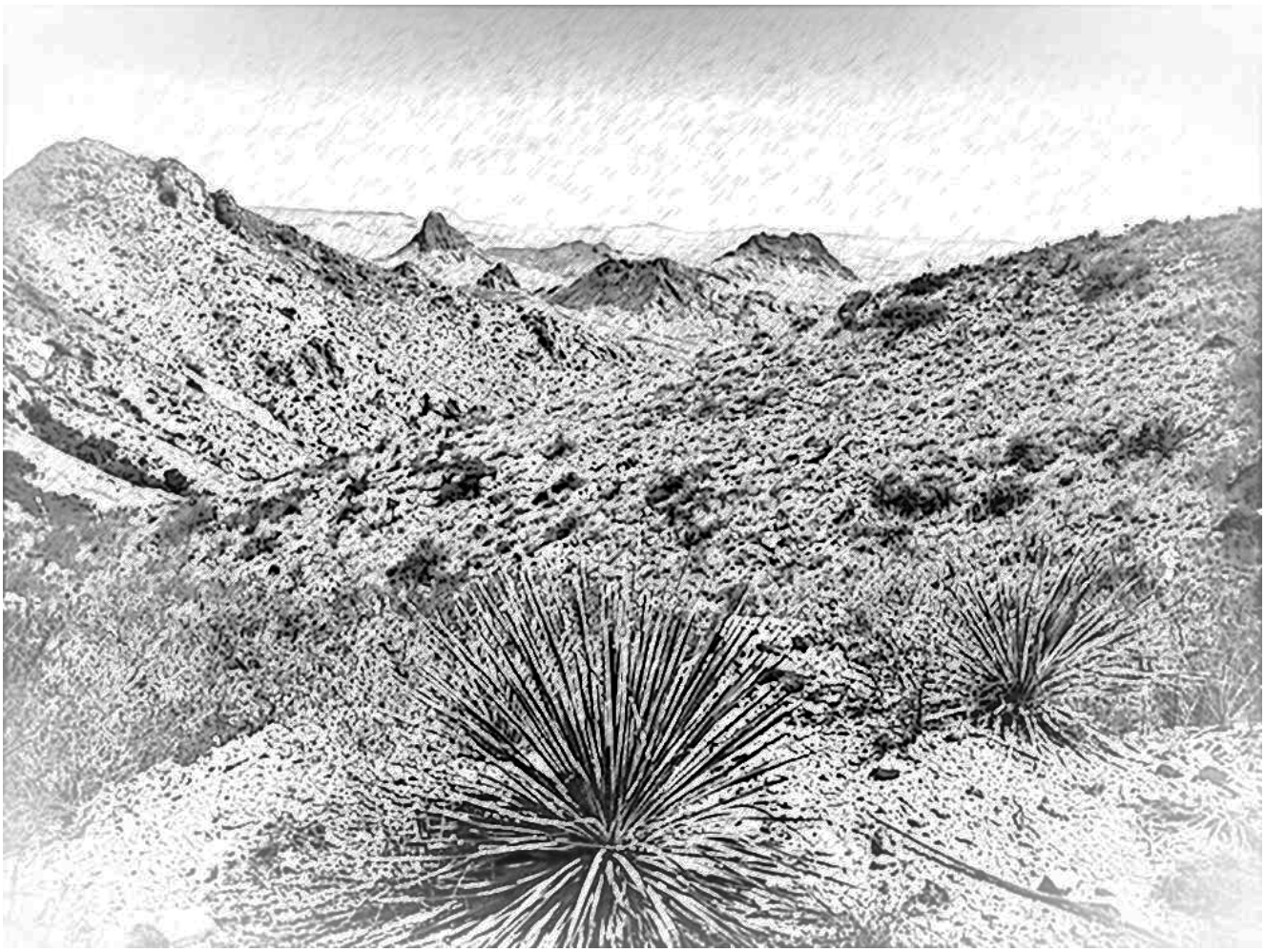
CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

2017



Terlingua Ranch Headquarters
Brewster County, Texas
May 22nd–24th, 2017

THE TEXAS STATE UNIVERSITY SYSTEM™

Sponsored by the Department of Biology at Texas State University

CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

Terlingua Ranch Headquarters
Brewster County, Texas
May 23rd–25th, 2016

Monday, May 22nd

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 (buffet available for attendees who did not preregister, $10)

Tuesday, May 23rd

8:30 am Field trip to Christmas Mountains overlook (meet in the parking lot next to the swimming pool)

8:30 am Geology stroll (meet on the patio outside the café)

1:30 pm Paper session (in the bunkhouse beneath the Bad Rabbit Café)

6:30 pm Dinner for meeting registrants at the Bad Rabbit Café (buffet available for attendees who did not preregister, $15)

Wednesday, May 24th

8:30 am Field trip to Christmas Mountains overlook (meet in the parking lot next to the swimming pool)

8:30 am Arroyo hike (meet on the patio outside the café)

1:30 pm Afternoon paper session (in the bunkhouse beneath the Bad Rabbit Café)

6:30 pm Dinner for meeting registrants at the Bad Rabbit Café (buffet available for attendees who did not preregister, $15))

FIELD TRIPS

Christmas Mountains Overlook
Trip leader: Michael Huston
Tuesday morning at 8:30 – meet in the parking lot next to the swimming pool

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.

Arroyo Hike
Trip leader: Michael Huston
Wednesday morning at 8:30 – meet on the patio outside the Bad Rabbit Café

We will carpool to an area near the base of the Christmas Mountains and spend the morning hiking up (and back down) one or more of the numerous arroyos that dissect this area. These drainages support a plant community that is distinctly different from that which occupies the dry slopes of the Christmas Mountains. The presence of greater amounts of soil moisture supports an abundance of shrubs and small trees such as persimmon (*Diospyros texana*), evergreen sumac (*Rhus virens*), Mexican buckeye (*Ungnadia speciosa*) and even a few oaks (*Quercus* spp.). The trip will focus on the natural history of the area, especially the vegetation and avifauna. This is a moderately easy hike, although there will be a few rough spots. Since we are in the desert, plan to carry at least a liter of water with you.

Christmas Mountains Overlook
Trip leader: Dave Lemke
Tuesday morning at 8:30 – meet in the parking lot next to the swimming pool

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.

2017 CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

Tuesday, May 23

1:30 Welcome and Introductions

1:45 An introduction to the Christmas Mountains – a site for education and research
David E. Lemke, Texas State University

2:00 A report on archaeological indigene rock structures in the borderlands of far west Texas
Samuel Cason, Sul Ross State University

2:15 Flowering plants of the Trans-Pecos and adjacent areas, update of a book manuscript in production at BRIT Press
A. Michael Powell, Sul Ross State University, Richard D. Worthington, The University of Texas at El Paso, Edward L. Schneider and Barney Lipscomb, Botanical Research Institute of Texas

2:30 Plant diversities in areas impacted by biological control of saltcedar (*Tamarix* spp.) in west Texas
Michelle Lawhorn and Christopher M. Ritzi, Sul Ross State University

2:45 Break

3:00 Assessing leaf area and nutrient content change of *Celtis reticulata* across the rainfall gradient of Texas
Michael Huston and Allison Bordini, Texas State University

3:15 Mary Poppins in the Chihuahuan Desert: what constitutes a good cactus nurse?
Martin Terry, Emmanuel Eleruja, Roy Saffel, Olanrewaju Oladosu, and Russell Klein, Sul Ross State University

3:30 Life in the desert with ocotillo
Frank Horne, Texas State University

3:45 A population analysis of *Chrysina woodii* (Coleoptera: Scarabaeidae) in the Davis Mountains of west Texas
Timothy G. Maddox and Ned E. Strenth, Angelo State University

4:00 Break

4:15 Preliminary results of a life history study of the southern plains crayfish, *Procambarus simulans* (Crustacea: Decapoda) from west-central Texas
Michael Lucero and Ned E. Strenth, Angelo State University

4:30 Stable isotope analysis to identify dietary variation of *Hyles lineata* in the Chihuahuan Desert
Michael Huston and Kate Seideman, Texas State University

4:45 Diversity in the diet of the microwhip scorpion (Palpigradi: Eukoeneniidae) as revealed by molecular analysis
Mary Jones, Ned E. Strenth, and Loren Ammerman, Angelo State University

Wednesday, May 25

1:30 Rehabilitating riparian ecosystems for people and wildlife through collaborative public-private partnerships
Aimee Roberson, American Bird Conservancy, Jeff Bennett, Big Bend National Park, and Russell Martin, Texas Parks and Wildlife Department

1:45 Surrogate riparian habitat use of the Big Bend slider (*Trachemys gaigeae*) in Lajitas, Texas
Ciara Brodie and Sean Graham, Sul Ross State University

2:00 Resurgence of the subtropical tamarisk beetle (*Diorhabda sublineata*) on saltcedar (*Tamarix* sp.) and athel (*Tamarix aphylla*) along the Rio Grande, with notes on the presence of the splendid tamarisk weevil (*Coniatus splendidulus*) and the tamarisk scale (*Chionaspis* spp.)
Christopher M. Ritzi and Alexandria Hassenflu, Sul Ross State University

2:15 Five years of bug collections: the ups and downs of bigs and littles
Michael Huston, Kate Seideman, Allison Bordini, and Virginia Brown, Texas State University

2:30 Post-drought recovery of wildlife populations in the Christmas Mountains
Leah Cuddeback, Jacquelyn Tleimat, and Michael Huston, Texas State University

2:45 Break

3:00 Cretaceous and Paleocene fossil woods of eastern Terlingua Ranch, Brewster County, Texas.
David E. Lemke, Texas State University

3:15 Geochemical modeling of springs in Big Bend Ranch State Park
Zach Weathers and Kevin M. Urbanczyk, Sul Ross State University

3:30 Modal mineralogical assessment of the Luna Vista sill using statistical analysis of x-ray maps in ArcGIS
Kevin M. Urbanczyk and William Bailey, Sul Ross State University

3:45 Preliminary analyses of geological lineaments in the Christmas Mountains to test ideas on the extent of the Tascotal-Mesa Fault
Felipe Alarcón-Canto, Jim Quisenberry, and Veronica Sanchez, Texas A&M University–Kingsville

4:00 Determining the depositional setting of a limestone unit in Big Bend Ranch State Park, Texas
Stephanie N. Elmore and David M. Rohr, Sul Ross 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. The potential for use of the property as an educational tool will also be discussed.

A report on archaeological indigene rock structures in the borderlands of far west Texas

Samuel Cason, Center for Big Bend Studies, Sul Ross State University, Alpine, TX

Structural rock features (e.g. stone circles, enclosures, and alignments) are a conspicuous and intriguing element of the indigene prehistoric, protohistoric, and historic cultural landscape. Diverse in morphology, setting, and associations, they form a substantial part of the archaeological record of the Pinto Canyon Ranch in a remote portion of Big Bend country. Stone structures represent a range of functions and activities, serving alternatively as domicile, logistical, and special use features. This presentation provides an overview of the ongoing study of the role that structural technology played in lifeways of Trans-Pecos inhabitants portrayed in data from the Pinto Canyon Ranch.

Flowering plants of the Trans-Pecos and adjacent areas, update of a book manuscript in production at BRIT Press

A. Michael Powell, Department of Biology, Geology, and Physical Sciences, Sul Ross State University, Alpine, TX, Richard D. Worthington, Department of Biological Sciences, The University of Texas at El Paso, El Paso, TX, Edward L. Schneider and Barney Lipscomb, Botanical Research Institute of Texas, Ft. Worth, TX

This is a report on the general content and status of a book manuscript titled *Flowering Plants of the Trans-Pecos and Adjacent Areas*. It features native and naturalized flowering plants in the topographically and biologically diverse desert and mountain part of Texas west of the Pecos River, essentially all of which is part of the great Chihuahuan Desert region. The Trans-Pecos proper is approximately the same size as South Carolina, and near the size of Maine, when floristically including parts of adjacent Texas counties east of the Pecos River. Elevations in the region range from 300 m at the mouth of the Pecos River to 2667 m at the top of

the Guadalupe Mountains. The book will include a brief introduction to the flora area, illustrated with more than 30 color photographs, including a map of the region, physiography, vegetative associations, phytogeography, and numbers of species involved, as well as the descriptive flora, a glossary, an extensive list of references, and an index. The major part of the book involves the descriptive flora, organized in two parts, eudicots and monocots, which provides a format for plant identification, including keys, descriptions, and taxonomic discussion of families, genera, and species, and 768 color photographs of selected taxa. The families and other taxonomic groups are arranged in alphabetical order. Approximately 2450 taxa of flowering plants are present in the Trans-Pecos and ca. 956 species (19% of the state's flora) occur only in the Trans-Pecos part of the state. Fifty-six flowering plant species are endemic to the Trans-Pecos. Approximately 54% of the species of concern in Texas occur only in the desert and mountain region. The largest families in the Trans-Pecos flora are Asteraceae (364 spp.), Poaceae (304 spp.), and Fabaceae (168 spp.). The cactus family (105 taxa) is also prominent in the region. Currently the manuscript is about half way through the production process at BRIT Press. The Press estimates that the book will be a hefty 1680 pages and will sport a hard cover with a beautiful dust jacket. It is expected that books will be available in late 2017 or early 2018.

Plant diversities in areas impacted by biological control of saltcedar (*Tamarix* spp.) in west Texas

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

Saltcedar (*Tamarix* spp.) is an invasive species of tree in North America, native to Asia and the Mediterranean. First introduced in the early 19th century for erosion control, saltcedar has spread to dominate over 800,000 hectares in the United States and Mexico. Biocontrol began in 2001 with the introduction of the saltcedar leaf beetle in Utah, Colorado, Nevada, and Wyoming; this has led to the control of over 80,000 hectares of affected land. Following this success, the saltcedar leaf beetle was released along the Rio Grande in Texas in 2008, where it has been having positive effects. Following a 2015 study which found increased insect biodiversity, this study served to compare the plant biodiversity of areas with controlled saltcedar populations versus areas still under mitigation for saltcedar. It is hypothesized that the control of saltcedar would increase overall biodiversity. From this, it was predicted that areas with controlled saltced ar populations would have an increased plant biodiversity, while the areas currently under management would still have reduced biodiversity due to a greater abundance of saltcedar in the area. It was found that areas with controlled saltcedar populations exhibited greater diversity and evenness than those currently under management.

Assessing leaf area and nutrient content change of *Celtis reticulata* across the rainfall gradient of Texas

Michael Huston and Allison Bordini, Department of Biology, Texas State University, San Marcos, TX

Plant nutritional quality is greatly affected by the precipitation in an ecosystem. While an increase in precipitation increases the leaf area and woody growth of plants, we expected these areas to have a decrease in the nutritious nitrogen available to herbivores. We collected 40 samples of *Celtis reticulata* across the latitudinal rainfall gradient of Texas in May 2016. Leaf area was calculated and the C/N ratio of each sample was processed using mass spectrometry in a FlashEA 1112 series carbon and nitrogen analyzer. Our results show that there is a significant relationship between precipitation (both annual and three months prior to sampling) and C/N ratio and between precipitation and leaf area. Linear regressions show that leaf area increases and nitrogen levels decrease with an increase in precipitation, suggesting that while there is more leaf matter, the quality of the leaf nutrients decreases.

Mary Poppins in the Chihuahuan Desert: what constitutes a good cactus nurse?

Martin Terry, Emmanuel Eleruja, Roy Saffel, Olanrewaju Oladosu, Russell Klein, Department of Biology, Geology, and Physical Sciences, Sul Ross State University, Alpine, TX

Despite the existence of a substantial literature on nurse plants that appear to have beneficial effects on the establishment and growth of various species of cacti *in situ*, much remains to be observed and explained about relationships between the nurser and the nursee. Here we present an *in situ* photographic examination of plants and abiotic objects that may serve as nurse plants/rocks/etc. to *Lophophora williamsii* (peyote) in the Chihuahuan Desert of Trans-Pecos Texas. Our objective is to illuminate both self-evident facts and questionable hidden assumptions about the roles that specific nurse organisms/objects play in regard to the ecology of the Chihuahuan Desert.

Life in the desert with ocotillo

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

Ocotillo (*Fouquieria splendens*) is a desert shrub with erect wand like stems that occurs on the lower slopes of the Chisos Mountains and on the surrounding desert. Plants are native to the southwestern United States and are the only representative of the family to occur in the U.S. The plants have many spiny, unbranched stems 2 to 7 m tall, that remain leafless and flowerless except during or immediately after a rainy period. Primary leaves form, but soon drop off as water availability decreases, and the petioles develop into heavy spines. Secondary leaves later appear in the axils of the spines at each rainy period. Brilliant orange to scarlet flowers are showy and are borne in long, terminal panicles. No flowering or leaf growth occurs in the winter. Plants readily germinate from seeds and grow rapidly with larger leaves than on more mature plants. Photosynthetic rates of young plants, as measured by CO_2 uptake, are similar to rates in more mature plants. Leaf quantities of chlorophyll *a* and chlorophyll *b*, as measured spectrophotometrically, are also similar between young and older plants. The larger leaves of the younger plants apparently facilitate rapid growth. Ocotillo is unusual in that the stems have some cyclic photosynthetic capability, but do not fix carbon dioxide into sugars. In the stems, ocotillo apparently converts some light energy into chemical energy as ATP and NADPH; these could then be used directly for growth or for synthesizing starch for storage in the stems. Ocotillo stems are important sites of starch storage. Glucose formed in the leaves is transported to the stems to be converted into starch. Since leaves are only present for short time periods, storage of starch would be essential for survival in long term droughts with no available soil moisture. The loss of leaves during dry periods protects the plant from excessive transpirational water loss, but production of new leaves is energetically costly. Ocotillo green-stem photosynthesis is similar to cyclic photosynthesis of the more primitive form of photosynthesis seen in cyanobacteria where chemical energy is produced but carbon is not fixed.

A population analysis of *Chrysina woodii* (Coleoptera: Scarabaeidae) in the Davis Mountains of west Texas

Timothy G. Maddox and Ned E. Strenth, Department of Biology, Angelo State University, San Angelo, TX

The genus *Chrysina* is a small group of 100 plus species of scarab beetles in the subfamily Rutelinae. Within the southwestern United States, four species of *Chrysina* are known to occur, often restricted to the higher elevations of their range. Of these four species, *Chrysina woodii* is reported to exhibit the most limited distribution, occurring only in the mountains of west Texas and southeastern New Mexico where it feeds on a limited number of host plants. This current study examined a population of *C. woodii* in Davis Mountains State Park in Jeff Davis County of west Texas from June 2015 to October 2016. A total of 1024 adult *C. woodii* were marked using handheld soldering irons in three sites totaling 2.35 hectares within the primitive area of the state park. Five marking trips were conducted from June to September 2015 and eleven collecting trips from June to October in 2016. Initial monthly population estimates using Program MARK and the POPAN models 95% confidence intervals are: June (24–57) individuals, July (162–253), August (197–280) September (164–245) and in October (28–64) beetles for 2016.

Preliminary results of a life history study of the southern plains crayfish, *Procambarus simulans* (Crustacea: Decapoda) from west-central Texas

Michael Lucero and Ned E. Strenth, Department of Biology, Angelo State University, San Angelo, TX

This study was undertaken to better understand the life history strategy of the southern plains crayfish, *Procambarus simulans*, from the Concho River drainage of west-central Texas. The population, inhabiting three temporarily contiguous pools along an approximately 5.5 km reach of Dry Lipan Creek, an intermittent tributary of the Concho River near Mereta, Texas, was monitored within the first ten days of each month starting in April 2016 and continuing through June 2017. Specimens were collected using minnow traps or burrow excavation, sexed, measured and then released. Males were determined as either form I (breeding) or II (non-breeding). Morphometric measurements of carapace length and width, abdomen length and width, chelae length, palmar width, and dactyl length were taken for each specimen. Both form I and form II males were observed consistently throughout the study; ovigerous females were observed during September and February. Young-of-the-year were observed in both October and November. As water levels within the pools dropped during the winter months, specimens were less readily collected. The largest sample size (n=31) was observed in August and the smallest sample size (n=2) in January.

Stable isotope analysis to identify dietary variation of *Hyles lineata* in the Chihuahuan Desert

Michael Huston and Kate Seideman, Department of Biology, Texas State University, San Marcos, TX

Stable isotopic composition of tissues can serve as a natural tracer of dietary inputs. Concentrations of carbon isotope (δC13) in metabolically inert tissues can distinguish between the C3 and C4 mechanisms of photosynthesis (thus cool and moist versus warm and dry environments, and grasslands versus forests), or between C3 and CAM plants that were consumed by insects as larvae. Deuterium (δD) can help to further distinguish between C4 and CAM plants, and acts as a proxy for climate. We expected primary consumers (insects) to feed primarily on C3 plants in years of higher precipitation. We captured *Hyles lineata*, the white-lined sphinx moth, in the Chihuahuan Desert from 2012 to 2016. We used dried wing fragments to infer larval environmental conditions and host plant type for 79 individuals. Results indicate that the *H. lineata* diet did not change significantly between years or seasons. While *H. lineata* is a generalist, we expected there to be a preference for C3 plants in seasons or years of higher rainfall. C3 plants require more water than C4 plants and C3 plants contain more accessible nutrients needed for herbivore growth.

Diversity in the diet of the microwhip scorpion (Palpigradi: Eukoeneniidae) as revealed by molecular analysis

Mary Jones, Ned E. Strenth, and Loren Ammerman, Department of Biology, Angelo State University, San Angelo, TX

The order Palpigradi is a poorly known group of arachnids found in caves and soil from numerous localities worldwide. Prior and preliminary studies have suggested arthropods and cyanobacteria as possible diet items of these organisms. The current study uses DNA sequencing to identify contents of the digestive tract. Three universal primer sets were used to target the COI, 16S rRNA, and ITS regions. These primers had been previously designed to specifically target arthropods, cyanobacteria, and fungi respectively. Additionally, a blocking primer was designed and used to limit the palpigrade DNA itself so as not to obscure the relatively tiny amounts of food DNA present in the gut. Nine specimens of *Eukoenenia* sp. were collected near the Devil's River in Val Verde County of southwest Texas. DNA from these specimens was extracted, amplified by PCR, and then sequenced using an Illumina MiSeq platform. Sequences were compared to the NCBI GenBank. Species level identification has been made for multiple species of arthropods and higher taxonomic identification has been made for bacteria and fungi sequences. These results further support the premise of generalist feeding habits for this species.

Wednesday Afternoon

Rehabilitating riparian ecosystems for people and wildlife through collaborative public-private partnerships

Aimee Roberson[1], Jeff Bennett[2] and Russell Martin[3], [1]American Bird Conservancy, [2]National Park Service, Big Bend National Park, TX, and [3]Texas Parks and Wildlife Department, Alpine, TX

The dominant hydrologic features of arid landscapes are often dry arroyos with ephemeral, intermittent and perennial reaches. Historic accounts of the Trans- Pecos paint a picture of a landscape with wetter creeks and larger, more extensive riparian forests than we see today. Resource extraction, such as mining and deforestation, often occurred without planning for site recovery and, consequently, streams in the region are now in a degraded condition. Among management techniques for degraded streams, rehabilitation must be the vanguard. By slowing erosion, promoting channel aggradation, and increasing the depth and extent of the riparian aquifer through riparian reforestation, streams will hold more water and be more likely to persist through dry spells and droughts, which will enhance riparian and aquatic habitat health, diversity, and resilience of ecosystem services. Terlingua Creek is a perennial stream and tributary of the Rio Grande in Texas. Historical accounts of perennial and intermittent streams within the Big Bend region indicate many were lined with large stands of cottonwood and willow. In 1933, Terlingua Creek was described as a "bold running stream, studded with cottonwood timber and . . . alive with beaver." Intensive rehabilitation efforts are desperately needed in this watershed as the riparian forest has not regenerated after mining and agricultural activities during the late 19th and early 20th centuries required harvest for fuel and structural material. We hypothesize that the old riparian forest provided the nursery conditions necessary for cottonwood and willow recruitment by reducing hydrologic forces during high flows. Once the forest was gone, normal annual flows were sufficient to scour young plants and prevent recolonization. Terlingua Creek

has been slow to recover as it is now characterized by little evidence of beavers, few cottonwoods, sacaton vegas, and abundant saltcedar. We will highlight lessons learned from our collaborative riparian rehabilitation projects along Terlingua Creek, as well as planned projects, and opportunities for landowners to participate in and learn from these efforts.

Surrogate riparian habitat use of the Big Bend slider (*Trachemys gaigeae*) in Lajitas, Texas

Ciara Brodie and Sean Graham, Department of Biology, Geology, and Physical Sciences, Sul Ross State University, Alpine, TX

The Rio Grande has been in decline for nearly a century, and conservation efforts to restore riparian habitat have had limited success. The Big Bend slider (*Trachemys gaigeae*) is endemic to the Rio Grande, has the fewest published studies of species in this genus in the United States, and is listed as vulnerable to extinction due to range contraction and loss of habitat. Anthropogenic water sources have been found to serve as surrogate habitat for species facing degradation of their historical riverine habitats. A comparative study of turtles inhabiting the Rio Grande and golf course water hazard ponds in the Chihuahuan Desert was conducted in the summer months of 2015 and 2016. Relative abundance, sex ratios, body condition and innate immunity were assessed for 62 slider turtles (*T. gaigeae*) and 98 softshell turtles (*Apalone spinifera*). *Trachemys gaigeae* captured at the golf course were more abundant, and had higher body condition indices, than those captured in the adjacent Rio Grande. *Apalone spinifera* were more abundant in the river and did not differ in body condition compared to *A. spinifera* captured at the golf course. There were no detected differences in innate immunity or expected sex ratios. In this arid desert, the water hazards at Lajitas serve as surrogate riparian habitat for at least one species of turtle, and warrant further consideration for conservation efforts of vulnerable Big Bend species.

Resurgence of the subtropical tamarisk beetle (*Diorhabda sublineata*) on saltcedar (*Tamarix* spp.) and athel (*Tamarix aphylla*) along the Rio Grande, with notes on the presence of the splendid tamarisk weevil (*Coniatus splendidulus*) and the tamarisk scale (*Chionaspis* spp.)

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

Saltcedar (*Tamarix* spp.) is a deciduous shrub or small tree that was introduced into the United States from Eurasia in the early 1800s to stabilize riverbank erosion and to serve as a windbreak and ornamental. However, due to a high reproductive potential, saltcedar has become invasive on many river systems in the western United States. Some of the worst tamarisk infestations have occurred in the southern areas of the Rio Grande, and in an attempt to control this plant by biological means, a consortium consisting of the USDA, NRCS, and Sul Ross State University released several species of tamarisk leaf beetle (*Diorhabda* spp.) in southern Brewster and Presidio counties in Texas. The suitability of the species was evaluated, and data suggested that the Tunisian subtropical species (*D. sublineata*) was best suited to this region. Observations have indicated that the tamarisk leaf beetles were capable of establishing on a close relative non-target species, the athel tree (*T. aphylla*). Six sites along the Rio Grande, from Lajitas to Candelaria, TX, have been routinely monitored to determine the long-term impact of leaf beetle defoliation on saltcedar and the non-target athel trees in the region. Although defoliation had been light or absent in the past two years, significant defoliation events were observed in 2016 due to subtropical beetle activity. Also of note was the continued presence and spread of the splendid tamarisk weevil, as well as documented defoliation by tamarisk scale in the same region.

Five years of bug collections: the ups and downs of bigs and littles

Michael Huston, Kate Seideman, Allison Bordini and Virginia Brown, Department of Biology, Texas State University, San Marcos, TX

The 3600-hectare Christmas Mountains property was transferred to the Texas State University System in September 2011, during the worst drought in recent memory. A large proportion of the hardiest desert grasses, shrubs, and cacti were dead. In March 2012, a small group of plant ecology students from Texas State University attempted to sample insects near ranch headquarters. This was the beginning of a long-term project of monthly insect samples using a standardized method in the Christmas Mountains and at Freeman Ranch near the Texas State University campus. Our sampling used a 15 watt UV fluorescent bulb powered by a 12-volt battery. The lights, in a container held above the vegetation with a tripod, were turned on 30 minutes after sunset and turned off 2 hours after sunset. In most months, the majority of the insects captured were moths, but we sometimes collected large numbers of grasshoppers, beetles, ants, and small aquatic insects known as water boatmen. Among the moths, there were two distinct size groups: large, fast-flying sphinx moths, and everything else. The small moths could not fly very fast or far, and we assumed that they were local moths that fed on the local vegetation. In contrast, the hummingbird moths could fly long distances, so could potentially have come from farther away. Over the past 5 years we observed the sphinx moths to increase in abundance over three years following the drought, then almost completely disappear during 2015, one of the wettest years on record with abundant growth of the plants that these moths require as larvae. Sphinx moth numbers remained low in 2016 and seem to be increasing in 2017. The abundance of small moths, which have a shorter life cycle than the large sphinx moths, seem to track local rainfall more closely, with very high numbers in September 2016 following the heavy rains in August and a burst of plant growth in September. Overall, small moths and other insect abundance tracks short-term plant growth in response to local rainfall, while the larger sphinx moths require longer to build up their populations.

Post-drought recovery of wildlife populations in the Christmas Mountains

Leah Cuddeback, Jacquelyn Tleimat and Michael Huston, Department of Biology, Texas State University, San Marcos, TX

The strong freeze in the winter of 2010–2011 followed by extreme drought in 2011 damaged or killed many plants, greatly reducing the food available for herbivores and thus reducing the populations of herbivorous animals that serve as food for predators. Terlingua Ranch residents observed a dramatic reduction, or complete disappearance, of many types of formerly common birds and mammals. In February 2015 we established a system of five wildlife cameras in two adjacent valleys on the west side of the Christmas Mountains, which was subsequently expanded to a total of nine cameras. In summer 2015, which was a year with unusually high rainfall, we began to pick up black bears on our cameras, consistent with the observations of local residents. We also began to detect mountain lions, and over the winter of 2015–2016 photographed three separate females with one, two, and three cubs respectively. Over the winter of 2016–2017, mountain lions were photographed at many different locations, and we photographed bobcats for the first time. One of

our new camera sites had extremely heavy use by multiple species of wildlife, including both predator species such as grey fox, bobcat, and mountain lion, and their prey—rabbits, quail, javelina, and deer. Overall, we have seen an increase in the abundance of native species, including predators, and a decrease in the most widespread exotic species, Barbary sheep.

Cretaceous and Paleocene fossil woods of eastern Terlingua Ranch, Brewster County, Texas.

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

Late Cretaceous and early Paleocene strata (Aguja, Javelina and Black Peaks formations) exposed across the eastern portions of Terlingua Ranch in southern Brewster County, Texas, contain an abundance of fossilized wood specimens. Material ranges from large logs 1.6 m in diameter and 15 m in length to much smaller logs and float. This study focuses on material collected from the Upper Cretaceous/Paleocene Black Peaks formation (ca. 67–54 Ma) in the eastern portion of Terlingua Ranch in proximity to Big Bend National Park. In contrast to the underlying late Cretaceous Aguja Formation, which is characterized by the presence of only coniferous taxa, preliminary examination of thin sections prepared from Black Peaks material indicates the presence of both conifers and angiosperms. A comparison between these fossil woods of Terlingua Ranch and those previously documented for Big Bend National Park, as well as implications for the paleoecology of the area, will be discussed.

Geochemical modeling of springs in Big Bend Ranch State Park

Zach Weathers and Kevin M. Urbanczyk, Department of Biology, Geology, and Physical Sciences, Sul Ross State University, Alpine, TX

As part of an inventory and assessment of springs in Big Bend Ranch State Park (BBRSP), we have compiled multiple existing water chemistry analyses from 1996 to recent. The analyses have been used to characterize the different sub-watersheds in the park and to relate the water chemistry to the bedrock geology. The springs are mostly calcium-bicarbonate facies with elevated sodium and potassium cations and have relatively low total dissolved solids (TDS; 230 to 660 mg/L). Where springs were analyzed for silicon, the levels were surprisingly elevated. These general chemical characteristics are due to the relatively shallow flow paths and short residence times in the primarily silicic igneous rock aquifers that are isolated from deeper circulation due to the presence of aquitards in the volcanic stratigraphy. In order to better understand the chemical evolution of the water, we have attempted inverse modeling using PHREEQC to produce probable phase transfers of minerals along flow paths. Review of the existing literature for bulk mineralogy of the rock units and precipitates present at spring exposures had led to a selection of mineral phases that produce unsatisfactory model results. Specifically, the abundances of K and Cl required the inclusion of unrealistic phases in the model. We are now in the process of analyzing aquifer rocks in varying states of alteration using x-ray diffraction and x-ray fluorescence to determine the alteration phases in order to improve the model results. Additionally, we are reanalyzing springs for silicon, aluminum, and iron—elements that are lacking from most of the compiled data. It is possible that the elevated silicon levels are due to eolian processes, which are being investigated. We are analyzing the geology of possible flow paths using ArcHydro and geologic cross sections in ArcGIS, and confirming these analyses with field observations. Finally, we are collecting new local precipitation data and building an evaporation component into the new models.

Modal mineralogical assessment of the Luna Vista sill using statistical analysis of x-ray maps in ArcGIS

Kevin M. Urbanczyk and William Bailey, Department of Biology, Geology, and Physical Sciences, Sul Ross State University, Alpine, TX

We have conducted modal analysis of thin sections of the Luna Vista sill (LVS) using classification routines in ArcGIS. The technique is similar to other classification schemes (e.g., a supervised multispectral classification of Landsat data), but uses x-ray maps generated with an energy dispersive x-ray detector instead of spectral "bands" of electromagnetic radiation. We are using a specific adaptation of this ArcMap capability created by Ortolano and others. The LVS is located in the Christmas Mountains in southern Brewster County. The LVS has a peralkaline quartz trachyte composition. The mineralogy of the rock includes alkali feldspar, arfvedsonite, eckermannite, ferro-eckermannite, aegirine augite, apatite with rare earth elements, zircon, ilmenite, hematite, calcite, and quartz. X-ray maps of thin sections of the LVS have been created for the elements Si, Ti, Al, Fe, Mg, Mn, Ca, Na, and K using an energy dispersive detector on a JEOL 6010LA SEM at the Sul Ross State University Analytical Laboratory. The x-ray maps are raster images in *.tiff format that include an 8-bit (0–255) signal per pixel for each element. The technique includes the initial application of a "Low Pass" or a "Focal Median" filter to reduce potential instrument noise, followed by a Principal Component Analysis (PCA). The PCA technique exploits the natural variation in the multiband data by creating a new multivariate space and a new multiband raster with the same number of principal components as were in the original x-ray map set. This is followed by an unsupervised or a supervised classification to determine the mineral "classes" that exist in the thin section. The results are variable due to the small areas analyzed with each set of x-ray maps (typically the field of view is less than 1 mm). Example results include 18% albite/25% sanidine/1% arfvedsonite/37% ilmenite/17% matrix for one set of x-ray maps, and 65% albite/ 16% sanidine/ 9% arfvedsonite/ 10% matrix for a second set. An overall modal assessment would require multiple analyses systematically distributed across the thin section.

Preliminary analyses of geological lineaments in the Christmas Mountains to test ideas on the extent of the Tascotal-Mesa Fault

Felipe Alarcón-Canto, Jim Quisenberry, and Veronica Sanchez, Department of Physics and Geosciences, Texas A&M University-Kingsville, Kingsville, TX

The Christmas Mountains laccocaldera developed steep elliptical domes ~42 Ma tilting the predominantly Cretaceous sedimentary rocks and Tertiary intrusive, extrusive, and volcaniclastic rocks. We hypothesize that the geology of the Christmas Mountains has been modified in more recent times by the southern segment of the Tascotal-Mesa transtensional fault system—a fault that has components of strike-slip (horizontal motion) and normal or oblique slip. The Tascotal-Mesa fault system is contained within the Texas Lineament Corridor, which is composed of faults that have complex structural histories and are currently acting as "extensional" systems in the present-day stress field. Previous observations show a lineament trend of N10–20°W in the northern corner of the study area within a series of weathered volcanic units that show significant differences in composition and eruptive styles. The southern section of the study area shows a N45°W to N50°W trend on field mapped fractures and larger scale lineaments interpreted from remote sensing. The structural and slope analyses and field data show a correlation between the fracture systems and the topographically highest areas near the southeast and gentle slopes toward the northwest. Remote sensing interpretations of lineament patterns were compiled in a geodatabase to support field mapping of major structural features of the Trans-Pecos region. This provided a model of the regional stress field to distinguish compressional versus extensional strain. Similarly, it was found that this is an area of fault steps and the trace of the fault does not change trend, but steps-over, sideways, and continues along N25°W trend consistent with an extensional transfer zone.

Determining the depositional setting of a limestone unit in Big Bend Ranch State Park, Texas

Stephanie N. Elmore and David M. Rohr, Department of Biology, Geology, and Physical Sciences, Sul Ross State University, Alpine, TX

A thin (~1 m) but relatively widespread Oligocene–Eocene limestone unit occurs within the Solitario conglomerate on Big Bend Ranch State Park in west Texas. Cenozoic limestones are unusual in this region of Trans-Pecos, Texas, because the area is dominated by volcanics and clastics, and the limestone is between two volcanic units. The limestone is thin-bedded, light-colored, locally dolomitic, and contains only 10–12% insolubles. Travertine textures are abundant as well as stromatolitic laminations, birdseyes, oncoids, and intraclasts. No bioclastic allochems were observed. SEM and EDS observations of fractured surfaces revealed calcified filaments (1 μm) of cyanobacteria penetrating the matrix. The absence of any Cenozoic marine units in the region suggests a lacustrine depositional setting for the limestone. The thinness of the unit, the light color (lack of organics) and the lack of variation in the carbonate facies indicates a closed lake. Stromatolites, lime mudstone rip-ups, and oncoids also indicate very shallow conditions. Birdseye structures appear to be of both stromatolite and travertine origin. An ephemeral lake or playa may have been fed by inflow from springs and groundwater seepage, which would explain the lack of clastics. The minor amount of clay-sized clastics is likely due to eolian processes. Besides seasonal variations, longer term changes in climate can cause the level of the water table to rise and fall through time causing a lake to form and then revert back to a clastic setting when the water table drops. The lake may have been similar to modern playas in tectonically active areas that contain travertine and grade laterally into alluvial plains or fans.

Welcome to Terlingua Ranch Lodge

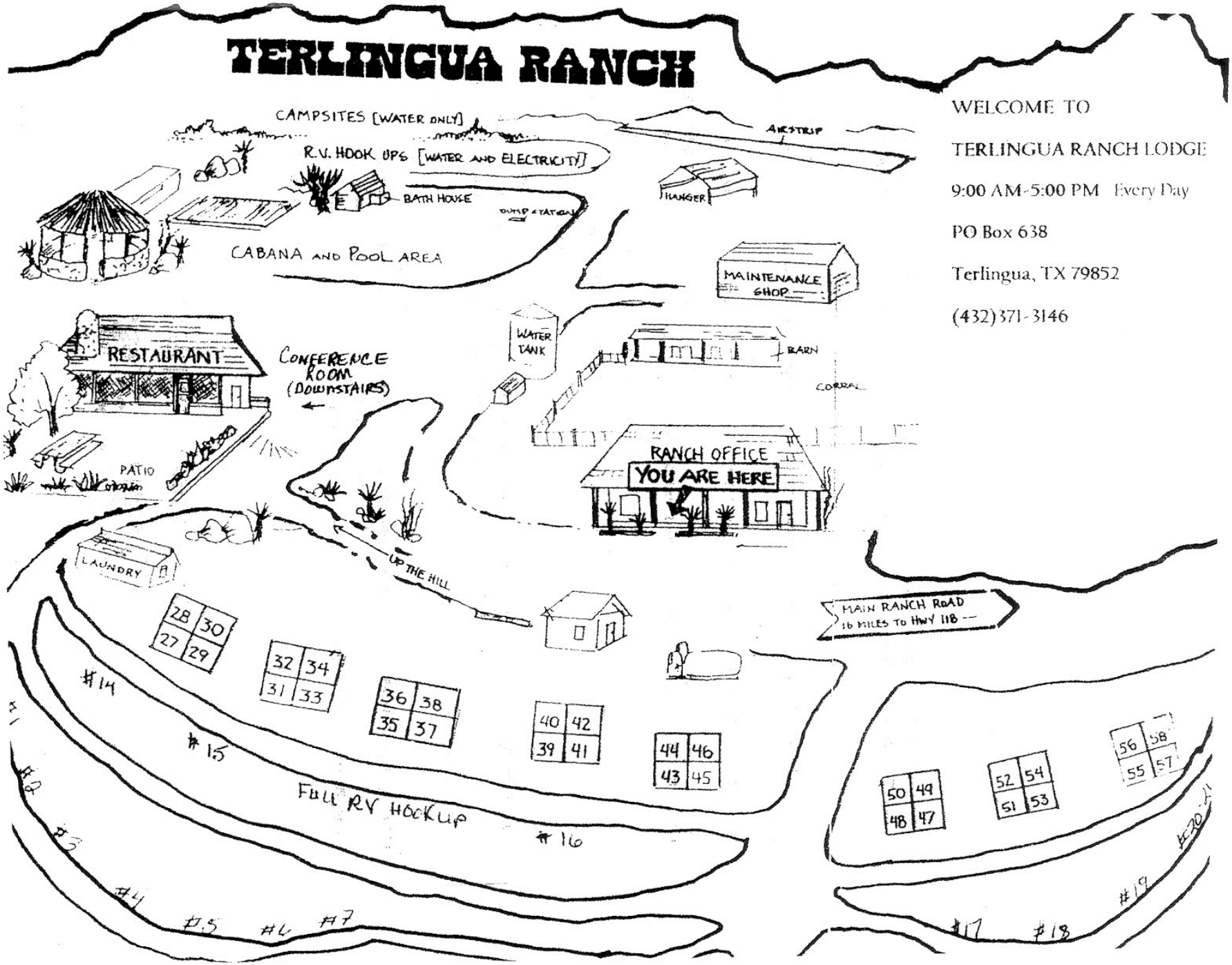
16000 Terlingua Ranch Road
P.O. Box 638
Terlingua Ranch, TX 79852
(432) 371-3146

www.terlinguaranch.com

Office open daily 8:00 am to 5:00 pm

- **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 8:00 pm Monday through Thursday, 7:00 am to 9:00 pm Friday and Saturday, and from 7:00 am to 6:00 pm on Sunday (hours are extended for holidays 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. The **911** phone is located on the patio next to the pool; you may also make credit card or phone card calls.
- **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. Due to the mineral content of our well water, we recommend saving your whites for when you return home.
- **Water** is scarce – please conserve.
- **Burn bans** may be in effect while you are here. Campfires and outdoor cooking are limited to existing fire rings and propane stoves. Please see the Front Desk for information regarding burn bans.
- **Smoking** is allowed outdoors only. Please dispose of cigarettes in butt cans located throughout the Lodge.
- **Christmas Mountains** access permits are available at the Front Desk.

- Please obey posted **speed limits**.
- Please respect **No Trespassing** and **No Hunting** signs throughout the ranch.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RANCH OFFICE
YOU ARE HERE
LAUNDRY
UP THE HILL
MAIN RANCH ROAD 16 MILES TO HWY 118
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32 34 31 33
36 38 35 37
40 42 39 41
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Terlingua Ranch Headquarters

May 21st–23rd, 2018