

CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

2015



Terlingua Ranch Headquarters
Brewster County, Texas
May 25th–27th, 2015



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CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

Terlingua Ranch Headquarters
Brewster County, Texas
May 25th–27th, 2015

Monday, May 25th

- 6:00 pm Informal social for meeting participants by the swimming pool
- 7:00 pm Dinner available (on your own) at the Bad Rabbit Café

Tuesday, May 26th

- 9:00 am Field trip to Christmas Mountains overlook (meet in the parking lot next to the swimming pool)
- 9:00 am Arroyo hike (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 (regular dinner menu will be available for others at the café)

Wednesday, May 27th

- 8:30 am Field trip to Adobe Walls Ranch (meet by the ramadas at Lake Ament)
- 2:00 pm Paper session (in the bunkhouse beneath the Bad Rabbit Café)
- 6:30 pm Dinner for meeting registrants at the Bad Rabbit Café (regular dinner menu will be available for others at the café)

FIELD TRIPS

Christmas Mountains Overlook

Trip leader: David Lemke

Tuesday morning at 9:00 – 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.

Arroyo Hike

Trip leader: Michael Huston

Tuesday morning at 9:00 – 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.

Adobe Walls Ranch

Trip leader: Gean Kearns

Wednesday morning at 8:30 – vans will depart from the parking lot next to the swimming pool at 8:00 am; those taking their own vehicles should plan to meet at the Lake Ament ramadas by 8:30

The owners of the Adobe Walls Ranch have graciously consented to allowing our group access to their property. Ranch manager Gean Kearns will discuss the history of land management practices on the ranch and will lead us to several sites that will demonstrate efforts that have been made to revegetate overgrazed landscapes with native grasses and forbs and to provide improved habitat for native animal species. Roads on the ranch are passable but do require a high-clearance vehicle (4WD not necessary); note that roadside brush is likely to leave its mark on the finish of your vehicle. Plan to carry at least a liter of water with you and please remember that we have been granted permission to observe – no collecting of plants, animals, geologic specimens or artifacts is permitted.

CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

Tuesday, May 26

1:30 Welcome and Introductions

1:45 An introduction to the Christmas Mountains
David E. Lemke, Texas State University

2:00 Directly above the center of the Earth
Tom Alex, Terlingua Ranch and National Park Service (retired)

2:15 Community collaborative rain, hail and snow network (CoCoRaHS)
Mark Strobin and Jim DeBerry, National Weather Service

2:30 Break

2:45 Collection of flow dependent biological and habitat data to inform instream flow requirements for the Big Bend reach of the Rio Grande
Kevin Urbanczyk, Jeff Bennett and Lydia Smith, Sul Ross State University and National Park Service

3:00 An assessment of long term and seasonal changes in the hydrology of the Rio Grande and related springs from the Big Bend to Amistad
Jonas Brandon Ball, Sul Ross State University

3:15 Geomorphic change detection to assess the impact of removal of invasive species, Boquillas Canyon, Big Bend National Park
Kevin Urbanczyk, Jeff Bennett and Lydia Smith, Sul Ross State University and National Park Service

3:30 Status of the subtropical tamarisk beetle (*Diorhabda sublineata*) as a saltcedar (*Tamarix*) biocontrol agent along the Rio Grande and its impact on a non-target species, *Tamarix aphylla*
Chris M. Ritzi and Anne Marie Hilscher, Sul Ross State University

3:45 Break

4:00 Wildlife and range management on the Adobe Walls Ranch
Gean Kearns, Adobe Walls Ranch

4:15 Activity patterns of black bears and other mammals in the Chisos Mountains of Big Bend National Park, Texas
Skyler Stevens, Patricia Moody Harveson, Catherine Dennison, Michael Stangl and Raymond Skiles, Sul Ross State University and National Park Service

4:30 Movements of puma in Big Bend National Park
D. Price Rumbelow, Bert Geary, Patricia Moody Harveson and Raymond Skiles, Sul Ross State University and National Park Service

- 4:45 Diel cycle and the investigation of age classes and prey species of mountain lion kills
Kendall J. AuBuchon, Thomas R. Simpson, L. Mark Elbroch and Floyd W. Weckerly, Texas State University and University of California, Davis
- 5:00 Habitat utilization and weather effects on scaled quail before and during the nesting season in the Trans-Pecos
Ernesto García-Ortega, Ryan S. Luna and Louis A. Harveson, Sul Ross State University

Wednesday, May 27

- 2:00 The vinegaroon and life in the desert
Francis Horne, Texas State University
- 2:15 Bee diversity in Big Bend National Park and Brewster County, Texas
John Pascarella, Sam Houston State University
- 2:30 Post-drought population changes in the white-lined sphinx moth (*Hyles lineata*)
Kate Seideman-Barclay and Michael Huston, Texas State University
- 2:45 Egg-laying habits of Slosser's buckmoth (Lepidoptera: Saturniidae) from Andrews County in northwest Texas
Trilby King, Nicholas Negovetich, Lendon Partain and Ned E. Strenth, Angelo State University

3:00 Break

- 3:15 Site factors that modify rates of tree mortality during drought
Beth Crouchet, Texas State University
- 3:30 Upper Cretaceous conifers of Terlingua Ranch, Brewster County, Texas
David E. Lemke, Texas State University
- 3:45 A review of fossil *Holospira* (Gastropoda: Pulmonata) from the Tertiary of west Texas
Ned E. Strenth, Mary Jones and Christopher Montag, Angelo State University
- 4:00 Stratigraphy and depositional environment of the basal Presidio formation (Lower Cretaceous) at Shafter, Texas
David M. Rohr, Thomas Reyes, Paul Dolliver and Elizabeth Measures, Sul Ross State University, PRECIMAT, and Geomap Company

4:15 Break

- 4:30 Body size variation as an indicator for secondary productivity
Virginia Brown and Michael Huston, Texas State University
- 4:45 Road-kill ecology: advances in Trans-Texas biogeography
Michael Huston, Jeremy Luther and Howell Pugh, Texas State University

ABSTRACTS

An introduction to the Christmas Mountains

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 be discussed.

Directly above the center of the Earth

Tom Alex, Terlingua Ranch and National Park Service, Big Bend National Park, TX (retired)

The Christmas Mountains stand apart from the surrounding desert—a starkly rugged landform that presents a challenge to researchers hoping to discover its secrets. The property is recognized for its singularity and has now been set aside for a time to allow research to study its potential wealth of knowledge. But the boundary of this property is ill-defined on the landscape and the need for precise knowledge of just where one is located is necessary to avoid trespass and insure successful research. Land survey data is imprecise and it is imperative that the Texas State University System determine where its property begins and where surrounding private properties begin. This presentation focuses on one attempt to use best available technology and reliable survey data to better define the Christmas Mountains boundary.

Community collaborative rain, hail and snow network (CoCoRaHS)

Mark Strobin and Jim DeBerry, National Weather Service, Midland, TX

West Texas is one of the most sparsely populated areas of the state. As result, meteorological observations here are similarly sparse. Even automated observing platforms are not as abundant out here as in more populated areas of the state, for funding for such systems logically tends to be concentrated where benefits will be maximized, i.e., population centers. As a result, west Texas rainfall climatology is poor. In 1998, the CoCoRaHS (Community Collaborative Rain, Hail and Snow) network was established. CoCoRaHS is a unique, non-profit, community-based network of volunteers of all ages and backgrounds working together to measure and map precipitation (rain, hail and snow). With a simple rain gauge and an internet connection, landowners can establish a climatology of rainfall on their land. The denser the observing network, the better, especially in mountainous terrain such as the Christmas Mountains, for rainfall can vary considerably in areas of dissimilar topography. CoCoRaHS is the cheapest, easiest-to-use network devised so far for measuring precipitation.

Collection of flow dependent biological and habitat data to inform instream flow requirements for the Big Bend reach of the Rio Grande

Kevin Urbanczyk¹, Jeff Bennett² and Lydia Smith², ¹Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX and ²National Park Service, Big Bend National Park, TX

Declining flows, a perturbed sediment regime and impaired water quality have negatively affected aquatic and cultural resources along the Rio Grande Wild and Scenic River (RGWSR). As part of a multi-agency effort, we are engaged in efforts to understand the interaction of degraded channel conditions, groundwater supported base flows, and the subsequent impacts on aquatic species and habitat. We have been conducting annual “eco-hydrology” research trips in the Lower Canyons reach of the RGWSR since 2012 to collect flow dependent ecological and habitat data that can inform the development of instream flow requirements. Fish and macroinvertebrate surveys are combined with geomorphic surveys, discharge measurements, water quality information, and repeat photography to assess condition and health of the groundwater dependent ecosystem of the Big Bend reach of the Rio Grande. Repeated and synoptic stream discharge measurements combined with water quality measurements indicate an increase in discharge over the reach and an accompanying decrease in specific conductance. Water quality and quantity improvements are the result of baseflow contributions from the Edwards Trinity Plateau Aquifer, potentially a transboundary aquifer. During baseflow periods the discharge at the gage at Foster’s Weir at the bottom of the reach can be 70% groundwater. The specific conductivity of the springs ranges from ~800 $\mu\text{S}/\text{cm}$ in the upper reaches of the Lower Canyons to as low as 350 $\mu\text{S}/\text{cm}$ in the vicinity of lower Madison falls and temperatures are as high as 31°C in the area of Rio Grande Village and decline moving downstream and east to 29°C. Geomorphology is currently assessed with a single cross section at each site. These are intended to assist in geomorphic change detection through time. A recent cross section reveals the influx of sediment visible as terrace development since the previous survey. This change is related to recent prolonged dam releases from Mexico. A sediment source has not yet been identified. Fish and macroinvertebrate surveys are conducted along with habitat parameters. For each habitat type, depth, substrate, velocity and fish and invertebrate samples are collected. Results include the continued presence of the Rio Grande Silvery minnow (*Hybognathus amarus*), a recently reintroduced species.

An assessment of long term and seasonal changes in the hydrology of the Rio Grande and related springs from the Big Bend to Amistad

Jonas Brandon Ball, Rio Grande Research Center, Sul Ross State University, Alpine, TX

The purpose of this study is to observe and assess hydrologic conditions of the Rio Grande in the Big Bend region by utilizing stream flow and groundwater data. A primary objective in the study is to assess long term and seasonal fluctuations on the flow of important springs located within the reach of the Rio Grande from the confluence with the Rio Conchos to Amistad Reservoir. Surface water data can be combined with a stream budget analysis in order to estimate stream and groundwater flow relationships. This can be joined with subsurface geologic data to determine if the stream is gaining or losing spring flow over time. The area of interest for this study is the Rio Grande in the Big Bend Region of west Texas, beginning at the confluence of the Rio Conchos and continuing downstream to Amistad Reservoir (BBTAR). The Rio Conchos is the first perennial tributary after more than 460 kilometers, dramatically affecting the hydrology of the Rio Grande with increased stream flow. However, during extreme low flow conditions, groundwater contributions from the Edwards-Trinity aquifer can contribute over 50% of total flow in the BBTAR reach. This study will identify long term and seasonal changes that affect spring flow within the BBTAR reach.

Geomorphic change detection to assess the impact of removal of invasive species, Boquillas Canyon, Big Bend National Park

Kevin Urbanczyk¹, Jeff Bennett² and Lydia Smith², ¹Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX and ²National Park Service, Big Bend National Park, TX

The Big Bend Reach of the Rio Grande is plagued with environmental problems associated with reduced flow, sediment accumulation, and the encroachment of invasive species such as giant river cane (*Arundo donax*) and saltcedar (*Tamarix*). The reduced flow is due to upstream diversion and drought and results in a river system that is in sediment surplus. The problem is compounded by the presence of the invasive species that tend to stabilize what would otherwise be mobile sediment in the channel area. The overall result is a narrow, confined channel with limited flood conveyance capacity and a degraded aquatic habitat. In order to assess the situation, we began a geomorphologic study of several sand and gravel bars in Boquillas canyon in 2004. The initial surveys were completed with a laser total station (TS) instrument and consisted of cross sections on the bars. The survey work evolved to include three dimensional TS coverage of most of the bars, the addition of Real Time Kinematic GPS (RTK) for georeferenced coverage and higher density point cloud development in 2012, an aerial radar Light Detection and Ranging (LIDAR) collection effort later in 2012 with an even higher point cloud density, and ground based LIDAR in 2015. These survey efforts are intended to assess geomorphic change that might result from changes in hydrology or changes in sediment mobility that might result from recent restoration efforts designed to remove giant river cane. We are also experimenting with photogrammetry techniques. The Geomorphic Change Detection (GCD) process requires repeat topographic coverage. The field data are processed into Digital Elevation Models (DEMs) and then subtracted to form DEMs of Difference (DODs) in order to assess sediment mobility. We have empirically determined the precision of our TS and RTK techniques and propagate the error through the process for statistically valid analysis. The data for the entrance bar at Boquillas Canyon indicate a large sediment loss between 2004 and 2011 (~40,000 m³), mostly due to the large 2008 flood event. There was little change between 2011 and 2012 and a sediment accumulation of ~4,500 m³ between 2012 and 2013.

Status of the subtropical tamarisk beetle (*Diorhabda sublineata*) as a saltcedar (*Tamarix*) biocontrol agent along the Río Grande and its impact on a non-target species, *Tamarix aphylla*

Chris M. Ritzi and Anne Marie Hilscher, 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 occur in the southern areas of the Rio Grande, and in an attempt to control this plant by biological means, the USDA 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 also indicated that the tamarisk leaf beetles were capable of establishing on the non-target athel tree (*T. aphylla*). Thirteen sites along the Rio Grande River, from Lajitas to Candelaria, Texas, are routinely monitored to determine the long-term impact on the saltcedar and on the non-target athel trees in the region. Although defoliation remained steady during the previous years, significant defoliation events were not observed until September and October of 2014.

Wildlife and range management on the Adobe Walls Ranch

Gean Kearns, Adobe Walls Ranch

Adobe Walls Ranch comprises fenced unimproved pasture and mountainous terrain in the Trans-Pecos region of Texas and is located approximately 70 miles south of Alpine in Brewster County. The current ownership has conducted what could be described as a style of land management geared towards wildlife and range management. Accordingly, soil and water conservation practices have been conducted and are essentially consistent with the academic definition of a wildlife management area. All livestock was pulled off the ranch over 15 years ago. Thirteen years ago, the water resources were minimal and primarily consisted of four stock tanks, two existing but inactive water wells, and three springs that are mostly intermittent. Since then, one high-producing water well that supplies the main source of water for the ranch has been added. There are now eleven water troughs with more being installed; after this year there will be a total of 16 throughout the ranch. There are also two rock and concrete tinaja dams that hold water, and several other low production springs. There are about ten dirt tanks on the ranch. There are four areas existing as food plots that have been reseeded with native grass and forbs. In 2015 there are plans to make five raptor artificial nesting sites/roosts. In 2012 there were about 25 power poles placed outside the power easement to provide nesting sites for elf owls. The raptor nesting sites that will be built on top of five of the power poles will be built soon. They are far enough from the power lines not to pose a problem for the raptors or the owls. The four 20-acre plots have been reseeded by broadcasting the seed that have been taken from stock in the Big Bend area, making sure that no non-native species were introduced. There has been close to an 85% success rate on germination of seed. We have just created a new food plot on the lower west side with irrigation.

Activity patterns of black bears and other mammals in the Chisos Mountains of Big Bend National Park, Texas

Skyler Stevens¹, Patricia Moody Harveson¹, Catherine Dennison¹, Michael Stangl¹ and Raymond Skiles²,
¹Borderlands Research Institute, Department of Natural Resource Management, Sul Ross State University, Alpine, TX and ²National Park Service, Big Bend National Park, TX

Once nearly extirpated from Texas, the black bear (*Ursus americanus*) naturally recolonized the Chisos Mountains of Big Bend National Park. Common throughout the mountain range, bears share the habitat with many other species of mammals, including Carmen Mountain white-tailed deer (*Odocoileus virginiana carmensis*), grey fox (*Urocyon cinereoargeneus*), rock squirrels (*Spermophilus variegatus*), desert cottontail rabbits (*Sylvilagus audubonii*), and black-tailed jackrabbits (*Lepus californicus*). There is little understanding, however, of how these species interact in the national park and partition temporal use of habitat. Identifying daily activity patterns leads to a better understanding of predation risk by prey species, predation opportunities of predators, and how the presence of a large omnivore affects species interactions. Remote cameras provide the ideal way to monitor a large number of species continuously over a long stretch of time. In this study, I placed a single Bushnell Trophy Cam remote camera at 58 sites within and around the Chisos Mountains in a system of 2.25 km² and 9 km² grids. Each site was chosen specifically for likelihood of animal movement, in areas such as draws and canyons, mountain passes, or saddles in a ridgeline. We collected pictures from the cameras throughout 2014. Pictures were sorted, organized, and analyzed using the programs ReNamer, DataOrganize, and DataAnalyze to identify the daily pattern of each species across the Chisos Mountains. We found daily peak activity times for these common species for each season.

Movements of puma in Big Bend National Park

D. Price Rumbelow¹, Bert Geary¹, Patricia Moody Harveson¹ and Raymond Skiles², ¹Borderlands Research Institute, Department of Natural Resource Management, Sul Ross State University, Alpine, TX and ²National Park Service, Big Bend National Park, TX

Big Bend National Park (BIBE) is one of the largest attractions bringing tourists to the Trans-Pecos. At over 800,000 acres it is also one of the largest sanctuaries of Chihuahuan Desert flora and fauna, including apex predators. Encounters with black bears (*Ursus americanus*) and puma (*Puma concolor*) reported by visitors are not uncommon. Not all encounters are seen as a negative and there are many visitors who come to BIBE because of the true wilderness this remote park still offers. That said, there are real dangers which must be addressed by BIBE to protect its visitors and wildlife. Although there has never been a death caused by puma in BIBE, there have been more attacks than in any other park in the National Park System and each attack in Texas has occurred in the park. The purpose of this research is to evaluate the potential of puma-human conflicts in Big Bend National Park. Puma in BIBE were captured and collared with GPS satellite-linked collars during two capture seasons, Jan 20–April 15, 2014 and Jan 15–April 15, 2015. This presentation will provide an overview of the project and examine factors that affect puma movement. Puma habits are only half of the equation but understanding this information will help predict when and where a puma-human encounter might occur.

Diel cycle and the investigation of age classes and prey species of mountain lion kills

Kendall J. AuBuchon¹, Thomas R. Simpson¹, L. Mark Elbroch² and Floyd W. Weckerly¹, ¹Department of Biology, Texas State University, San Marcos, TX and ²Department of Wildlife, Fish and Conservation Biology, University of California, Davis, CA

The understanding of activity patterns and hunting behaviors can provide insight into life history and predator-prey dynamics. The mountain lion (*Puma concolor*) occupies the largest geographical range of any terrestrial mammal in the western hemisphere. Mountain lions live in a variety of habitats including mixed forests, high elevation plateaus, shrub communities, open steppe, valley bottoms with steep slopes, and riparian habitats. Previous research has shown their activity patterns occur primarily during the nocturnal and crepuscular periods. The primary prey of mountain lions are mule deer and elk, but they also rely on smaller prey such as beaver and porcupine, among others. We investigated characteristics of mountain lion kills in response to diel cycle and across seasons. We looked at sex and age classes of their primary prey species. Data were collected from March 2011 to December 2012 on 432 predation events from eleven different mountain lions fitted with Global Positioning System collars near De Beque, Colorado. In the southern Yellowstone ecosystem in Wyoming, 484 predation events were investigated from November 2012 to June 2014 from eleven different mountain lions. We used a linear mixed-effects model to assess whether the data points collected have a specific pattern or are due to random chance. Diel cycle had significant effects on mountain lion kills and there were also significant effects on prey species. Most kills occurred on fawns and calves, followed by adults. Among the adults killed, females were killed more frequently than males. Understanding mountain lion hunting behaviors will aid in management of this predator as well as management of its prey populations. In an era of technological advances and urban growth and development, these management practices will allow us the knowledge and tools to successfully cohabitate with this iconic species.

Habitat utilization and weather effects on scaled quail before and during the nesting season in the Trans-Pecos

Ernesto García-Ortega, Ryan S. Luna and Louis A. Harveson, Borderlands Research Institute, Department of Natural Resource Management, Sul Ross State University, Alpine, TX

Scaled quail (*Callipepla squamata*) populations have experienced a decline throughout their range since the early 1960s. Anthropogenic factors have been identified as the main cause of their decrease in the Trans-Pecos region. Since its introduction, radiotelemetry has provided the means to gain better information about scaled quail home range movements and their basic ecology. Using radio-tagged females, this research (1) determined the habitat utilization through dispersal of scaled quail before and during the nesting season, (2) analyzed the weather variables that can affect the nesting season and nest-site selection, and (3) estimated a seasonal home range for female scaled quail. In order to accomplish these objectives, Very High Frequency (VHF) portable receivers, Yagi antennas, VHF radio collars, and Global Positioning System (GPS) units were used for the monitoring of female scaled quail from early April to mid-September 2014. The location of each female during the spring and summer seasons was recorded by GPS units and later used in ArcGIS software. A micro-weather station was used to record temperature, precipitation, and relative humidity every 4 hours with 1-minute sampling. By the end of September, 901 locations from 32 female scaled quail were obtained, which averaged a home range of 0.427 km², the smallest being 0.138 km² and the largest, 0.984 km². This research will continue recording data through 2015 in order to provide better understanding of scaled quail needs. Habitat improvement and better land management practices will be the final output needed to preserve this species.

The vinegaroon and life in the desert

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

Desert arthropods have a major problem in conserving water. Predaceous species such as the vinegaroon (*Mastigoproctus giganteus*) especially have more of a problem in handling their dietary nitrogen load from their prey than do herbivores. One of the strategies used to thwart water loss is to excrete highly insoluble purines as their nitrogenous excretory wastes. The vinegaroon, like many other arachnids, excretes primarily guanine with much lesser amounts of hypoxanthine, and no urea. Because of the low solubility of both guanine and hypoxanthine in water, excreta can be voided with minimal water loss. The greater nitrogen content of guanine further increases its efficiency in reducing water loss. After feeding on crickets that are uric acid excretors, the vinegaroons occasionally have some uric acid in their excreta which apparently has its origin in the insect. As time since feeding increases, the vinegaroon excreta has no detectable uric acid. The more water-soluble purines, xanthine and adenine, have not been detected in the excreta. Physiological and ecological implications of excreting primarily guanine as their nitrogenous waste will be discussed in relation to water loss.

Bee diversity in Big Bend National Park and Brewster County, Texas

John Pascarella, College of Sciences, Sam Houston State University, Huntsville, TX

As part of a larger checklist of the bees of Texas, bee diversity in Big Bend National Park (BBNP) and Brewster County in the Chihuahuan desert ecoregion of Texas was reviewed, using published revisions and online specimen databases. Additional records are being entered from the Texas A&M entomology collection and other sources. Five families of bees with 184 species are found in Big Bend National Park and 262 species in Brewster County. Big Bend National Park and Brewster County contain approximately 19% and 28%, respectively, of the bee fauna for the state of Texas, which has approximately 946 species. The most speciose family in both BBNP and the county is Megachilidae (60 species in the park, 77 species in the county), followed by Apidae (56, 76), Andrenidae (35, 55), Halictidae (17, 32), and Colletidae (16, 22). Both the park and the county have similar proportions of species by family with the park having fewer species, with additional species primarily found in and around the Alpine, Texas, area. The genus *Hesperapis* in the family Melittidae has not been documented for the park or county but does occur in adjacent counties in the region. The most speciose genera in the county are *Perdita* (32), *Megachile* (24), *Lasioglossum* (17), *Colletes* (15), *Andrena* (14), *Ashmeadiella* (14), *Melissodes* (13), *Diadasia* (11), and *Anthophora* (10). Thirteen parasitic genera (*Sphecodes*, *Dioxys*, *Coelioxys*, *Stelis*, *Dianthidium*, *Xeromelecta*, *Zacosmia*, *Leipodus*, *Orepasites*, *Nomada*, *Paranomada*, *Epeolus*, *Triepeolus*) occur in the county. One introduced species (*Apis mellifera*) is found in the county and park. The number of endemic species is seven, with three known only from BBNP and four other species endemic to Brewster County. The fauna is primarily southwestern, with some central Texas and widespread faunal elements. The bee fauna in Brewster County is both richer than and distinct from the bee fauna of the Piney Woods region of eastern Texas that has 179 species in 31 counties, with only 30 species found in common between the two regions containing 401 species. Bees collected from the Christmas Mountains and Terlingua Ranch will be displayed.

Post-drought population changes in the white-lined sphinx moth (*Hyles lineata*)

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

Hyles lineata (white-lined sphinx moth), the most common sphinx moth of the Chihuahuan Desert, is a globally-distributed species occurring in North America from Canada to northern Mexico, and is particularly prevalent in arid environments. They are considered excellent pollinators because the adults feed on a broad range of nectar-producing plants in over 40 families. Larvae have been found to feed on seven different families of host plant. We have collected insects, including *Hyles lineata*, using UV light traps for the past three years at two locations near Terlingua Ranch Headquarters at the base of the Christmas Mountains. Wing and body length are known to decrease when there is a lower quantity and quality of food during the larval stage, which often occurs when precipitation is low. We have noticed that the total biomass of *H. lineata* collected has increased over the past three years (2012–2014), with most individuals being captured during the monsoon season. Total rainfall in Terlingua has increased slightly over these three years, potentially increasing the abundance, as well as the wing length and body size of *H. lineata* if the larval stage occurred locally. Wing length, body length and body width of individual *Hyles* were measured to 0.01 mm. Dry mass was measured to 0.01 g after 72 hours in a 60°C oven. Preliminary analysis considering all body measurements simultaneously determined there was a difference due to sex and the interaction between sex and year; there was no difference in body size due to year. Post-hoc ANOVAs determined that there was a difference between sexes for all body measurements; males were significantly smaller than females. The migration patterns of *H. lineata*

have yet to be described and it may be that *H. lineata* do not migrate and are a local species. Further investigation of the species is needed to determine if there is migratory behavior.

Egg-laying habits of Slosser's buckmoth (Lepidoptera: Saturniidae) from Andrews County in northwest Texas

Trilby King, Nicholas Negovetich, Lendon Partain, and Ned E. Strenth, Department of Biology, Angelo State University, San Angelo, TX

Slosser's buckmoth (*Hemileuca slosseri*) inhabits the rolling sand plains of southeastern New Mexico, northwest Texas, and southwestern Oklahoma, where the larval stages of this species feed exclusively on the leaves of *Quercus harvardii*. Adults emerge in November and immediately complete their egg laying activities. Observations in the field during the fall of 2013 reveal that many of the newly deposited egg rings were positioned in close proximity to existing hatched egg rings left over from the previous year. This study was undertaken to observe the egg laying habits of *H. slosseri* in Andrews County and to determine if there is any correlation between the presence of existing hatched egg rings and the deposition of new eggs. Following all seasonal reproductive and egg laying activities in January 2014, a 12 x 40 m study area was established adjacent to Highway 115 approximately 13 km SW of Andrews, Texas. All egg rings were mapped as to location, and height above ground as well as the stem diameter of each egg ring was recorded. A total of 134 egg rings were observed on the study plot (91 hatched and 43 un-hatched). Height above ground did not vary between new and old egg cases (unhatched: 22.8 ± 0.79 cm; hatched: 20.7 ± 0.66 cm; $P < 0.065$), but new eggs were found on smaller stems compared to old eggs (unhatched: 1.69 ± 0.089 mm; hatched: 2.17 ± 0.072 mm; $P < 0.0002$). All egg cases exhibited an aggregated dispersion that appeared to follow the dispersion of *Q. harvardii*. Nearest neighbor analysis supports this claim, but it does not suggest an association between new and old egg rings. Therefore, stem diameter and not presence of hatched egg cases appears to be the determining factor in the positioning of the new egg rings. Additional field studies are currently underway and should provide a more complete resolution of the factors affecting oviposition in female moths.

Site factors that modify rates of tree mortality during drought

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Climate models predict an increase in the frequency of severe weather events, including prolonged drought conditions. Texas experienced intense drought conditions in 2008 and again in 2011. The latter year is thought to have caused the death of six percent of all trees in Texas, though not all tree species and all locations were equally affected. The purpose of my research is to identify some of the local factors that modified rates of tree mortality at the plot scale. In 2014, I censused 62 plots across the state of Texas, mostly on the Edwards Plateau. In 30 m x 30 m plots, each tree above a minimal size threshold was identified to species, its basal circumference measured, and its health status recorded in one of seven categories. Saplings of knee-height or more were counted and classified as either alive or dead. I will use a Generalized Linear Model to determine whether tree and sapling mortality or health status were species- and/or density-dependent and, if so, whether the density of some species was more important than that of others. In the future, additional analyses will be performed to determine which physical site factors contributed significantly to setting mortality rates, including elevation, slope, aspect, soil texture and depth, and precipitation history. The ultimate goal of this project is to determine landscape-scale factors that modify tree vulnerability to drought.

Upper Cretaceous conifers of Terlingua Ranch, Brewster County, Texas

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Late Cretaceous and early Tertiary strata (Aguja, Javelina and Black Peaks formations) exposed across 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 Aguja formation (ca. 80–70 mya) in the eastern portion of Terlingua Ranch in proximity to Big Bend National Park. Preliminary examination of thin sections prepared from this material indicates the presence of several conifer taxa, including representatives of the fossil genus *Cupressoxylon* and taxa related to the extant families Cupressaceae and Podocarpaceae. A comparison between the fossil conifers 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.

A review of fossil *Holospira* (Gastropoda: Pulmonata) from the Tertiary of west Texas

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The genus *Holospira* is an extant group of xeric adapted land snails that currently range from southern Arizona to central Texas and south to southern Mexico. Fossil specimens of this genus date from the late Cretaceous period and extend from Alberta in western Canada to Guerrero in southern Mexico. Fossil specimens are known from the nearby states of New Mexico, Chihuahua, and Tamaulipas. No fossil material currently assigned to this genus has been reported from Texas. This study examines fossil material from two locations in west Texas that are deposited in the Texas Memorial Museum in Austin: several specimens from the Delaho Formation in Big Bend National Park and a single specimen from the base of the Devil's Graveyard Formation in the Agua Fria region north of Study Butte. Poor preservation and weathering have left these specimens without apertures or external shell material. High resolution x-ray computed tomography of the Delaho specimens failed to reveal any defining internal structures. However, a single specimen in this group does appear to exhibit both external annulations and whorls which are characteristic of living specimens of *Holospira*. Preliminary analysis of the specimen from the Devil's Graveyard Formation appears to reveal both an external annulation pattern and internal whorl angles that are indicative of the genus *Holospira*. While the preliminary results of this study would initially appear to support the assignment of one or more of these fossil specimens to the genus *Holospira*, it is apparent that additional collections and morphometric analysis will be required to reliably resolve the taxonomic assignment of these fossil specimens from Brewster County.

Stratigraphy and depositional environment of the basal Presidio formation (Lower Cretaceous) at Shafter, Texas

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The Lower Cretaceous (Aptian-Albian) Presidio Formation unconformably overlies the Middle Permian Mina Grande Formation and records the first transgressive marine depositional cycle of the Cretaceous. The lower part of the Presidio Formation has previously been described as a basal conglomerate. Data from 412 continuous diamond drill cores, underground workings, as well as outcrops within the Shafter Mining District indicate that the conglomerates occur up to 150 feet above the unconformity and are rarely at the basal contact. The basal unit is composed of sandstone, marl, and breccias/gravels of poorly-sorted, pebble-to cobble-size chert and limestone clasts in a mud, silt, and clay matrix with calcite spar-cement locally present. Thick micrite rims symmetrically coat individual fossiliferous Permian limestone clasts. The micrite rims indicate subaqueous algal growth in the photic zone, and the lenticular conglomerate beds are interpreted as tidally influenced, braid-delta channels. The Cretaceous-Permian unconformity is obscured in many cores by mineralization, but the unconformity consists in part of a marine hardground and karst. The hardground surface is well exposed in outcrop and exhibits closely spaced, gourd-shaped *Gastrochaenolites* bivalve borings into Permian limestone overlain directly by symmetrical ripples in Cretaceous sandstone. These borings into limestone are infilled with sand and can be etched free. The basal lithology at one underground exposure consists of black shale and does not correlate throughout all cores drilled in the vicinity. The highly localized nature of the black shale could be partially due to the irregular topography of the eroded and possibly karsted Permian surface. Equivalent-aged basal conglomerates of the Shutup Conglomerate Member of the Yucca Formation exposed in the Solitario in Big Bend Ranch State Park contains mostly Paleozoic, pebble-sized clasts of angular to sub-angular Caballos novaculite and Maravillas chert, which indicate a source from the Marathon Uplift. An absence of similar chert clasts in the conglomerate units at Shafter points to an unrelated source.

Body size variation as an indicator for secondary productivity

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The energy that plants produce through photosynthesis is positively correlated with the amount of plant and animal biomass in ecosystems. Growth of herbivores is affected by the quality and quantity of the plant material they consume. Lepidopteran larvae (caterpillars) are herbivores, with only a few exceptions. Due to this relationship we hypothesize that there should be a positive correlation between plant productivity and the number and biomass of Lepidoptera in a given area. We collected moths in the Chihuahuan Desert and in an Edwards Plateau grassland ecosystem, which differ in annual precipitation by a factor of five. Within each ecosystem two sites of differing plant composition were sampled to investigate this relationship. The Chihuahuan Desert sampling sites, located near the Christmas Mountains, are a hillside and a valley. The grassland sampling sites, located at Freeman Ranch near San Marcos, Texas, are an open grassland and a wooded thicket. Using a UV light trap, adult Lepidoptera and other flying nocturnal insects at both sites have been sampled monthly for an hour and a half between the full moon and the new moon lunar phases. All individual moths are sorted to morphospecies, then dried and weighed to allow analysis by size classes. Use of size classes for analysis is intended to standardize variability due to different species composition among sites. Preliminary results indicate that both the total weight of all insects and the average size of individual insects is

greater in the desert ecosystems than in the grasslands, contrary to expectations based on rainfall. Unusual weather patterns in both areas may have affected the results. More research and sampling is needed to determine if moths can be an indicator of the overall primary production in these Texas regions.

Road-kill ecology: advances in Trans-Texas biogeography

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Texas is a large state with a high diversity of mammals. While there is relatively good information on what mammals occur in each county, there is very little information on how abundant each species is, and how its abundance varies across the wide range of environmental conditions found in Texas. We have been collecting data on road-killed mammals along Interstate-10 between Comfort, Texas (mile marker 523) and the Texas Highway 67 intersection with I-10 (mile marker 250) during our monthly trips to the Christmas Mountains. By recording the location of identifiable species killed along the highway, we are building a map of the relative abundance of common mammal species along the I-10 corridor. In addition to the 273 miles of I-10 west of Comfort, we also have been collecting similar data along 90 miles of I-10 east of Luling, in an area that gets much more rainfall. We are also able to detect seasonal variation in the activity of different species, based on how many are killed each month on a given section of highway. The species ranked by relative abundance as road-kill from most common to rarest are striped skunk, raccoon, white-tailed deer, grey fox, coyote, armadillo, and porcupine. Other species we have noted include rock squirrels, cottontail rabbits, peccaries, wild boar, axis deer, red fox, dogs, and cats. At the much smaller scale of the Christmas Mountains, we have been making monthly surveys of local roads for live mammals, of which kangaroo rats and jackrabbits constitute the majority of sightings. We will discuss the patterns of mammal abundance that we have found at both the Trans-Texas I-10 scale and the local Terlingua Ranch scale.

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 9:00 am to 5:00 pm

- **Check-in** time is 3:00 pm. If you need additional 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 normally open from 7:00 am to 2:00 pm Monday and Tuesday, 7:00 am to 7:00 pm Wednesday and Thursday, 7:00 am to 8:00 pm Friday and Saturday, and from 7:00 am to 7:00 pm on Sunday (hours are extended for holidays and hunting season). The café will be serving dinner until 8:00 pm on Monday, Tuesday and Wednesday (May 25–27) to accommodate our group.
- **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 24 hours a day, although the hours may be modified somewhat during spring break and holiday weekends. 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.



Make plans to join us next year

CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM 2016

Terlingua Ranch Headquarters

May 23rd–25th, 2016