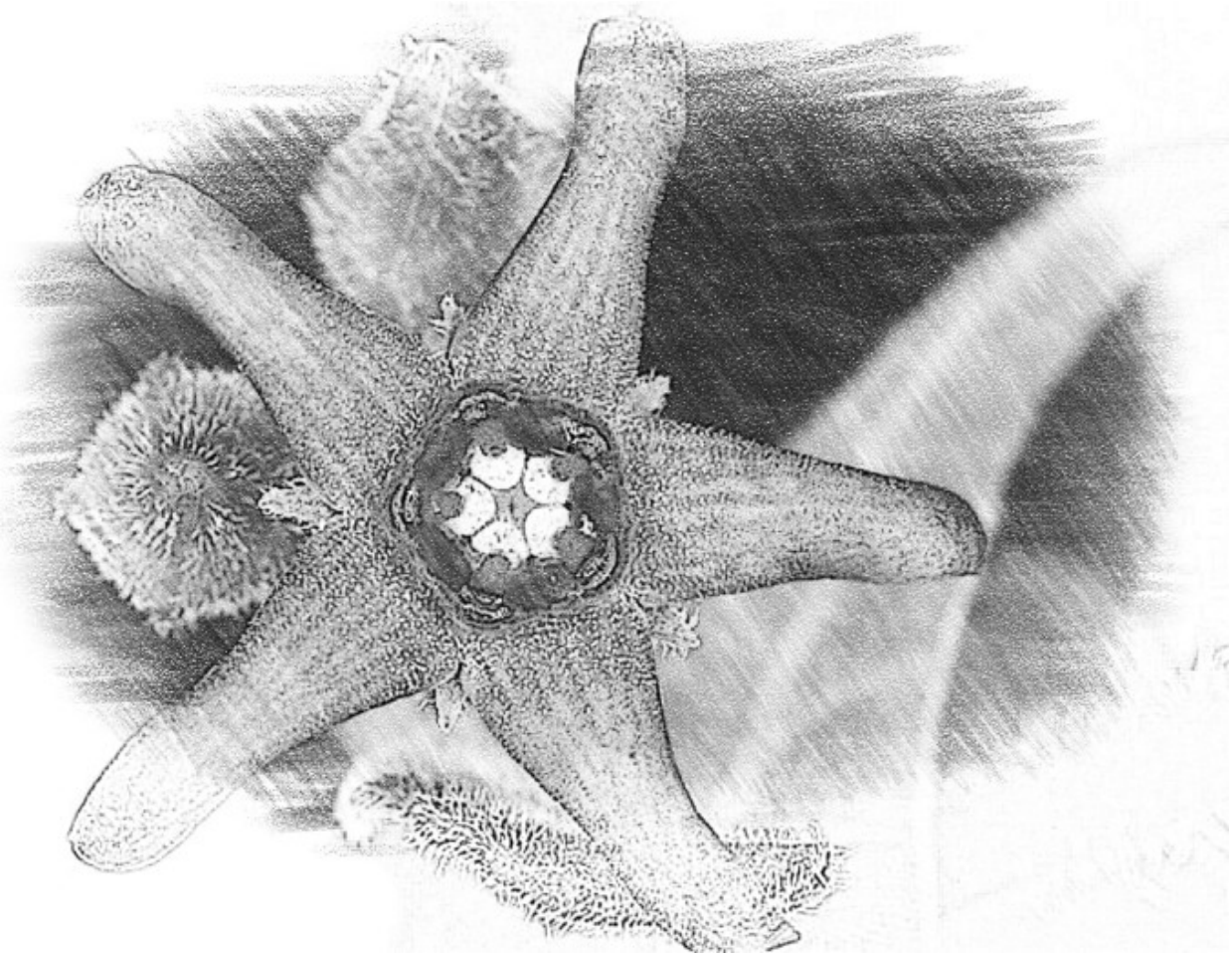
CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

2022



Terlingua Ranch Headquarters
Brewster County, Texas
May 23–25, 2022

CHRISTMAS
MOUNTAINS
THE TEXAS STATE UNIVERSITY SYSTEM

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

2022 CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

Terlingua Ranch Headquarters
Brewster County, Texas
May 23rd–25th, 2022

Monday, May 23rd

5:00 pm Informal social for meeting participants on the patio by the café

6:00 pm Dinner for meeting registrants at the Bad Rabbit Café (buffet available for attendees who did not preregister, $18.00)

Tuesday, May 24th

8:30 am Field trip to Christmas Mountains overlook (meet in the parking lot outside the bunkhouse)

8:30 am Paleontology and Geology of the Cretaceous Upper Aguja Formation (meet on the patio outside the café)

2:00 pm Paper session (in the bunkhouse beneath the Bad Rabbit Café)

6:00 pm Dinner for meeting registrants at the Bad Rabbit Café (buffet available for attendees who did not preregister, $24.00)

Wednesday, May 25th

8:30 am Field trip to Christmas Mountains overlook (meet in the parking lot outside the bunkhouse)

2:00 pm Afternoon paper session (in the bunkhouse beneath the Bad Rabbit Café)

6:00 pm Dinner for meeting registrants at the Bad Rabbit Café (buffet available for attendees who did not preregister, $24.00)

FIELD TRIPS

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

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

Please note that the Old Mine Road requires high-clearance vehicles and, consequently, the number of participants on this trip will, of necessity, be limited by the number of vehicles we have at our disposal.

Paleontology and Geology of the Cretaceous Upper Aguja Formation Exposed East of the Terlingua Ranch Lodge
Trip leaders: Thomas Shiller, Sue Mulroney and Adam Myers
Tuesday morning at 8:30 – meet on the patio outside the Bad Rabbit Café

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

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2022 CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM

Tuesday, May 24

2:00 Welcome and Introductions

2:10 An Introduction to the Christmas Mountains – a site for education and research
David E. Lemke, Texas State University

2:30 Living in Place – The School of Constructive Arts
Bob Estrin, The School of Constructive Arts

2:50 Desertification Reversal
Jadene Mayla, Terlingua Ranch

3:10 Break

3:30 Effects of Patch Burning on Rangeland Forage Quality and Avoided Grazable Areas
Katherine E. Haile, Laura E. Goodman, Samuel D. Fuhlendorf, John R. Weir, and Bryan D. Murray, Oklahoma State University

3:50 Adaptations for Surviving in the Desert
Frank Horne, Texas State University

4:10 Comparative anatomy of the photosynthetic stems of *Euphorbia antisyphilitica* (Euphorbiaceae) and *Asclepias subulata* (Apocynaceae)
Jackson F. Burkholder and David E. Lemke, Texas State University

4:30 How Dark is It? Determining Darkness and Why it is Important
Amber Harrison, International Dark-Sky Association

Wednesday, May 25

2:00 Anatomy and Morphology of the Seed Coat in the Texas Species of *Argemone* (Papaveraceae)
Shelby L. Conway and David E. Lemke, Texas State University

2:20 A Preliminary Review of the Distribution of the Freshwater Algal Species *Sheathia involuta* (Rhodophyta: Batrachospermales) from the Southwestern U.S. and Northern Mexico
Bethany S. Guajardo and Ned Strenth, Angelo State University

2:40 A River Ran Over It: A Study of the Damage to Cultural Sites along the Rio Grande in Big Bend Ranch State Park
Tim Gibbs, Texas Parks and Wildlife Department

3:00 Break

3:20 Gain/Loss Study of the Rio Grande in the Big Bend Region
Kevin Urbanczyk, Sul Ross State University and Jeff Bennett, American Bird Conservancy

4:00 Reconnaissance Mapping of Tertiary Intrusive Bodies in the Contrabando Lowlands, Big Bend Ranch State Park
Jeff Lewis, Lone Star College, Kenneth Johnson, University of Houston-Downtown, and Tim Nix, Lone Star College

4:20 Identification of an Interesting Petrified Log from the Late Cretaceous Olmos Formation of Maverick County, Texas
David E. Lemke and Shelby L. Conway, Texas State University

ABSTRACTS

Tuesday Afternoon

An 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, most of the area supports a desert grassland ecosystem comprising several distinct plant community types. Over the past several years the property has been used as a field site by a number of college and university classes, as well as a research site for both students and faculty. Plans by the Texas State University System to enhance the utility of the site for education, outreach, and research will be presented and discussed.

Living in Place – The School of Constructive Arts

Bob Estrin, School of Constructive Arts, Terlingua Ranch, TX

This presentation will center on the School of Constructive Arts, a field school teaching design, building, and ecology through direct participation and experimentation. We will discuss our approach, plans, and current projects here in the Big Bend. Since before history people have found innovative ways to build and live in harmony with a range of changing environments. Cycles and weather were carefully observed; water channeled, and earth cultivated to yield food; wind, sun, and rain harnessed to heat and cool; earth, stone, and wood shaped and utilized in myriad ways. Modern industry introduced new materials, methods, and possibilities, from glass and steel to photovoltaic panels and wind turbines. With thousands of years of human experimentation and an array of powerful modern technologies, we have everything we need to build and live in comfort, beauty, and harmony with our environment. Examples will be discussed to give context and depth to the philosophy and methodology of the School of Constructive Arts.

Desertification Reversal

Jadene Mayla, Terlingua Ranch, TX

The Chihuahuan Desert is a beautiful but degraded landscape. Simple, practical strategies and techniques can be employed by anyone with access to land to be improved. I will share tips on how attendees can seize the opportunities presented by the local landscape of Terlingua Ranch as well as discuss how permaculture can be wielded to dramatically and quickly improve the health and economy of land in other places.

Effects of Patch Burning on Rangeland Forage Quality and Avoided Grazable Areas

Katherine E. Haile, Laura E. Goodman, Samuel D. Fuhlendorf, John R. Weir, and Bryan D. Murray, Department of Rangeland Ecology and Management, Oklahoma State University, Stillwater, OK

Patch burning involves burning portions of a pasture and allowing cattle access to unburned and freshly burned areas simultaneously. Other studies have shown that cattle select for burn patches. In this project based in the mixed grass prairie of Oklahoma, we strategically burned areas that cattle avoided to modify their behavior and redistribute grazing pressure in a pasture. We also evaluated the effects of patch burn grazing on vegetation composition, structure, forage quality, and minerals. Additionally, because riparian areas are sensitive to grazing pressure, we measured cattle use of these areas before and after burning. Five cows, individually equipped with a GPS collar, were placed in each of the three study pastures during the summerS of 2020 and 2021. At the end of the first field season, the collars were removed and the cattle distribution was analyzed using a Hot Spot analysis to determine avoided areas. Two patches (high and low fuel load) were burned in the spring and the summer within each pasture in 2021. Cows were released in the pastures after the dormant season burn. The vegetation composition, nutritional components, and mineral contents were sampled periodically as the patches recovered from fire. The vegetation responses were evaluated among the different burn treatments. Results show that cows changed their use of previously avoided areas with a significant increase in use once burned. During the first summer, they spent 4% of their time in the avoided areas that we later delineated to burn. After burning, they spent 18% of their time in the burn patches. Cows are successfully drawn to previously avoided areas using patch burning. Nearly all of the forage nutritional components measured were higher in the burned patches compared to unburned areas until approximately six months after fire. Patch burning is a useful tool in managing livestock distribution and promoting forage quality in recent burns while maintaining forage quantity in unburned areas.

Adaptations for Surviving in the Desert

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

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

Comparative Anatomy of the Photosynthetic Stems of *Euphorbia antisyphilitica* (Euphorbiaceae) and *Asclepias subulata* (Apocynaceae)

Jackson F. Burkholder and David E. Lemke, Texas State University

We compared the structural features of two unrelated perennial herbs with photosynthetic stems native to desert regions of the southwestern United States: candelilla (*Euphorbia antisyphilitica*, Euphorbiaceae) and desert milkweed (*Asclepias subulata*, Apocynaceae). Both species exhibited characteristics commonly seen in plants, other than cacti, with photosynthetic stems: epidermal cells with thickened walls, the presence of a hypodermis, the development of a palisade cortex, and the absence of cortical bundles, a collapsible cortex, and medullary bundles. Nonetheless, the species could be easily distinguished anatomically. The desert milkweed was characterized by a narrow, but well-developed, palisade cortex (cortex:pith ratio ca. 0.2) and the occurrence of internal phloem, while candelilla exhibited a much more extensive, although weakly-developed, palisade cortex (cortex:pith ratio ca. 1.6) and more typical collateral vascular tissue.

How Dark is It? Determining Darkness and Why it is Important

Amber Harrison, International Dark-Sky Association, Tucson, AZ

The Big Bend region was recently designated as an International Dark Sky Reserve by the International Dark-Sky Association. This designation grew from years-long efforts of Big Bend National Park, Big Bend Ranch State Park, and the Black Gap Wildlife Management Area pursuing similar designations as International Dark-Sky places in 2012, 2017, and 2021, respectively. These designations are significant and confirm what we all know about the Big Bend – that it's dark at night! But how do we know just how dark it is? This presentation provides a brief overview of how we determine darkness worthy of these special designations and what it means to those who visit, manage, and live in these places.

Wednesday Afternoon

Anatomy and Morphology of the Seed Coat in the Texas Species of *Argemone* (Papaveraceae)

Shelby L. Conway and David E. Lemke, Department of Biology, Texas State University, San Marcos, TX

Argemone is one of the largest genera within Papaveraceae, comprising 32 species of annual, biennial, or perennial herbs. The most recent complete taxonomic revision of the Texas species of *Argemone* is the work of Ownbey, dating back to 1958, who recognized eight species occurring in the state: *A. aenea, A. albiflora, A. aurantiaca, A. chisosensis, A. mexicana, A. polyanthemos, A. sanguinea,* and *A. squarrosa*. Ownbey used a variety of morphological characters to delimit species within the genus, including petal, latex, stamen and stigma color; presence/absence of clasping leaves; shape of the bud and capsule; presence of prickles on foliage bracts or on stems; and seed dimensions, and most treatments of the genus in published Texas floras have been based on Ownbey's work. Several authors, however, have noted that Ownbey's taxonomic distinctions are not necessarily always clear due, at least in part, to the largely continuous morphological variation seen in many of these characters. Because studies of seed coat morphology have often proven useful in the delimitation of taxa (including other genera in Papaveraceae) and in providing data for the generation of phylogenetic hypotheses, we chose to study whether or not morphological and anatomical features of the

seed coat would prove useful for distinguishing among the Texas species of this genus. Seed morphology was examined using light and scanning electron microscopy, while standard botanical histological procedures were used to study development of the seed coat. Although the seeds of all Texas species of *Argemone* are similar in gross morphology, consistent differences in seed size and shape, surface microsculpturing patterns, relative prominence of the hilum, raphe, and chalazal umbo, and certain anatomical features appear to provide characters useful for species delimitation.

A Preliminary Review of the Distribution of the Freshwater Algal Species *Sheathia involuta* (Rhodophyta: Batrachospermales) from the Southwestern U.S. and Northern Mexico

Bethany S. Guajardo and Ned Strenth, Department of Biology, Angelo State University, San Angelo, TX

While the type locality of *Sheathia involuta* (Vis & Sheath) Salomaki & Vis is in central Texas and the distribution of this species is widespread in eastern North America, there are few documented collections from the southwestern U.S. and northern Mexico. This study examined the lotic environments of the major tributaries of West Texas, New Mexico, Coahuila, and Chihuahua for the presence of the filamentous red algal genus *Sheathia*. Collection trips began in January 2020 to these areas and resulted in a total of ten different sample sites from seven different river systems. Although preliminary morphological comparisons support the existence of a single species, identification within this group is often difficult using morphological characteristics alone due to their phenotypic plasticity and cryptic diversity. The cytochrome oxidase I (COI) barcode and the ribulose-1,5-bisphosphate carboxylase/oxygenase large-subunit (rbcL) gene were amplified, sequenced, and compared to existing GenBank sequences to confirm the morphological identifications. The preliminary sequencing results also support the existence of a single widespread species.

A River Ran Over It: A Study of the Damage to Cultural Sites along the Rio Grande in Big Bend Ranch State Park

Tim Gibbs, Texas Parks and Wildlife Department, Big Bend Ranch State Park, Brewster/Presidio Counties, TX

Detailed condition assessments of 26 sites along the Rio Grande Corridor of BBRSP have documented widespread impacts associated with river and creek flooding, historic occupations, and highway construction and maintenance. Sites in proximity to the river have been more damaged by flooding, but all sites have been impacted by erosion and/or human activity. Some riverine sites retain potentially intact deposits but are imminently threatened by future largescale flood events and should be further investigated as soon as possible. Testing will contribute to our understanding of the effects of destructive river flooding on preservation and integrity, as well as potentially answer questions related to time depth and cultural connections to the region at large.

Gain/Loss Study of the Rio Grande in the Big Bend Region

Kevin Urbanczyk[1] and Jeff Bennett[2], [1]Department of Biology, Geology and Physical Sciences, Sul Ross State University, Alpine, TX and [2]American Bird Conservancy, Alpine, TX

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

Reconnaissance Mapping of Tertiary Intrusive Bodies in the Contrabando Lowlands, Big Bend Ranch State Park

Jeff Lewis[1], Kenneth Johnson[2], and Tim Nix[1], [1]Department of Geology, Lone Star College, Houston, TX and [2]Department of Natural Science, University of Houston-Downtown, Houston, TX

Tertiary intrusive rocks previously mapped as gabbros and syenogabbros and tentatively dated at around 34 Ma to 40 Ma intruded into Cretaceous bedrock of the Pen and Boquillas formations and are now exposed in the Contrabando Lowlands. Faulting related to crustal extension and erosional episodes related to the Fresno Canyon drainage have affected the positions, relationships and exposures of multiple intrusions. Petrographic and geochemical analyses confirm the syenogabbro character of the largest northern intrusive body. It is a laccolithic intrusion, with the basal contact exposed in some areas by a prominent down-to-the-south normal fault and erosion, and the top contact seen at erosional remnants on hilltops. Columnar jointing within the syenogabbro occurs along the basal contact of the laccolith. Sill or sill-like related intrusions are found in canyons south of the fault exposure of the laccolith, though only the top contacts of these are exposed. Intrusive contacts suggest there may have been a transgressive sequence of sill intrusions, with dikes from earlier sills feeding others in the stratigraphic sequence, but confirmation or an ordering of the sequence requires further observations.

Identification of an Interesting Petrified Log from the Late Cretaceous Olmos Formation of Maverick County, Texas

David E. Lemke and Shelby L. Conway, Department of Biology, Texas State University, San Marcos, TX

A petrified log approximately 22 m in length and with a colorful history is on display at the Witte Museum in San Antonio, Texas. The log was originally exposed on a hillside about 6.5 km north of Eagle Pass, Maverick County, Texas, on the Late Cretaceous Olmos Formation and was first noted by former Confederate Army officer William Wallace ("Captain Bill") Townsend in 1887. The log was moved by W. A. Bonnet, an Eagle Pass businessman and notary public, to his family's yard in the city sometime after 1893. It was eventually purchased from Mrs. W. A. Bonnet by businessman and philanthropist Albert Steves of San Antonio, the sections numbered end to end and shipped by rail car to San Antonio, and presented to the museum by Mr. Steves in 1928. The Olmos Formation has yielded a diverse fossil flora in which angiosperms dominate, although pteridophytes, one possible bryophyte, and several gymnosperms have also been described. The Witte Museum log is a gymnosperm, characterized by distinct growth rings with an abrupt transition, an absence of resin canals, tracheids averaging 48 μm in tangential diameter and 37 μm in radial diameter in the early wood and 22 μm in tangential diameter and 9 μm in radial diameter in the late wood, uniseriate to biseriate intertracheary pitting, no helical or callitroid thickenings, and a diffuse arrangement of axial parenchyma. The wood is similar in structure to that of several gymnosperms previously described from the Olmos Formation of adjacent Coahuila, Mexico.

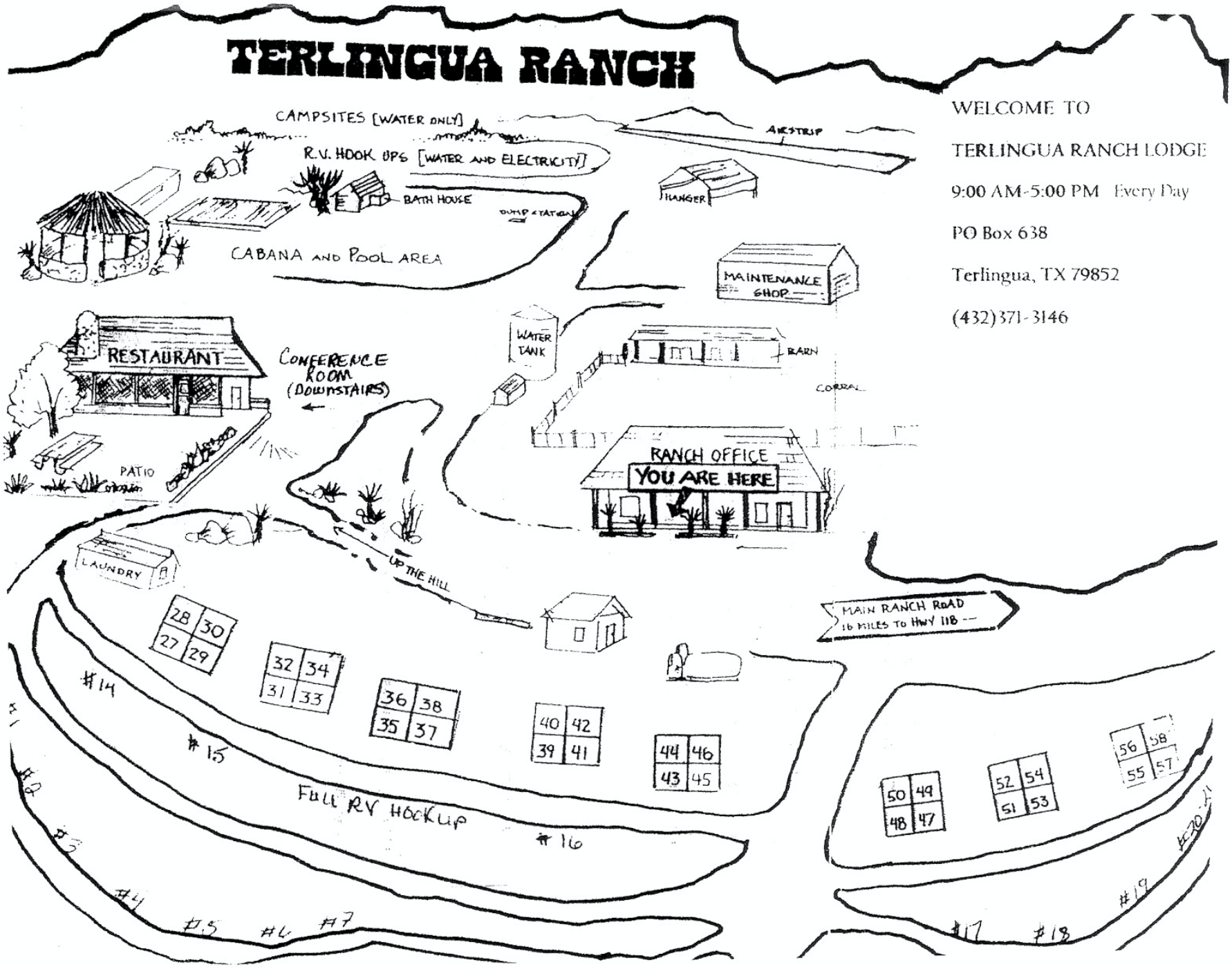
Welcome to Terlingua Ranch Lodge

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

www.terlinguaranch.com

Office open 9:00 am to 3:00 pm

- **Room service.** If you need additional towels or linens, please come to the Front Desk.
- **Check-out** time is 11:00 am. If you wish to extend your stay, please notify the Front Desk prior to check - out.
- **The Bad Rabbit Café** is open from 7:00 am to 8:00 pm Tuesdays through Saturday (hours may be extended for holidays, special occasions, and hunting season).
- **Security and Assistance** – for after-hours emergencies, please contact Security in the Security house located across the parking lot from the main office or phone (432) 371-2960. A **911** phone is located on the patio next to the pool.
- **Pets** must be on a leash in common areas.
- **Pool hours** are 10:00 am to 10:00 pm. The bath house is open 24 hours, seven days a week.
- **Laundry** is open noon to 10:00 pm.
- **Water** is scarce – please conserve.
- **Burn ban** is currently in effect for Brewster County with warm temperatures and dry, windy conditions. Please confine outdoor cooking to the use of propane stoves. See the Front Desk for more information regarding burn bans.
- **Smoking** is allowed outdoors only. Please dispose of cigarettes in butt cans located throughout the Lodge.
- Please obey posted **speed limits**.
- Please respect **No Trespassing** and **No Hunting** signs throughout the ranch.


TERLINGUA RANCH
CAMPSITES [WATER ONLY]
R.V. HOOK UPS [WATER AND ELECTRICITY]
BATH HOUSE
DUMP STATION
CABANA AND POOL AREA
AIRSTRIP
HANGER
MAINTENANCE SHOP
WATER TANK
BARN
CORRAL
RESTAURANT
CONFERENCE ROOM (DOWNSTAIRS)
PATIO
RANCH OFFICE
YOU ARE HERE
LAUNDRY
UP THE HILL
MAIN RANCH ROAD
16 MILES TO HWY 118
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Full RV Hookup
WELCOME TO
TERLINGUA RANCH LODGE
9:00 AM-5:00 PM Every Day
PO Box 638
Terlingua, TX 79852
(432)371-3146

Make plans to join us next year

CHRISTMAS MOUNTAINS RESEARCH SYMPOSIUM 2023

Terlingua Ranch Headquarters

May 22nd–24th, 2023

Front cover illustration: The darkstar milkvine (*Matelea atrostellata*; Apocynaceae) is presently known from only three localities: a limestone area NW of Musquiz in Coahuila, Mexico, the Chisos Basin in Big Bend National Park, and a single arroyo in the Christmas Mountains. Vegetatively and in fruit morphology, the species is similar to two other Trans-Pecos milkvines, but the darkstar milkvine can be easily distinguished by its dark red, dark green, or occasionally pale orange flowers. Original photo taken by D. Lemke in the Christmas Mountains.