

The Black Range Naturalist

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A Special Issue About the San Andres Mountains

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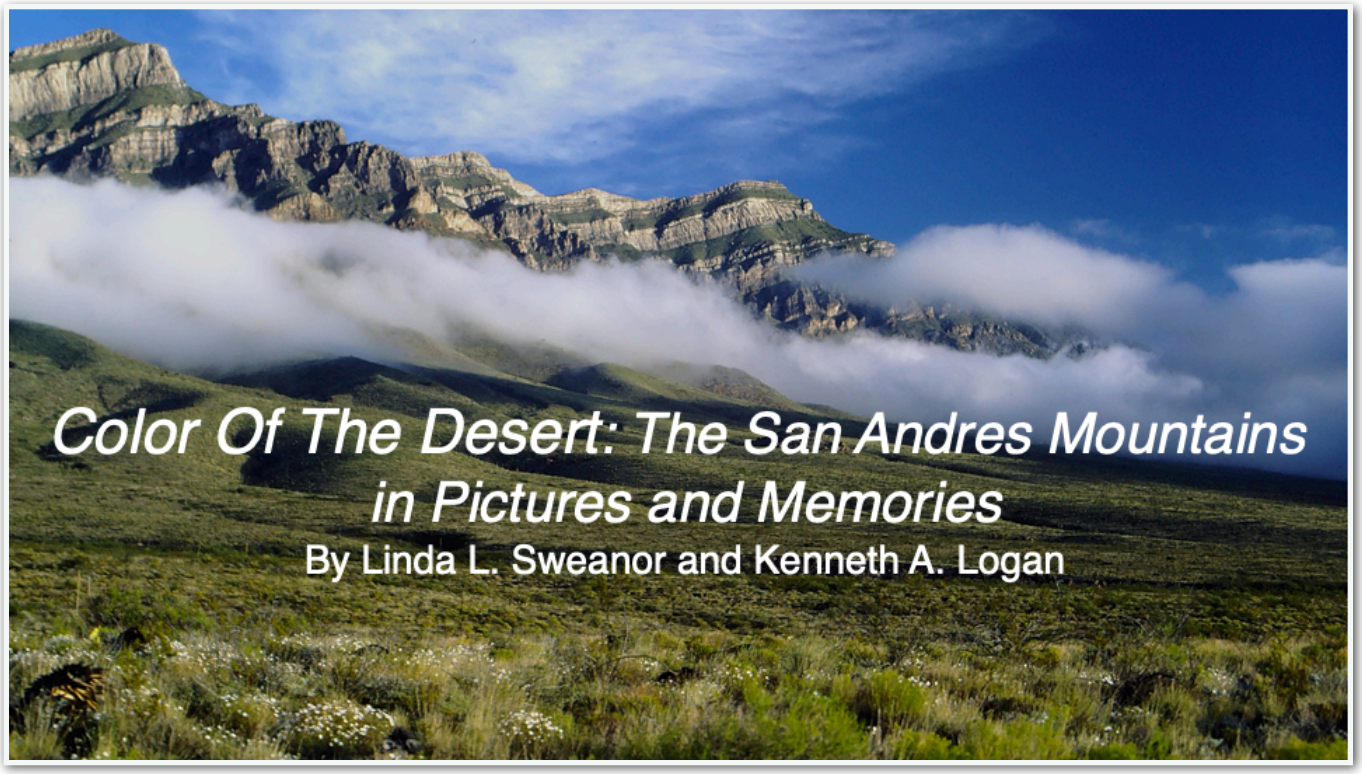
Above: The east slope of San Andres Peak, depicted here, is the namesake of the San Andres Mountains and is the heart of the San Andres National Wildlife Refuge. The refuge, established in 1941, covers 89 square miles in the southern portion of this mountain range.



The Black Range is now home to us. But gaze eastward on a clear day, from a perch on Emory Pass or even while descending the windy road from Hillsboro to Interstate 25 and you can see it - the blue silhouette of the San Andres Mountains. As the crow flies, the nearest point of this range to our home in Kingston is almost 60 miles away in Hembrillo Basin. In turn, the Basin is roughly halfway between the range's southern origin at San Augustin Pass and its northern end at Mockingbird Gap, a reach of almost 100 miles. It is also flanked by two expansive desert basins: the Jornada del Muerto to the west, and the Tularosa Basin to the east. The San Andres Mountains lie completely within White Sands Missile Range, so to most people, they are a mysterious ghost range inaccessible to anyone not possessing the security credentials to enter. Years ago, we had that access. Because we documented our time there with photos, we sought this opportunity to lift the curtain, so to speak, and let others experience the grandeur of this landscape.

The San Andres Mountains is 795 square miles of one of the wildest, most ecologically intact, and largest expanses of Chihuahuan Desert mountains in the southwestern United States. It has been this way except for a relatively brief period of less than a hundred years, when ranchers raised cattle, sheep, goats, and horses in those mountains. Those inhabitants were driven from the area after the establishment of the White Sands Proving Grounds in 1945, which then expanded into White Sands Missile Range in 1958. The missile range is an exclusive federal jurisdiction as a military installation and is managed by the United States Army. The U. S. Army has since protected these mountains, and this has allowed natural ecosystem processes to dominate their character.

Here, we present a way to experience the San Andres Mountains in a collection of photographs that we took during 1985 to 1995. We used 35 mm format cameras with Kodachrome, Ektachrome, and Fujichrome slide film. We have scanned the slides into digital format for this article. These mountains were the outdoor laboratory for our research. We explored the canyons, ridges, and slopes of these mountains while conducting an ecology on the puma, *Puma concolor*. The scientific work on our endeavor is published in a peer-reviewed book, *Desert Puma: Evolutionary Ecology and Conservation of an Enduring Carnivore,* (K. A. Logan and L. L. Sweanor, 2001, Island Press, Washington, D.C.). This presentation, however, is not about that, but about those wild desert mountains, through our photographs and memories.









Top of the previous page:

The San Andres Mountains, from San Augustine Pass on the south to Mockingbird Gap on the north, covers 795 square miles of a *de facto* wilderness of Chihuahuan Desert Mountains. They are contained within the 3,200 square miles of the U.S. Army White Sands Missile Range.

This photo of San Andres Peak was taken from the crest of Black Brushy Mountain with a view toward the northern extent of the range. Salinas Peak, the highest elevation, is barely visible on the extreme right skyline and just beyond the patch of white sands.

Bottom of the previous page:

Mineral Hill in winter. This hill is bordered on its south flank (right side) by U.S. Highway 70 which connects Las Cruces with Alamogordo.

Top of this page:

The San Augustin Mountains at the southern end of the San Andres Mountains chain.

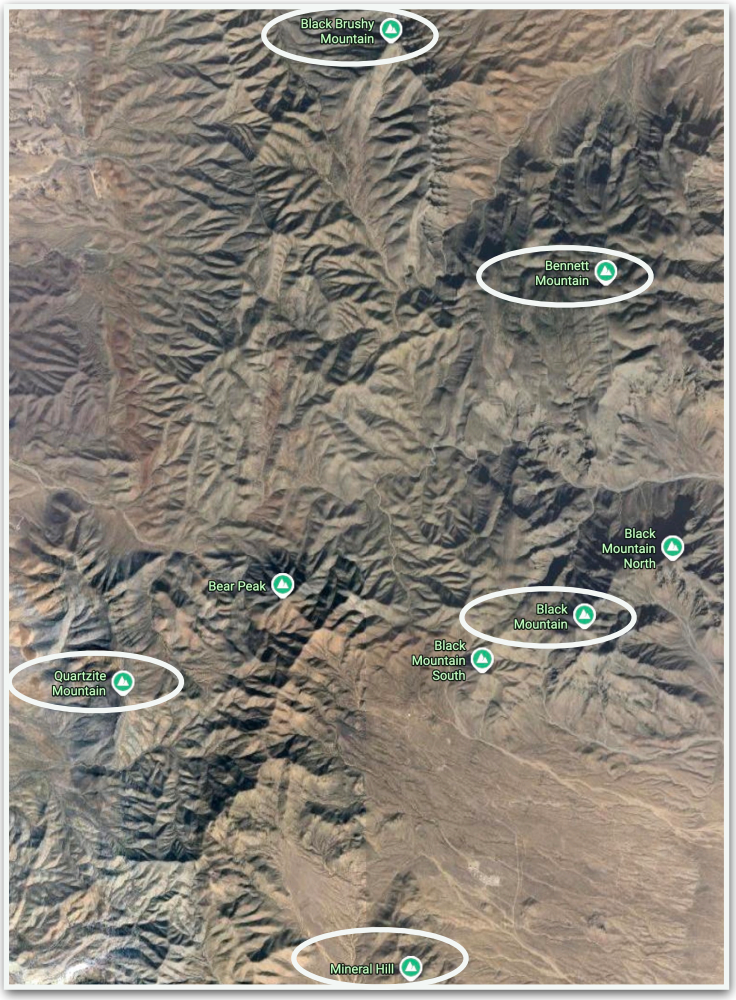


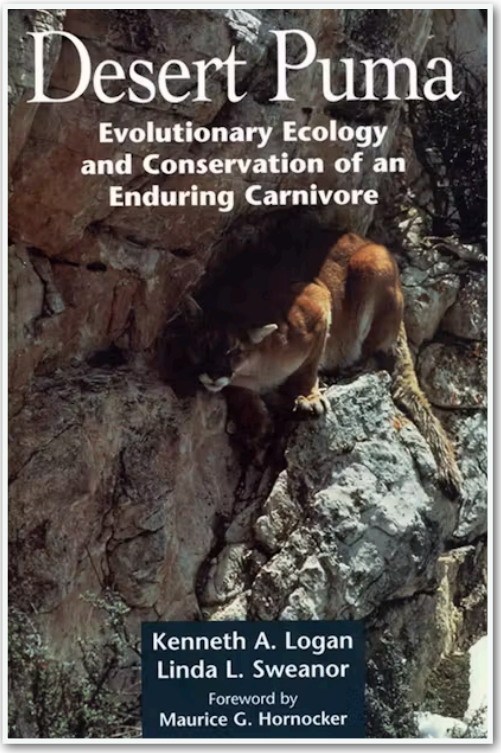


Above: Looking north down Loman Canyon from the crest of the San Augustin Mountains. Quartzite Mountain is on the left. San Andres Peak is on the skyline.

Below: Looking south across the southern extent of the San Andres Mountains and the adjacent San Augustin Mountains with the Organ Mountains in the skyline. Quartzite Mountain is on the right. Upper Ash Canyon is in the foreground. This photo was taken from the west slope of San Andres Peak on a winter day.







Ed.: Read an extensive review of "Desert Puma: ..." at pages 57-59. Follow the link on the cover for more information about this book.

Black Mountain flocked with snow.





Above: Standing on the crest of Black Brushy Mountain and looking south across the mouth of San Nicholas Canyon and to Bennett Mountain. Black Mountain is on the skyline in the middle, and the Organ Mountains are on the right.



Below: Linda Sweanor sits beside the origin of Hummingbird Spring in a canyon on the north slope of Bennett Mountain. San Andres Peak is in the distant background.

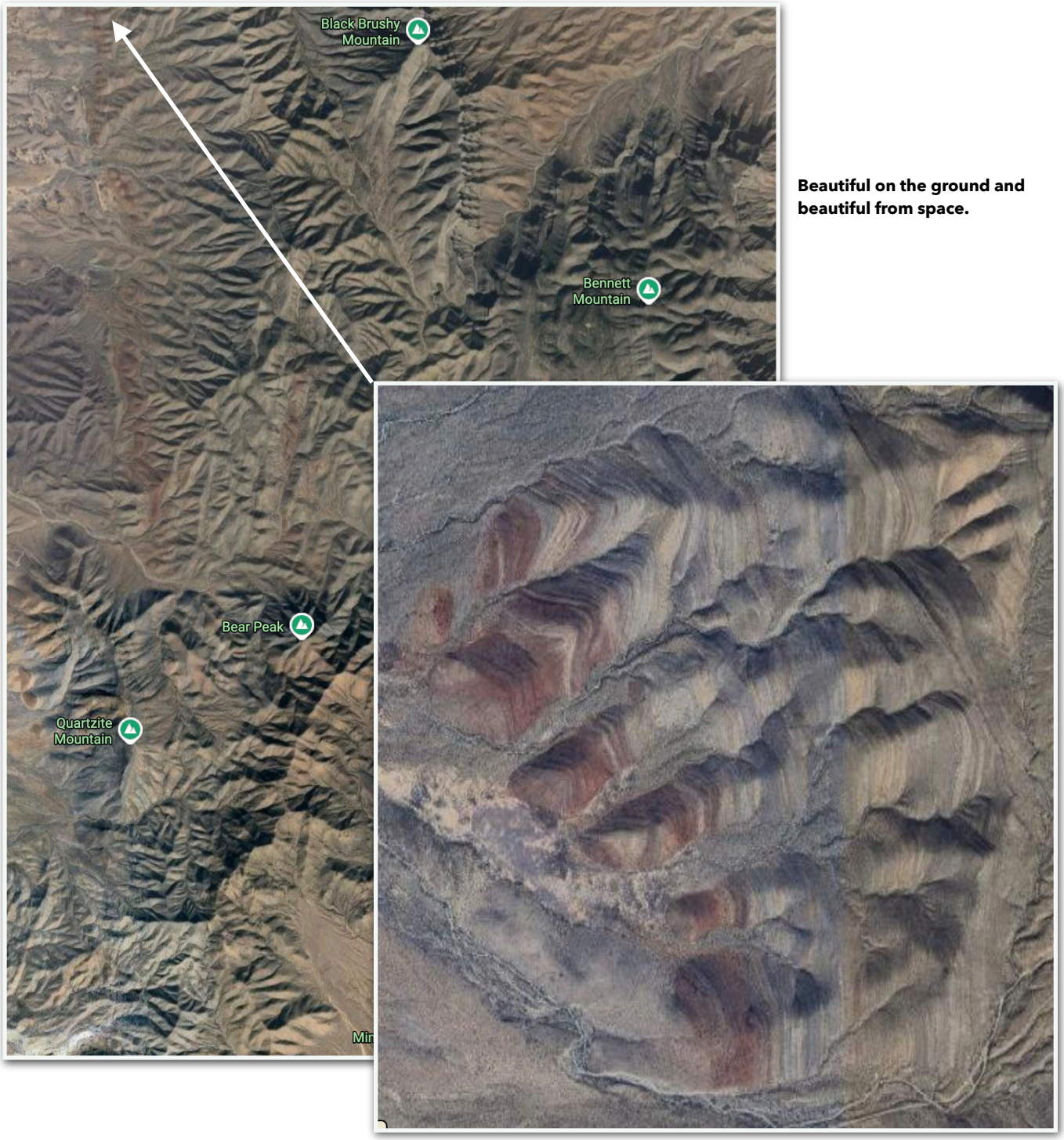


Above: Looking east toward Goat Mountain (on the right) and Black Brushy Mountain (on the left). In the gap between these two mountains lie The White Sands and the Tularosa Basin. These mountains are on the San Andres National Wildlife Refuge.

Below: Looking south down north Bear Canyon toward Bennett Mountain. The Organ Mountains are on the distant skyline.

See the following page for a different perspective.





Beautiful on the ground and beautiful from space.

Top of the following page: The White Sands from the top of Bennett Mountain. Ken Logan and Max Canestorp (White Sands Missile Range Biologist) in left foreground.

We sometimes encountered deep shafts and tunnels, evidence of the hard rock mining activity which was widespread in these mountains during the period of settlement from the late 1880s through the 1930s. The range held mineral deposits that included gold, silver, lead, iron, copper, turquoise, coal, fluorite, and zinc. These mines, however, were relatively unproductive compared to other mining districts in surrounding mountain ranges.

Bottom of the following page: Upper Little San Nicholas Canyon.







Lower Little San Nicholas Canyon. The steep east escarpment of Black Brushy Mountain flanks the canyon on the right.





Looking south down upper Big San Nicholas Canyon. The Organ Mountains are on the skyline in the distance.

[Ed. Note: See p. 23, Figure 7, of *Stratigraphic Studies of the San Andres Mountains*, New Mexico, by Frank E. Kottlowski, Rousseau H. Flower, M. L. Thompson, and Roy W. Foster (1956, State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining and Technology, Socorro, New Mexico) for a topographic detail which includes Little San Nicholas Canyon.]



Above: Northeast slope of Black Brushy Mountain.

Below: San Nicholas Camp is on the San Andres National Wildlife Refuge, which is managed by the U. S. Fish and Wildlife Service. For a time, we shared this 1940s vintage trailer with a ringtail that lived in the cabinet under the sink. The ringtail accessed the trailer through a hole for the the drainpipe.





Above: Looking north and down upper Salt Canyon. San Andres Peak is under the clouds on the right.

Below: Looking up lower Ash Canyon toward San Andres Peak.



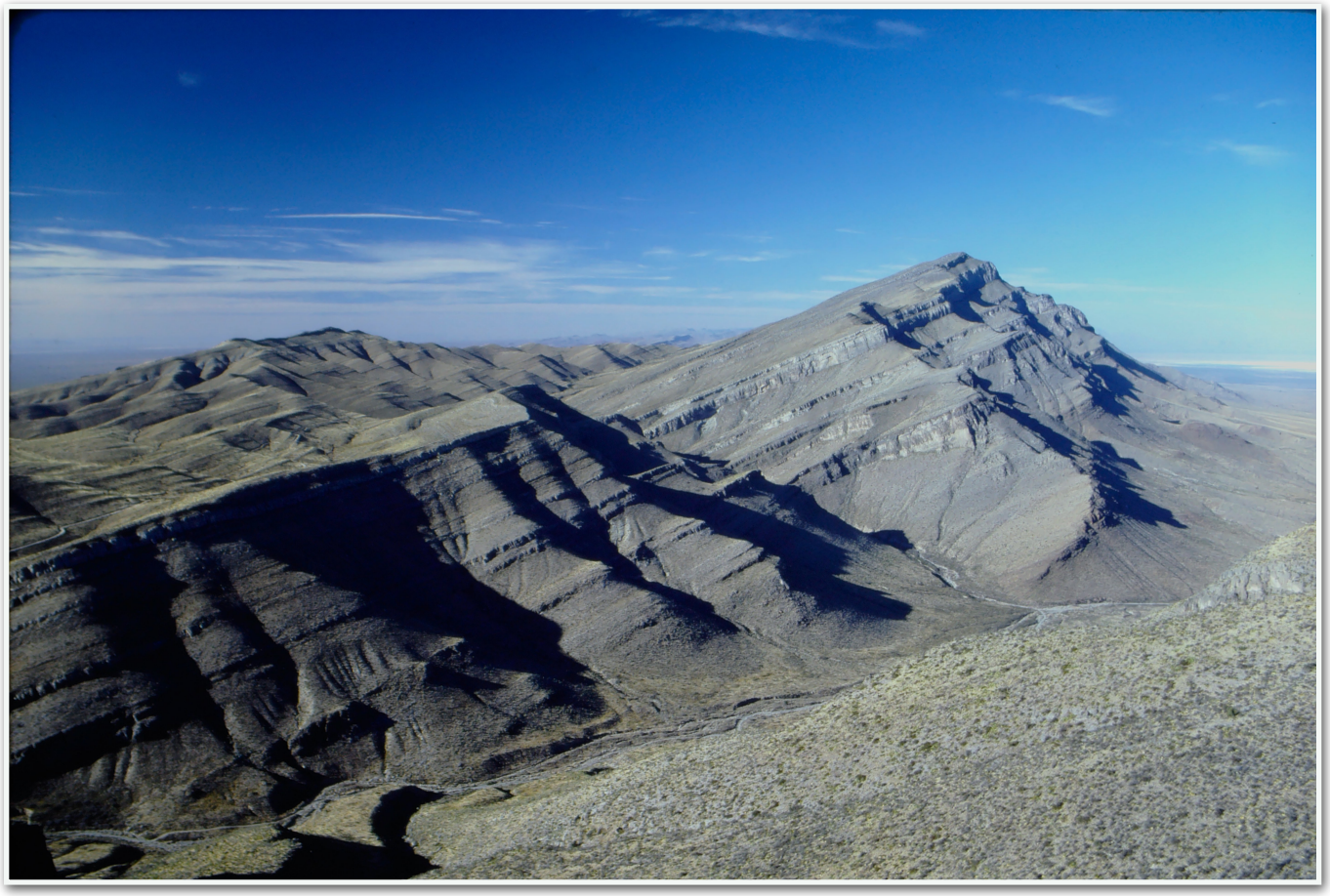


Looking down upper Ash Canyon toward Black Brushy Mountain on the skyline on the right and Bennett Mountain in the distance on the left.



[Ed. Note: To the east of San Andres Peak, in the valley between the San Andres Mountains and the gypsum dunes of White Sands National Park, is Lake Lucero. During the dry season, selenite crystals, like those to the right, form in the lake bed and seem to erupt upward. Selenite is the source of the gypsum of the White Sands dunes.]





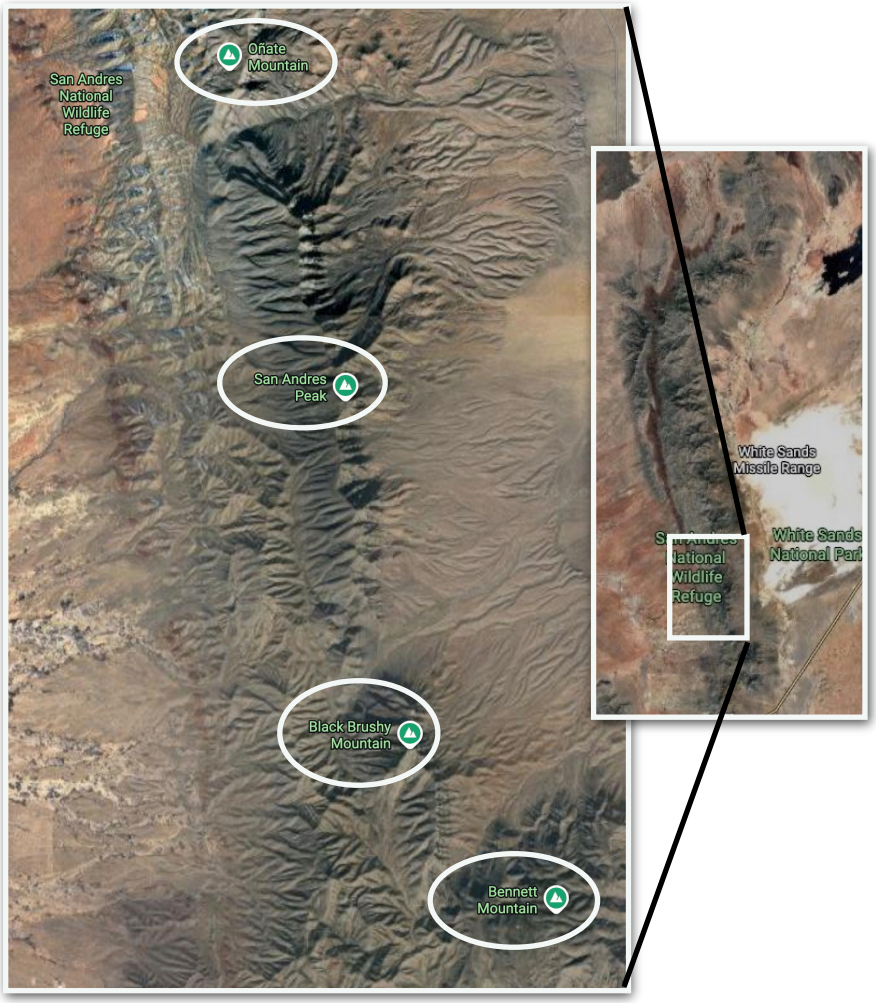


Top of previous page: Looking north from Bennett Mountain across Salt Canyon to the mouth of Ash Canyon (right of center) and San Andres Peak (far right).

The San Andres Mountains are composed of rocks of Precambrian (roughly 1 billion years ago) granite and Paleozoic-age (roughly 490-270 million years ago) limestone, dolomite, sandstone, and shale exposed in late Cenozoic (roughly 10-25 million years ago) westward fault block mountains and adjacent basins. The steep east slope is characterized by cliff-forming limestone sedimentary layers representing periods of shallow sea deposits. The western slopes are relatively gentle and lean into the Jornada del Muerto.

Bottom of previous page: The extremely steep northeast slope of San Andres Peak.

Below: San Andrecito Camp was located at the head of Mayberry Canyon. The northwest foot of Oñate Mountain is on the right, and Block Mountain is on the left. The wood shack on the right of the canvass wall tent was established by the San Andres National Wildlife Refuge and was built from the sides of huge crates that once carried missile engines.







Above: Ken Logan on the crest of Oñate Mountain, with San Andres Peak in the background. We frequently used promontories such as this to receive radio signals from collared pumas, mule deer, and desert bighorn sheep that we studied. A receiver antenna sits on top of the stack of rocks on the left.

Below: Looking toward the west slopes of Block Mountain (left), Oñate Mountain (center), and San Andres Peak (right). This photograph is of the northern extent of the San Andres National Wildlife Refuge.



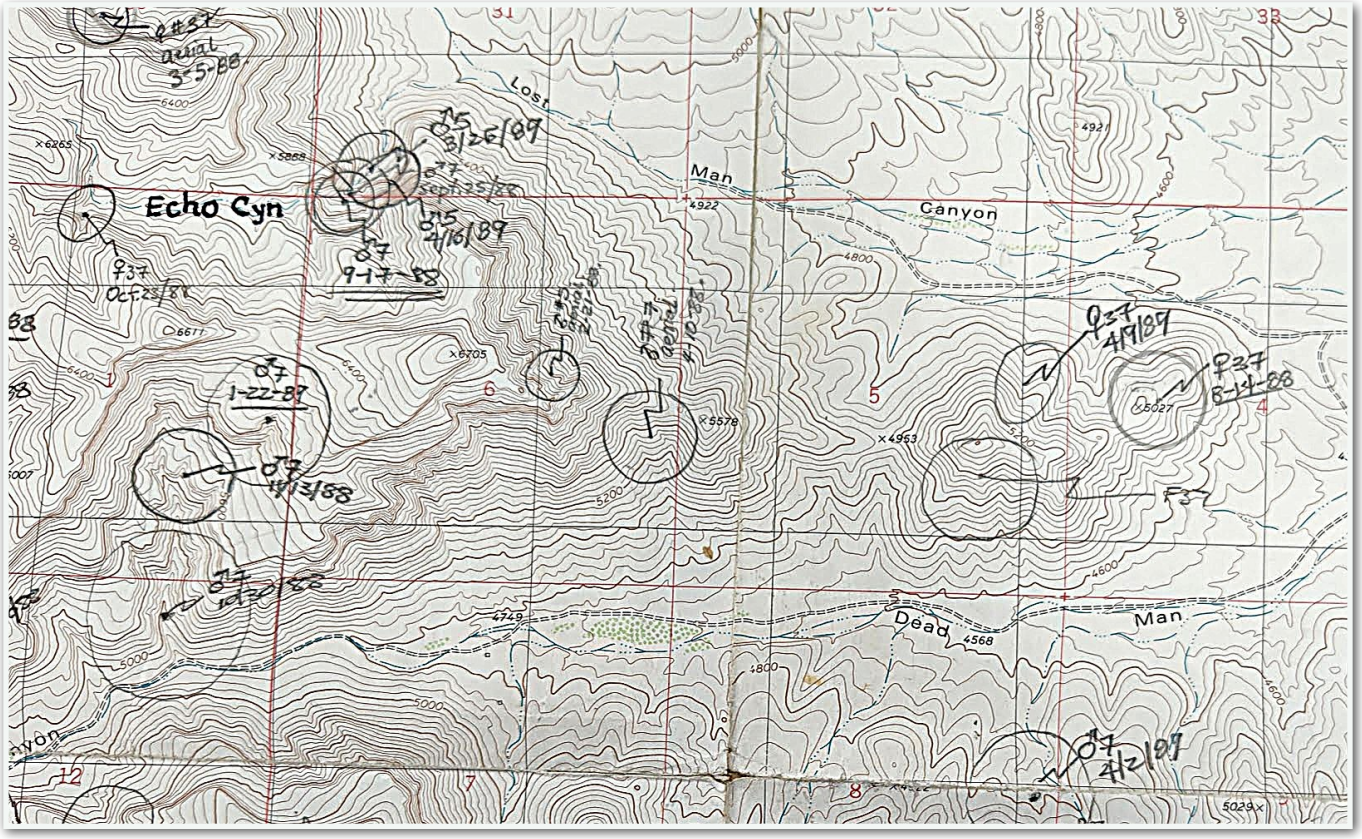




Top: The steep eastern slopes of Echo Canyon in Lost Man Canyon. (See also the bottom image on page 21.)

Bottom: Topo Map depicting Lost Man, Dead Man, and Echo Canyons. The circles depict aerial locations of 3 different radio-collared pumas between March 1988 and April 1989.

Right: Linda Sweanor using radio-telemetry to obtain a bearing on the signal from a puma's radio-collar. Black Mountain is in the background.



Editor: In *Dogs and Lions*, Harley Shaw discusses his role in the development of radio telemetry as used in tracking research animals (Pumas). Recorded in Hillsboro.





Top of previous page: Linda Sweanor at Lost Man Camp.

We used 16 strategically-located base camps so we could thoroughly search the mountains for pumas. Most of our camps consisted of tent shelters to protect us from the elements. Other camps were just under the stars. A few camps were in structures including a vintage trailer, a tar paper shack, a hunter check station, a historic ranch house, and a decommissioned guard station. For our research we normally spent weeks operating from each camp in efforts to capture and mark the pumas that used those areas. This allowed us to thoroughly cover the study area repeatedly. Usually, each member of our four-person team operated alone from individual camps. We were in daily contact with each other by two-way radio.

Bottom of previous page: The divide between Lost Man and Dead Man canyons.

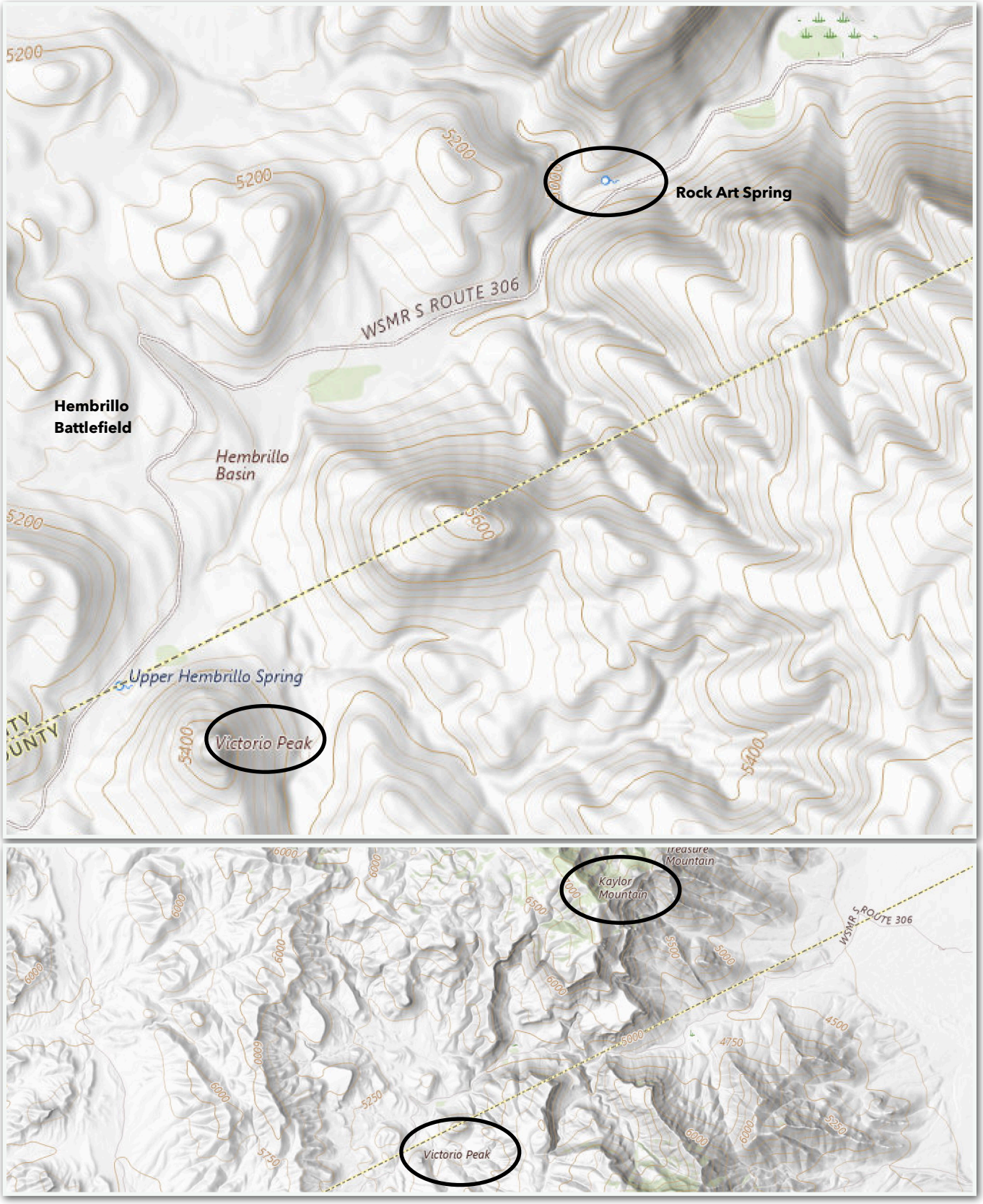
Right: Looking up Hembrillo Canyon from its mouth. The cottonwood copse in fall colors in the upper middle of this photo marks the location of Rock Art Spring and our nearby Hembrillo Narrows Camp.

[Ed. note: The Doña Ana County Historical Society visited the Hembrillo Battlefield and Rock Art Spring on February 13, 2016. Their trip report may be read at the link above.

A definitive study of Hembrillo - An Apache Battlefield of the Victorio War (The Archaeology and History of the Hembrillo Battlefield) was conducted by Karl W. Laumbach and may be read or downloaded at the link. The battle occurred on April 6 and 7, 1880. The opening paragraph of Laumbach's report is shown to the right.]



"It was early on the morning of April 7, 1880. The dawn's first light was hitting the interior valleys of the San Andres Mountains in south-central New Mexico. Captain Curwen McLellan reined in his horse and looked into the morning mists that cloaked the Hembrillo Basin. From far below he could hear the occasional muffled roar of a .45- 55 army-issue carbine. He quickly motioned Second Lieutenant Charles Gatewood forward and the company of twenty-one Apache scouts followed the young officer off of the high bluff and into the basin below. As McLellan waited for their return, terse orders were given to place the pack animals in a secure position and prepare to attack."



Top of the following page: Hembrillo Narrows Camp.

We normally worked for 10 days in succession with 4 days off in between. But often, if we detected a new puma in the area at the end of the 10 days, we stayed longer in efforts to capture and mark the animal. Regardless, one of our 4 days off was really a workday. One of us, usually Linda, flew in a light fixed-wing airplane to locate the radio-collared pumas. Once per month we also monitored the survival of radio-collared mule deer and desert bighorn sheep. After each flight came the work of archiving the recorded data for later analyses.





Directly above: Kaylor Mountain and lower Hembrillo Canyon. The depth of the sedimentary layers is well defined here.



Above: A pictograph, presumably of a puma, at Rock Art Spring which was located a short distance up the canyon from Hembrillo Narrows Camp. These pictographs are thought to be made by people of the Jornada Mogollon culture who preceded the Apaches.



Bottom of the previous page: Hembrillo Basin Camp.

This camp was located at the edge of a battlefield where Chief Victorio, leader of the Ojo Caliente Apache band, fought with the United States Cavalry in 1880.

Sometimes when we hiked across Hembrillo Basin while searching for puma tracks, we encountered small clusters of .45-55 or .45-70 rifle brass from firearms used in the battle. The image to the right is page 36 of the Laumbach report referenced on page 22 of this issue.

Bottom of this page: Looking south across upper Hembrillo Canyon. While searching for evidence of pumas in undercut ledges pitched high in the north wall of the canyon such as this, we found corn cobs that might have been left there by the Apaches.

Ed.: Ojo Caliente - Home of the Red Painted People is a short video of the spring and stream northwest of Monticello, New Mexico which is believed by many Inde / Diné / Apache to be their source of origin. (Video framegrab directly below).]

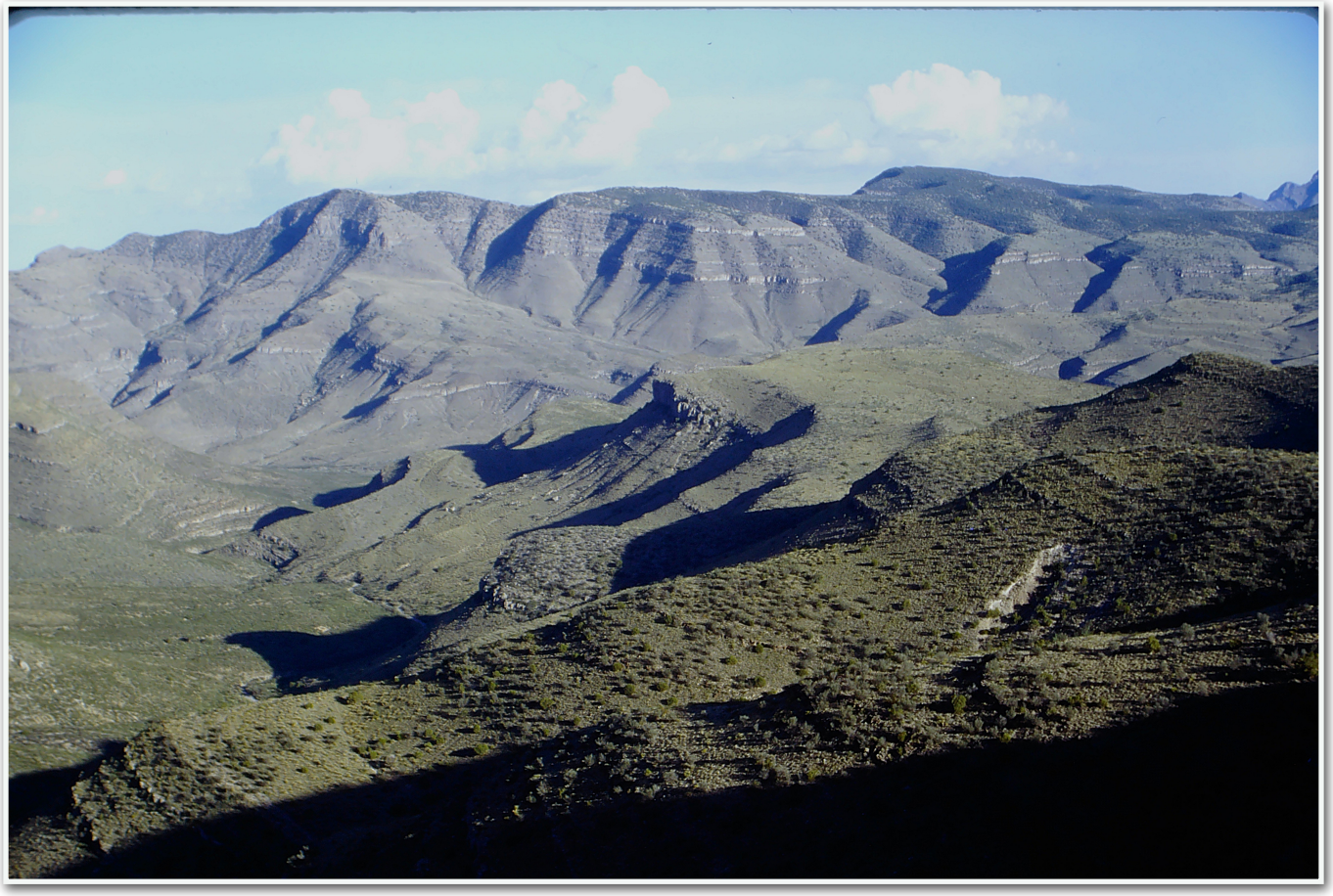




Photograph by Karl W. Laumbach and Ozzie Bagg

Photo 19. Representative cartridges from the Hembrillo Battlefield (top row l-r: .45 Colt, .44-40 Winchester, .50-70, .45-55 carbine, .45-70 rifle; bottom row l-r: .41 rimfire, .44 Henry rimfire, .50-70 [2], .45-55 [2]).





Above: Sulphur Canyon occurs in the approximate geographic center of the San Andres Mountains.



Below: Looking south across lower Sulphur Canyon toward Squaw Canyon and the west slope of Kaylor Mountain.



Above: Sulphur Camp in the summer. Our stays at camps for 10 days or more at a time required us to haul in all the food, water, and fuel that we would need. The fuel was for cooking and for our trucks. During winter, we also needed to bring propane for our small heaters to warm the tents in the early mornings and evenings.

Below: Looking down Sulphur Canyon.





Sulphur Camp in winter. The tarp over the tent helped to shed snow from the roof. During storms in which rain turned to snow at night, the freezing rain would cause the snow to stick to the tarp. To prevent the weight of the ice and snow from caving in the tent, one needed to go outside several times at night to sweep the snow off the tarp. The spot bare of snow in the foreground is where our truck was parked.



Above: A pictograph in Sulphur Canyon. We sometimes found pictographs and petroglyphs that had not yet been catalogued by White Sands Missile Range archeologists. These were some of the discoveries we found while searching for or tracking pumas.

Below: El Paso Canyon, a western tributary of Sulphur Canyon.





The very steep east slope of Workman Canyon and the location of puma F128's nursery.



Above: Looking southeast down Sulphur Pass from Pilot Knob on the Chalk Hills. Kaylor, Block, Oñate, and San Andres Mountains are on the distant skyline.

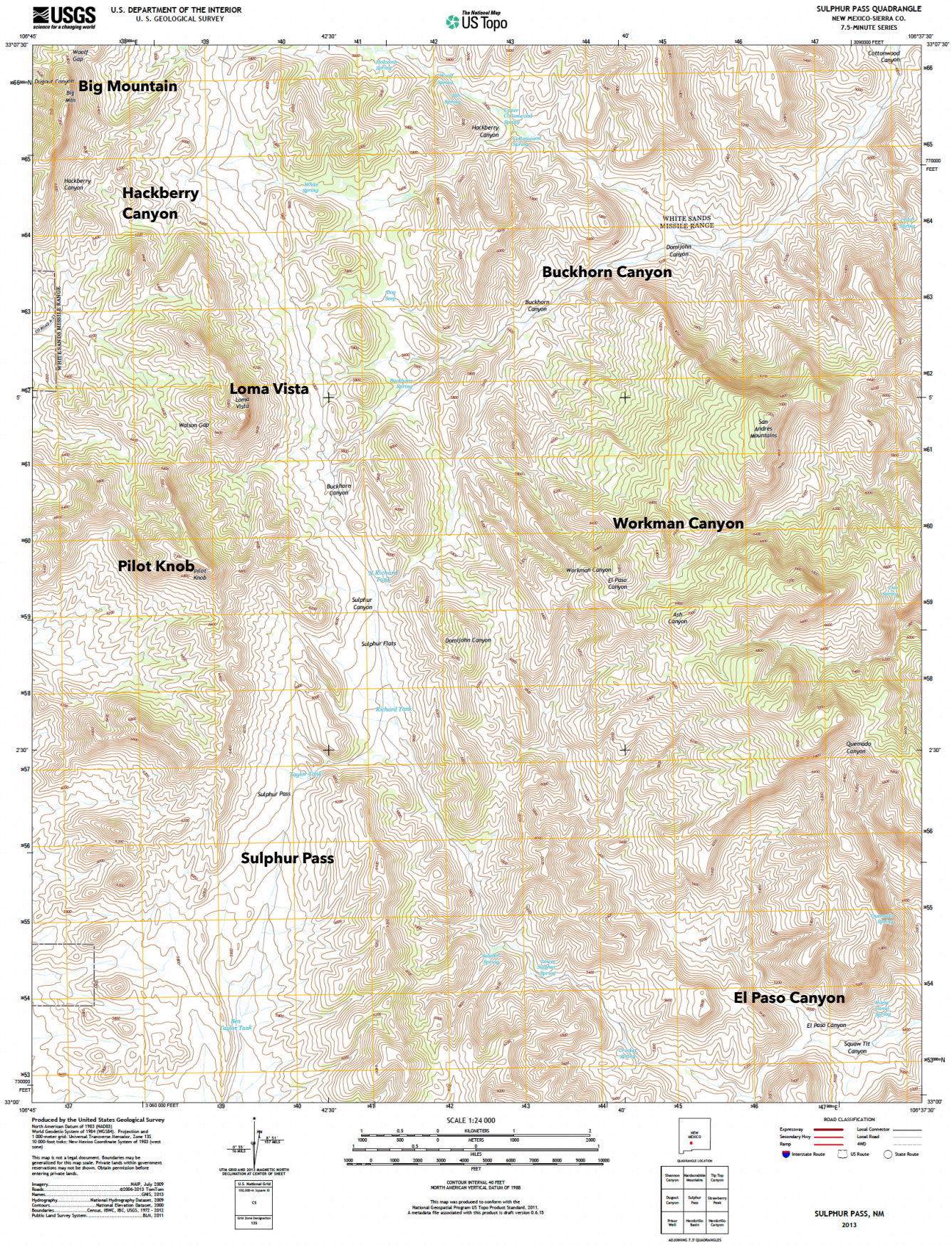
The San Andres Mountain Range is a huge protected ecosystem complete with the large mammals that lived here for millennia, including mule deer, desert bighorn sheep, pronghorn, and javelina, and the predators those animals coevolved with, the puma and coyote. To a lesser extent, elk and black bear also live here. We found one record of a jaguar that was reportedly seen by a government hunter in these mountains in 1937, but no records of grizzly bears or wolves. These mountains might contain some yet undiscovered species of small vertebrates, invertebrates and plants owing to the broad expanses of the Tularosa Basin and Jornada del Muerto which separate them from other mountain masses to the east and west.

[Ed. Note: As noted by the authors, above, the possibility exists that "These mountains might contain some yet undiscovered species of small vertebrates…." There is also the possibility that they harbor species which have not been recorded in the area.

One such species might be the Organ Mountains Colorado Chipmunk (*Neotamias quadrivittatus australis*) or another subspecies of Colorado Chipmunk. The Organ Mountains Colorado Chipmunk is known only from the Organ Mountains. There are populations of Colorado Chipmunk in the mountains east of Socorro (across the Rio Grande). In between? No reports. Maybe there are none, maybe the Organ Mountain population is truly disjunct. Maybe not. What lies between the two populations: the San Andres Mountains.

In the April 2025 issue (Vol. 8, No. 2) of this journal we explored the natural history of this subspecies based on a series of observations by James Von Loh, who took the photograph to the right.]





[Ed. Note: USGS topographic maps are sometimes questionable sources of topographic names. Note multiple El Paso Canyon, Hackberry, and Buckhorn Canyon entries on this map.]



Above: Buckhorn Spring in upper Buckhorn Canyon.

These natural springs produced local riparian ecosystems that supported diverse plant and animal species.

Below: Looking northwest from Sulphur Flats toward Loma Vista on the left and the Chalk Hills on the skyline on the right.

Loma Vista has a natural undercut rock shelter on its east face containing corn cobs probably left there by the Apache.





Above: Looking northwest across upper Buckhorn, Hackberry, and Cottonwood Canyons and toward the Chalk Hills.

Below: Looking northwest from upper Buckhorn Canyon toward the Chalk Hills.





Above: Looking northwest across the grasslands in upper Cottonwood Canyon rimmed on the west side by the Chalk Hills. These grasslands have recovered from the previous intensive grazing of domestic livestock since the U. S. Army took management authority over the mountains beginning in 1945.

Below: Looking across lower Cottonwood Canyon from Hardscrabble Mountain. Jeff Augustine is on the right side. Jeff was a wildlife biologist who worked with us on the puma study.





Above: Looking southwest across upper Cottonwood Canyon and toward the southern part of the Chalk Hills. Loma Vista is on the left side of the hills, and Big Mountain has the three prominences on its crest on the right.

Below: Big Mountain looms over upper Cottonwood Canyon.





Above: The southern portion of the Chalk Hills in winter splendor. Big Mountain is on the left. Woolf Gap and Indian Trail Gap are the two saddles to the right of Big Mountain.

Below: Upper Cottonwood Canyon. Frank Smith and Brian Spreadbury, two Wildlife Biologists on our study, search for a puma nursery in the lower part of this photo.







Above: This abandoned ranch house in lower Cottonwood Canyon represents the scattered ranches that were established in these mountains beginning around the 1860s. Ranchers raised cattle for the beef industry, angora goats and sheep for the mohair and wool industries, and horses. Individual ranches had from a few hundred to a few thousand head of livestock. With the creation of White Sands Proving Ground in 1945, ranching declined, then was eliminated in the 1960s after the designation of White Sands Missile Range in 1958. The U. S. Army needed the land to test long range missiles and rockets for the military and for space exploration.

Top of the Following Page: Looking southwest across the grasslands in upper Cottonwood Canyon. Loma Vista is the peak on the left side of the Chalk Hills. After the ranching industry exited and the U. S. Army protected the San Andres Mountains, natural processes have restored these mountains to a state of de facto wilderness.

Bottom of the Following Page: Looking up lower Rhodes Canyon with Hardscrabble Mountain on the skyline. Linda Sweanor and a visitor to our study are sitting at the bottom center of this photo.

The dirt road in Rhodes Canyon was established as a wagon trail in the early 1900s. It linked the east side of the Tularosa Basin with Engle in the Jornada del Muerto and Hot Springs and other communities along the Rio Grande. In the 1930s the Civilian Conservation Corp (CCC) improved the road and had a tent camp in Rhodes Canyon while they were doing that work. Access to this road is now strictly controlled by White Sands Missile Range.







Looking north up Bear Den Canyon from Hardscrabble Mountain. This is the north tributary of Rhodes Canyon.



Above: Looking up the lower reaches of Rhodes Canyon (left) and Bear Den Canyon (right).

Below: The south slope of lower Bosque Canyon, a southern tributary of Rhodes Canyon.





Above: Rock House Spring in upper Rhodes Canyon probably was developed initially for people and their livestock. Here decades later, this is a vital water source for wildlife.

Below: The juniper-grasslands vegetation community in upper Rhodes Canyon.

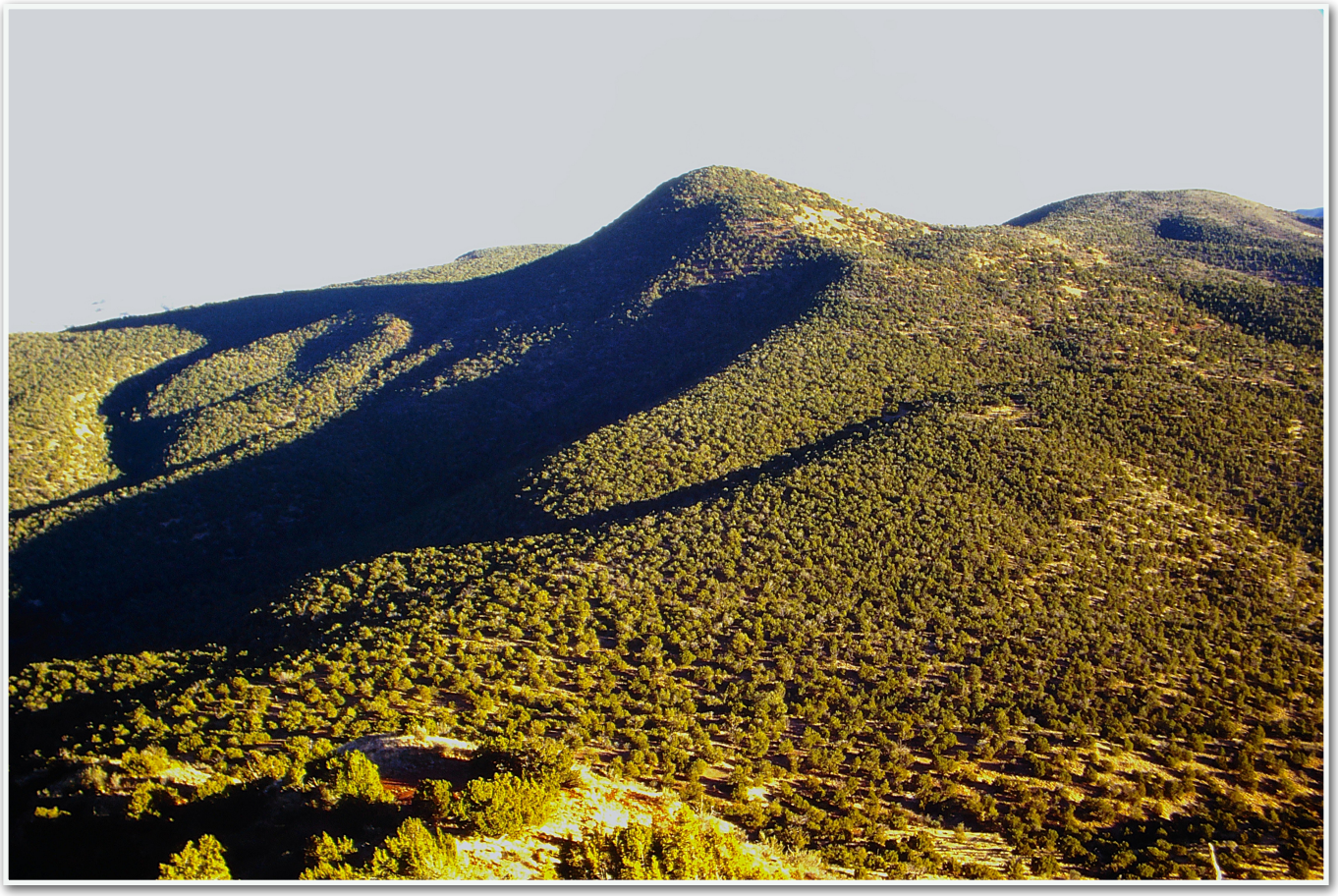




Above: Looking down upper Rhodes Canyon. Rhodes Canyon is named after Eugene Manlove Rhodes (1869-1934), who lived here. He authored western novels with stories and characters placed in this region, including *Pasó Por Aqui*. Eugene is buried at Rhodes Pass at the head of this canyon.

Below: Looking south from Panther Peak and across upper Rhodes Canyon.





Above: Panther Peak on the west Bear Den Canyon divide with upper Rhodes Canyon.

Below: Looking south down Bear Den Canyon.





Above: Looking across lower Rosebud Canyon.

Below: Lower Good Fortune Canyon. Jeff Augustine, a project Wildlife Biologist, is on the right checking for signals from radio-collared pumas.

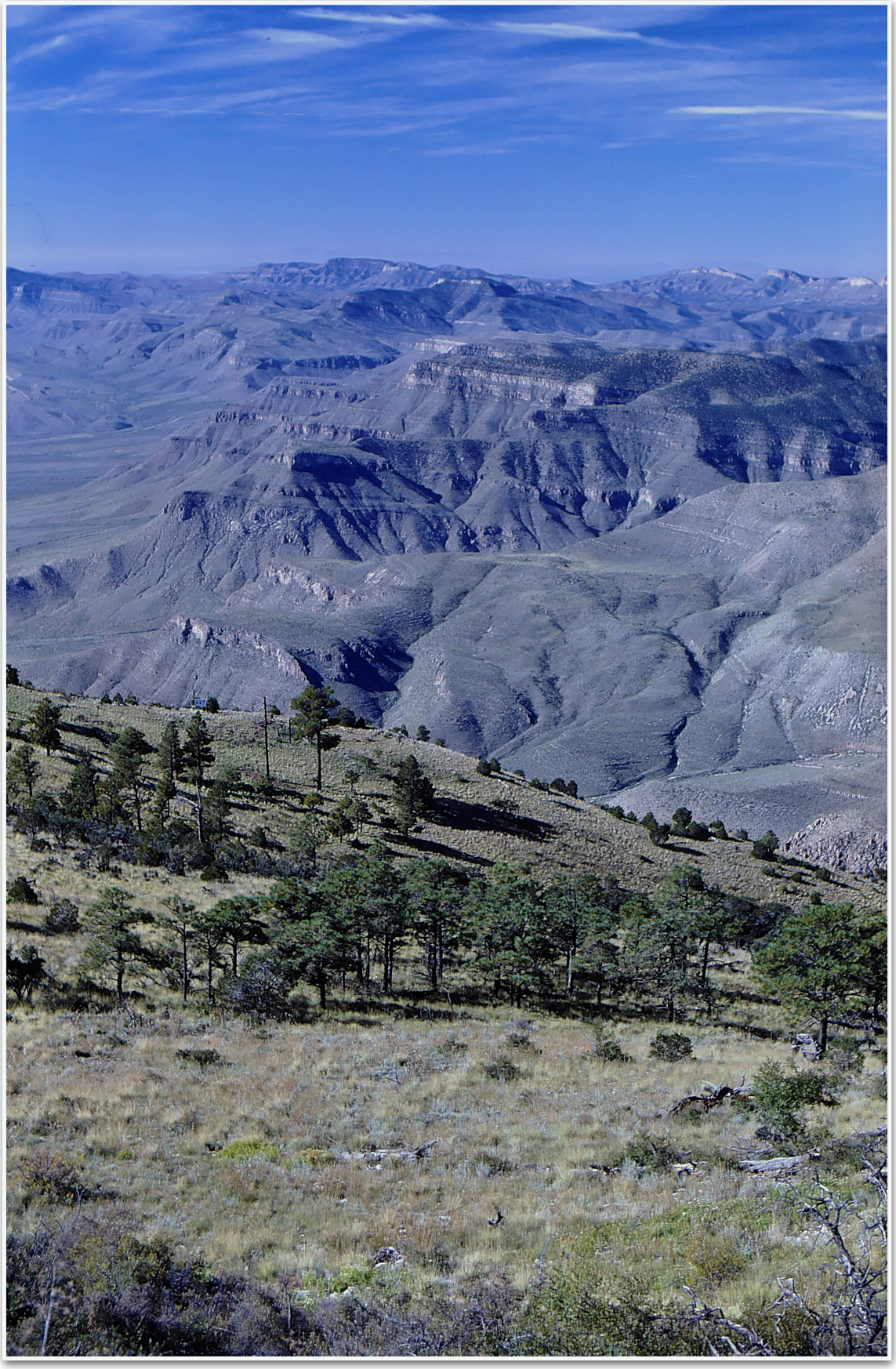




Above: The mouth of Good Fortune Canyon and southern divide with White Rock Canyon.

Below: Looking south down Good Fortune Canyon. Yet another example of the extent and beauty of grasslands in these mountains.





Looking south across the eastern escarpments of the San Andres Mountains from Salinas Peak, the highest elevation in these mountains at 8,965 feet. Note the Ponderosa Pine savannah in the foreground on Salinas Peak; it is the only place this vegetation community occurs in the San Andres Mountains..

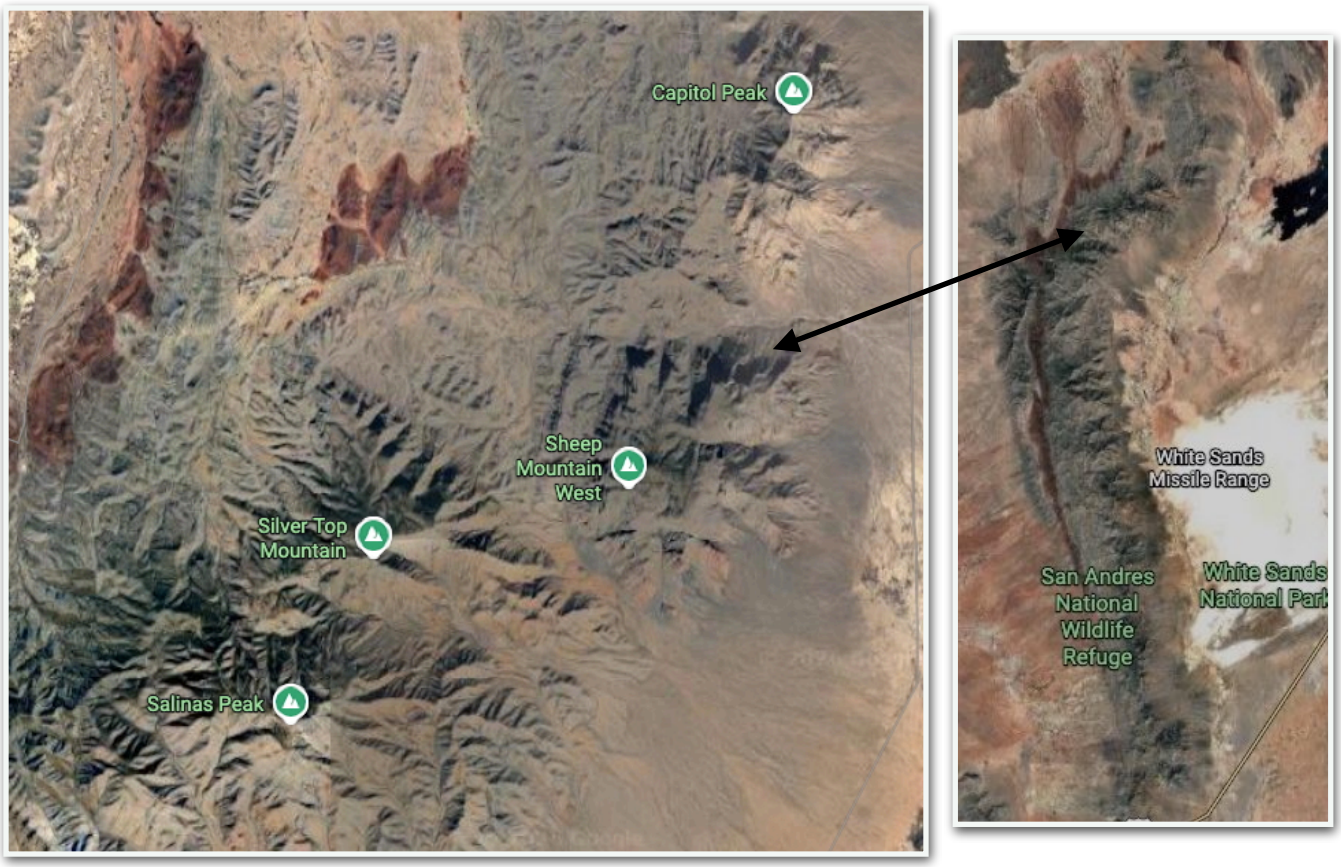
Traditional Mescalero Apache consider Salinas Peak their Sacred Mountain where medicine men obtain their power.



Above: Looking northeast from Salinas Peak towards Silvertop Mountain on the left and Sheep Mountain on the right. Capitol Peak can be seen farther north and between these two mountains. The Oscura Mountains are on the skyline far to the north.

Below: Looking down Lee Canyon from the crest of Silvertop Mountain.





Below: Salinas Peak Camp. Jeff Augustine stands at the tent entrance. Jeff was an excellent cook. Before we hiked to search for puma cubs to gather data on reproduction, Jeff would bake a batch of his "Cub Cookies"; huge, rich chocolate chip cookies. Only after we had successfully found the cubs, marked them, recorded the data, and placed them back in the exact nursery did we reward ourselves by sitting on a canyon rim to enjoy the scenery and eat the cookies.





Above: Looking south down Sweetwater Canyon.



Below: The lower elevations of Sheep Mountain. Hike up this canyon and you would find a long-abandoned log cabin.



Above: Looking south from the west slope of the Mockingbird Mountains. Fairview Mountain is on the right. Salinas Peak is the highest prominence on the ghostly distant skyline.

Below: Another view looking south from the Mockingbird Mountains (on left), and Silvertop Mountain and Salinas Peak in the distance (on the right). Here, too, the desert grasslands adorn the gentler slopes





Above: What we called "The Boulder Jungle" in the Mockingbird Mountains where some mother pumas had their nurseries.

Below: Here, a mother puma stands guard at the entrance of her nursery in the "Boulder Jungle", Mockingbird Mountains. This mother had three cubs in her litter. Three cubs was the most frequent litter size that occurred during our study.





Above: Edifice Camp on the northeast slope of the Mockingbird Mountains. This open-air camp is at the base of the huge boulder at the bottom left.



"For us, this project was an expedition, not only into a region of the Chihuahua Desert that was little known, but also into our own physical, intellectual, and emotional limits. Ten years is a long time to maintain peak intensity in laborious field research. But the place and the life kept us always looking and stepping forward. Without a doubt, our deepest satisfaction was in trying to figure out why life works the way it does on a piece of Earth, the San Andres Mountains. Every canyon, ridge and mountain peak became familiar to us. It was inevitable. Daily, we searched for or followed pumas wherever they might go, which was everywhere in these desert mountains. A clandestine helicopter crew could have blindfolded us and plunked us down alone in some secluded spot in the middle of night, but by daybreak, or even before, we would have known where we were. The rigors and pleasures of the land, its seasons, and the animals defined our way of life. We will always regard the San Andres Mountains as 'our home'."

K. A. Logan and L. L. Sweanor - ***Desert Puma: Evolutionary Ecology and Conservation of an Enduring Carnivore***





Linda Sweanor and Ken Logan back in the day when they were studying pumas on the San Andres Mountains, 1985 to 1995. They now live in Kingston, in the Black Range of New Mexico. On a clear day they can see the blue-gray silhouette of the San Andres Mountains far to the east, pining to revisit the sublime beauty of those canyons and mountains.

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***Desert Puma: Evolutionary Ecology and Conservation of an Enduring Carnivore*. By Kenneth A. Logan & Linda L. Sweanor. Washington, D.C.: Island Press, 2001. Pp. 463. $70.00 hardcover, $45.00 paper.**

The authors' work launches a "flag-ship" study for the Hornocker Wildlife Institute and emerges as a landmark in puma research and conservation, an epic journey in the pursuit of knowledge of these illusive big cats. The ten-year study from 1985 to 1995 explores the secret life of desert pumas inhabiting the San Andres Mountains of New Mexico. This first long-term intensive study of pumas living in a desert environment becomes the largest investigation ever conducted on any single puma population. It encompasses about 9,780 total person days of field research, with capture and release of 241 individual pumas. Tracking the big cats year round by air and ground gives nearly 14,000 radiotelemetry locations, yet this is only a fraction of the total effort and material presented in this monograph.

The scope of this book serves three different audiences. It targets the academic community as an absorbing scholarly treatise. The story is told in twenty-one chapters under five headings: (1) Setting the stage; (2) Puma life history strategies and population dynamics; (3) Puma behavior and social organization; (4) Puma-prey relationships; (5) Pumas and people. The authors present ten years of detailed data in nearly 100 combined figures, tables, and plates dispersed throughout the sections along with analytical and statistical methods. Review of scientific literature includes information on the large cats in general, the puma being the fourth largest cat in the world, and compares methods of data collection and analysis between this study and prior studies of the puma and other large felids. The work explains and tests various hypotheses concerning survival strategy and reproductive strategy in relation to population structure and dynamics, prey dynamics, innate puma behavior, habitat, climate, and other aspects of its ecology. Many illustrative photographs are given throughout the chapters. The overall content and rigorous scholarship of the authors' work advances scientific knowledge of pumas well beyond that of any previous studies.

Logan and Sweanor's research also serves another audience, that of wildlife managers. The New Mexico Game Commission, to its credit, initiated this long-term investigation to provide scientific information for field application. This study thus establishes basic biological and ecological findings needed for management decisions to sustain self perpetuating populations of pumas and their prey, while at the same time balancing the needs of other diverse and vested interests. These interests include but are not limited to those of recreational puma hunting, big game (deer) hunting, which may compete with the puma for the prey base; interests of protecting endangered desert bighorn sheep living in the San Andres Mountains; and the interests of minimizing puma predation on livestock. Always present is interest to protect humans and their companion animals that may encroach on puma habitat. Desert Puma provides a massive tome of information for the wildlife manager, although some practical aspects of the

material may be cumbersome to retrieve due to the extensive detail in the monograph.

A third audience for the book is encouraged as part of a total conservation effort. This may include anyone with some scientific background, an interest in puma or big cat conservation, and the desire to enter the milieu of scholarship to better understand the subject. Many areas of interest are well served, including those of natural resource policy, zoo or mammalian biology, various aspects of environmental study, as well as broader areas of public education on such issues. The involvement of informed advocates is essential, according to the authors, to help transform the scientific findings of this study into a format the general public can understand and become responsive to. Successful conservation efforts need the active interest of the public. Such efforts require a broad-based acceptance of our ethical obligation to protect natural systems, combined with widely accepted knowledge based on scientific understanding of how natural systems work. Only then can efforts to protect the big cats from extinction be successful.

It may be hard for anyone other than a field biologist to appreciate the effort and commitment involved in this ten-year study' Pumas are among the most difficult of the large terrestrial mammals to study since they naturally shun human contact, have cryptic coloration and are crepuscular and nocturnal. The only reliable method of study requires tracking, then immobilization and capture of each puma. Each is given individual identification, and all but cubs are fitted with a radio collar. Data is recorded from each animal. After this processing, the subjects are released at or near the site of capture. Movements are followed by radiotelemetry both from light aircraft and on the ground. Fieldwork continues year round, in this case ten days in the field followed by four days in civilization to regroup. Tracking and capturing animals involves many skills unknown to the ordinary researcher. These include map reading, orienteering, rappelling, tree climbing, handling dangerous animals, facing many other physical dangers, and living with the privations of life in remote places. Surviving the elements of weather, being lost, hunger, and tiredness are all part of the experience. All of these add to the element of adventure and romance and give epic proportion to this study. Extensive knowledge of many aspects of field biology as well as courage and indomitable spirit are prerequisites.

The San Andres Mountains offer an ideal habitat for long-term basic research on pumas. The mountains are part of the basin and range physiographic province, composed of broken narrow ranges flanked by large desert basins. Isolation of the mountains by the surrounding desert basins provide a self-contained ecosystem wherein none of the large mammals migrate seasonally. Another factor makes this area ideal for study. The land is restricted by the U.S. Army and is relatively undisturbed by humans, minimizing many confounding variables from human activity.

In this study, the scientists' first hurdle was to censor the San Andres puma population using the methods of capture-mark-release and radiotelemetry tracking. They repeated the censor process annually throughout the ten years and found the population on average is comprised of 61 percent adults, 6 percent sub-adults, and 33 percent cubs. Population structure and dynamics are further elaborated in several chapters of the book. These include chapters with information on adult home-range characteristics, interactions between pumas, puma social organization, and dispersal (or ranging) behavior. The researchers found that the San Andres pumas constitute a metapopulation, which is defined as a network of semi-isolated populations with some level of regular or intermittent gene flow among them. Such populations depend on both emigration and immigration to and from other groups for numeric and genetic augmentation. This structure allows for the best local adaptation to habitat while avoiding the adverse effects of isolation, that of increasing genetic load from inbreeding. In practical terms, it is important for wildlife managers to provide corridors or land linkages to allow contact between localized populations of pumas to maintain genetic diversity and long-term survival.

Several aspects of reproduction are discussed in a chapter that gives information on fecundity rates, natality rates, timing of births, mating system, gestation, birth intervals, sex-ratios of offspring, nursing litter size, puberty, philopatric females, icteroperous females, reproductive behavior, and more. Information on mortality and survival is given in another chapter in which the researchers establish intra-species strife, with pumas killing other pumas, as the dominant mortality factor in the population. This is not unique to the San Andres pumas. Other chapters describe diet, interactions with desert mule deer, and interactions with desert bighorn sheep.

An experimental reduction of one part of the San Andres puma population was made in late 1990 to mid 1991 to allow study of population dynamics following a sharp decline in resident pumas in a given area. One section of the study area, designated as the Treatment Area (TA), 703 km. sq., was utilized for this manipulation. Thirteen pumas were experimentally translocated without injury to northern New Mexico. Three others either died of natural causes or disappeared. In all, the resident population of the TA was reduced by 47 percent. The remainder of the study area was designated as the Reference Area (RA), 1356 km. sq., in which the puma population was not manipulated. The undisturbed RA allowed the scientists to continue observing in an area free of human manipulation. Various aspects of population dynamics in the TA and RA were monitored and compared during the remainder of the study. Much detail is given in the results, but in essence, the population recovered within 31 months. Recruits were from progeny born within the TA, as well as from immigrants from both the RA and from outside the study area. Recruits were basically of the same number and sex as animals removed. This shows the strong influence of mating system and social behavior on puma population structure, and that protected populations can quickly recover from a sudden and sharp decline.

The final two chapters of the book include discussion of overall conservation and management of wild pumas. The authors argue that protected zones of habitat, such as the San Andres Mountains, are vital to prevent unnecessary overkill of the puma. Safe corridors or land linkages are needed to allow movement between the protected areas.

Empirical data from this study suggests that protected zones should be at least as large as the San Andres Mountains chain, about 3,000 km sq. The full details of this study add greatly to the richness and fabric of human understanding of an illusive predator, the desert puma. Hopefully this information will be heard. Scientists Logan and Sweanor give us all the elements of an extraordinary adventure story as well. It deserves the wide popular readership enjoyed by the best of the genre of popular animal stories. All that is needed is an old-fashioned storyteller.

Bret Snyder MS, Stanford University and DVM, Colorado State University; Head Veterinarian, Albuquerque Biological Park, 1977-2000; Continued affiliation with the Biological Park as a consultant.

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Early Settlement and Arizona Cypress

The July 3, 2022 issue of this journal included an extended discussion of the relict population of Arizona Cypress, *Cupressus arizonica* var. *arizonica*, found just north of Cooke's Peak. A portion of that article is reprinted here because it edifies the issues associated with human introduced species and the difficulty sometimes experienced in distinguishing them from the native flora of the area - and in this particular situation when the introduced may have been part of the flora which existed in the area during the Pleistocene. The following copy of the 2022 article has not been altered.

Arizona Cypress in Ash Canyon San Andres Mountains

As noted above, the population of Arizona Cypress in Ash Canyon, in the San Andres Mountains which border White Sands to the west, are believed to be introduced. Since discussions of this group of trees comes up periodically it is worth spending some time discussing it.

The question usually arises because of specimens in the University of New Mexico Herbarium collection, collected by J. Von Loh and others. Here we discuss the history of these specimens and how the determination was made that this population was initially planted by humans.

It can be difficult, at times, to determine if a specimen is native to the area in question or has been introduced by human actions. In general, if specimens are located at human habitations or areas of human activity, but nowhere else, they are assumed to be introduced.

Applying this rule results in a conclusion that only the Cooke's Peak stand of Arizona Cypress is native to New Mexico, as Richard Felger concluded, (see above).

Note, however, that "New Mexico" is a completely artificial construct based on human politics. When the USGS range map is viewed, the Cooke's Peak population is simply an outlier, at the edge of the range. That, of course, has implications for the stand because of the political boundaries drawn by humans.

The specimen sheets in question, accessed via SEINet, are:

- ✦ Several specimens including #59488, collected by J. Von Loh on May 20, 1975, in Upper Ash Canyon of the San Andres Mountains (32.65744859 -106.4612695 and 32.62689887 -106.5296113 +/-15m.). See specimen sheet on the following page; and

- ✦ #5309 collected by Kenneth Heil, Dave Anderson, and Patrick Alexander on September 9, 2010, at about the same location as J. Von Loh's collections (32.6355333333 -106.5465166667).

Readers of this magazine will probably recognize that "J. Von Loh", who made the original collection, made major contributions to the April 2022 issue of this magazine on butterflies. Jim noted in his Master's thesis that the trees "were introduced into the canyon some twenty years ago." That would be in the mid 1950s. On March 8, 2022, he noted:

> *"that was me when I was a puppy at UNM – my MS thesis is: "A Floristic Inventory of the San Andres National Wildlife Refuge, Dona Ana County, NM." (1977). I would travel in with Refuge Manager, Doyle Day and grab plant specimens like crazy while he counted desert bighorns and graded roads with a WWII surplus bulldozer . . ."*

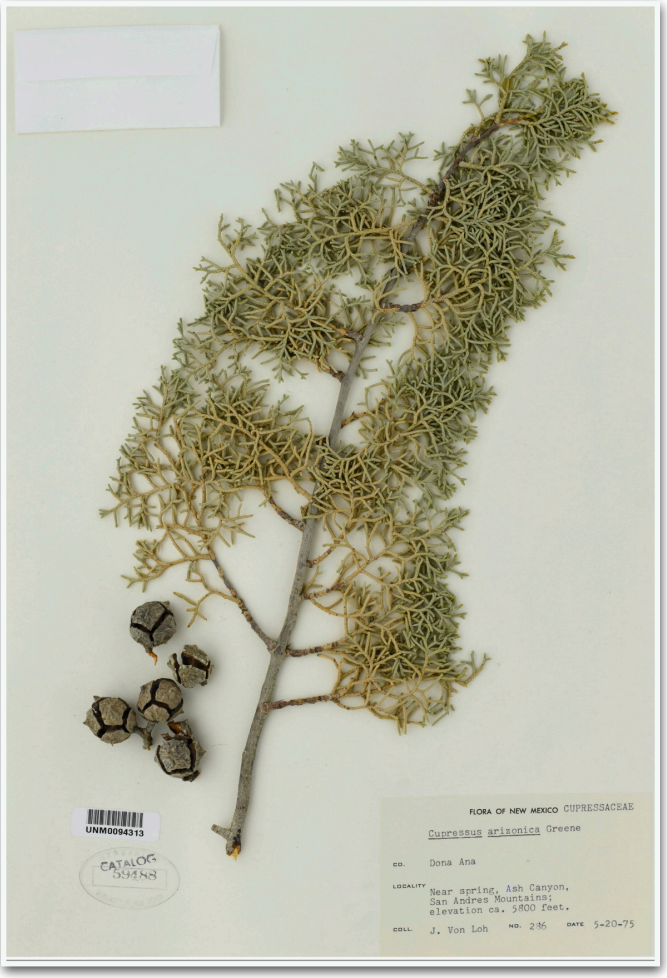
On March 14, 2022, Von Loh noted that:

> *"The people with the most intimate knowledge of Refuge resources then, and whom I interviewed in 1975, were Dr. Carlton H. Herbel; Research Leader, Jornada Experimental Range (Dr. Herbal maintained and allowed me access to a small herbarium collection at JER) and SANWR Manager, Mr. Doyle Day (by agreement with WSMR and NWRS, Doyle was required to accompany me into SANWR for my specimen/ photography collecting trips or access would be denied - he was a treasure-trove of local and Refuge knowledge). They were my most likely sources for this Arizona cypress information."*

Over the years, the trees at this site have been observed by various naturalists, Anderson, Hall, Alexander, Logan, and Allred for starters.

Ken Logan and Linda Sweanor's book, *Desert Puma: Evolutionary Ecology And Conservation Of An Enduring Carnivore*, is based on their years of experience doing Mountain Lion research in the San Andres Mountains. In correspondence of March 5, 2022, Logan noted that:

> *"When we were there, that part of Ash Canyon had high puma travel, so we consistently ran a snare line there. I vaguely remember crawling on my hands & knees under the dense growth at the upper reaches of the spring flow and encountering those strange cones."*







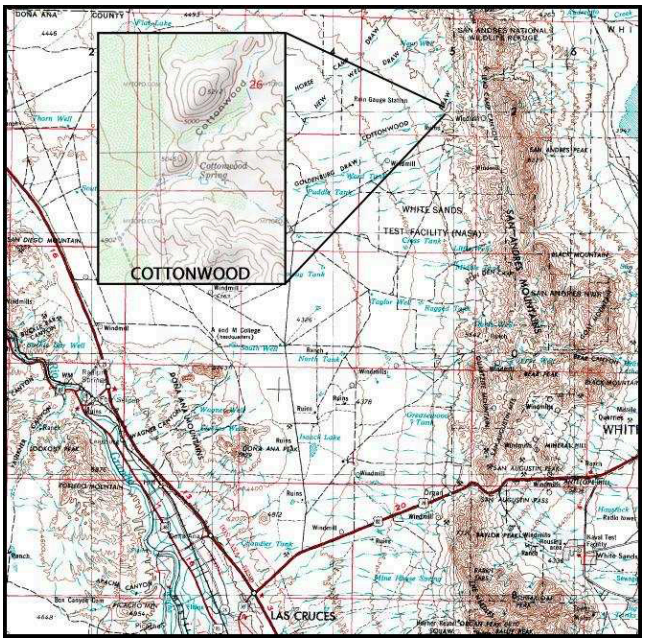
The photographs of Arizona Cypress, right, are from Ash Canyon, by Kelly Allred. His visit to the site on November 18, 2015 was part of a larger study. At the time he described the trees as:

> ***"there are only two large trees of about the same size, with some saplings beneath, but no other trees in the canyon or in the entire San Andres mountain range (as far as is known, but the area has been combed pretty well by various botanists and wildlife folks). The trees are at a place that used to get quite a few picnickers back in the day, and there used to be an outbuilding there. If the population were relictual, I would expect to find other aged trees away from these two, and perhaps stumps or something to indicate other individuals. So, I cannot be sure of the provenance of these trees, and we suspect that they might have been planted by early visitors/settlers. These were popular ornamental trees back in the 30's-50's (or earlier) and we find similar sized trees on campus here and around old buildings. Of course, we cannot be sure, and it is possible that seeds were dropped by birds or spread by browsing animals.***
>
> ***I think all of the specimens you have seen from Ash Spring or Ash Canyon are from these same trees."***

San Andres Mountains Archeological Studies

The San Andres Mountains are rich in natural history. There are also numerous archeological sites in the area, many have been surveyed and thoroughly documented. Others have likely yet to be discovered. See the following:

- **Berrier, Margaret. 2010. "Rock Art Recording at Cottonwood Springs, New Mexico". *Advances in Jornada Mogollon Archaeology: Proceedings from the 17th Jornada Mogollon Conference*. 2013. The map to the right shows the area of study.**
- **Office of Contract Archeology (OCA), the University of New Mexico, conducted an assessment of a large site at the mouth of Cottonwood Canyon "one of few natural routes across the rugged San Andres Mountains between the Rio Grande Valley to the west and the Tularosa Basin to the east. Throughout the site, evidence of activity during the later Archaic and early Formative periods indicates the procurement of local cherts for the manufacture of bifacial tools. However, two portions of the site received intense occupation from the 11th to 13th centuries AD, corresponding to the Doña Ana and early El Paso phases of the Jornada Mogollon sequence, based on pottery styles and radiocarbon dates. From only two test excavations in each of these areas, large quantities of lithic refuse and processed faunal remains, at least two specimens of maize, and examples of an astonishing variety of pottery types were recovered. Distinct from most contemporary sites with faunal assemblages, a large portion of the animal bone came from deer and similar sized species, rather than primarily from rabbits and smaller game. Perhaps reflecting the location along a natural communication route, more than twenty pottery types were identified, including not only Jornada Mogollon wares, but examples of other pottery traditions from throughout southern and central New Mexico, and even possibly into eastern Arizona and northern Chihuahua. Finally, projectile points and a radiocarbon date indicate that the site was visited during protohistoric times as well."**
- **OCA conducted an evaluation of the Lee Canyon site (east flank of the San Andres Mountains) and found among other things - middens 3 to 4 feet deep which dated from the mid 6th and mid 9th centuries.**
- **Post-European sites are found in the mountains including evidence of Spanish travel associated with salt harvesting in the Tularosa Basin and battle sites like that documented by Karl Laumbach (see earlier cite).**
- **Perhaps the most heavily publicized work in the area is the excavation of human and other animal footprints from ~23,000 years ago at Lake Lucero. See articles like Holliday et al. "Paleolake geochronology supports Last Glacial Maximum (LGM) age for human tracks at White Sands, New Mexico". Science Advances, 18 June 2025.**
- **Eidenbach, P. L., and B. Morgan, editors. 1994. *Homes on the Range: Oral Recollections of Early Ranch Life on the U. S. Army White Sands Missile Range, New Mexico*. Eidenbach and others have documented the ranching history of the San Andres Mountains. The photograph directly above is from the work cited here.**



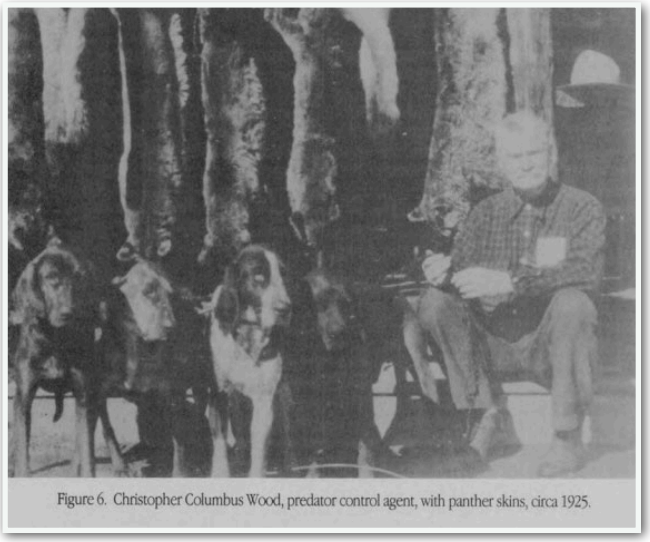


Figure 6. Christopher Columbus Wood, predator control agent, with panther skins, circa 1925.

Sometimes archaeology (especially of more recent times) and "local color" can be difficult to separate. As Jim Eckles writes in *Pocketful of Rockets* (see earlier cite):

> **"During the 1930s, a solitary man roamed the mountains on foot. He tried to avoid people but to survive he needed the generosity of the ranch families who often fed him. ...well, he was just like a little quail. He could get out of sight faster than anybody. ... If he saw you first, he went and hid in a ditch."**

Of course, "the bottom line", is that the casual observer of archaeology is likely to have a hard time seeing the "cultural history" of the San Andres Mountains. There are, however, occasional opportunities sponsored by organizations which have been granted visitation rights by the military.

San Andres Mountains Access

As noted in the article by Ken Logan and Linda Sweanor, access to the San Andres Mountains is severely restricted. For the most part only researchers are allowed into the area, whether they be naturalist like Logan and Sweanor; historians, like Laumbach; or anthro-archeologists like the teams doing excavations at Lake Lucero, the nature and extent of the work being done is carefully defined and delineated by the military.

That is not to say that there is no access, however. What follows are two examples, one a recurring opportunity, the other of the type which requires vigilance to ferret out.

Reprint of an article from the April 2025 Issue of BRN

Lake Lucero & White Sands National Park

The gypsum dunes of White Sands National Park are not unique, but they are one of the most dramatic manifestations of this land form. They cover 275 square miles of the Tularosa Basin. To the west of the dunes lies the Alkali Flat, whose southwestern end is the area now known as Lake Lucero covering an area of about 10 square miles. The dunes, the flat, and the lake are all part of a dynamic geologic process which may have started 24,000 years ago. At that time gypsum was dissolved in water, in both the San Andres Mountains to the west and in the Sacramento Mountains to the east of the Tularosa Basin. This runoff formed Lake Otero, which is estimated to have been about 1,600 square miles in area. By about 12,000 years ago the influence of the last glacial period had waned and Lake Otero began the slow process of evaporation, concentrating the gypsum in the Basin. Lake Otero gradually diminished in size, and its remanent is what we now call Lake Lucero.

Rainwater (from the sky and as runoff) periodically pools in Lake Lucero and then evaporates out. The concentrated gypsum in the area forms selenite ($CaSO_4 \cdot 2H_2O$) crystals. These crystals break down into the white sand which forms the dunes to the east of the lake. (Prevailing winds in the area are to the east and north.)

Selenite is very soft (a hardness of 2 on the Mohs scale - you can scratch it with your fingernail) and it readily forms beautiful crystals. See images on this page of the playa (Lake Lucero when it is wet) and crystals from the playa.

Tours of the lake, which is in a restricted zone, occur periodically. Contact the White Sands National Park headquarters for details.

The dunes of White Sands National Park are the largest concentration of gypsum dunes in the world. The three largest gypsum dune complexes are located at: 1) White Sands; 2) Cuatro Cienegas, Coahuila, Mexico; and 3) Guadalupe National Park, Texas. All three are in the Chihuahuan Desert.







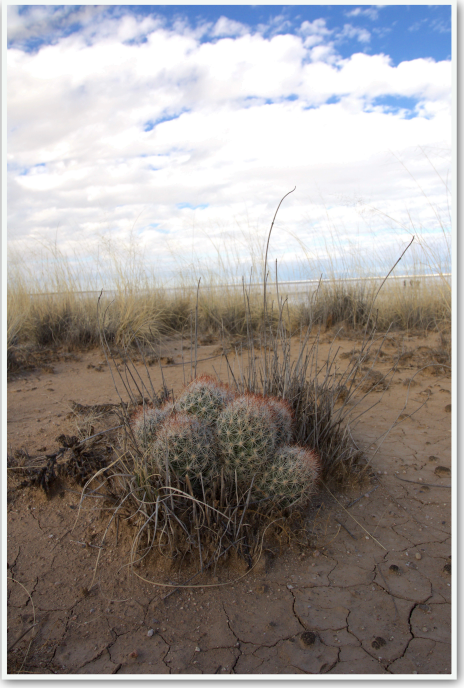
End of Reprint

Ed. Note: Don't expect a solitary experience on the National Park outings. Additional photos from Lake Lucero are shown on the following two pages, several with the San Andres Mountains in the background.











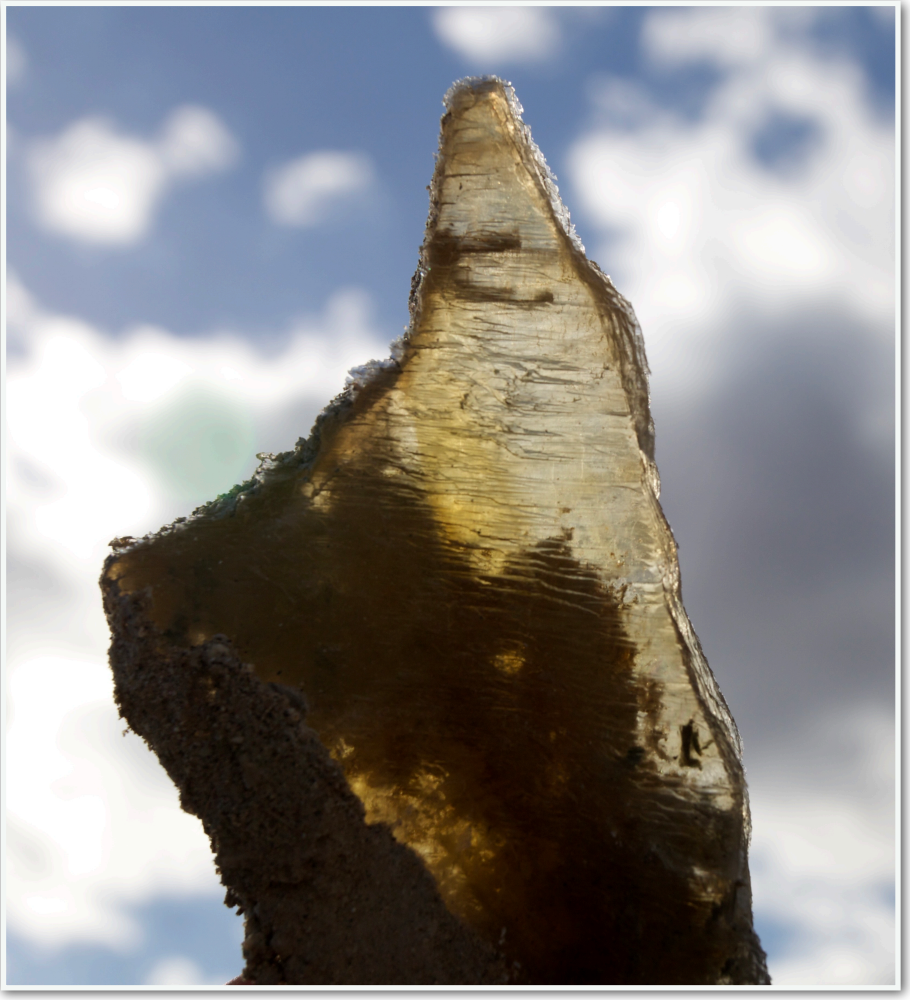


$CaSO_4 \cdot 2H_2O$









There are places where you can legally collect selenite crystals, like the Great Salt Plains National Wildlife Refuge in Oklahoma. The collecting area at that site is pictured directly above. Interestingly (perhaps), the U. S. Army Air Corps used this area as a bombing range from 1942 to 1946.

New Mexico Native Plant Society Trip to Rhodes Canyon

Occasionally non-profits are able to arrange one-day trips into the San Andres Mountains - via the White Sands Missile Range. On September 21, 2019 - for instance - the Las Cruces Chapter of the New Mexico Native Plant Society arranged a trip to Rhodes Canyon. That outing went as far as the gravesite of Eugene Manlove Rhodes.

On that particular trip, the group was able to study various grasses and plants like the *Salvia pinguifolia*, Rock Sage pictured at the right.

The area is, however, a military installation and there are little reminders of that fact all around.









Geology of the San Andres & Organ Mountains

The two photographs on the following page present the markedly different geology of the Organ (top) and San Andres (bottom) mountains.

The Organ Mountains (La Sierra de los Órganos) dominate the Las Cruces skyline and are high enough to affect the distribution of flora and fauna in the area. When viewed from the east they rise from the Tularosa Basin in a rather dramatic fashion. The photograph at the top, of the northern part of the Organ Mountains, was taken on September 21, 2019.

The San Andres Mountains (below) are just to the north of the Organ Mountains, literally on the other side of San Augustin Pass. US-70 separates two dramatically different geological landscapes.

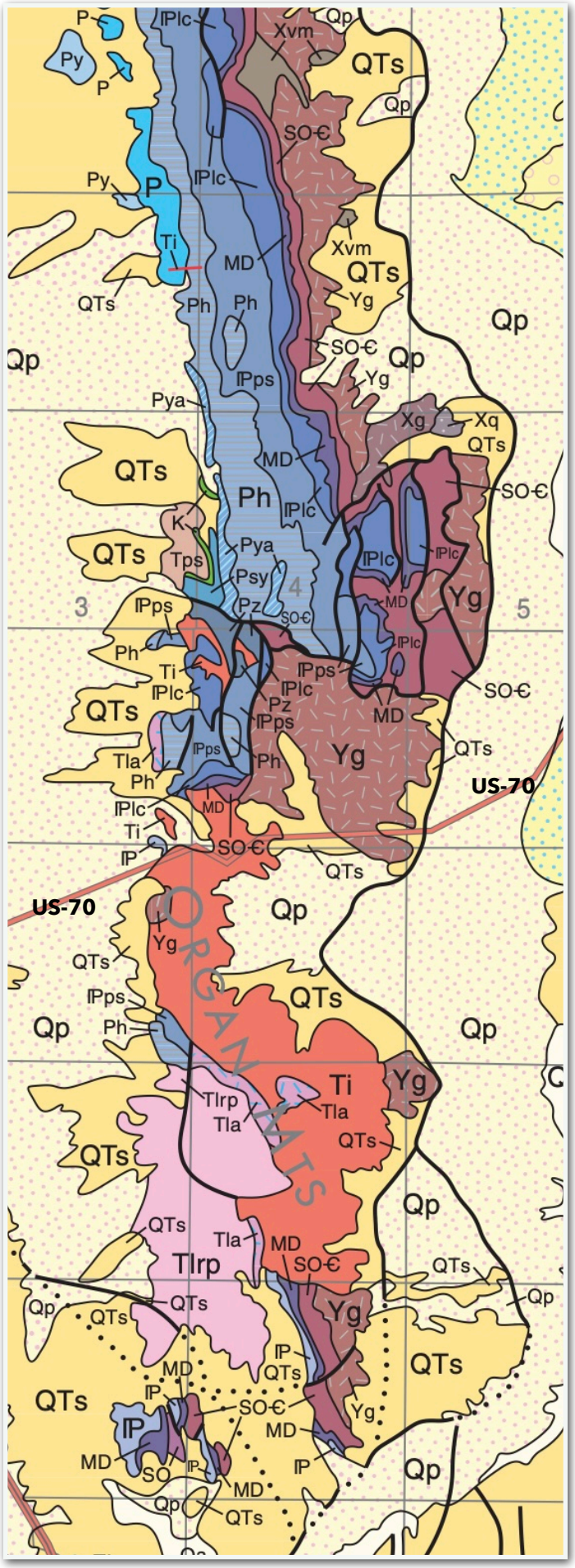
The major geologic formation in the Organ Mountains is the "intrusive rocks of intermediate to silicic composition" from the Tertiary. The igneous rock of the Organ Mountains, mostly granite to the north and rhyolite to the south, is of

different origin and age from that of the San Andres Mountains to the north (and the Franklin Mountains to the south).

The blue colors on the geologic map shown on the next page show that the San Andres Mountains are much older than the Organ Mountains. They date from the Paleozoic and are sedimentary. "Ph", the Hueco Formation, and "IPps",







the Panther Seep Formation, are both limestone. The sedimentary layers of the San Andres Mountains are shown in the bottom photograph on the previous page. (Note that there is some "IPps" found in the Organ Mountains - adjacent to "Ti" (Tertiary Intrusive) rock, in case you thought that it might be straightforward.)



Structure at Potsy Potter Ranch in Rhodes Canyon.



The Eugene Manlove Rhodes Gravesite
Rhodes Canyon
San Andres Mountains

THE 11TH ANNUAL

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