O. Box 638
Terlingua Ranch, TX 79852
(432) 371-3146

www.terlinguaranch.com

Office open Monday/Tuesday 8:00 am to 5:00 pm, Wednesday–Sunday 8:00 am to midnight

- **Check-in** time is 3:00 pm. 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 check-out.
- **The Bad Rabbit Café** is open from 7:00 am to 7:00 pm Mondays and Tuesdays, 7:00 am to 9:00 pm Wednesday through Saturday, and from 7:00 am to 2:00 pm on Sunday (hours are extended for holidays, special occasions, and hunting season).
- **Security and Assistance** – for after-hours emergencies, please contact Security in the Security house located across the parking lot from the main office or phone (432) 371-2960. A **911** phone is located on the patio next to the pool.
- **Pets** must be on a leash in common areas.
- **Pool hours** are 10:00 am to 10:00 pm. The bath house is open 24 hours, seven days a week.
- **Laundry** is open 10:00 am to 10:00 pm.
- **Water** is scarce – please conserve.
- **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**.
- Please respect **No Trespassing** and **No Hunting** signs throughout the ranch.

TERLINGUA RANCH



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Make plans to join us next year

CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

2020

Terlingua Ranch Headquarters

May 25th–27th, 2020

Front cover illustration: Buzzard, or "Big Dog," was one of only a handful to have attended each of the first six Christmas Mountains Research Symposia. Known for his friendly demeanor and perpetual doggie smile, Buzzard was a friend to anyone willing to spend a moment petting him. Buzz passed away last summer after providing ten and a half years of companionship, but his rambunctious successor, Rufus, will be on hand to greet attendees at this year's symposium. Original photo taken by D. Lemke in the Christmas Mountains.