# The Black Range Naturalist

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# IN THIS ISSUE

## Restore To What

Things come, things go away. That has always been my working definition of history.

Application of that definition creates some problems, technical and philosophical. When it comes to human history some of those who study the topic are more than willing to ascribe broad motivations and behaviors to older societies, to pontificate endlessly on causal factors - even when the study of our current societies (about which, arguably, more information is available) is unable to achieve such an "understanding" for those which exist in the here and now. Discounting "the good ol' days" mythology only helps a bit.

When it comes to natural history, understanding the global milieu of a time or place is even more difficult. There is so much more to know and the vast majority of it remains unknown.

To restore, to fix something which is broken, is a manifestation of human arrogance. But humans are humans and we will keep trying. So be it. But let us try to do it a bit more thoughtfully, a bit more humbly.

This rant may be surprising, given the positive tone of the efforts we describe later. It is driven by a belief that there are no good answers, no panaceas, no holy grails. It is driven by frustration.

We are quickly attaining the skill to restore species which are no longer present on the earth. Should we do that given our general lack of understanding of the world which existed when that species existed? What are the implications for this time, this world, when an extinct species is reintroduced?

The "why" is often given short shrift in discussions about such efforts. Are we really only wanting another theme park? Are we really only about hubris and arrogance? Do we ever consider that "Should we do it?" is just as valid a question as "Can we do it?"

There is no one answer to these questions. We might find a strategy focused on Neanderthals or Woolly Mammoths lacking, when the same strategy would be appropriate for the Dodo, for instance. And such a strategy might be imperative for the American Elm, the Mexican Gray Wolf, or the American Beaver.

## Shifting Baselines - A Core Question for Reintroduction Programs

There are two significant issues which should be addressed by a person or entity proposing a restoration or reintroduction program. The first is philosophical, although it might not sound like it at first - "To replicate what time?" The second is more technical, "How do we know what that time was like?"

Let us discuss the American Beaver (*Castor canadensis*) and the Dodo (*Raphus cucullatus*). In Volume 7, Number 2 (April 2024) of this journal we discussed efforts to restore populations of the American Beaver where they have been decimated and programs to restore that species to locations from which it had been recently extirpated, by humans. In that issue we discussed the value judgements which go into deciding when, where, and how much. Controversies abound about those value judgements in the case of the American Beaver, and we know a fair amount about the natural history and ecology of the American Beaver. Quite remarkably, we know a fair amount about the natural history and ecology of the Dodo. We extinguished that species in relatively modern history. Proposals to restore that species are more technical than those proposed for the American Beaver - after all, the Dodo is extinct. Whether those efforts are driven by societal guilt, the desire for a new theme park, or to repair something we broke is really beside the point. All are value judgements. It is about what we value. The questions of value are in the end those which determine our actions, to what time do we, or not, attempt to restore a species and its ecology.

> *There's currently no way to bring an animal back from extinction based on genomic sequences alone. However, some lab groups and individuals hope to "bring back" extinct animals – including mammals, birds and amphibians – by modifying the genome of an existing species so the animal resembles an extinct relative and plays a similar ecological role. For instance, scientists with the Revive & Restore project have proposed using gene manipulation to create elephants that have the heavy coats of woolly mammoths. The same types of methods can be applied to currently endangered species; for example, adding genes to help a species cope with rising heat or survive an infection from an invasive pathogen. There are laws governing this kind of work. In the U.S., modifying existing species requires permits from federal agencies.* – Robert Fleischer, head of genomics, Smithsonian's National Zoo and Conservation Biology Institute

However, there are times when a bit of informed knowledge can add some wisdom to the discussion. And acquiring knowledge can be technically difficult. In "A shifting ecological baseline after wolf extirpation" Ripple et al. grapple with the issues associated with understanding the past. What we take for normal (our baseline) is not the same as that believed to be normal in 1950, 1823, 1902, . . .

Ripple et al. studied the status of Gray Wolf (*Canis lupus*) populations (as an area of interest in itself and as a surrogate for apex predators) over time and how the changing of that population was often not addressed in establishing the baseline used in many ecological studies. They note that: "Studying an altered ecosystem without recognizing how or why the system has changed over time because of the absence of a large predator could have serious implications for wildlife management, biodiversity conservation, and ecosystem restoration, like diagnosing a sick patient without a baseline health exam."

Just one more thing to consider before we jump to judgement.

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*William J Ripple, Christopher Wolf, Robert L Beschta, Apryle D Craig, Zachary S Curcija, Erick J Lundgren, Lauren C Satterfield, Samuel T Woodrich, Aaron J Wirsing, A shifting ecological baseline after wolf extirpation, BioScience, Volume 74, Issue 7, July 2024, Pages 430–434.

Dodo describing a caucus race to Alice. - John Tenniel 1865

# Is It Possible to Bring Back Extinct Species?

The process of **de-extinction** attempts to restore species that no longer exist and have been historically lost to extinction. Despite being known as **resurrection biology**, research in this field is less concerned with raising the dead and more focused on creating new organisms that are—or greatly resemble—members of extinct species. These de-extinction strategies are known as a form of conservation called **genetic rescue**.

Here, we illustrate the prime candidate species being investigated in de-extinction research.

## A De-Extinction Needs Reliable DNA

DNA is the natural set of building instructions for all living things. With genetic rescue, DNA is crucial as it is a record that describes every biological detail that made an extinct species unique.

DNA completely disintegrates after **6.8 million years**. Species identified past this point are completely unrecoverable, so de-extinction requires "fresher" DNA.

### TIMELINE OF EXTINCTION

This timeline illustrates the state of select extinct species' DNA over time, based on either the last recorded member or youngest found specimen.

Species closer to the right-hand side are both more recently extinct and have more potential for better, intact DNA. Theoretically speaking, they are more "potent" for resurrection.

6 800 000 Years Ago | 1 000 000 Years Ago | 100 000 Years Ago | 10 000 Years Ago | 1000 Years Ago | 100 Years Ago | 1 Years Ago




## B Ways to Resurrect an Organism and Conserve DNA

The only way to produce a true, authentic resurrection requires a species' entire DNA, or genome. Since genomes are lost to degradation over time, de-extinction looks at ways to best conserve DNA and species' traits before they are lost to time. Species created this way are not true resurrections and may only slightly resemble extinct species—they are known as **hybrid species**.

Colored circles next to species in the timeline correspond to which method researchers are currently trying to conserve DNA.

**Cloning** involves producing organisms that are genetically identical. It is the only true way to bring back an extinct species as it uses and preserves all original DNA.

**Genome editing** can change the genetic code of a gestational creature to closely resemble an extinct species. However, it will combine with the parents' DNA and create a hybrid that only resembles the extinct species.

**Back breeding** attempts to increase the amount of a **trait** that has been declining. It requires the trait to still be present in a population in any frequency, though it will not produce the original extinct species—just the appearance of it.

VISUAL CAPITALIST

RESEARCH, WRITING AND DESIGN Mark Belan

SOURCES: "Animals | Endangered List." Endangered List, endangeredlist.org/extinction-timeline. Quill, Elizabeth. "These Are the Extinct Animals We Can, and Should, Resurrect." Smithsonian Magazine, 23 Apr. 2015, www.smithsonianmag.com/science-nature/these-are-extinct-animals-we-can-should-resurrect-180954955. Revive & Restore. "The Woolly Mammoth Revival." Revive & Restore, 10 Feb. 2022, reviverestore.org/projects/woolly-mammoth. Zimmer, Carl. "Your De-Extinction Questions Answered." Science, 4 May 2021. www.nationalgeographic.com/science/article/your-de-extinction-questions-answered.




## Reintroduction Programs

There are several types of reintroduction programs underway world wide. Some involve captive breeding programs, where individuals from an endangered species are captured and bred. Their offspring (initial or later generations) are reintroduced into the wild. Establishing seed banks and restoring native plants is another example of activities at this end of the continuum. These program are sometimes referred to as "restoration" efforts. At the other end of the range of efforts are programs involving resurrection biology or genetic rescue.

Arguments in favor of reintroduction programs are myriad and include the richness and security derived from a diverse biome at one end of the spectrum to judgements about the human role in the extinction of other species at the other end.

Existing species, and those which have gone extinct within the recent past (last 100,000 years?), arguably have a stabilizing influence on the ecology of the planet. Those involved in efforts to reestablish populations of endangered/extinct species often point to this fact as justification for their programs. Many also point to the complexity (and great diversity) of the evolutionary process. The gene bank which exists because of that process is large and has been successfully mined for medicines and other medical treatments, to enhance the production of foods and materials that humans value, and as a springboard to understanding biological processes generally (pure science awaiting our understanding to morph into applied science).

Genetic rescue programs are based on the ability to obtain the DNA of the species in question. Some programs focus on the mixing of DNA from different species in an attempt to resurrect an extinct species. This might involve mixing the DNA of an extinct species with that of an existing species or it might involve the cross-breeding of existing species to achieve individuals with the attributes of extinct species. DNA has a half-life of a little over 500 years; that is, on average, a sample of DNA will contain only half of its original material after 500 years. After about 6.8 million years, all of the material will be gone. For species which have gone extinct many thousands of years ago the mixing of other genetic material with the original DNA samples is often required to obtain material which can be used in any type of reintroduction program. Reintroducing a previously extinct species into the wild is called "rewilding".

To perform cloning, a complete DNA genome is required. This restricts the time horizon for such efforts. Some genome editing may be possible in such cases.

Genome editing, trying to recreate a creature (or something close to the creature) by the editing of DNA to emphasize the attributes of the extinct species, is a more aggressive and problematic approach. It is used when the complete genome is not known. Therefore, how do you know that you got it right?

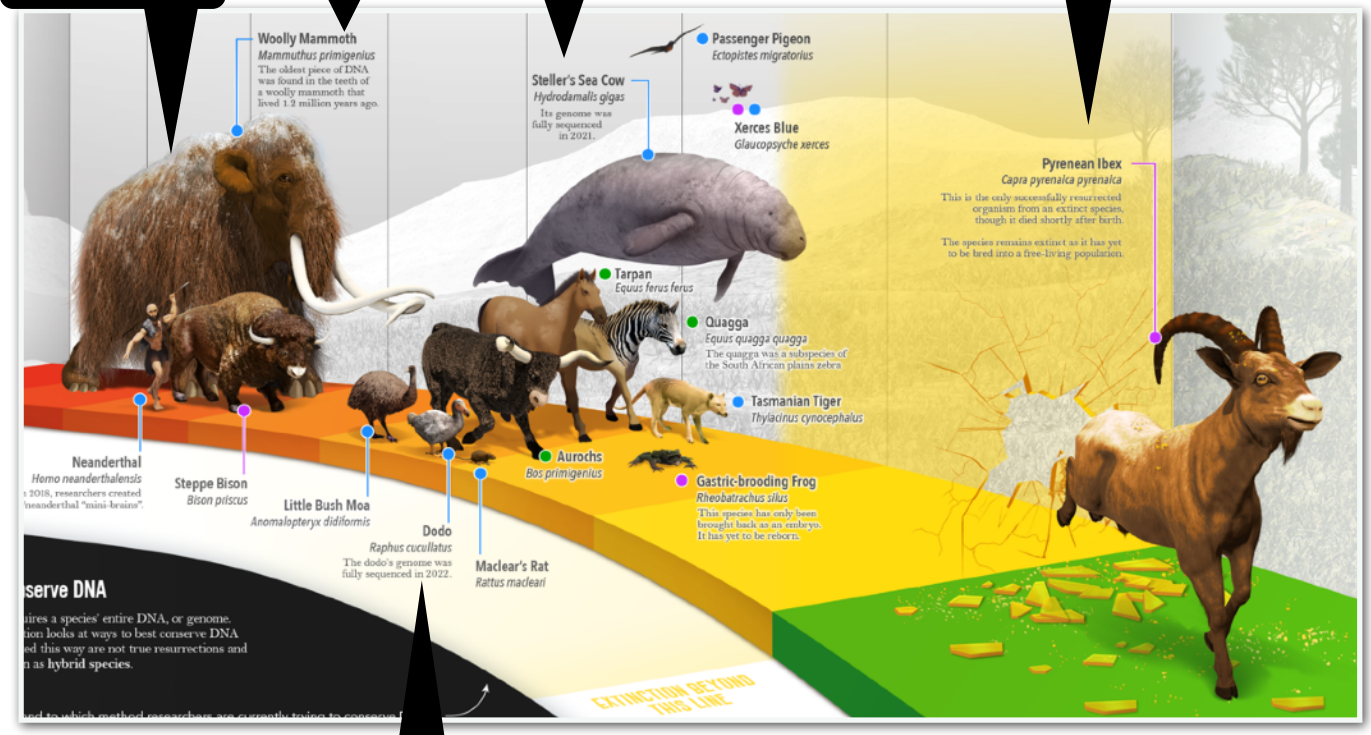
Back-breeding is the technique of breeding species which have diverged from a common ancestor (or near ancestor) to emphasize the characteristics of a now-extinct species.

On 15 January 2025, Colossal Laboratories & Bioscience announced it had raised an additional $200M to fund its de-extenction efforts.

Three-dimensional genome architecture persists in a 52,000-year-old woolly mammoth skin sample *Cell*, July 11, 2024

Steller's sea cow genome suggests this species began going extinct before the arrival of Paleolithic humans Nature Communications, April 13, 2021

Spectral ecologies: De/extinction in the Pyrenees Transactions of the Institute of British Geographers, June 16, 2021




A 'De-extinction' Company Wants to Bring Back the Dodo *Scientific American*, Jan. 31, 2023

**Beyond all of the policy issues associated with de-extinction programs and protocols, the technology is complicated and uncertain.**


**Why the concern? The magnitude of the problem. The summary of the International Union for Conservation of Nature's Red List of Threatened Species shown above was retrieved on August 15, 2024. By the time you read this the figures will have gotten worse.**

# Extant Species of Concern in the Black Range

A listing of species of concern for any area is problematic for several reasons. A formal listing by a government agency is as much a political process as it is a scientific process. Species which are "listed" by governmental agencies have undergone rigorous study and a gauntlet of political machinations designed to stop them from being listed. Once listed the protection afforded a species is often superficial.

There are many species which are arguably more in danger of extirpation or extinction than those which are listed by official sources. The reasons why governing agencies do not take action to try to protect them are myriad but generally based on political rather than scientific considerations.

The International Union for Conservation of Nature's (IUCN) Red List of Threatened Species is the most authoritative source for information about how "threatened" a species is. Its assessment of the species found on this planet is far from complete.

The total number of species at risk is overwhelming, and the complexity of the linkages of those species to others is brain numbing in scope.

A survey of the species in our area which are listed by the federal government provides a superficial assessment of the scope of the problem we face. Note all of the above when considering the following. (State agencies have some additional listings of species.)

In some cases, "critical habitat" has not been designated by governmental entities and in some cases the habitat in the Black Range, where these species may be found, has not been designated "critical habitat".

## IPaC

The Information for Planning and Consultation (IPaC) is a tool maintained by the U. S. Fish and Wildlife Service. It is used to identify species at risk within specified (project) areas. We used the tool to identify listed species which are found in the Black Range. (We have augmented this listing with information not found at the U.S. Fish and Wildlife IPaC website.) Our high-level search yielded the following result:

- Mexican Wolf, *Canis lupus baileyi,* Endangered/ Experimental Population, Non-Essential. Observations from our general area reported to iNaturalist include those made by Danny Tipton and Sarah Solis. As with all observations of endangered and many threatened species, the exact location of the observation is obscured to protect the species from bad human actors.
- Mexican Spotted Owl, *Strix occidentalis lucida*, Threatened, See the index to *The Black Range Naturalist* for the listing of articles about this species.
- Northern Aplomado Falcon, *Falco femoralis septentrionalis*, Endangered/Experimental Population, Non-Essential. Observations from our general area reported to iNaturalist include those made by Nick Pederson and M. L. Watson (at the Armendaris Ranch hacking station).
- Southwestern Willow Flycatcher, *Empidonax traillii extimus*, Endangered. We know of no specific reintroduction programs associated with this subspecies. Observations from our general area reported to iNaturalist include those made by Kara White.
- Yellow-billed Cuckoo, *Coccyzus americanus*, Threatened. We know of no specific reintroduction programs associated with this species. This species has been observed in Hillsboro. Observations from our general area reported to iNaturalist include those made by M. L. Watson and Kevin Floyd.
- Narrow-headed Gartersnake, *Thamnophis rufipunctatus*, Threatened. The Phoenix Zoo maintains a conservation breeding population of this species. Observations from our general area reported to iNaturalist include those made by Kathleen Slocum from the Gila River and Jason Roback from the same area.
- Chiricahua Leopard Frog, *Rana chiricahuensis*, Threatened. Observations from our general area reported to iNaturalist include those made by Joel Gilb and Giulio Del Piccolo.
- Chihuahua Chub, *Gila nigrescens*, Threatened. Observations from our general area reported to iNaturalist include those made by Giulio Del Piccolo and "mwm1991".
- Gila Topminnow (incl. Yaqui), *Poeciliopsis occidentalis*, Endangered. Some authorities considered the two subspecies of *P. occidentalis* to be separate species; both are Endangered. An observation from south of Cliff N. M. was reported to iNaturalist by Christopher Rustay.
- Gila Trout, *Oncorhynchus gilae*, Threatened. Various restoration efforts are underway. See following article.
- Loach Minnow, *Tiaroga cobitis*, Endangered. Observations from our general area reported to iNaturalist include those made by Giulio Del Piccolo and Steven A. Lovelace.
- Rio Grande Cutthroat Trout, *Oncorhynchus clarkii virginalis*, A candidate for listing.
- Rio Grande Silvery Minnow, *Hybognathus amarus*, Endangered/Experimental Population, Non-Essential.
- Spikedace, *Meda fulgida*, Endangered. Observations from our general area reported to iNaturalist include those made by Tom Kennedy and Owen Ridgen.
- Alamosa Springsnail, *Tryonia alamosae*, Endangered
- Monarch Butterfly, *Danaus plexippus*, A candidate for listing. See the index for *The Black Range Naturalist* for the listing of articles about this species.
- Todsen's Pennyroyal, *Hedeoma todsenii*, Endangered.
- Zuni Fleabane, *Erigeron rhizomatus*, Threatened.

# Reintroduction and Restoration Programs in the Black Range and Adjacent Areas

## Bolson Tortoise
## *Gopherus flavomarginatus*

**In New Mexico, there are three programs established to safeguard the existence of the Bolson Tortoise, *Gopherus flavomarginatus* (Legler, 1959).**

**The Bolson Tortoise is known by a variety of other English common names, including Yellow-bordered Tortoise, Mexican Gopher Tortoise, Mexican Giant Tortoise, and Yellow-margined Tortoise. Latin binomial synonyms for the species include *G. huecoensis, G. flavomarginata,* and *G. polyphemus flavomarinatus*.**

**Of the six tortoise species found in North America, the Bolson Tortoise is the largest, with an average carapace (upper shell) length of a foot and a half.**

**Currently, the native range of this species is limited to the Bolsón de Mapimí in the southernmost part of the Chihuahuan Desert. (A bolson is an endorheic drainage system in which there is no natural outlet.) The Cuatro Ciénegas in northeastern Coahuila lie within this bolson. See Volume 4, Number 3, for an article about ciénegas generally and Cuatro Ciénegas in particular. See also *Science*, 3 July 2020, Vol. 369, Issue 6499, "Improbable Oasis - Pools in the Mexican desert are a hot spot of microbial diversity - and window into**


**Map provided by Smallchief under a CC BY-SA 3.0 license.**

**Above: Bolson Tortoise, *Gopherus flavomarginatus*, Chiricahua Desert Museum, Rodeo, New Mexico, August 26, 2016.**

**Two Below: Armendaris Ranch, New Mexico, August 23, 2024**

early life", pp. 20- 25, by Rodrigo Pérez Ortega.

The Living Desert Museum in Carlsbad and the Chiricahua Desert Museum in Rodeo both have breeding programs. The largest effort in New Mexico is operated by the Turner Endangered Species Fund with activities at the Ladder Ranch and Armendaris Ranch in Sierra County.

Although the Bolson Tortoise was mentioned in a Nature article on rewilding (https://doi.org/10.1038/436913a, Josh Donlan, "Re-wilding North America", *Nature* 436, 913–914, 2005), the operations of the Turner Endangered Species Fund are a restoration program. (See *Ecological Restoration*, Vol. 27, No. 2, 2009, "Beyond Historic Baselines: Restoring Bolson Tortoises to Pleistocene Range" Joe Truett and Mike Phillips.)

In 2016 the Bolson Tortoise Ecosystem Preserve was established within the current range of the Bolson Tortoise by the Turtle Conservancy.

There is, of course, more to reintroduction programs than breeding a small population and releasing their offspring into suitable habitat. Genetic diversity of this species was reported on in "Genetic Assessments and Parentage Analysis of Captive Bolson Tortoises (Gopherus flavomarginatus) Inform Their "Rewilding" in New Mexico", Taylor Edwards, Elizabeth Canty Cox, Vanessa Buzzard, Christiane Wiese, L. Scott Hillard, Robert W. Murphy, *PLOS One*, Published: July 16, 2014 https://doi.org/10.1371/journal.pone.0102787. The authors concluded that the "populations exhibited very low genetic diversity and the captive population captured roughly 97.5% of the total wild diversity, making it a promising founder population." Complicating factors uncovered in the study included the fact that most of the turtles which were transported to the Armendaris Ranch in 2006 were hybrids *G. flavomarginatus* × *G. polyphemus* and could not be used in this captive breeding reintroduction program. The low genetic diversity of the breeding population was apparently due to factors other than its small sample size. The small wild population may also be a contributing factor. The cited study found that "wild Bolson tortoises have experienced tremendous reductions in population size since at least the last glacial maximum. . . . This low level of genetic variation in *G. flavomarginatus* might owe to an extreme population bottleneck caused by range reduction. However, a pattern can also result from a perpetually small population size." These findings of low genetic diversity were consistent with the findings of other studies of the species (Ureña-Aranda, C. A., & de los Monteros, A. E. (2012). "The genetic crisis of the Mexican Bolson Tortoise (Gopherus flavomarginatus: Testudinidae)". *Amphibia-Reptilia*, *33*(1), 45-53. https://doi.org/10.1163/156853811X621508.)

As a side note, tracking devices are obvious on the tortoise photographed at the Armendaris Ranch (previous page). The bottom photograph gives an impression of the speed with which these tortoises can move. In the photograph two feet are off the ground: this creature was moving quite fast.

Mexican Gray Wolf pup, part of the reintroduction program at the Ladder Ranch (Turner Endangered Species Fund), Black Range.

## Mexican Gray Wolf
## *Canis lupus baileyi*

The U. S. Fish & Wildlife Service describes this species so: "The Mexican wolf (*Canis lupus baileyi*), is the smallest, southern-most occurring, rarest, and most genetically distinct subspecies of gray wolf in North America. Mexican wolves typically weigh 50 - 80 pounds and measure about 5 ½ feet from nose to tail, and stand 28 to 32 inches at the shoulder. They have a distinctive, richly colored coat of buff, gray, rust, and black, often with distinguishing facial patterns; solid black or white variations do not exist as with other North American gray wolves."

One of the techniques used by this reintro-duction program - there are multiple participating partners - is known as fostering. In fostering, a pup born in captivity is introduced to a wild den site. The 100th pup, which came from the captive breeding program at the Living Desert Zoo & Gardens State Park in Carlsbad, New Mexico, was introduced at a wild den site on April 25, 2024. This milestone was reached after a decade of effort.

A major benefit of fostering programs is that they can be used to increase the genetic diversity of wild populations. During the spring of 2024, 27 pups were fostered to 8 wild dens as part of this program. In addition to the five pups from the

Living Desert Zoo in Carlsbad, New Mexico, seven pups came from the Brookfield Zoo Chicago in Illinois, six pups came from the Endangered Wolf Center in Eureka, Missouri, five pups came from the Wolf Conservation Center in South Salem, New York, and four pups came from two litters at the Sevilleta Wolf Management Facility in New Mexico.

The Turner Endangered Species Fund maintains operations at the Ladder Ranch, with wolf pups going to Mexico. (See Volume 4, Number 3 - July 3, 2021, of this journal for additional information.)

The illegal killing of Mexican Gray Wolves has been a continual problem within New Mexico and Arizona. False claims by ranchers have also been a problem. Many people in the conservation community refuse to report wolf sightings because they do not trust the agency personnel taking the reports. All of this makes it difficult to find effective solutions to this human-caused problem.

## Northern Aplomado Falcon
## *Falco femoralis septentrionalis*

There have been two reintroduction efforts for the Northern Aplomado Falcon in our area, one at the Nutt Grasslands on the southeastern border of the Black Range and the other at the Armendaris Ranch just east of the Rio Grande. The effort at the Armendaris Ranch apparently failed. The exact reasons are unknown but climatic conditions and habitat may not have matched species needs. The program at the Nutt Grasslands was located in prime habitat, but it was abandoned because of management considerations associated with the establishment of the wind farm just north of NM-26, west of Nutt.

An individual of the southern subspecies.


Reintroduction programs in the Gulf Coast of the U.S. have been more successful.

**9th Natural History of the Gila Symposium**

The Natural History of the Gila Symposiums (NHGS) which have been held at Western New Mexico University over the last twenty years have provided a forum for research in our area. Topics are wide-ranging and the presentations are informative. We mention this here because the 2022 Symposium included a track of presentations on aquatic ecology. The schedule and abstract for the 9th Symposium (23-24 February 2022) is found at this link. Other symposiums in this series also covered these topics.

## Chiricahua Leopard Frog
## *Rana chiricahuensis*

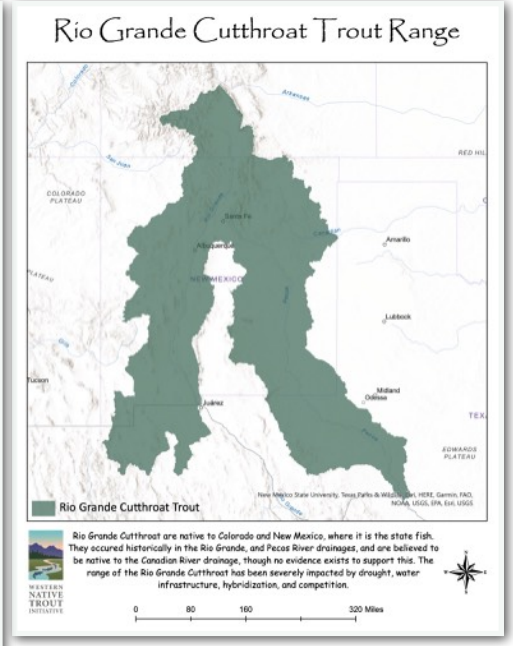
The photograph at the top of the following page was taken by Joel Gilb and is shown here via iNaturalist and a Creative Commons license.

The Turner Endangered Species Fund is active in restoration efforts associated with this species. Their website (August 28, 2024) states, "Listed as threatened under the Endangered Species Act in 2002, the Chiricahua leopard frog has suffered significant population declines due to factors including disease, invasive species, habitat degradation and drought. The Turner Endangered Species Fund and our conservation partners are using the Ladder to conserve and expand wild populations, maintain a captive breeding and refugia program, and conduct research to advance conservation of the species. The Ladder is the focal point for range-wide recovery of the Chiricahua leopard frog. "

Others, of course, are engaged in this effort. The project in Arizona is described in "Chiricahua Leopard Frog Management in Southern Arizona", by Whitney Noel, Julia Sittig, and Elsie Gornish, the University of Arizona Cooperative Extension Service, January 2023.

Like many other amphibian species, the Chiricahua Leopard Frog has been negatively affected by *Batrachochytrium dendrobatidis* (the amphibian chytrid fungus), which causes the disease chytridiomycosis. This fungus is thought to be native to East Asia and to have originally been spread by infected amphibians sold in the pet trade. More than 500 species have suffered significantly as a result of the spread of this fungus and more than ninety amphibian species have been driven to extinction. As a fungus, it can affect entire reaches or even entire water systems, complicating any restoration or reintroduction programs immensely.

A side note is prudent at this point. The assessment of the number of species affected by this fungus is from a paper by B. C. Scheele, published in *Science* in March of 2019. (See Ben C. Scheele et al., "Amphibian fungal panzootic causes catastrophic and ongoing loss of biodiversity", *Science* 363, 1459-1463, 2019.)




The methodology employed in that study has been challenged. (See Max R. Lambert et al., "Comment on 'Amphibian fungal panzootic causes catastrophic and ongoing loss of biodiversity'", *Science* 367, eaay1838[2020], DOI:10.1126/science.aay1838.) Lambert et al. argue that "Chytridiomycosis has irrefutably harmed amphibians. Existing evidence already warrants actions to mitigate chytridiomycosis. However, methodological and transparency issues leave Scheele *et al.*'s conclusions largely unsubstantiated." This, of course, elicited a response (See Ben C. Scheele et al., "Response to Comment on 'Amphibian fungal panzootic causes catastrophic and ongoing loss of biodiversity' ", *Science* 367, eaay2905(2020), DOI:10.1126/science.aay2905). Depending on where you entered the fray your impression of the importance of the fungal infection in the demise and diminishment of amphibian species will vary.

## Rio Grande Cutthroat Trout (*Oncorhynchus clarkii virginalis*), Rio Grande Sucker (*Pantosteus plebeius*), and Rio Grande Chub (*Gila pandora*)

The Turner Endangered Species Fund is active in restoration efforts associated with these species. Their website (August 28, 2024) states that "Las Animas Creek on the Ladder and adjacent Gila National Forest is the southernmost known historical locale of Rio Grande cutthroat trout. Unfortunately, other, non-native trout were stocked in the stream in the past and the native cutthroat trout were extirpated. Ladder has worked with the U.S. Forest Service and New Mexico Game and Fish to restore the imperiled native community of Rio Grande cutthroat trout, Rio Grande sucker, and Rio Grande chub in Las Animas Creek, and conserve the sucker and chub in other watersheds on the Ladder."

An assessment of the Rio Grande Cutthroat Trout population and ecology was made in May 2016 and, although dated, still provides useful information. See: Rio Grande Cutthroat Trout.

In reference to the Rio Grande Sucker the U. S. Fish and Wildlife Service notes that "Populations have been impacted from reduced flows due to increased temperatures and dewatering, as well as habitat degradation from channelization of streams and trans-basin water diversions. Non-native species like northern pike (*Esox lucius*), brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) prey on Rio Grande suckers, while white suckers (*Catostomus commersonii*) compete for limited resources like food and spawning habitat and can hybridize with their Rio Grande cousins."

On June 20, 2024, the U. S. Fish and Wildlife Service announced that the Rio Grande Chub was "not warranted for Listing as Endangered or Threatened Species" status. At page 51867 they provide the basis of this assessment.

In that same Federal Register listing (and at the same link) the U.S. Fish and Wildlife Service made the same determination for the Rio Grande Sucker. The argument they present for not listing the species is provided on page 51867.

At the time the Federal Register notice was issued the contact given for additional information was Shawn Sartorius, Field Supervisor, New Mexico Ecological Services Office, shawn_sartorius@fws.gov, 505-346-2525.

## Gila Trout *Oncorhynchus gilae*

The presentation abstract of Ryder J. Paggen (New Mexico Department of Game and Fish) at the 9th NHGS reads:

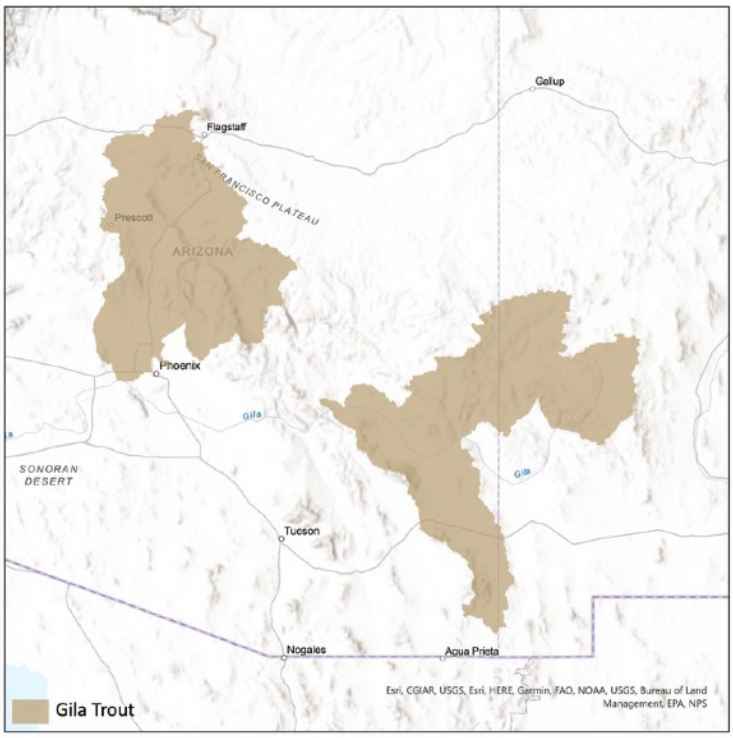
"The 2012 Whitewater Baldy Fire negatively affected many Gila trout (*Oncorhynchus gilae*) populations in New Mexico and significantly hampered recovery of the species.


**However, it did provide restoration opportunities for several Gila trout streams, including Whitewater Creek. For the last seven years, the New Mexico Department of Game and Fish has been working with the U. S. Forest Service, U.S. Fish and Wildlife Service, and local communities to restore Gila trout to the Whitewater Creek drainage. The project required three piscicide treatments of rotenone to remove all nonnative trout. Removal success was then verified with over 200 environmental DNA samples and thousands of seconds of electro-fishing. Over 40 helicopter flights and 150 mule loads were required to deliver gear and personnel to the project area. Currently, over 25,000 Gila trout have been repatriated to the drainage with a third stocking planned for August 2022. Whitewater Creek is expected to be one of the most robust populations of Gila trout, providing significant contributions to recovery and a great angling opportunity for local communities."**

**On September 14, 2022, the U. S. Fish and Wildlife Service announced its final revised recovery program for the Gila Trout. See this link. This document contains a substantial amount of information about the natural history of this species and how it has been affected by the human community.**

**In his presentation abstract Paggen noted the effects of the Whitewater Baldy Fire. Since that fire there have been several other fires in the greater Gila area including the mega**

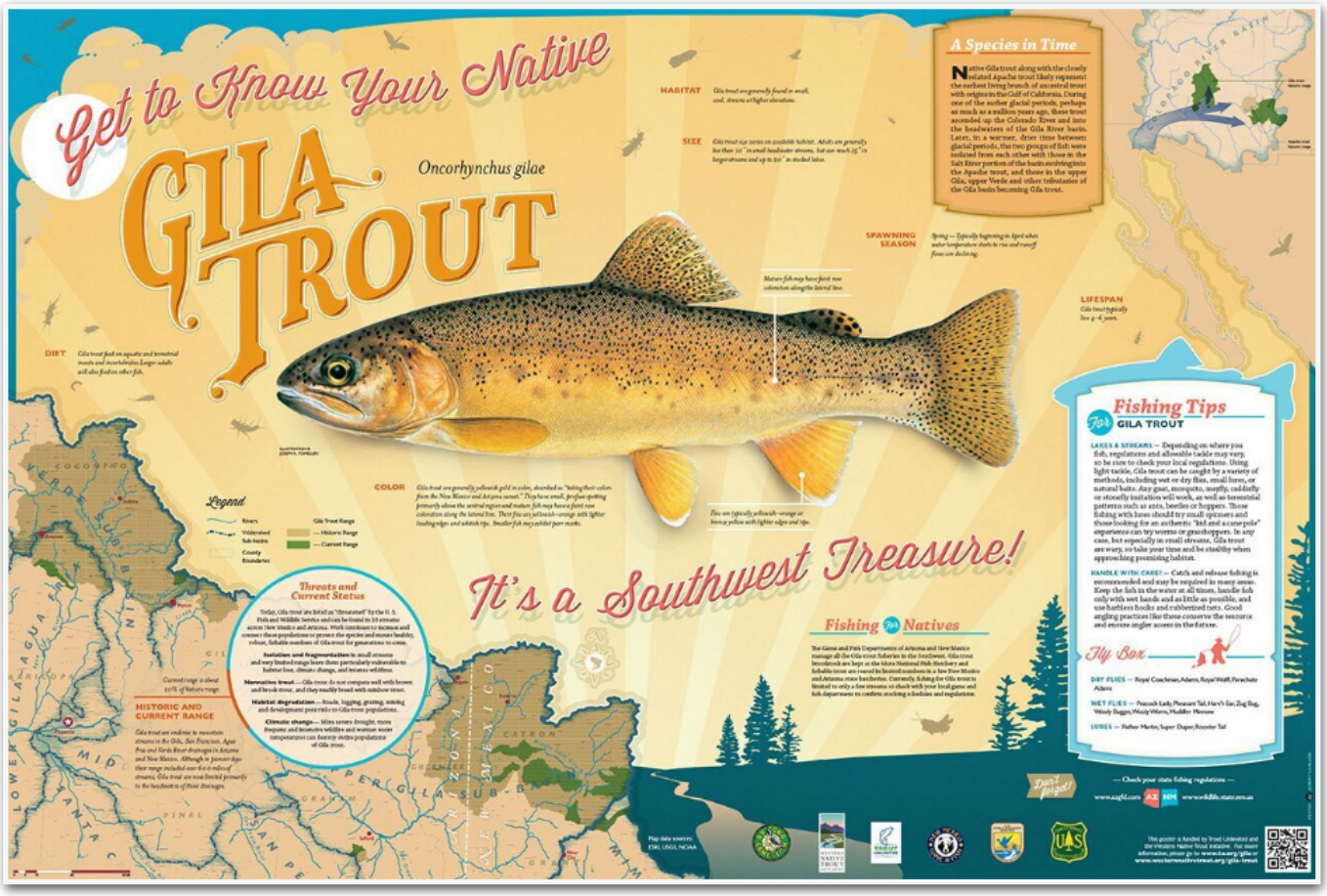
Gila Trout Range




The Gila Trout is one of the rarest trout species in the United States, found in New Mexico and Arizona. By the 1950s, its range was reduced to only four streams in the Gila River headwaters in New Mexico. The Gila Trout was listed as federally endangered in 1967 and re-classified as threatened in 2006 after efforts to restore populations were successful. Currently, five remnant lineages exist, and there are pure populations of Gila Trout in 21 streams in New Mexico and four streams in Arizona.

0 45 90 180 Miles

WESTERN NATIVE TROUT INITIATIVE




**Silver and Black Fires in the Black Range. This journal has discussed the substantial impact that these fires had on the Black Range in previous issues of this journal.**

**These fires presented particular challenges for the Gila Trout. Significant heavily-laden debris flows followed the fires, this as well as the challenges created by fire ravaging the native habitat of the species. Forest Service efforts to minimize these effects included Gila Trout rescue in Diamond Creek, including helicopter relocation documented in the left column of the next page. Photographs by USDA Forest Service.**

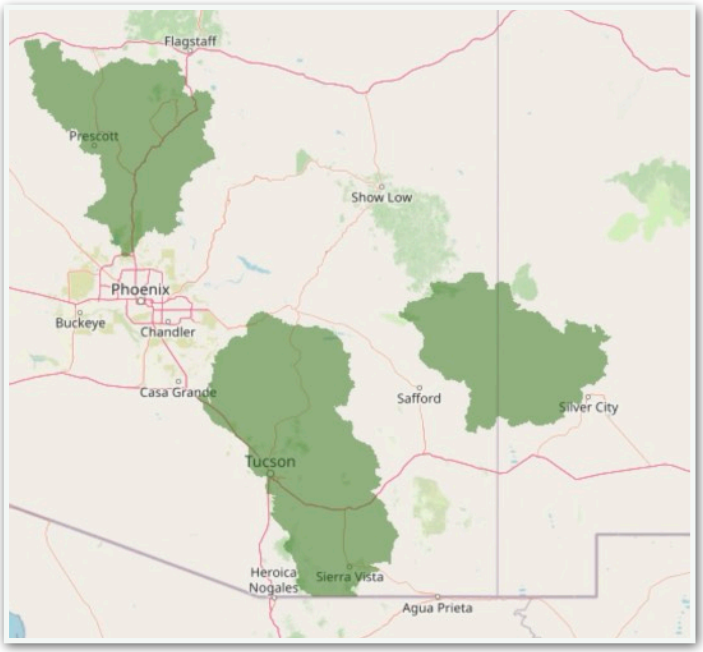

## Northern Mexican Gartersnake
## *Thamnophis eques*

**This is another species being studied rigorously as part of a population stabilization and reintroduction program. It is a threatened species with a native range which extends from central and southeast Arizona to west-central New Mexico. *In Northern Mexican Gartersnake Demographics and Movement Ecology* (Cooperative Science Series #158-2024, U. S. Fish and Wildlife Service) Javan Bauder, Anthony Pawlicki, and Matt Goode describe their study of this species in southeastern Arizona and along the way impart a nuanced description of the natural history of the species.**

## Gila Chub, *Gila intermedia*

**At the 9th NHGS Kelsie Field (New Mexico State University) made a presentation entitled "Habitat suitability and predictive analytics for informing a repatriation of an endangered desert fish". The abstract from that presentation reads: "Repatriation is a critical element in the recovery strategy for the endangered, endemic desert fish, Gila Chub (*Gila intermedia*). Replications of populations are critical to ensure resiliency to environmental pressures. However, the lack of suitable habitat at the repatriation site is understood to be a contributing factor for failed repatriation attempts. Our goal will be to provide suitable repatriation recommendations based on a systematic habitat assessment of extant populations in Arizona and New Mexico, as well as extirpated populations in New Mexico...."**

**The current range of this species is shown in the US Fish and Wildlife Service map below. It includes that part of the Gila which lies to the west of the Black Range.**




## Summary

**Reintroduction programs are hard. They are complex. They are multi-variant. And as we continue to heat up the Earth, the need for such programs will increase and they will become more difficult. The messes we make are always more difficult to clean up than they are to make.**

## *Lycostomus (Lycus) loripes*

**At the end of August 2024 we were able to update the photo gallery of *Lycostomus loripes* on the Black Range Website.**

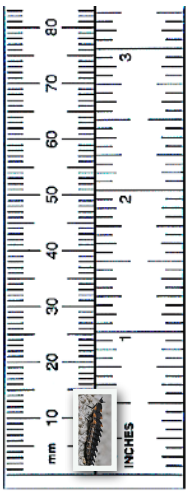
**In July 2022 we had photographed adult flying beetles (center top of the following page) in Hillsboro. We identified the species as *Lycus loripes*. It now appears that Latin binomial has been superseded by *Lycostomus loripes* (Chevrolat, 1835).**

**In September of 2018 I had photographed an instar of what I believe to be this species (females of the species are very similar in appearance to the last instar) but had not identified it.**

**In early August 2024 I concluded that the larval instar photographs were *Lycostomus loripes* based on general appearance and the presences of adults here at the appropriate times.**

**There are many species of these Net-winged Beetles (*Lycidae*), several of which may be found in our area. I have not been able to find photographs of any instar of this species, however. There is a general lack of information about both the genus and the species. Most of the published material is about Eurasian species.**

**The larval instar photographs on this page were taken on August 27, 2024, in Hillsboro. Watch video of this individual at this link.**




**These are small creatures. The photograph at the center of this page has been reduced to scale on the ruler to the right.**

**The general form and shape of this instar is similar to that of some species of lightning bugs and ladybugs.**

**The material at the upper right on the following page is from Thomas Eisner, Frank Schroeder, Noel Snyder, Jacqualine Grant, Dabiel Aneshansley, David Utterback, Jerrod Meinwald, and Maria Eisner. "Defensive Chemistry of Lycid Beetles and of Mimetic Cerambycid Beetles that Feed on Them". *Chemoecology,* February 2008. As noted in the abstract to this study: "Beetles of the family *Lycidae* have long been known to be chemically protected. We present evidence that North American species of the lycid genera *Calopteron* and *Lycus* are rejected by thrushes, wolf spiders, and orb-weaving spiders, and that they contain a systemic compound that could account, at least in part, for this unacceptability. This compound, a novel acetylenic acid**

**that we named lycidic acid, proved actively deterrent in feeding tests with wolf spiders and coccinellid beetles."**

**This material is provided to show similar looking species and as a warning - don't eat this beetle.**

**When a species is "chemically protected" it is likely that other species will mimic its appearance to gain some protection from predators. Whereas the study cited above looked at the nature and efficacy of this chemical protection, earlier studies looked at the mimicry which resulted from its presence. This mimicry was reported on by E. G. Linsley, T. Eisner, and A. B. Klots, in "Mimetic Assemblages of Sibling Species of Lycid Beetles", *Evolution* 15, pp. 15-29, March 1961. An example of their findings is shown at the bottom of the next page.**

**Researchers, being researchers, are known to test concepts. The March 1961 study includes the following statement: "Three specimens that were chewed and swallowed by one of us (two of the *loripes* and one of the *fernandezi* type) had no apparent astringency or ill flavor of any kind. A faint odor, vaguely resembling fresh hay, characterized the living beetles, and persisted for at least several days in pinned specimens."**

**H. C. Fall & T. D. A. Cockerell reported *Lycus loripes* from the Magdalena Mountains in an article entitled "The Coleoptera of New Mexico" in 1907. It appeared in *Transactions of the American Entomological Society*, 1907, Vol. 33, pp. 145-272.**

**Our research on *Lycostomus loripes* (Chevrolat, 1835) led contributors to provide material on other Net-winged Beetles.**

## *Lycostomus sanguineus*

**The photograph of a Net-winged Beetle on an Apache Plume flower shown at the top of the next page was taken by Gordon Berman in 2011. Again, these are small creatures. The individual shown here is possibly *Lycostomus sanguineus* (Gorham 1884). The type specimen for this species is maintained at Harvard University's Museum of Comparative Zoology and is shown at bottom right. That specimen was collected near Prescott, Arizona. The collection date and the name of the collector are not recorded.**

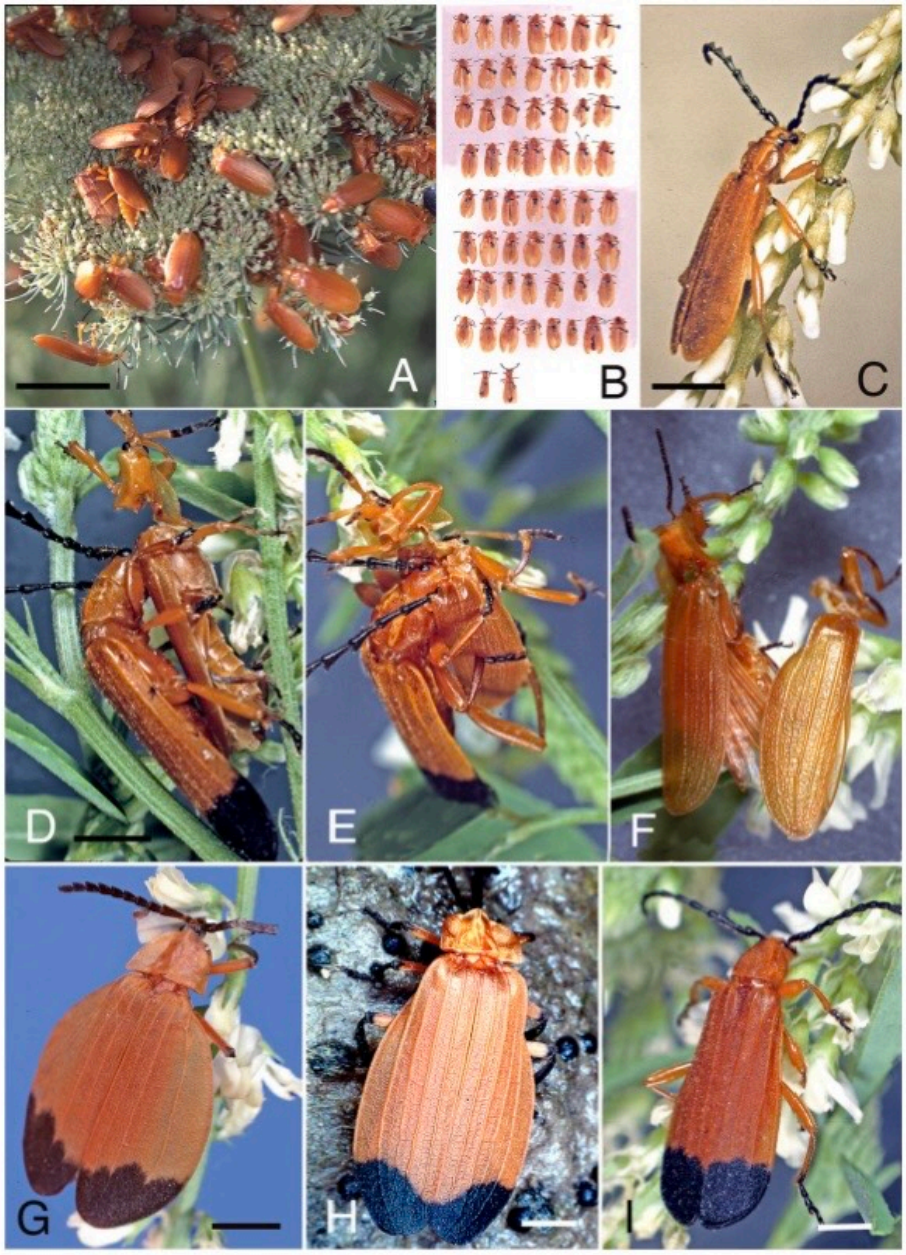



**Fig. 2.**
**(A)** Detail of an aggregation of *Lycus loripes*, Arizona (photo by Noel Snyder). **(B)** Sample taken from one such aggregation, showing the skewed ratio of model to mimic. The latter, *Elytroleptus ignitus*, is represented by the two specimens in the bottom row. **(C)** *E. ignitus*. **(D–F)** Stages in the consumption of a lycid (*L. loripes*) by an *Elytroleptus* (the latter in this case is an *E. apicales*, a mimic not of *L. loripes*, but of *L. fernandezi*; in the laboratory *Elytroleptus* do not discriminate between these lycids. In **(D)** and **(E)** the cerambycid is chewing into the thorax of its victim; **(F)** shows the leftovers of the meal (it is quite typical for *Elytroleptus* to eat only a portion of its prey.) **(G–I)** The principal members of the *Lycus fernandezi* mimetic complex: **(G)** *L. fernandezi*; **(H)** *L. arizonensis;* **(I)** *Elytroleptus apicalis.* (Reference bars: A = 10 mm; C, D, G–I = 2mm)

**BugGuide has an image of an instar identified to this species which looks very similar to the instar shown at the beginning of this article. That image page states that "other Lycus larvae are colored differently and (are) not surface ambulatory". That statement would argue that the instar on the previous page might be this species. Both *L. sanguineus* and *L. loripes* are found in this area. The contributor of that specimen thought that it might be *L. fernandezi*, which is also found in this area. No material has been found to support the statement that other *Lycostomus* instars are not surface ambulatory and, as noted elsewhere, instar images identified to species in this genus are rare and inconclusive. What does all this mean? Question authority, even the judgment of the editor.**

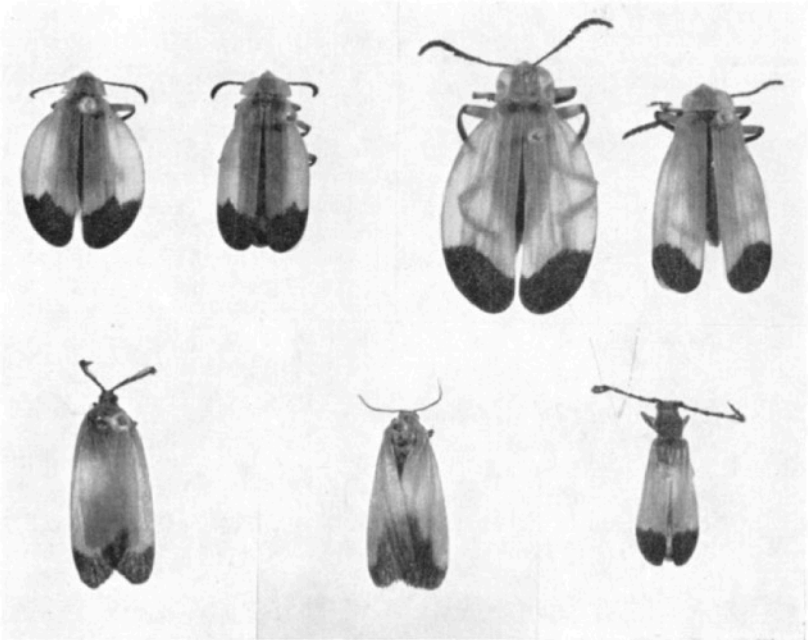
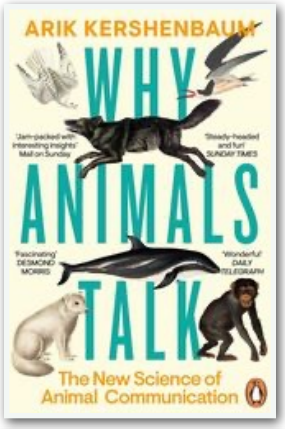
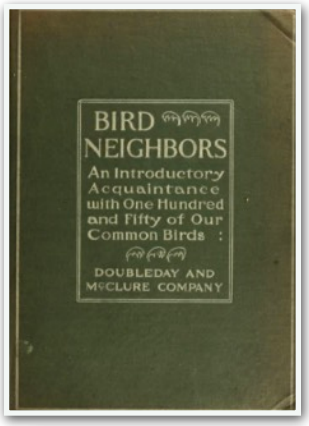


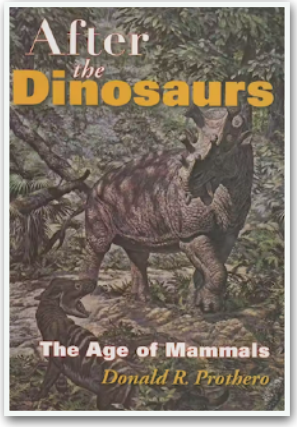
FIG. 2. The *Lycus fernandezi* mimetic complex. Upper left, *L. fernandezi* Dugés (male left, female right); upper right, *L. arizonensis* Green (male left, female right); lower left, *Seryda constans* (Henry Edwards), lower center, *Ptychoglene coccinea* (Henry Edwards), lower right, *Elytroleptus apicalis* LeConte.

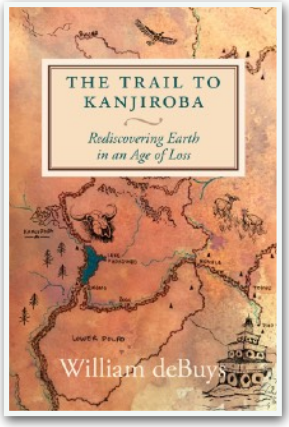
# What People Are Reading and Listening To

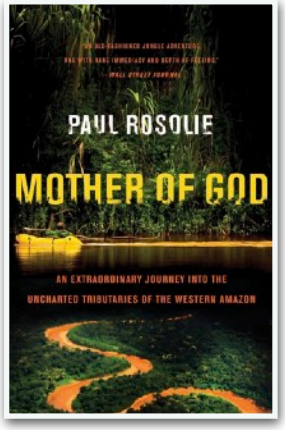







## Why Animals Talk

A full review of this book is available at this link. That review correctly notes that one of the fundamental concepts which the book is based on is "Why animals need to talk is the important question to ask before we can answer how and what animals are saying." (p. 14 of the book)

I decided to give this book a try even though the title was a bit trite, or at least I thought it was. It seemed a bit too "new agey". But that impression was soon dispelled as Kershenbaum went about presenting a balanced, nuanced, and comprehensive discussion of the topic. This is not the work of a "science writer" but rather that of a research practitioner who has worked in the field for decades. From his perspective, "why do it, for what purpose", is the fundamental question which we must ask ourselves before venturing far into this topic.

A good read/listen. Although the species examples are informative, it is the body of the work which is most profound.

## Nature's Garden & Bird Neighbors

One hundred and twenty-five years ago *Nature's Garden: An Aid to Knowledge of our Wild Flowers and their Insect Visitors*, by Neltje Blanchan (Blanchan De Graff Doubleday) was published. I have just now gotten around to looking at it - something of a backlog I suppose.

At 125, and with a focus far from the Black Range, you might question its utility. This is a great book, a useful resource, and a reminder of the type of material generally available at the time the Black Range was winding down from the mining era. The flowery (pun very definitely intended) prose of this book is typical of nature writing of the day and might lead us to dismiss the work as lacking seriousness. That would be a mistake; it is loaded with information.

Neltje Blanchan, Neltje Blanchan De Graff, Neltje Doubleday, whatever you wish to call her, published 11 books under her pen name (Neltje Blanchan) with a focus on flowers, birds, and indigenous people.

Doubleday used a (flower) color key to organize her work, much like many popular botanical books of this age. She went beyond the flowers to discuss the natural history of the insect/flower relationship. This book really has a lot of information in it and is much more interesting than a simple catalog of flora in a specific area with a general description of the species.

*Nature's Garden* was not the first major publication success which she enjoyed. In 1897, she had published *Bird Neighbors* (which sold over a quarter of a million copies - an extremely respectable sales figure, even in today's inflated global market). John Burroughs wrote the forward.

The photographs in *Bird Neighbors* are obviously of dioramas and the quality of the printed image is typical of the time. But note that the photograph of a Rose-breasted Grosbeak, below, is in color and,

except for the nesting behavior, could have been taken out the window here in Hillsboro.

These books are included as a reminder of where we have come from and the, often joyful, accomplishments of the past.

## After The Dinosaurs

The publisher's review may be read at this link. At times this book is just a laundry list of family and genera names but if you are able to get past

that material you are treated to some insight about the flora and fauna relationships and the movement of species worldwide. Worth the effort, but sometimes it is an effort.

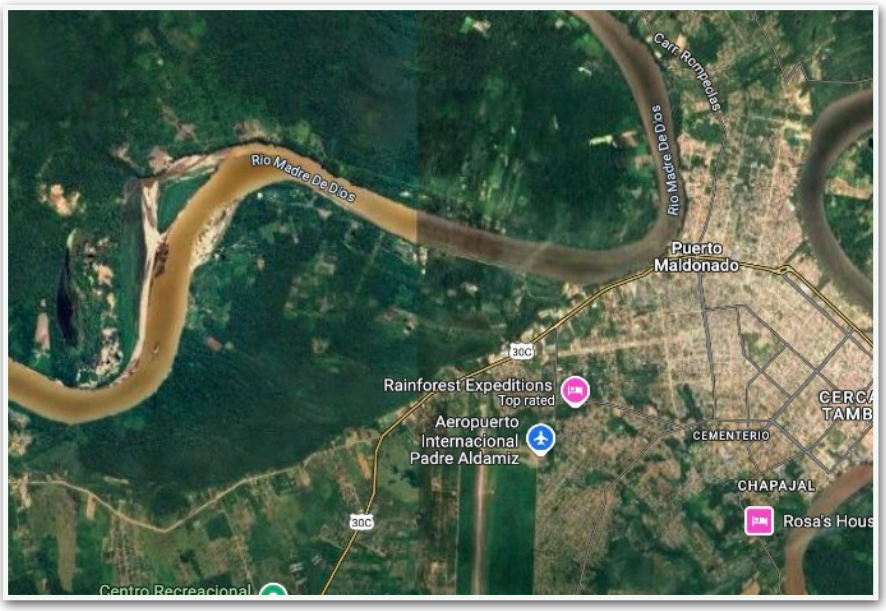
## The Trail to Kanjiroba – Rediscovering Earth in an Age of Loss

William deBuys is an award winning New Mexican writer (including a Pulitzer Prize finalist) keenly attuned to the people, ecosystems, lifeways, and history of our state. Among his 10 books are the deeply loved *River of Traps, The Walk,* and *Enchantment and Exploitation*, telling the intimate history of northern New Mexico. He was also the founding chair of the Valles Caldera Trust and is an internationally respected conservationist.

The review below first appeared in the November-December 2024 issue of the *Hillsboro Community Library News*, Volume 19, Number 6.

"This summer, I twice had the accidental privilege, and gift, of hearing Mr. deBuys speak at the Santa Fe Literary Festival and again at the New Mexico Native Plant Society. At the latter venue he was the Keynote Speaker and addressed his remarks to his most recent book – The Trail to Kanjiroba: Rediscovering Earth in an Age of Loss.

Mr. deBuys explained this is the third book in a trilogy he had no thought to write (starting with *A Great Aridness* followed by *The Last Unicorn*). In 2016 he found himself in a state of depression, grief, and anger, very nearly despair, over the human triggered alteration of Earth's ecology and biosphere, including the eminent collapse of ecosystems our species and uncounted others depend on and love. Then he spontaneously joined a friend's nomadic medical mission to ancient, isolated villages in one of the harshest places where humans can live - the Upper Dolpo of Nepal. The land he describes is of breathtaking, perhaps inhuman beauty, and the trail through it immensely difficult both physically and emotionally. What he learned on the way, however, was the grace of "earthcare", the




compassionate triage, hospice for the Earth, the species thereof, and its caregivers. Although Earth and all its life is not dying and only some species (perhaps ours) will be lost, life in some form will persist until the sun goes nova or collapses into a frozen cinder. However, we are now a major force of changes that used to require a super volcano or an asteroid strike to equal. We will dictate which species make it onto the Ark, and which will not. Useful, beautiful, beloved, ancient, rare? And how to find peace with those eternal losses for ourselves.

In the final chapters deBuys discusses 7 possible processes which could alter, or at least ameliorate, the road of severe climate change – already harder and faster than originally projected (or hoped)- which we are on.

When he stopped speaking, there was silence in the auditorium for several moments before the whole place erupted into a long, standing, ovation. Behind me a woman said "That was not a conference keynote address. That was the Sermon on the Mount, and now I believe". Me, too.

If planting one tree that will grow to shade one patch of ground and take one quart of CO2 from the air to grow one green leaf that makes one grasshopper happy that then feeds one bright kestrel's nestling. That is one step on the trail.

Long journeys are made up of single steps."

Review by Kathleen Blair

## Mother of God

The title of Paul Rosolie's book, *Mother of God*, takes its name from the Rio Madre De Dios which is located in southeastern Peru, northwestern Bolivia, and western Brazil. Rio Madre De Dios is a major river, but much of the book centers on Rosolie's time in the Peruvian reach west of Puerto Maldonado. I can't claim to know the area very well but I have been there. As he described his time in the area, the fact that I knew firsthand what he was referencing made me more in awe of the jungle when I was supposed to be, angrier (if that is possible) when he described the human devastation of the area, more annoyed at the drama which occasionally crept into the book.

A good summary of the book is depicted in the satellite view of the area shown above. Where the river once flowed through pristine, highly diverse, extraordinarily beautiful jungle there are now farms, ranches, towns, even small cities. There is a segment of humanity which believes that is a good thing.

Sometimes this book is an Amazonian adventure story, sometimes it grows philosophical about humanity's misdeeds, sometimes it is a story about personal relationships. In the

end, the reader is left with as good an understanding as one can get from a book, about a place and the failings of humanity.

The map is nice and clear. On the ground the destruction created by miners, loggers, and ranchers is incredible. That is a hard message to be reminded of, in case you are ever able to forget it.

The book starts with a description of being in a thunderstorm flowing through the jungle. It was one of those "been there, done that, don't really want to do that again" descriptions that brought back some vivid memories of standing beside my son on a jungle trail with our heads craned back looking skyward, the gushing rain running off our faces. It is not that we wanted to see the massive trees being tied in knots, or bending half over, of suddenly being lit by lightening, returning to a dark and dismal display of shifting shadows just as quickly. No it was about watching for the falling branches, some as big as any tree which grows in the Black Range. It was a fool's errand. What were we to do if one came falling from the sky, just as fast as the rain? Nothing. Such limbs and trees crush a half acre when they land, and it all happens fast, really fast. The front of the storm raged on; we heard the roar, a roar which many have described as sitting on a bridge trestle as a train crosses a few inches above, for a long time as the wind, but not the rain, subsided and the front passed over and through the jungle. The earthquakes created by the landing of large branches and trees diminished and we continued on the trail, now more slippery than before, and thought about getting out of the rain.

Yep, that is what happened. Rosolie described his experiences with such weather fronts and I remember mine, even that sick feeling in my stomach. I was hooked.

A good read and a terrible reminder, tinged with hope.

- R. A. Barnes
Hillsboro

## Raptors of New Mexico & Wild Carnivores of New Mexico

This review by Harley Shaw, Hillsboro, first appeared in the November-December 2024 issue of the *Hillsboro Community Library News*, Volume 20, Number 1.

*Raptors of New Mexico* is edited by Jean-Luc E. Cartron. *Wild Carnivores of New Mexico* is edited by Jean-Luc E. Cartron and Jennifer K. Frey.

I won't suggest that anyone do as I did and read these cover to cover. It takes a lot of time, but should you take them on, odds are that you'll learn a lot. I did, and I've been studying wildlands and wild species in the Southwest since about 1955--just a year short of 70 years. These two books convinced me that I am still way behind in knowledge on most wild critters. Scientific study of predators has bloomed in the last 30 years, due to advances in remote monitoring of species and their habitats, along with the ability of computers to process large volumes of data. New facts don't stick to my gray matter the way they did 50 years ago, and modern statistics and modeling leave me befuddled, so I truly appreciate such massive compilations of clear and readable information.

These are reference books, not field guides designed to fit in a pocket of your vest. *Raptors*, published in 2010, has 718 pages and weighs 4.5 pounds. *Wild Carnivores*, published in 2023, has 1123 pages, weighs about 6.4 pounds. I can imagine that lead editor, Jean-Luc Cartron, spent much of the first 23 years of Century 21 finding qualified authors, nudging them along, writing his own chapters, and reviewing, editing, and herding the manuscripts through publication. Although research on the avian species discussed will undoubtedly continue, *Raptors of New Mexico* will endure as a baseline for field studies of the 37 species of hawks, owls, and vultures that reside at least seasonally in our state. A final chapter of the book acknowledges incidental occurrence of another 7 species that make brief and/or irregular appearances in our state. For *Wild Carnivores of New Mexico*, Cartron recruited co-editor Jennifer Frey, the long- tenured mammalogy prof at NMSU. They have assembled information on an amazing array of mammalian carnivores that includes not only those known to be currently extant, such as coyotes, cougars, gray foxes, raccoons, and black bears, but also those extirpated in the past 100 years such as black-footed ferrets, Mexican gray wolves, brown bear (ergo grizzly), and American mink. They also discuss species for which New Mexico records appear sparsely, surprisingly including the Pacific martin, American ermine, wolverine, and Canada lynx, seeping in from Rocky Mountains states to the north; and jaguars wandering in from Mexico. Interestingly, no records of ocelot occur, although this species has been found in the bordering states of Texas and Arizona.

Even if you choose to not consume the full volumes, the pages up to 67 in Raptors and 117 in Wild Carnivores are worth reading for a current perspective on basic ecology and management of the species covered. A chapter that I found fascinating in Wild Carnivores at the end of the book assesses free ranging domestic dogs and cats as wild predators. I was fascinated by the amount of research that has been done on tabbies and Fidos gone wild, and I plan to read this chapter again, more slowly.

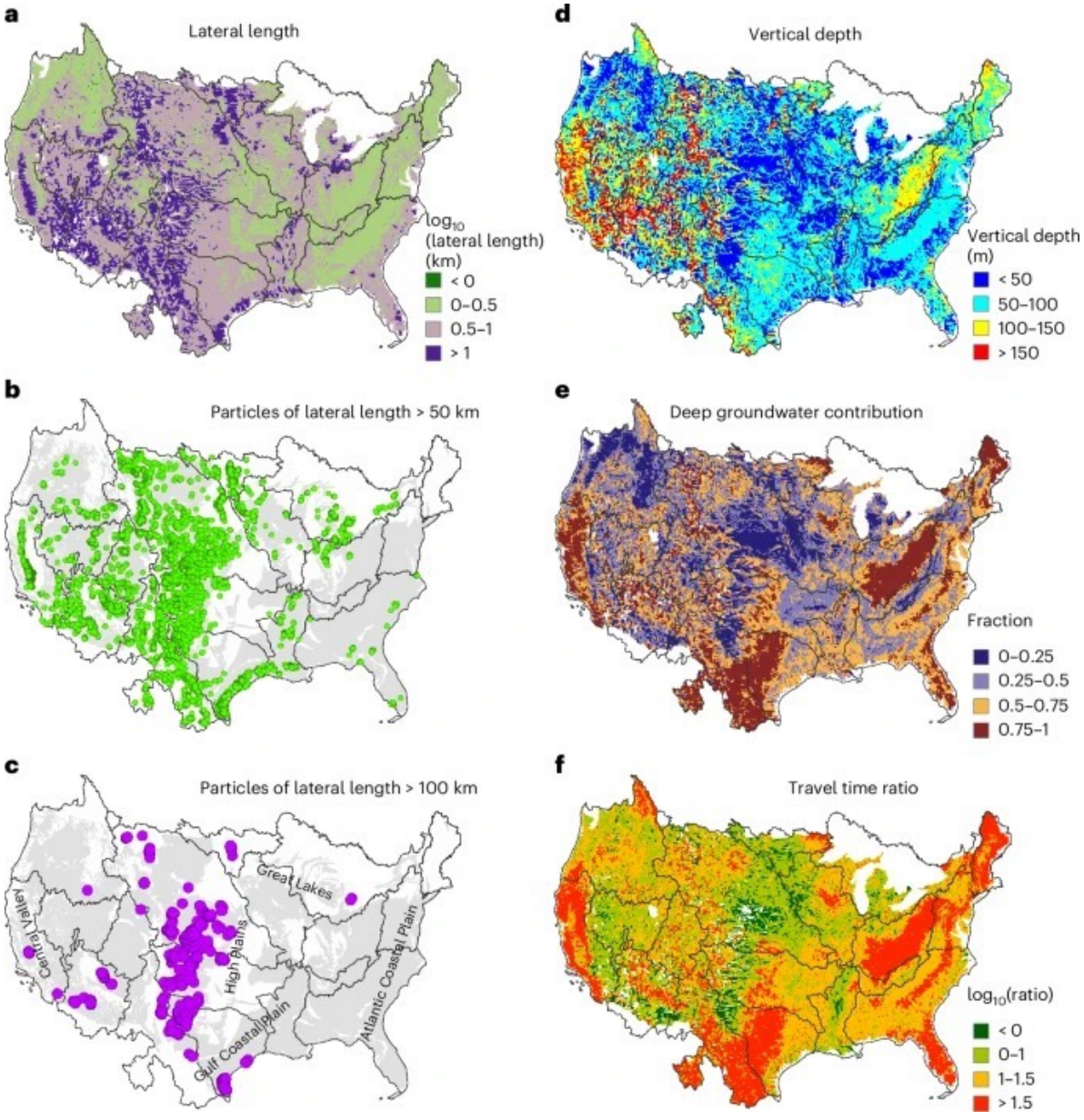
Finally, each chapter has an ample bibliography in case you might want to go to the sources, and both books have lengthy appendices presenting details regarding locations of study materials and background data about scarce or poorly-known species. These volumes present so much material that a full review would be overwhelming. Suffice to say that these will be starting points for finding facts on predaceous birds and mammals in New Mexico for decades to come.


## Understanding Our Groundwater

We have noted the significant degree to which New Mexico water law matches fantasy many times in the past. We leave the legal rule making to lawyers, fantasy football league players, monied interests, and politicians. We have enough trouble trying to understand reality.

And the understanding of something which is unseen, operationally complex (growing ever more so with every bit of knowledge we gain about it), and influenced by myriad outside systems is hard. And the more honest a person is, the harder it is to understand groundwater. Much easier to read law, pick the ultimate cornerback, and look at the checkbooks of those who have and who determine the polling results.

Nonetheless, we try. In "Black Range Surface and Groundwater" (Volume 4, Number 3), pp. 33-38, we explored the implications of long-term drought and the nature of the karst topography which exists in much of the




**Groundwater of lateral lengths larger than 50 km are common, and deep groundwater from consolidated sediments substantially contributes to streamflow. a–f, This figure plots the lateral length from stream (discharge location) to land surface (recharge location) over CONUS (a), the discharge locations of particles with lateral length >50 km (b), the discharge locations of particles with lateral length >100 km (c), the vertical depth across CONUS (d), the fraction of deep groundwater to streamflow over CONUS (e) and the ratio of travel time in consolidated sediments to that in unconsolidated sediments spent by a flow path (f). Note that variables in a and d–f are averaged at the subbasin scale (Methods), grey lines are HUC2 watershed boundaries and grey areas in b and c are US major aquifers. (This figure is from the study cited on the next page.)**

Black Range. In "Black Range Soils" and "Groundwater and Ephemeral Streams" (Volume 8, Number 1) we discussed Black Range watersheds and the contributions of ephemeral streams to permanently flowing water systems.

In "Unraveling groundwater-stream connections over the continental United States", Chen Yang, Laura Condon, and Reed Maxwell (*Nature Water*, 06 January 2025) discuss the findings of their modeling of the water systems of the "lower 48" (and immediately adjacent areas) of the United States. This is an information-dense article, and slow reading is (was for me) required.

They found that water tended to flow underground for longer distances than anticipated (in the west, for instance, distances of more than 50 km were common) and at greater depths (greater depths were generally associated with steep gradients), that the age of water (time it entered the ground to the date of measurement) was generally consistent with previous models (that is, in the low thousands of years in the Rio Grande basin), and that there was a substantial amount of water movement between subbasins (read watersheds). They validated their study with 635,000 streamflow and water table observations.

# Tidbits and Follow-ups

## House Finch Leg Color

It has long been postulated that the intensity (brightness) and saturation of color in many species reflect their health, and thus the likelihood that individuals will be a satisfactory breeding partner.

Much of the research in this area has focused on bright colors. Coleman et al.* focused on the leg color of House Finches, *Haemorhous mexicanus*, to determine: 1) if leg color in House Finches is an indicator of health and 2) how subtle color variation can be - are these "signals" limited to changes in bright coloration. They found "that infection with a bacterial pathogen affected house finch leg color. Legs became less bright earlier during infection and then brighter and less saturated later in infection. Taken together, these results show that leg color can encode information about infection status in house finches."

### NSO - Nordic Society Oikos

The *Journal of Avian Biology* regularly publishes peer-reviewed open access research papers. NSO also publishes *Ecography*, *Oikos* (Ecology), *Nordic Journal of Botany*, and *Wildlife Biology*. All publish peer-reviewed open access articles and, as you may have already guessed have an "Old World" slant.

### Ornis Fennica

In the same vein as the NSO offerings is *Ornis Fennica*, the Journal of BirdLife Finland. It too offers peer-reviewed open access articles with an "Old World" slant. But gems abound. Take for instance the book review of *Ecology and conservation of mountain birds* by Chamberlain, D., Lehikoinen, A. & Martin, K. (eds.), *Ecology and conservation of mountain birds*, Cambridge University Press, 2023, 450 pp. https://doi.org/10.1017/9781108938570

They surmised, but did not study the possibility, that melanin pigments played a key role in the color change. For those who have a keen interest in ornithology, the discussion of melanin which is included in this paper is worthy of consideration. They also noted that carotenoids may play a role in the color change, as well, or primarily.

The change in leg color is a quick indicator of infection; plumage changes take longer to announce. Or as the study notes: "In some socially monogamous birds, including house finches, important aspects of pair formation can occur during and prior to the first winter, when many birds have not fully molted into their carotenoid-based, breeding plumage. This is also a time of year when MG infection increases meaning that such signals could be particularly salient in this species. As the birds in this study were collected during that time window, the leg colors they expressed may provide information not yet encoded by plumage-based signals and/or encoded on a different timescale (i.e. not only during molt). Specifically, the browns and greys of legs could provide salient information about infectious status, which could impact pairing decisions, especially across the range of time when plumage signals are not fully developed. However, additional work, such as mate-choice experiments, must be conducted to determine if this pattern truly has consequences for sexual selection." (Footnote references within the quote have been removed by the editor. See the original study.)

*Coleman, S.M., Adelman, J.S. and Tillman, F.E. (2024), "House finch leg color changes with infection", *Journal of Avian Biology*, 2024: e03187.

## Lower Gallinas Canyon Trail

In the January 2025 issue (Vol. 8, Number1) of this journal we included an update and additional information to our Gallinas Canyon Trail entry in Walks in the Black Range Vol. 3.

The first part of this trail (from the Railroad Canyon Campground to the first junction) is sometimes referred to as the Railroad Canyon Trail. On 5 December 2024 Gordon Berman (Las Cruces) noted the following species from this section of the trail:

"12 August 2023: *Delphinium* sp., Western White Clematis (*Clematis ligusticifolia*), Beardlip Penstemon (*Penstemon barbatus*), Nodding Onion (*Allium cernuum*), Abert's Squirrel (*Sciurus aberti*), and Pinewoods Geranium (*Geranium caespitosum*) (with several flies on it).

22 August 2024: Mylitta Crescent (*Phyciodes mylitta*), *Delphinium* sp. - maybe a different species than the one from 2023, Echo Azure (*Celastrina echo*), Scarlet Gilia (*Ipomopsis aggregata*), Desert Ageratina (*Ageratina herbacea*), and Geranium sp."

Ed. Note: Modified by the editor to capitalize common names.

## Longhorn Beetles

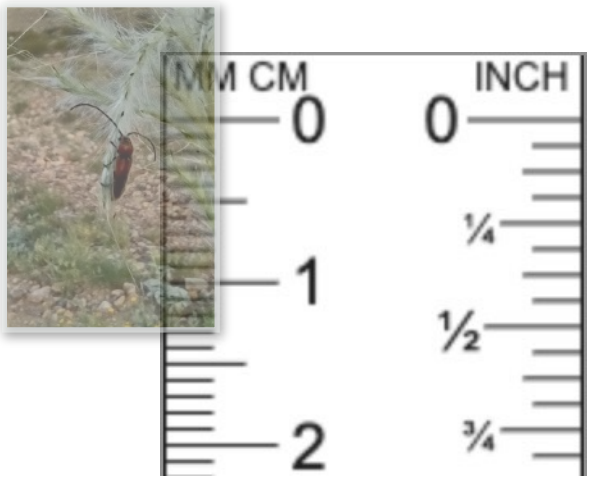
**On September 16, 2024, I was taking an early morning stroll along one of the mining roads east of Hillsboro when I came upon one of the Longhorn Beetle species (shown at the right and bottom left). This individual was very small. The grass seed-head that it was clinging to is gigantic in comparison.**

**Compare this species with another Longhorn Beetle species, *Prionus californicus*, which was featured in this journal a year ago (October 2024, Volume 7, Number 4). It is shown next to a cottonwood leaf in the image directly below.**

**The Family *Cerambycidae* (Longhorn Beetles) has more than 1,000 species in North America,**

**north of the US-Mexico border, and 30,000 species worldwide. Please forgive me for not trying to identify this individual below the family level.**

**That number of species is indicative of the huge range in size which is found across this family, typified by the two species shown here.**



**Gordon Berman provided the photographs of a Longhorn Beetle (*Stenaspis* sp. [*solitaria*?]) on a Catclaw Mimosa.**

**There are two species of *Stenaspis* found in our area, *Stenaspis solitaria* (Say, 1823) appears to be a match for this individual. This species sometimes has a fair amount of red on its antennae, legs, head, and body. Black is apparently the more typical coloration, however, thus the other common name for the species, Say's Solitary Black Bycid. Its range extends from southern California to western Texas, south into northern Mexico.**

**In Texas, the adults are found from May to October. They are often found on plants of the *Mimosoid* clade (Acacia, Mesquite, Mimosa, etc.).**

**Where it is common, this species can often be found flying about on hot days.**

# Caterpillar Feet and Prolegs

**In Volume 6, No. 2 (April 3, 2023) of this journal we described the basic anatomy of a caterpillar and briefly touched on their feet and locomotion style. A topic which we go into in a bit more depth here.**

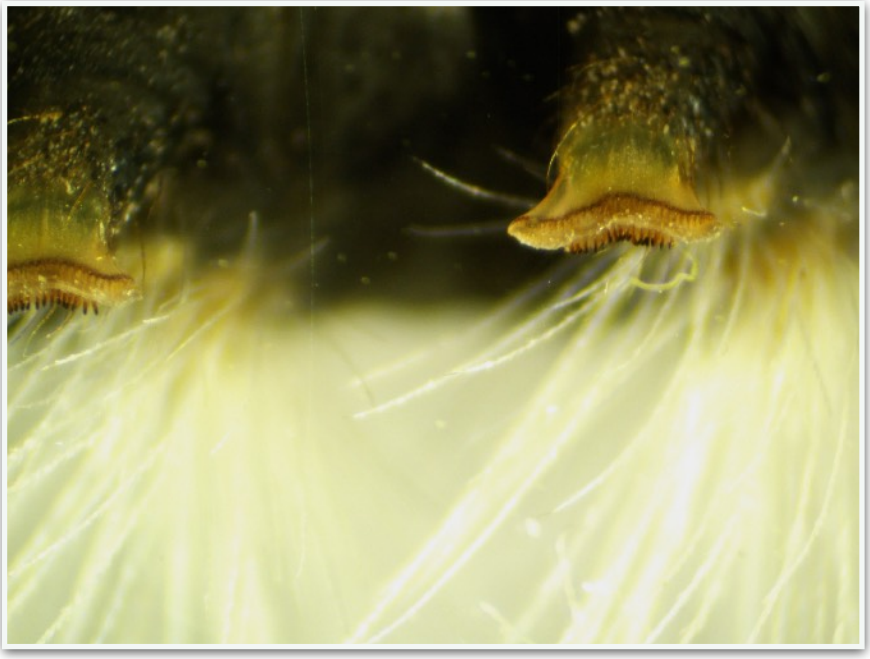
**Caterpillars have 3 pairs of legs, which are on the thorax. The legs are segmented and have joints; each has a small claw at its end. During metamorphosis, these legs will be transformed but will be retained through pupation to the adult stage of the moth or butterfly where they remain attached to the thorax.**

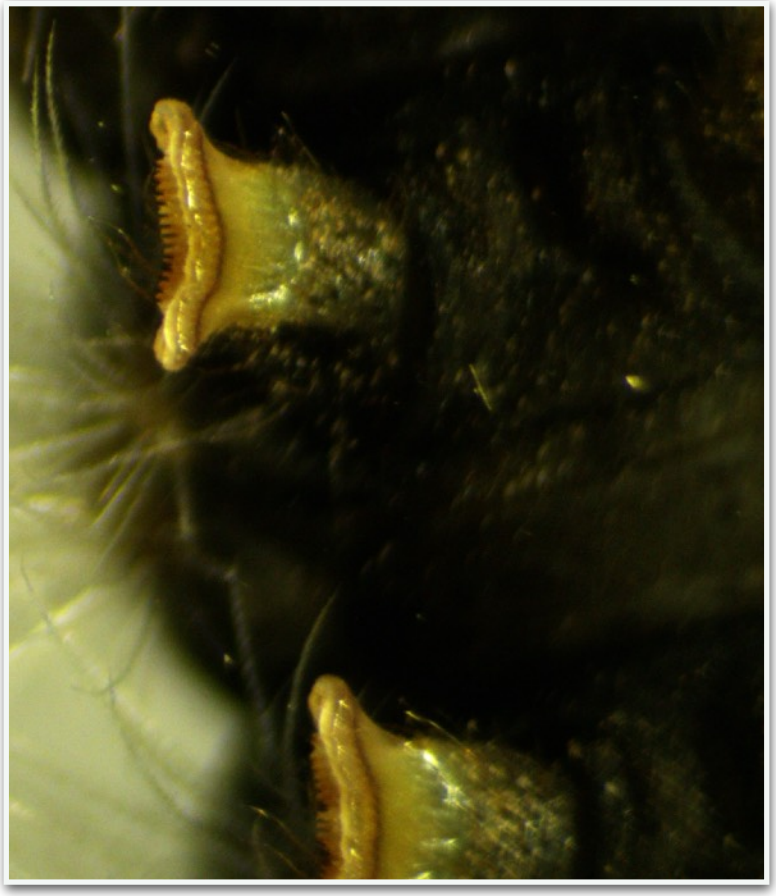
**Butterflies in the family *Nymphalidae* show only two pairs of legs in the adult stage because one pair has atrophied. Compare the Monarch, *Danaus plexippus* (*Nymphalidae*) at the lower right with the Cabbage White, *Pieris rapae*, at the bottom center (family *Pieridae*).**

**Caterpillars also have five or fewer pairs of prolegs, even none. Unlike legs, prolegs are resorbed during metamorphosis, and do not reappear at the adult stage. If one of these legs is lost prior to metamorphosis the adult insect will still have six legs.**

**Prolegs look like fancy suction cups; examples are shown at the right. Prolegs are used to clasp and for walking. The filaments visible at the end of the prolegs at the right are called crochets: each has a "hook" at the end. The crochet hooks something in the substrate the caterpillar is on and forms a holdfast. The caterpillar is not held in place by "muscle power" but rather by simple mechanics.**

**Larvae of other insect species may have more than five pairs of prolegs. If you find a caterpillar with more than five pairs of prolegs it may not be a butterfly or moth caterpillar, it may be another insect (fly, wasp, etc.) larva, even though for all intents and purposes it appears to be the caterpillar of a butterfly or moth.**



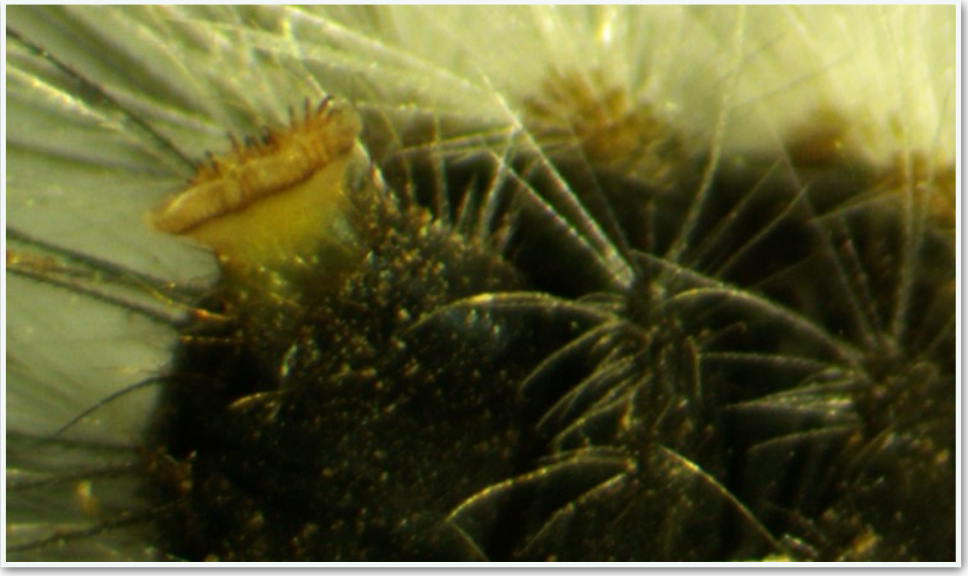


**For any given individual (and for all individuals in the species), there will be the same number of prolegs in the various life stages (multiple instars).**

**Some species of *Hymenoptera* (primarily sawflies and some wasps) have also developed prolegs and use them in the same way, for the same purpose, as those found on butterfly and moth caterpillars.**

**Prolegs are attachment points: attach to something with one set, detach with another and move the body forward, reattach - continue process. Since**

**caterpillars do not have internal skeletons and cannot pressurize parts of their bodies to mimic a skeleton they have to move differently. The sequential attaching and detaching described earlier is the solution. Muscle is used to cause the crochets to attach or detach (causing the proleg to attach or not) and to move part of the body forward.**

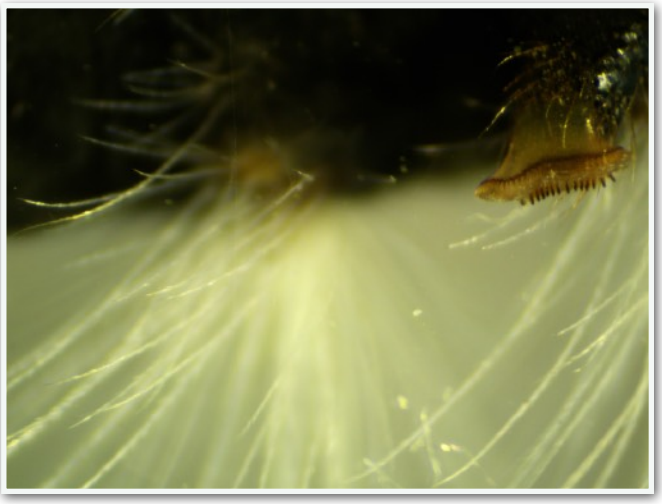


**As in cephalopods this movement process is "decentralized"; it is not controlled by the brain of the caterpillar. Rather the sensory hairs in the proleg detect the need for proleg placement, and the direction of muscle movement and proleg placement is all localized.**

**This is a rather elaborate process but, of course, it is much more complex than what is described here. Take for instance the fact that "the gut which accounts for a substantial part of the caterpillar's weight, moves independently of the body wall during locomotion."***

**(As an aside, a local naturalist was pursuing the study of rattlesnake locomotion a few years ago and posited a similar concept of locomotion for those snakes. Fix on substrate, move body, detach, reattach farther on, move body etc.)**

***Griethuijsen, L & Trimmer, Barry, (2014), "Locomotion in caterpillars", *Biological reviews of the Cambridge Philosophical Society,* 89.10.1111/brv.12073.**



# *Epithelantha micromeris* - Button Cactus

***Epithelantha micromeris*** **(Engelmann 1856) var. *neomexicana* is one of the smallest cacti. Note the 1-cent piece next to the one shown at the right in a photograph by Mike Shoop (Albuquerque). He and Jim Laupan (Hillsboro) found this specimen on 11 December 2024 in the southern Black Range.**

**This species has a limited range, northern Chihuahua in Mexico and adjacent areas in the U. S. borderlands, from Arizona to Texas (basically the Chihuahuan Desert). Some sources list the range as somewhat broader in Mexico.**

**Interestingly, this species is autogamous. Although "self-fertile", it requires a pollinator to fertilize the flower. (Self-fertilization, technically, means that no outside entity is required by a plant to transfer the pollen from the anther to the stigma.)**

**This species is known by several different common names, including Ping-pong Ball Cactus, Button Cactus, and Common Button Cactus. It has a number of scientific synonyms and was originally placed in *Mammillaria* by Engelmann.**

**An excellent description of the species can be found at this (commercial) link. An extensive discussion of the species is included in A. Michael Powell and James F. Weedin's *Cacti of the Trans-Pecos & Adjacent Areas*, pp. 364-368. (Less expensive at sources other than the link.)**

**The variety name (*neomexicana*) is apparently unpublished and a term used in the cactus trade. Jim Laupan uses the llifie.com website for some of his online research. The previous link will take you to the entry for this species, at that site.**

**On April 14, 2020, I photographed the specimen shown at the center of this page at roughly the spot where Mike and Jim found their's. But I (editor) misidentified it as *Echinomastus intertextus*. When Mike Shoop shared his photograph I went on a search through thousands of personal photographs because I was sure I had seen something similar. Two searches, one in the field and one through the photo archives helped develop my skill in identifying cacti, which has now advanced to 2 on a scale of 1 to 10, with 10 being "the expert".**

**Mike noted that the fruit of this species is dark red but the flower is very pale.**

**I know that I would never be able to find the specimen I photographed at the center, again. But now I have one more small thing on the ground to focus on instead of singing birds on the tops of bushes.**

**Following a review of the draft of this article, Gordon Berman provided the two photographs directly above, taken in Dog Canyon near the Oliver Lee Memorial State Park Visitor Center. He also noted that they have been found (by others) at Anthony Gap.**

**In discussions with folk who live south of Hillsboro it has come to light that there may be several other populations in that area.**

**This species is one of those which may be poached, so care should be exercised in describing the specific locations of plants you may encounter.**

# Tools of the Trade - Equipment Reviews

**In previous issues we have discussed techniques, data bases, and applications used in the study of natural history. Here we begin an assessment of equipment which can be used in that endeavor, starting with various camera applications. In all cases, we have no commercial interest in the equipment reviewed (and require a statement to that effect from all reviewers).**

## Drone - DJI Avata 2

**The DJI Avata 2 drone takes very nice imagery, connectivity is often lost when there are obstacles between the controller and the drone, drone recovery protocols do not always work, and the economic value of repair/replacement policies is very questionable.**

**Statement of Conflict of Interest: None. I have no association with, and have received no consideration from, DJI or any of its competitors. - R. A. Barnes**

**Background: I have been exploring the usage of drone footage to augment the articles which appear in *The Black Range Naturalist*. At this point I have placed some drone footage from the Percha Box on our Vimeo account and linked to it in articles in our October 2024 issue. We have also used framegrabs from the drone video in the October issue. I believe that the difference in perspective is additive and worth the effort.**

**I started my exploration of the use of drone technology several years ago with the purchase of a GoPro system. Unfortunately, the only thing I was able to do was crash the thing.**

**In April 2024 I acquired a DJI Avata 2 system with goggles and DJI RC Motion controller - and of course multiple batteries. Knowing that I would be flying this drone in trying circumstances I purchased the replacement policy in case of damage or in case the "drone flew away".**

**Batteries: The batteries are advertised at 23 minutes of flight time. My experience was that we were lucky to get 15 minutes. This assessment is based on multiple flights with three different batteries. In responding to my inquiry about this, DJI responded: "The data on our website is testing data in a controllable flight environment. During the various flights, the height, wind speed, and temperature are different. The battery lifetime will be different."**

**Video: The video is very nice 4K imagery. Quality frame grabs are possible from the video files (three are shown above). Video of November 2024 flights near Hillsboro and at the confluence of Seco Creek and the Rio Grande may be viewed here (1080 HD version of 4K material). More recently, video taken by this machine has been used in the Mines of the Hillsboro Mining District.**

**Goggles and Controller:** After a learning curve which is not that steep, but definitely exists, the use of the goggle/controller for a first-person viewer flying experience is quite exciting. The setup and linking between the goggles, controller, and drone is straightforward. Goggle and controller battery life have been excellent.

**Video Recording:** 4K Video is recorded to a micro SD card on the drone. At the same time, the HD video image transmitted to the goggle is recorded onto a micro SD card in the goggle, recording the lower resolution imagery along with the various bits of control information visible in the goggle. The goggle micro SD card is a very important part of the system, as noted below.

**Video Editing:** Video is recorded in industry standard protocols and loads easily into Final Cut Pro, which is the video editing software which we use.

**Drone Connectivity:** Distance and obstacle obstruction can, of course, block or diminish connectivity between the drone and the control system. This is basically a line of sight system.

**Drone Recovery:** DJI touts various safety features including automatic return to home protocols and "beeping and flashing" on lost drones. On two occasions we have experienced a loss of connection and an automatic return to home (once because of low battery). The system worked well on those two occasions.

**Return To Home (RTH):** When the RTH is activated, automatically or by the operator, the drone rises to a fairly high elevation and returns to the launch site. If there is an intervening obstacle the drone will fly into it.

**Beeping and Flashing:** If a drone is lost, the recovery software has a beeping and flashing feature. If you lose the drone you push a button on the app and the drone beeps and flashes to help you find it. Sounds good. But reflect on the concept for a moment. If you lose a drone it will be some distance away, you may have only a vague idea of where it is, and the terrain may be rugged. Even if you are able to get to the approximate location of where you believe the drone may have gone down it is very probable that the drone battery will have been drained of power - there ain't going to be any beeping and flashing. This is a gizmo feature which sounds useful but, unfortunately, will usually not be of any help.

**Our Lost Drone Experience:** On November 15, 2024, we were flying the Avata 2 drone referenced above when connectivity was lost. End of story. The drone did not return home, connectivity was not reestablished. We accessed the goggle SD card to see the area where connectivity was lost - very rugged of course.

Apparently we had an electrical short which fried the SD card shortly after I looked at the last very distorted image. Apparently the flight record is recorded only to the SD card. If the SD card malfunctions you will have no way of providing flight information. After 14 hours of on-the-ground searching in the general area we gave up, tired, bummed out, and with some ripped pants from barbed wire.

We then tried to initiate our replacement plan. After all, we had paid for the service, might as well use it. DJI insisted that we provide flight data for the drone before they'd consider replacing it. Not an unreasonable request but since the SD card was fried we were unable to provide that information. That could have been the end of the story, but after seven weeks we had a replacement drone.

**Final Assessment:** Regardless of the advertisement, and there is certainly a lot of that, the flight systems and recovery tools touted by DJI simply did not work on this occasion. Exactly what the drone did when connectivity was lost is unclear. Under the replacement policy, which costs $99, a replacement drone currently costs $199. We are uncertain of the particulars, but with the cost of the policy and the replacement cost, we assume that DJI recovers the production cost and associated overheads for the replacement drone. There may even be some profit in the transaction.

From a user perspective the calculus is simple. If you believe that you can prove the drone flew away, and would like a new one, the replacement policy (especially if you are a new flyer) may be worthwhile - but note that you do not save very much by assuming this risk. The policy is $99 and the replacement drone cost is $199. At this point, a replacement is costing you $298. On November 18, 2024, the cost of a drone was $499. The question you should ask is how sure are you that a problem will develop with the drone. If you are comfortable that there will be a problem, the replacement policy will save you roughly $200. If there is no problem with the drone you are out $99.

This is a fairly easy machine to operate and the video it records is very nice.

## Remote Camera Bird Feeders

Another version of remote imagery recording came our way in November 2024, in the form of a bird feeder with camera. On December 21, 2024, this feeder/camera cost $130 on Amazon. We received it as a gift.

**Statement of Conflict of Interest: None. I have no association with, and have received no consideration from any remote camera bird feeder company or any of their competitors. - R. A. Barnes**

**This equipment is not something which I would have purchased for myself. However, we have enjoyed the installation immensely and provide the following for your consideration.**

**The bird feeder: Well, it is a bird feeder with a hamper in back which gravity feeds into a tray.**

**Video and/or still images are transmitted from the camera, over an onsite wi-fi network (2.4GHz). Video and images are recorded locally on a micro SD card which is part of the camera system. Transmitted images are recorded onto a cloud account or may be watched "live". Remote reviewers (up to 4 for the machine referenced here) may access the image system through standard account and password protocols. Recordings are made at 2K or lower resolutions, depending on connectivity. A photo from the system is shown at the bottom right on the previous page.**

**In addition to our use of the system, two other users - one on each coast - are able to view the live video at no cost.**

**Some cloud storage is provided as part of the feeder purchase, and more may be ordered if desired.**

**The system is battery powered and includes a small solar panel which provides sufficient energy, even during the winter.**

**Downside: Success. During an average winter day we record in the range of 300 events. (When we're not watching live, the system records 10 seconds of video each time it is triggered. This material is stored on the cloud service and on the SD card.) Sorting through the events becomes a daily "chore". (Thumbnails are available, and you do not have to watch an entire video before deciding to delete it or archive it in some manner.)**

**During a period of snow in January 2025 the antenna on the feeder became coated with snow and live-cam coverage was periodically lost.**

**This is a good way to study the feeder birds in great detail. A Curve-billed Thrasher eye which takes up most of the screen is "in great detail" for instance. Do not expect "art" from these cameras.**

**We know of several other remote camera bird feeders in use in the area. It appears that most use the same camera and connectivity equipment.**

**Some systems offer species recognition systems; they identify (more or less) the bird at your feeder. Attributes of the various feeder systems (and there are several at this point) vary a bit but we have noted no clear standout.**

**We found these systems to be additive to our natural history experience. Once set up they become a live "trail cam" in your yard.**

## OM System OM-1 Mark II

**There are many camera choices for those who have an interest in taking photographs with something other than a smartphone.**

**Statement of Conflict of Interest: None. I have no association with, and have received no consideration from, OM System or any of their competitors. - R. A. Barnes**

**For decades, I carried a heavy tripod, camera, lens, batteries, etc. through the jungle, across the tundra, where-ever. Then I got old. I still had the burning desire to create beautiful images but the bod was not up to carrying that weight. Intermediate steps with lighter equipment (carbon fiber tripods, bridge cameras) served their purpose but eventually were not enough.**

**And interest changed. If you want to take macro images I recommend this system, the reference camera with a M. Zuiko Digital ED 90mm F3.5 Macro IS PRO lens. The reason is simple: handheld macro photography with in-camera photo stacking, enabled by exceptional image stabilization protocols. The drop of pine sap shown above was made with this system (handheld - photo stacking).**

## To Obscure or Not

**Premise One: There are humans on this planet, and like all (or at least most) other animal species, they include bad actors. People who do harm out of malice and greed or out of ignorance (sometimes both, sometimes both and much more) - bad actors.**

**Premise Two: Bad actors destroy, steal, and do a lot of other things to advance their personal standing (wealth, prestige, whatever), without regard to the broader human and non-human communities.**

**Premise Three: There is not an effective way to deal with bad actors, especially in remote areas like the Black Range. Law and order advocates only believe in "law and order" when it meets their needs, for instance. Law enforcement agencies and other government agencies lack the funds to conduct enforcement activities - unless it supports their personal and/or agency agendas. This is not a society governed by law, it is a society governed by targeted enforcement.**

**Premise Four: Poaching, unauthorized taking, looting, etc. of our commonly held natural heritage is fairly common. Take a plant illegally or kill a creature illegally and their is little danger of capture and even less of any type of punitive action being taken against you. In some quarters you may even be seen as a "hero".**

**Premise Five: In a world where bits of the natural world have value if they are killed or dug up or . . ., information about where they can be found is mined regularly.**

### Discussion

**Science and knowledge are advanced and the good of humanity is enhanced when they are shared freely.**

**The sharing of that information can enable the bad actors to do their dirty deeds, with impunity.**

**The obscuring of locational information is one method that the "good guys" use when they wish to share substantive information but do not wish to enable the bad actors.**

**The lack of locational information can diminish the efforts associated with the spread of scientific knowledge and understanding. The sharing of locational information can support the spread of scientific knowledge and understanding.**

**In our society, the bad actors have won. They either get the goods or the threat of their actions causes others to withhold information.**

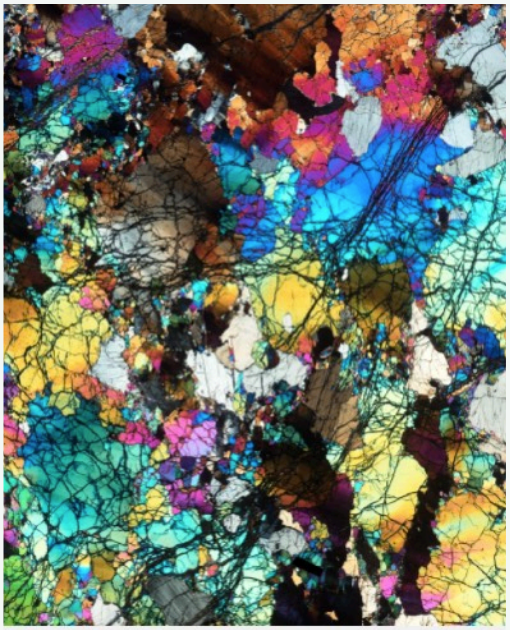
**Any person willing to spend the time, and bad actors are willing to do so, can locate just about anything. It is simply about logging the time and distance. Whether it is a Mimbres site from a thousand years ago, an aging Alligator Juniper, or a tiny cactus plant, they can be found. Do you want to make it easier? Do you want to make it harder for a "good guy" to learn something about the world?**

**Our inclination is to share, but increasingly we choose to place limits on locational information. When you share information with us please indicate your preferences about the sharing of locational information relative to that information. We will honor requests to obscure locational information. If you have a crying need to know the location of an object we have obscured, please contact the editor. We will inform the contributor of your request. If you feel that a decision to obscure or not is inappropriate, please let us know and detail your rationale.**

**Are they imaginary? Or is it just that we don't see?**

**As a follow-up on our many discussions of light, photography, and images we present that to the right. A thin section of some of the oldest rock on earth shown with cross-polarized light (a general concept we have noted often enough). A simple enhancement to our view of the world which creates a work of art and science.**

**The Gakkel Ridge is a large area, so no need to obscure the location further.**



*A thin slice of the ancient rocks collected from Gakkel Ridge near the North Pole, photographed under a microscope and seen under cross-polarized light. Credit: E. Cottrell, Smithsonian.*

## Salt Cedar and White-winged Doves

**The legacy of Salt Cedar in the southwest of the United States has become convoluted and characterized by pro camps, anti camps, and many who just say "what a royal mess".**

**Sometimes a revisit to earlier times can add a bit of perspective. Here we try to provide some of that perspective without landing in one camp or the other, trying to stay out of the thicket of things.**

**In November 1961, Harley Shaw wrote the following article. It is about the area in southern Arizona where he lived and worked during his early years, but it could be about the Rio Grande or any of its tributaries. We follow his report with a bit of personal perspective from his early years and insights that he and others have gained since that time - about White-winged Doves and Salt Cedar.**

# Influence of Salt Cedar on White-winged Doves in the Gila Valley

by Harley Shaw

### Salt Cedar as a Pest

The exotic plant, salt cedar, *Tamarix pentandra* has during recent years, drawn considerable attention from ground water engineers, flood control agencies, and weed control experts as well as many southwestern agriculturists. It is rated as the phreatophyte most damaging to ground water levels in Arizona, New Mexico, and Texas. Its eradication is considered to be one of the most promising and easily available sources of ground water reclamation. In some areas, salt cedar jungles clog seasonally dry stream beds causing flash floods to spread over surrounding lowlands and resulting in damage to farms or dwellings that may be present. Farmers find its habit of spreading along canal banks and clogging irrigation ditches extremely annoying (Robinson, 1958).

### Salt Cedar as Nesting Habitat

Until recently, no important positive value of salt cedar was recognized. In the summer of 1959, however, the advent of a salt cedar removal and flood control program in the Gila Valley near Phoenix, Arizona caused the Arizona Game and Fish Department to focus some attention upon this species. The area along the Gila River bottom between the town of Maricopa and Gillespie Dam has, since about 1950, furnished white-winged dove (*Zenaida asiatica*) hunting for the Phoenix metropolitan area that is probably unequaled anywhere in the United States. That the doves were nesting in the mesquite bosques along the river was well known. To what extent they were using the river bottom salt cedar thickets was uncertain. A study was initiated to gather information on the nesting populations in the area so that the department could estimate accurately the damage to recreational values to be expected as a result of the flood control program.

The study, though limited in extent, was sufficient to show that the doves, especially whitewings, were using the salt cedars heavily for nesting. The area surveyed lies between Gillespie Dam and the confluence of the Salt and Gila Rivers. It is approximately forty miles in length and covers a total area of about 20,500 acres. Of this, 7000 acres are covered by salt cedar thickets, and of this 7000 acres, approximately 2500 acres are mature growth suitable for extensive use as nesting habitat. The nest transect data indicate that a total of approximately 400,000 nesting doves were using the salt cedar during July of 1959 (see appendix). These combined with their potential production yield a total population of over 1,000,000 doves. Approximately sixty percent of these were whitewings. The above estimates include neither birds unmated at the time of the study nor their potential production, so the total population could be well upward of one million birds. (Shaw and Jett, 1959).

The present densities of doves using salt cedar as nesting habitat imply that the plant is important. Such figures, however, do not show the complete relation of the plant to dove populations. That is, they do not show clearly the effect of the removal of salt cedar on the dove populations. In order to better understand the value of salt cedar to doves in the Gila Valley, I have attempted to survey the history of both doves and salt cedar in the area. During the summer nesting survey, several trunk sections of salt cedar were collected in an effort to determine the exact age of the thicket. These sections were taken to the University of Arizona Dendrochronology Laboratory to be dated. At the time of this writing, no report has been received from the dendrochronologists. However, Saul (1956) verifies the validity of annual rings as age indicators in salt cedar and I have estimated the ages of specimens collected by ring-counts alone. The approximate ages and description of the trees are presented in Table I; the implications of this information will be discussed along with the historical survey. (Editor's Note: Laboratory results have since been received and are presented in Table I, next to the author's estimates.)

### Vegetation Changes and Whitewings

Salt cedar is a native of the Mediterranean. It was apparently brought to this country by early Spanish settlers. No clear records of its advance through its present range are available. It was first collected and recorded in the United States on the San Jacinto River in Texas in 1884, and apparently did not begin to spread noticeably until after 1915 (Bowser, 1958). Exactly when it first appeared in the Gila Valley is not known.

In 1857, Emory wrote the following description of the Gila River at a point slightly downstream from the present site of Gillespie Dam.

"The bottoms of the river are wide, rich, and thickly overgrown with willow and a tall aromatic weed, and alive with flights of white brant (wing tipped with black) geese, and ducks, with many signs of deer and beaver. "

Emory also noted large mesquite bosques at other points along the river in this vicinity. His failure to mention salt cedar does not necessarily indicate that it was not present then, but any jungles such as those now in the area would certainly have been mentioned.

Since Emory's party passed through this region in the winter, he had no occasion to describe whitewing populations. Further reference work in an effort to uncover descriptions of dove populations in the undisturbed natural vegetations would be extremely interesting. In view of Emory's description of the vegetation present and in view of present knowledge of whitewing habits, we might speculate that nesting habitat was abundant. The mesquite bosques and willows probably offered ample room for all of the nesting doves that the local food supply could support. The food supply was probably the major limiting factor, for the desert surrounding the river, according to Emory, supported mainly creosote bush (*Larrea tridentata*). Saguaro (*Carnegia gigantea)* is now scattered through the surrounding desert and was probably present at that time. If so, it, along with some Indian grains, probably furnished the major source of food for nesting whitewings. Except for limited areas, the amount

TABLE I. Description, approximate age, and nesting value of salt cedar collected from the Gila Valley between Gillespie Dam and the confluence of the Salt and Gila Rivers, summer, 1959.

| Catalog Number | Location Code* | Largest Radius | Smallest Radius | Approximate Tree Height | Approximate Tree Age | Aging by Lab. Analysis |
|---|---|---|---|---|---|---|
| 1 | fp-g | 8. C cm. | 5. 0 cm. | large | 14 yr. | 16 |
| 2 | fp-p | 4. 2 | 2. 5 | 12 ft. | 8 | 8 |
| 3 | fp-n | 3. 8 | 2. 5 | 10 | 8 | 7 |
| 4 | fp-n | 3. 3 | 1. 2 | small | 5 | 7 |
| 5 | rb-g | 12. 4 | 6. 7 | 25 | 15 | 15 |
| 6 | rb-g | 17. 7 | 12. 8 | 25 | 22 | 23 |
| 7 | rb-p | 2. 6 | 1. 5 | small | 5 | 5 |
| 8 | rb-f | 6. 6 | 4. 5 | 12 | 13 | 11 |
| 9 | fp-f | 8. 0 | 4. 5 | 12 | 12 | 11 |
| 10 | fp-g | 12. 7 | 9. 4 | large | 23 | 23 |
| 11 | fp-g | 6. 6 | 4. 4 | 15 | 23 | 24 |
| 12 | fp-p | 4. 7 | 1. 1 | 9 | 10 | 12 |
| 13 | fp-f | 12. 3 | ? | 12 | 21 | 20 |
| 14 | fp-g | 10. 2 | 5. 5 | 25 | 25 | 25 |
| 15 | fp-P | 6. 0 | 1. 7 | 10 | 23 | 26 |
| 16 | rm-n | erratic | growth | 8 | ? | 18 |
| 17 | rm-n | 1₁ | • 1 | 8 | ? | 29 |
| 20 | rb-g | 11. 8 | 5. 0 | large | 23 | 23 |
| 21 | rb-f | 10. 0 | 3. 3 | 12 | 25 | 25 |
| 22 | rb-n | 3. 6 | 1. 6 | 8 | 12 | 12 |
| 23 | rb-p | 5. 3 | 2. 0 | 11 | 19 | 24 |
| 24 | fp-g | 17. 4 | 15. 0 | 20 | 30 | 23 |
| 25 | fp-n | 6. 9 | 4. 4 | small | 12 | 12 |
| 26 | fp-P | 4. 2 | 3. 2 | 9 | 12 | 12 |

*** These figures include locality type and estimated value of each specimen as nesting habitat.**

**fp - Flood plain above river channel; wet during rainy seasons.**
**rb - River bottom right along the river channel; close to permanent water.**
**rm - River margin. Higher sandy banks away from channel. Plants here must send roots several feet to water.**
**g - Good nesting habitat. Ample nesting sites and cover.**
**f - Fair nesting habitat. Usable but not perfect.**
**p - Poor nesting habitat. Barely suitable for nesting.**
**n - Valueless for nesting**

**of grain and saguaros present within flight radius of the river bottom was probably not sufficient to support an overly large population of doves in spite of the amount of nesting habitat in the valley.**

**Early in the twentieth century, several factors acted together to change the vegetation in the river bottom. The Salt and Gila Rivers were impounded and diverted for irrigation, and the permanent water flow in the river bottom stopped. Concurrently with this reduced flow came the development of agriculture on a large scale in the Gila Valley. Grain crops increased considerably the amount of food available to doves along the river. Increasing agriculture and settlement, however, also increased the need for land and firewood, and the mesquite bosques began to disappear. Wetmore, in 1920, described the bottomlands near Arlington as composed of patches of mesquite in the lowlands, cottonwoods and willows bordering the river which still flowed, and extensive alkaline flats which formed marshy areas. The mesquite patches were already broken up by farms. The largest remaining was "over a mile square". A few other smaller thickets also remained. Salt cedar was not mentioned. Approximately 2000 pairs of adult whitewings inhabited the largest mesquite thicket mentioned above. Many pairs were scattered over the desert, in cottonwoods, and in willows along the river. Wetmore's opinion of the status of the whitewing at the time of his study is best exemplified by the following quotation.**

**"With the rapid settlement of the country and the reclaiming of land under new irrigation projects under way, the large colonies of the white-winged dove in the lower Gila Valley will disappear. The mesquite groves in which these birds nest furnish valuable wood for domestic use and for fence posts so that the mesquite montes are being steadily cut away. The doves will in consequence be reduced in number as they have been elsewhere, near Phoenix and Tucson, but should remain fairly common, as**

scattered pairs will continue to nest on the desert and others will take up domiciles in cottonwoods and other trees scattered through the cultivated fields and along the irrigation ditches."

Neff, (1940) found river bottom jungles to be the population centers for whitewings. The largest of these was the New York thicket above the confluence of the Salt and Gila Rivers. He found a large concentration of whitewings occurring between Phoenix and Laveen, but noted a marked decrease in the valley between 1937 and 1938. He estimated the total population of whitewings between Gillespie Dam and Yuma to be 20, 000 birds.

By the time of Neff's surveys, a new factor was beginning to affect the doves. Hunting seasons lasted through the summer months and game workers felt that this was damaging dove populations severely. By 1942, Arnold considered the whitewing a threatened species and recommended a severe reduction in season length and bag limits.

About this time, salt cedar probably began to become important. Mr. Ernest Douglas, a long-time resident of the Gila Valley, places his first experience with salt cedar at sometime after the turn of the century. He remembers it appearing in small patches along the river near Gila Bend. Wetmore's failure to notice the species indicates that it was not yet dominant in the area in 1920. The tree-ring data indicates that the largest, oldest trees now present in the study area probably first became established about 1929. It also shows that salt cedar trees are not suitable for nesting habitat before an age of nine to fourteen years. The thicket, if established about 1929, then, was apparently barely becoming available for nesting between 1940 and 1945. Neff noted whitewings nesting in salt cedar upstream from the study area near Sacaton, Arizona in 1939, but he did not mention the occurrence of the plant in other areas.

By 1950, Lawson noted a general increase in whitewing populations throughout the state. He felt that the short hunting seasons were allowing them to increase and recommended that the hunting season be extended to take in the last half of August. He did not mention salt cedar.

The present conditions in the study area are ideal for doves. The birds nest most heavily in the dense old growths along the river channel or on the flood plain immediately adjacent to the channel. The north bank of the river is almost completely cultivated with fields of cotton, milo maize, hegari, barley, wheat and other crops. Saguaros are scattered along the south bank. Since 1950, the white-wing season has been increased from fifteen days in length to almost one and one-haif months. The daily bag limit has been raised from ten birds per day to twenty-five. The human population of the valley is increasing steadily resulting in increased hunting pressure on the doves, but as far as can be discerned, the whitewing populations are remaining extremely high.

## Summary

The above information is incomplete. Much more knowledge is needed of present nesting populations and of populations in the past before a complete history can be accurately traced. That the whitewings have shown a considerable recent increase in the Gila Valley is fairly certain. The historical information gathered to date allows one to hypothesize the following summary of whitewing history.

In the original state, mesquite bosques and other riverside vegeta-tion probably offered ample nesting habitat for dove populations in the Gila Valley. The most important limiting factor, if any, was probably the food supply. After the turn of the twentieth century, white man's agriculture caused the mesquite bosques to be cleared. At the same time, it increased the food supply tremendously, hence the factor limiting dove populations was shifted from food to nesting habitat. During this shift, the population may have undergone a small degree of increase, but as the bosques were reduced more and more, nesting populations were forced to concentrate into areas such as the New York Thicket or move to scattered desert nesting sites. At this same time, hunting pressure began to increase and nesting whitewings were constantly being harassed along the valley. By 1942, whitewings were approaching the status of a threatened species.

While all of this was happening, water ceased to flow in the Gila River. This allowed salt cedar to invade the bottomlands and establish its dense jungles. By 1945, several thousands of acres were beginning to furnish nesting sites along the river bottom immediately adjacent to hundreds of acres of grain. This, combined with the opportune release of hunting pressure allowed whitewing populations to boom to densities that are probably higher than those found in the undisturbed natural vegetation.

Again, this encompasses a lot of speculation. Much more reference work is needed to disclose the exact conditions of populations in the original vegetation. More information is needed concerning the present degree of use of salt cedar throughout the Gila and Colorado River Valleys. More must be known about population fluctuation on a statewide level before salt cedar can be given credit for present high populations. Many gaps remain between the historical references cited. In view of the above information, however, one cannot help but wonder if without the advance of salt cedar into the Gila Valley, Wetmore's prediction of decreased and scattered populations would have been fulfilled.

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***BRN* Editor's Endnote: *Tamarix pentandra, Tamarix chinesis, or Tamarix ramosissima?* The taxonomic determinations associated with the species (singular/plural) which have spread throughout the Southwest are in flux. The three may be one species and that species may be *T. chinesis*. Or multiple hybrids may be involved.**

APPENDIX

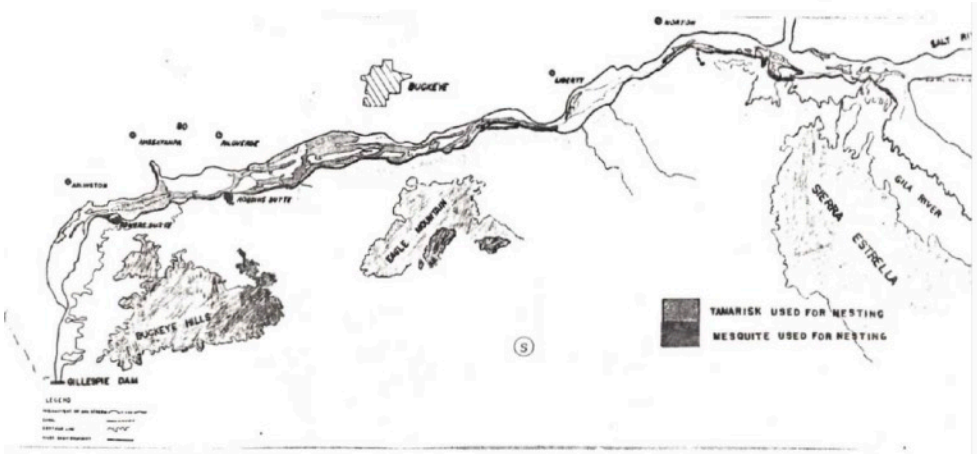
TABLE I. Areas of the dove nesting habitat forms occurring between Gillespie Dam and the confluence of the Salt and Gila Rivers, Maricopa County, Arizona.

| Description of vegetation | Mean area | 90% confidence interval |
|---|---|---|
| Mesquite monte | ca. 400 a. | |
| Large salt cedar 25'-35' open understory | ca. 300 a. | |
| Salt cedar 15'-25' much debris | 2223 a. | 1655-2800 |
| Salt cedar 4' - 15' sparse growth | 4490 a. | 3230-5730 |
| Total bottomland area | 21, 220 a. | 20, 500-22, 230 |

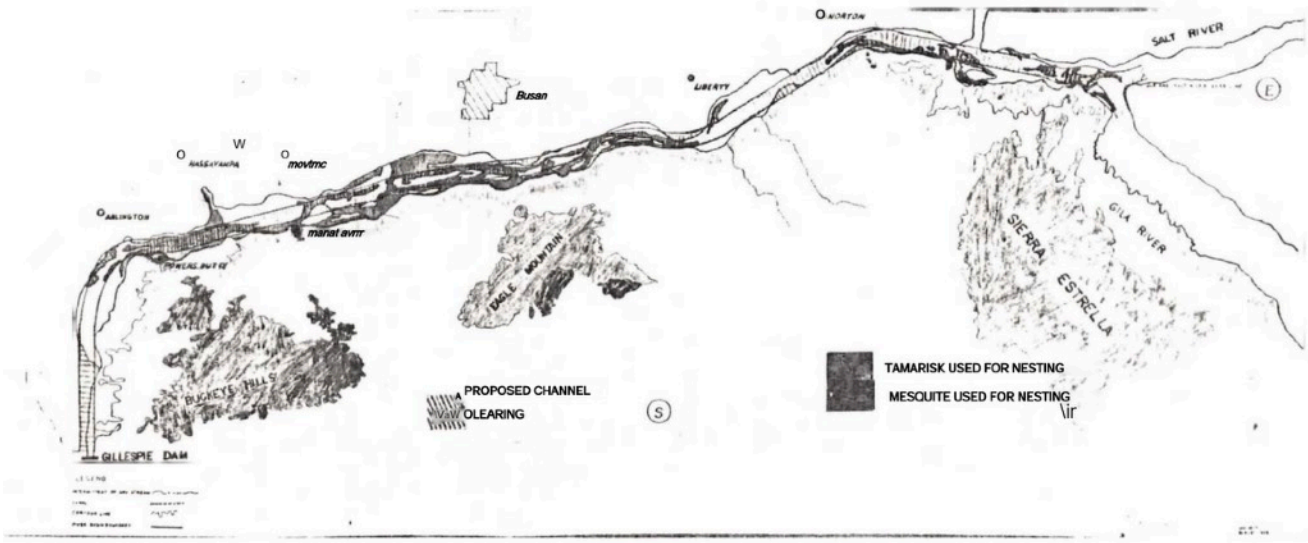
TABLE II. Approximate nesting density of mourning doves and white-winged doves in the salt cedar subtypes, Gillespie Dam to the confluence of the Salt and Gila Rivers.

| | Salt cedar 25 -35' | Salt cedar 15'-25' | Salt cedar 4' -15' |
|---|---|---|---|
| Mourning dove | | | |
| Mean nests/acre | over 16.8 | 11. 03 | under 5. 8 |
| 80% confidence | | 9. 69-12. 37 | |
| White-winged dove | | | |
| Mean nests/acre | over 30. 0 | 19. 5 | under 10. 0 |
| 80% confidence | | 17. 0-22. 0 | |
| Species undetermined* | | | |
| Mean nests/acre | over 1 3. 2 | 8. 8 | under 4. 2 |
| 80% confidence | | 7. 0-10. 6 | |
| Total nests | | | |
| Mean nests /ac re | over 60. 0 | 39. 3 | under 20. 0 |
| 80% confidence | | 34. 1-43. 5 | |

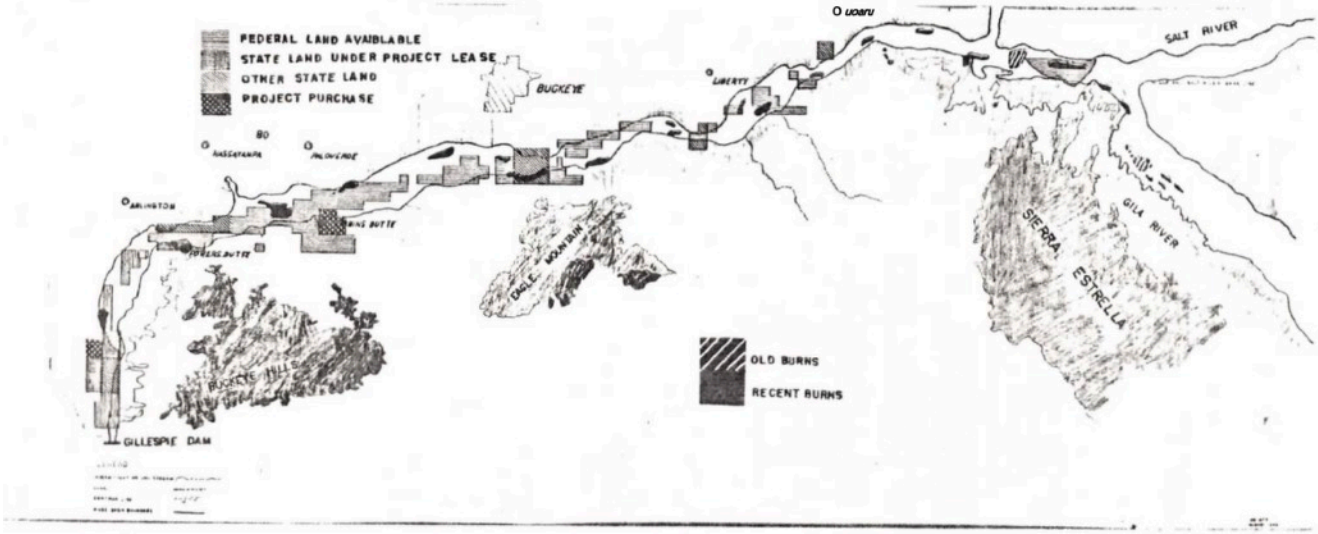
* Either mourning dove or whitewing.




Map 2. Distribution of vegetation along the Gila River which was determined to be of major importance as dove nesting cover.




Map 3. Gila River study area showing the effects of the proposed 2, 000 ft. channelization in the removal of prime dove nesting habitat.




Map 4. Distribution of federal and state land along the Gila River study area that has been withdrawn for the purpose of protection of wildlife habitat.

**Ed. Note: Map 1 is currently unavailable.**

## The Salt of Salt Cedar

Tamarix stands are typified by close growth which reduces available sunlight at ground level, use of ground water (but generally associated with above ground flow in riparian areas), and increases of salinity in the soil. Here we explore the last characteristic.

Issues associated with increases in soil salinity created by Tamarix stands was explored in Michelle Cederborg's paper (2008), published online at the Colorado Riparian Association website. In "Which came first, the salt or the saltcedar? - A quantitative study of soil and groundwater chemistry along the Middle Rio Grande, New Mexico" she characterizes the issue thusly: "One of the most often cited mechanisms of ecosystem change by this species stems from its ability to sequester salts in its tissues. This deciduous tree can extract salts from the groundwater, excrete these compounds through leaf tissue, and deposit them onto the soil surface through mature leaf senescence and exudation. This alteration of surface salt concentrations has the ability to disrupt soil nutrient dynamics and contaminate surface waters with potential negative consequences for local plant and animal populations. Knowledge of invasion mechanisms and long-term environmental impacts of saltcedar is fundamental for understanding habitat restoration and revegetation potential upon its removal. . . .Unlike saltcedar, most native riparian species do not possess salt glands (structures that serve to sequester and dispose of ingested salts without harm to the plant's internal structure and function)." (See link for references embedded in the original material.)

Of course, the world is seldom - if ever - simple. Cederborg notes that "Preliminary results also suggest that beyond a certain age of saltcedar, surface soil salinity begins to decrease. This finding is contrary to what would be expected in an environment that has been subjected to repeated salt inputs for longer periods. Decadent saltcedar growth, however, tends to consist primarily of older woody material and has lower leaf area indices than younger saltcedar stands. The reduced saltcedar leaf area in older infestations likely leads to less salt redistribution to the soil surface through leaf material. In addition, the dense aboveground woody network associated with older growth may reduce solar radiation and elevate localized humidity levels at the soil surface; both of which can contribute to reduced capillary rise of salts to surface soils in arid regions."

## Salt Cedar and That Other Bird - Willow Flycatcher

Active Salt Cedar removal programs have been ongoing for some time. One of the "management" techniques involved the introduction of beetles in the genus *Diorhabda* (typically *D. carinulata*, the Northern Tamarisk Beetle - see photographs below). These beetles effectively reduced Tamarisk stands and spread.

Then someone noticed that the endangered Southwestern Willow Flycatcher, *Empidonax traillii extimus*, had taken up nesting in Salt Cedar stands (after Salt Cedar replaced the native willow stands). Implicit in the last statement is that the Salt Cedar was the active agent in the replacement of the willow stands, rather than that Salt Cedar was introduced after the willow stands were eradicated.

Seems to be a lot of blame to pass around. Ranchers getting rid of riparian vegetation to allow greater access for their cattle, whoever introducing new vegetation (Tamarix) for flood control, or new vegetation moving into the vacated niche, or "Salt Cedar uses too much water and salts the land", followed by "let's introduce a foreign creature", and "oh my gosh - the flycatcher".

## Salt Cedar and Water

The abstract of Owens and Moore's 2007 paper "Saltcedar Water Use: Realistic and Unrealistic Expectations" in *Rangeland and Ecology Management* 60(5) September 2007 says it all:

> "Saltcedar (Tamarix spp.) is a widespread invasive plant found in riparian corridors and floodplains in 16 western states. In addition to

Northern Tamarisk Beetle, *Diorhabda carinulata* (Desbrochers, 1870) is a species introduced as a biological pest control for the non-native Tamarisk or Salt Cedar. James Von Loh of Las Cruces took the above photograph on 19 September 2024. In the image, a male Powdered Dancer, *Argia moesta* (Hagen, 1861), perches on a Tamarisk twig, attracted to the larva of the Northern Tamarisk Beetle. The dry appearance of the Tamarisk leaves is possibly due to the foraging beetles.

being associated with such problems as increased soil salinity and decreased plant diversity, saltcedar has been reported to be a prolific water user. Popular press articles widely report that each individual saltcedar tree can use as much as 757 L (200 gallons) per day. Consequently massive control and removal efforts are underway to reduce transpirational water loss and increase water salvage for arid and semiarid environments. Although the potential economic benefits of these control efforts are touted, it has not been proven whether such water savings are possible on a stream level. The original citation for the 757-L estimate does not list the experimental design or techniques used to arrive at this value. We use three lines of evidence – peer-reviewed scientific literature, sap flux rates and sap wood area, and potential evaporation rates – to demonstrate the improbability that saltcedar, or any other woody species, can use this much water per tree on a daily basis. A more realistic estimate of maximum tree-level daily water use derived from sap flux measurements would be 32.2 gallons. Estimates of water salvage would be grossly overestimated using the popular water use value 757 L and economic benefits from saltcedar control based solely on water salvage are questionable."

A very different view of Tamarisk and the reaction to it in the southwest is presented in "The Monstering of Tamarisk: How Scientists made a Plant into a Problem" by Matthew Chew, *Journal of the History of Biology* (2009) 42:231-266. In the abstract of his paper he notes "The story of tamarisk (Tamarix spp.), flowering trees and shrubs imported to New England sometime before 1818, provides an example of scientific ''monstering'' and shows how slaying the monster, rather than allaying its impacts, became a goal in itself. Tamarisks' drought and salt tolerance suggested usefulness for both coastal and inland erosion control, and politicians as well as academic and agency scientists promoted planting them in the southern Great Plains and Southwest. But when erosion control efforts in Arizona, New Mexico and Texas became entangled with water shortages, economic development during the Depression and copper mining for national defense during World War Two, federal hydrologists moved quickly to recast tamarisks as water-wasting foreign monsters. Demonstrating significant water salvage was difficult and became subsidiary to focusing on ways to eradicate the plants, and a federal interagency effort devoted specifically to the latter purpose was organized and continued until it, in turn, conflicted with regional environmental concerns in the late 1960s."

## Some Memories of Salt Cedar and Whitewings

### Personal email between Harley Shaw and Bob Barnes, 9 December 2020:

"During those summers I was working on whitewings as a student (1957, 58, 59), I remember passing, and once entering, a new, official-looking building on Baseline Road in Phoenix (or maybe Tempe – the towns overlapped about there). It was fairly close to ASC (now ASU).

"It was a USDA establishment, as I remember, and was called the Phreatophyte lab. I later got acquainted with someone who had worked there. He was a phreatophyte hater. The term applied to just about anything that grew along a stream or drainage that had its roots in groundwater.

"Even native cottonwoods were deemed economically evil. This all changed with the work, in the 1970s, of Roy Johnson and Steve Carothers, wherein they pointed out the importance of "phreatophytes" to nearly all of the desert wildlife, particularly birds. Almost overnight, phreatophytes became riparian vegetation and the plans of the Salt River Project to turn the Southwest into "paved" watersheds went away. Of course, in the big valleys, such as the Salt River Valley, urbanization quietly accomplished the goals of SRP, all the while reducing irrigated acreage.

"My old stomping grounds as a kid, then a winding transfer ditch between two major canals, was lined with large old cottonwoods. I didn't realize it then, but it was a special place for a desert kid to grow up. You might say, I grew up in Riparia. We fished, swam, hunted a little along it, and even gave names to specific fish and bullfrogs we got to know personally.

"That drainage, if it still exists, is now subterranean pipes passing under freeways and high rises. I tried once to find the site where our old frame house sat via Google Earth. Couldn't even make a close guess.

"I'll see if I can find a draft of that paper that Johnson, Carothers, and I tried to write. Perhaps they carried on with it. It doesn't fit Black Range, either, but the whole history of moving water downhill (and, in the case of the Colorado River, uphill) is pretty interesting."

### Personal email from Kathleen Blair to Bob Barnes, 9 December 2020:

"When I was doing quarterly transect surveys on the Bill Williams River for 18 years I found higher numbers of birds in salt cedar dominated riparian habitats than cottonwood willow dominated habitats. Diversity was only 6 species higher in the native as I recall. Not to mention swifts almost exclusively used tamarisks."

# Swainson's Hawk - *Buteo swainsoni*

**During the breeding season in the northern hemisphere, Swainson's Hawks are some of the most common raptors in the Black Range. They arrive from Argentina hungry and ready to mate. As in many hawk species, their coloration is variable but they generally have white wing linings and darker flight feathers.**

**The type specimen for this species was collected in 1827, in Canada. It was, however, misidentified (as a Common Buzzard - a European species) at that time. In 1832, it was correctly identified as a different species by Charles Lucien Bonaparte, who used a drawing by John James Audubon as the basis for his description, not the original specimen.**

**When they are feeding their young they hunt small mammals and reptiles, good sources of protein in a good sized package. At other times, they tend to feed on insects, generally dragonflies and grasshoppers which are also protein rich but come in much smaller packages. In addition to hovering like a kite they also hunt by running along the ground with outstretched wings.**

**Males select the nest site and do most of the building. Generally, the nests are near the top of trees near open expanses. However, some nests have been found in mesquite, only a meter above ground level.**

**The population of this species has been fairly stable, but periodic fluctuations due to hunting and poisoning (primarily by pesticides) have occurred.**

**The photographs to the right were taken in the Nutt Grass-lands, at the southeastern corner of the Black Range, the top center photograph on June 23, 2017, the bottom right photograph on May 13, 2016, and the rest on August 22, 2014.**

## The Front Cover - A Few More Lichens

Here we follow up Nichole Trushell's article in Volume 7, Number 4 (October 2024), "The Lichens Among Us - A Lichen Primer", with some additional images from the fungal world.

The fruticose lichen from Sawyer Peak Trail, June 13, 2010, which is shown on the cover of this issue, is possibly *Usnea intermedia* (Motyka) but note the discussion below.

There are no visible differences between the western North American (*Usnea arizonica, U. retifera)* and the European specimens (*U. intermedia*), and therefore they are considered here as conspecific. No test was conducted on the specimen shown here but the Consortium of Lichen Herbaria (link above) reports that "a specimen with thamnolic acid has been found in New Mexico." (Ibid.) The chemical attributes of the lichens in this genus are used to distinguish between species, but "Detailed studies are needed to understand the signification of these different chemistries." (Ibid.)

At this time (January 2025) *U. arizonica* is treated as a synonym for *U. intermedia* on the iNaturalist site.

The large "flat" forms on this lichen are apothecia. Apothecia are open flat cup shaped structures which are made up of three parts. The hymenium is the flat surface visible here. The hypothecium is the remainder of that structure and the excipulum is the point of attachment.

Lichens in the genus *Usnea* are an excellent bioindicator of air quality. They are found in areas with minimal pollution. Lichens in this genus have also been used for a variety of medicinal purposes in traditional treatments, and extracts are commonly used in western medicine. Note that usnic acid (a chemical found in this group of lichens) can have serious negative side effects (especially for the liver).

Even in the basic definition lichens are associations of at least a fungus and an alga there is the following study. Gulnara Tagirdzhanova et al. note in "Complexity of the lichen symbiosis revealed by metagenome and transcriptome analysis of Xanthoria parietina" (*Current Biology* 35, 799-817, February 24, 2025) that the research team found "168 genomes of symbionts and lichen-associated microbes across the sampled thalli, including representatives of green algae, three different classes of fungi, and 14 bacterial phyla." However, that statement only hints at the complexity of these organic structures. There are at least three developmental stages which lichen grow through and the associations in each seem to vary.

Two things to note: Before you step on that lichen encrusted rock, think about the incredible complexity of the community you are about to ravage, and if you have an interest in the details of such communities, the cited paper is a great start.

There were other fruticose lichens, like that shown at the upper right, along the Sawyer Peak Trail on the day the *Usnea* was photographed.

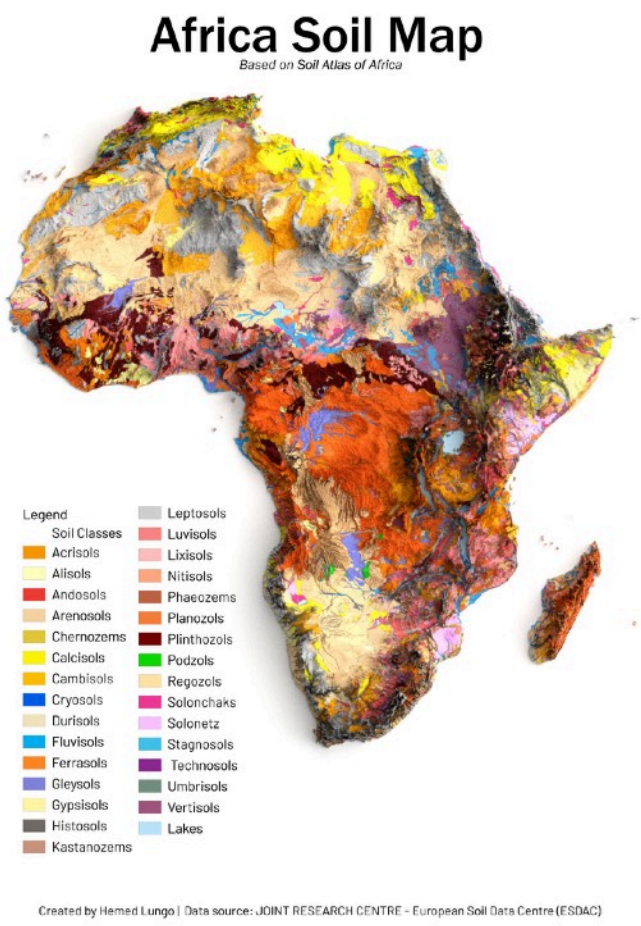
Foliose lichen are common in the Black Range as well. The two shown at the center and lower right were photographed near the Lower Gallinas Campground, Black Range, New Mexico, on July 11, 2024.

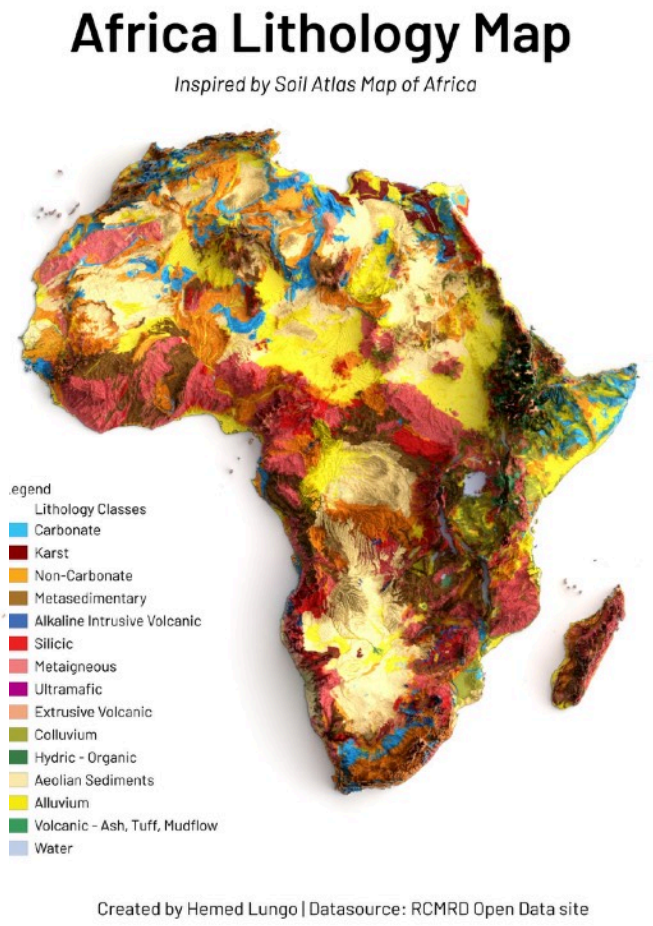
The foliose lichen shown at the bottom left was photographed by Nichole Trushell and demonstrates how variable the growth habit can be.

Carl Linnaeus (1707-1778) developed the initial latin binomial system used to describe the forms of life and first published its application in *Systema Naturae* (1735). The latin binomial system (and all that entails) has served us well but increasingly its utility is strained by the variability of life. Remembering for the moment that this system is about more than two words describing a species, it is about the "Russian dolls" of taxonomy. Species are split into subspecies, groups of subspecies, varieties, and more. Groups of species are lumped into "super-species" (used to acknowledge how closely some species are related), and all higher classifications (genus, family, order, etc.) have various groupings and alternative subdivisions. As we parse the complexity of life our need to describe relationships becomes more demanding and at times it appears that the Linnean system may not be up to the task, even with the modifications which have evolved within it.

In the meantime it works for most applications and with some verbiage and common understanding its utility remains. And then along comes the lichen, an association of at least two life forms and we need to describe the association as if it were a discrete species. I can hear the rivets popping.

For additional challenges, see Common Mosses of the Gila, by Russ Kleinman and Karen Bisard. Also at Plants of the Gila Wilderness website.




## Penstemons of the Black Range

**In last year's October issue we discussed the soils of the Black Range. On other occasions we have mentioned the relationship between various plant species and geologic strata. For instance, how well Ocotillo (*Fouquieria splendens*) grows on limestone. Indeed, if you see Ocotillo in the Black Range you will almost certainly find that you are in an area where limestone beds are at or near the surface. However, a statement like Ocotillo = limestone beds leaves out an important part of the equation: the soil which is built up on the limestone beds as the limestone is broken down by chemical and physical forces. Soil types are generally closely related to the underlying geologic strata. The maps (above) of the soil types and geologic strata (lithology) of Africa demonstrate the relationship between soil type and the strata upon which it rests. (There are, of course, various exceptions and anomalies but we are talking in [rather narrow] generalities here.)**

**There are, however, soil/plant relationships which are more indirectly associated with the underlying strata of a site. Many times the relationship between soil type and the plant species which typically grow on it are a function of the physical characteristics of the soil. Even in such situations, however, the chemical characteristics of the soil are important (and are often associated with particular physical characteristics).**

**The American Penstemon Society provides a succinct guide to the soil which matches the needs of the "typical" penstemon species. (Yes, we are talking home garden here but we believe the advice they render adequately describes native growing conditions). The parentheticals in the following quote from their site have been added by the editor to reinforce the relationship discussed above.**

**"Whatever style of garden and penstemons you select, you should have soil that is well aerated and drains quickly. (ed.: physical characteristic) This may mean digging deeply for a perennial bed or building a raised bed above the surroundings with a mix of coarse sand and fine gravel. It should be about 6" deep if you live in an area where precipitation is high or if your soil is an impervious clay. (ed.: physical characteristic with strong chemical relationships) Many eastern and mid-western gardeners grow a great variety of penstemons, even species from arid sites, by building beds of sand and gravel above their normal soil or by creating slopes. Roots will travel down to anchor the plant in the soil, but the crown, the most vulnerable part of a plant, will be protected from standing water. (ed.: physical characteristics linked directly to the characteristics of the plant) Even in arid locations, the garden area selected should have good drainage, and often the plants will perform better and bloom longer if some humus and fine gravel and/or coarse sand are incorporated into the**

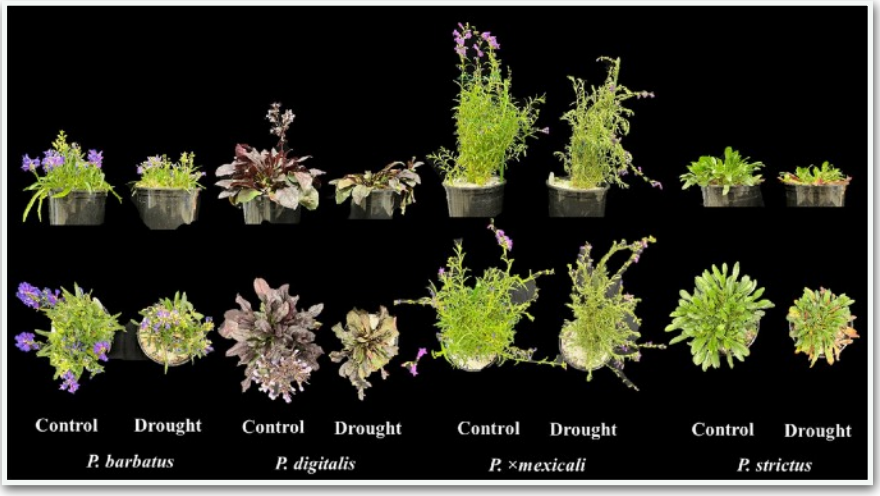
soil. Fine gravel will reduce capillary action in the soil and slow evaporation from the surface. (ed.: physical characteristic) Soil amendments such as peat moss and manure should be avoided, especially in dry climates. The best amendment is homemade compost (leaf mold and mushroom compost are also used) but it should be only a small percentage, except where you are growing hybrids. The American and Canadian hybrids do well in average to good soils but the large-flowered hybrids from milder climates require soil that is porous and holds enough moisture that plants never totally dry out. Most penstemons do not seem to be fussy about the soil pH, although slightly alkaline soil seems preferred by many species and hybrids. If your soil is quite acidic, it would be good to add some pumice, ground oyster shell or something else that would bring it nearer to neutral. (ed.: chemical characteristics)"

In the Black Range, penstemons are often found growing in "harsh" sites. For instance, it is not uncommon to find one growing in the middle of an old mining road, hardly anything but sand and rock. But there are always exceptions!

How penstemons respond to temperature extremes specifically and temperature range generally, is explored in Chen, J., Sun, Y., Kopp, K., Oki, L. R., Jones, S. B., & Hipps, L. (2023). "Physiological and Canopy Temperature Responses to Drought of Four Penstemon Species", *HortScience*, *58*(5), 539-549. The bottom line? You can find some species of penstemon anywhere you wander in the Black Range.

The photograph at the upper right depicts lowland penstemon habitat east of Hillsboro. The photograph at center right was taken less than half a mile north of the top photograph. The two together exemplify the temperature and precipitation variability found in the Black Range.

Noting where plants are found, or under what conditions they are found, is only part of the story. The image at the bottom right is from the article cited above. It is a nice graphic demonstration of the effect that drought has on four penstemon cultivars. I sometimes have a bias which equates plant range to healthy plants. That is a bias, and as this graphic clearly shows, it is incorrect. A second bias creeps in sometimes as well, the bias of the general rule. There are always small niches where animals or plants survive well in an otherwise harsh environment.

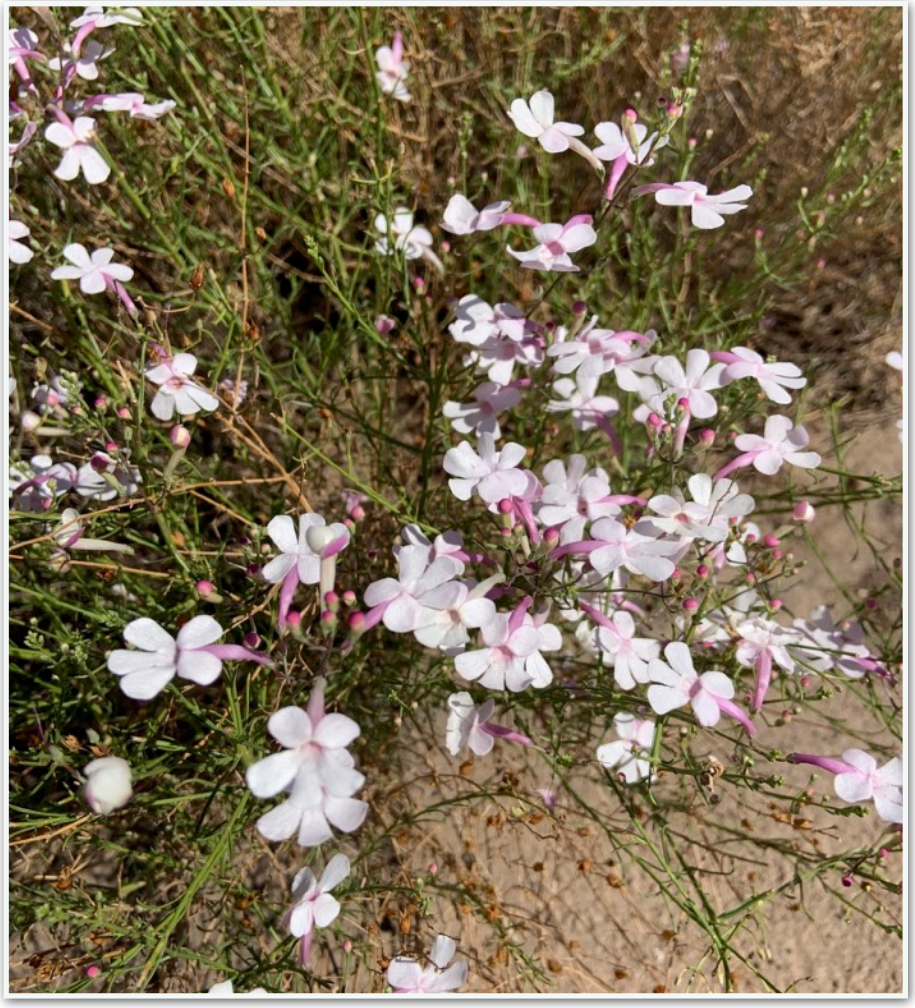


There are 47 species of *Penstemon* found in New Mexico (roughly 250 in North America). Less than a quarter of the species found in New Mexico are found in the Black Range. The following listing of species from the Black Range includes images from nearby locations.

## *Penstemon ambiguus* (Torrey)

Common names include Sand Penstemon, Moth Beardtongue, and Gilia Beardtongue. (The last common name, "*Gilia*" is a widely used common name and apparently is not a mislabeling of "Gila". Instead the name probably refers to the genus *Gilia*.)

As of December 27, 2024, there were no observations of *Penstemon ambiguus* in the Black Range. On 8 July 2022, "kassteck" added an observation (shown at the upper right under a creative commons license) of this species from Rincon.



The Vascular Plants of the Gila Wilderness site provides several images of a plant from the Pinos Altos Range (Pinos Altos).

This species is typically found at lower elevations in our area but observations have also occurred at well drained sites at middle elevations, usually at sites which are between 2,000' and 7,000' in elevation (some references restrict the elevational range to between 4,500' and 6,500' in elevation).

This species begins blooming in May, continuing through October. This species is well adapted to high temperatures and dry conditions.

In appearance, *Penstemon ambiguus*, may look like a small woody shrub rather than "the usual penstemon". The leaves are "needle like" being from .5 to 1 mm wide and 5 to 30 mm long.

## *Penstemon barbatus (Cavanilles)*

The main difference between *Penstemon barbatus barbatus* and *Penstemon barbatus torreyi* lies in their leaf shape. The nominate form has broader, sometimes wrinkled leaves with more prominent yellow hairs in the flower throat, while *P. b. torreyi* has narrower, smoother leaves and usually lacks these hairs. It is the more common subspecies at lower elevations in the Black Range.

This species can be found in masses along the trails of the Black Range. It is the species of Penstemon most commonly seen as one drives across the Black Range on NM-152. It is not a rare plant. It is a beautiful plant and when it is in mass it can be breath-taking. It is also known as the Southwestern Beardtongue, Scarlet Penstemon, and/or Scarlet Bugler. Here and northward into southern Colorado this plant is referred to as Varita de San Jose (St. Joseph's Staff).

Rufous Hummingbirds migrate south at the time this species reaches the height of its blooming and they actively feed and pollinate; indeed, we saw a number of hummers (including some Broad-tailed Hummingbirds) working the stands of Scarlet Penstemon along the trail on 24 August 2014.

The USDA recognizes three subspecies of *Penstemon barbatus; P. b. barbatus, P. b. trichander* (both with a common name of Beardlip Penstemon), and *P. b. torreyi* (Torrey's Penstemon or Torrey's Beardtongue). Vascular Plants of the Gila Wilderness lists the nominate form and *P. b. torreyi* in this area. *P. b. torreyi* was once considered a full species and *P. b. barbatus* was once described as *P. b. puberulus*. *Penstemon barbatus* was first described by Antonio José Cavanilles who described it from specimens received from the new world. He never left Europe.

## *Penstemon barbatus subsp. barbatus* (subspecies by Roth)

There are no observations of this subspecies recorded from the Black Range on iNaturalist (12/27/24).

Radha Veach observed a specimen identified as this subspecies at Gila on 17 June 2023. It is shown at the top right under a creative commons license. The Vascular Plants of the Gila website provides images of the species from the Burro Mountains. The photograph at the bottom right was taken in Railroad Canyon on 4 September 2023. The other three photographs were taken along the Sawyer Peak Trail on 27 July 2017. The photograph at the top right on the following page is also from Sawyer Peak Trail on 27 July 2017.

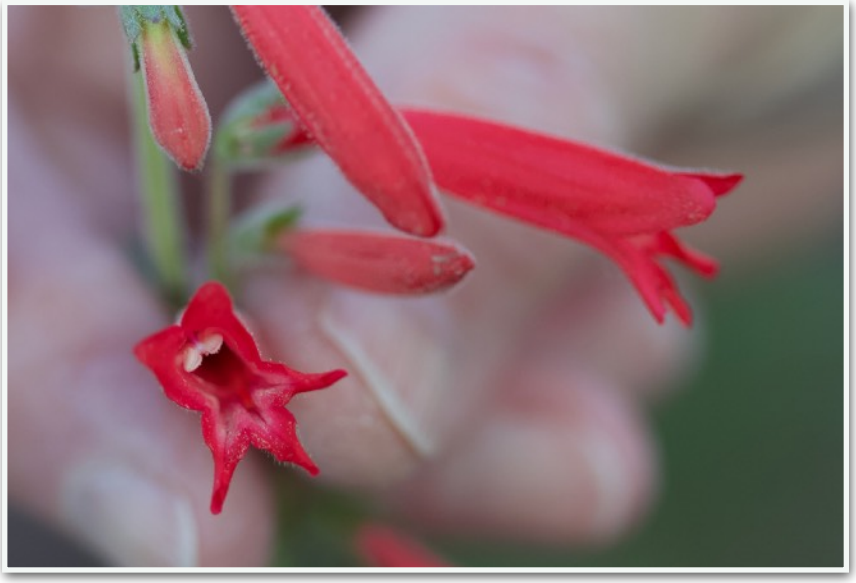
The New Mexico Native Plant Society has an excellent discussion of the "red penstemons" with this general shape at this link.

Both subspecies of *P. barbatus* are typically found in areas with poor soil, generally rocky and sandy. Disturbed areas along NM-152 are favorable habitat for this species. That said, the soil along Sawyer Peak trail (Ponderosa Pine, oak, New Mexican Elder, locust, etc.) can contain much more organic material than that found along the edge of the road. On the hillsides, however, the depth of the soil is minimal and bedrock is frequently seen at the surface.

## *Penstemon barbatus var. torreyi*

*Penstemon barbatus torreyi* is found widely in the Black Range, typically at mid-elevations. The Vascular Plants of the Gila website includes photographs from the Burro Mountains and from the Black Range Crest Trail between Emory Pass and Hillsboro Peak.

***Penstemon barbatus* (Cavanilles) *Roth* var. *torreyi* (Bentham) Gray is found widely in the Black Range. The photograph above is of the nominate form, the other photographs on this page are *P. b. torreyi* and were taken near the Rattlesnake Mine east of Hillsboro on 17 May 2020.**



## *Penstemon fendleri (Torrey & Gray)* - Fendler's Penstemon

**Photographs on the following page.**

**Left Column: Hillsboro, on April 7, 2020.**

**Top Right: North Wicks Canyon, east of Hillsboro on April 5, 2020.**

**Middle Right: Percha Box Overlook, east of Hillsboro on April 8, 2020.**

**The flowers of P. fendleri are arrayed along the top half of the flower stalk, which is, like the leaves, smooth and waxy (succulent-like) without hairs. Most of the leaves are basal, those on the flower stalk are alternate. The flowers shown here are at the beginning of the flowering period, which extends to the later part of August.**

**As can be seen in the top left photo, this species seems to prefer sandy/stony soil, often very shallow.**

**Although this species is generally found at lower elevations (the foothills of the Black Range being a prime example) they are sometimes found as high as the Piñon-Juniper forest.**

**The yellow hairs of the staminode are obvious and often substantial. In this species a staminode (a sterile stamen which does not produce pollen) is found at the bottom of the flower opening, where the yellow "hairs" are found. In cases like this the reference to the flower part is "bearded staminode".**

**Photographs on the following page:**

**Top left: Percha Box Overlook, east of Hillsboro, on 8 April, 2020.**

**Other photographs on the next page: Ready Pay Gulch, east of Hillsboro, 30 March 2017.**

**Within Mexico, its range appears to be limited to the states of Chihuahua and Coahuila. In the U. S. it is found in Arizona, New Mexico, Oklahoma, and Texas.**

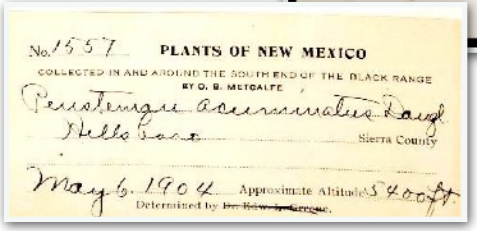
**Fendler's Penstemon is also known by a number of other English Common Names, including: Fendler Penstemon, Fendler's Beardtongue, Fendler Beardtongue, and Purple Foxglove. There appear to be no scientific synonyms.**

**In late March the hillsides can have large numbers of Fendler's Penstemon in bloom or coming into bloom. The Vascular Plants of the Gila website has excellent photographs of the inside of the corolla. This species was first described by John Torrey and Asa Gray in the "Reports of explorations and surveys, to**

**Photographs on this page: March 29, 2014, east of Hillsboro, NM**

**ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean, made under the direction of the Secretary of War" (1857).**

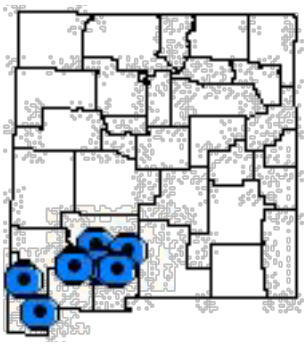
**Southwest Biodiversity (SEINet) provides more than 200 specimen sheets for this species. The specimen sheet shown at the right is a plant collected by O. B. Metcalfe near Hillsboro on 6 May 1904.**




## *Penstemon lanceolatus (ramosus)* (Benth.) - Lanceleaf Beardtongue

**See Anderson, Williams, and Williams 2007, for a discussion of the taxonomic history of *P. ramosus/ P. lanceolatus*. See, also, the SEINet entry for this species, which states: "There appear to be lingering questions as to whether this species is indeed a separate species, *P. ramosus*. If it is separate as it was treated in 1966 by Crosswhite, then it is a narrow endemic species native to southeastern Arizona and New Mexico. Anderson et al. 2007 argue that it is not a distinct population, but instead found many specimens across its range back into Mexico."**

**The New Mexico Rare Plants site treats this penstemon as *Penstemon ramosus* (Crosswhite) - Branching Beardtongue. That site notes that "The Mexican *Penstemon lanceolatus*, which enters the U.S. only in Big Bend National Park, is very closely related. It differs from *P. ramosus* in its unbranched habit, non-revolute leaves and toothed anther sutures." New Mexico Rare Plants identifies a very restricted range for *Penstemon ramosus* (see center).**



**The photographs on this and the following page were taken in August 2021, east of Hillsboro.**

**As *Penstemon ramosus*, the state of New Mexico considers the species vulnerable (S3 statewide by Natural Heritage New Mexico and NatureServe) but it has been dropped from the Rare Plant List.**

## *Penstemon linarioides linarioides* (Gray) - Toadflax Beardtongue, Narrowleaf Penstemon, and Linaria Penstemon

**The photographs on this page, and on the following, were taken along the scenic trail from near the Kingston Cemetery to Emory Pass on 14 August 2022.**

**The species *P. linarioides* has been dropped from the Rare Plant List by the State of New Mexico, but a subspecies, *P. l. maguirei*, remains on the list.**

***Penstemon linarioides* is found at elevations between 4,600′ and 8,400′, thus, most of the Black Range.**

**Among the species characteristics are: leaves are more numerous near the base of the stem than they are near the top and flowers tend (not an absolute) to grow on one side of the stem. See links for additional information.**

## *Penstemon metcalfei* (Wooton & Standley)

**Photographs on this page were taken on the slopes of Cross-O Mountain in the Black Range on 2 September 2023.**

**The New Mexico Rare Plant website considers this species "endangered" with a state ranking of "S1 Critically Imperiled - Critically imperiled in NM because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from New Mexico. Typically 5 or fewer occurrences or very few remaining individuals (<1,000)". The US Forest Service considers the species "sensitive" ("likely to occur or have habitat on National Forest Service System lands and that has been identified**

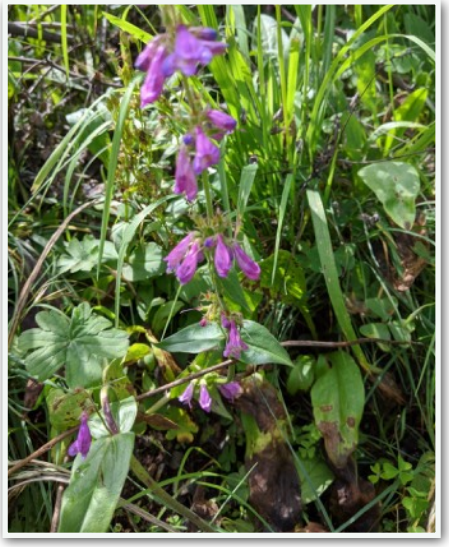
**by the Regional Forester as of concern for reduction in population viability as evidenced by: significant current or predicted downward trends in population numbers or density, or; significant current or predicted downward trends in habitat capability that would reduce the species' distribution").**

**The photograph at the right was taken on the slopes of Cross-O Mountain in the Black Range on 2 September 2023. All other photographs were taken at the same location, 5 August 2023 by Philip Conners (bottom right) and Rebecca Hallgarth on 25 August 2023 (all others - including the "general site" image at the bottom left).**

**The photographs on this page were taken on the slopes of Cross-O Mountain in the Black Range on 25 August 2023 by Rebecca Hallgarth.**

**Fire and fire suppression are considered major threats for the species. Grazing is also listed as a threat. The species has survived the last two major fires in the Black Range (Silver Fire and Black Fire), with known populations only being minimally affected (no scorched earth where populations are found).**

**The range of Metcalfe's Penstemon is generally given as Sierra County. Although there are no known populations within Grant County it is quite possible that some exist along the crest of the Black Range.**



## *Penstemon palmeri* (A. Gray, 1868) - Palmer's Penstemon

**The dense array of flowers is typically found on one side of the stem. Dense yellow hairs are found on the staminode (beardtongue) of the flower and the flower opening is large relative to the rest of the flower. The dark guidelines are visible in the photograph at the top left on the following page.**

**The leaves are fleshy, lance-shaped, and grow on opposite sides of the stem. Note that the two opposite leaves completely surround the stem.**

**Palmer's Penstemon is typically found at elevations between 3,600' and 5,900' in soil which is sandy, rocky, and typically has little organic matter. These conditions are often found on hillsides and that is where these plants are often found.**

**This species is found widely in the west. SEINet has an extensive collection of specimen sheets in its listing for this species. There are a number of varieties/subspecies.**

**The type specimen of this species was collected by Edward Palmer and Elliott Coues on the river bank of Rio Verde in Arizona in 1865. The type specimen sheet is maintained at the Harvard University Herbaria and shown below. Most of the historical specimens of this species were collected in Arizona and other areas west of here.**

**The photographs on this and the next page were taken by Matilde Holzwarth, south of Hillsboro on May 16, 2012.**

## *Penstemon pinifolius* (Greene) - Pineneedle Beardtongue

**Other common names for this species include Pine-leaved Penstemon, Pineleaf Penstemon, and Pine Needle Beardtongue.**

**The flowering mat of this species does not grow much higher than 10 inches. It is typically found at higher elevations (5,500' to 11,000') in rocky conditions. Although it tolerates low temperatures it requires a sunny well drained exposure.**

**Pineneedle Beardtongue typically blooms between June and August (inclusive). Flowers are sometimes yellow.**

**Its range is restricted to the mountains of southwestern New Mexico and southeastern Arizona.**

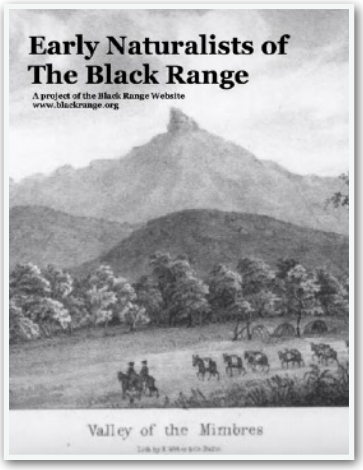
**The common name refers to the "pine-needle-like" leaves of the plant. Since this species grows at higher elevations it is often found in beds of Ponderosa Pine needles.**

**Above: Pineneedle Beardtongue from Emory Pass, Black Range. Photographed by Andrew Tree on 16 August 2022. Shown here under a creative commons license.**

**Below: Pineneedle Beardtongue along the Hillsboro Peak Trail, Black Range. Photographed by "miguel1958" on August 1, 2024. Hosted on iNaturalist and shown here under a creative commons license.**

**Vascular Plants of the Gila Wilderness website includes several photographs from the Black Range.**

**Edward Lee Greene, the original describer of this species, is included in the Early Naturalists of the Black Range at pp. 98-101. His close working relationship with O. B. Metcalfe is addressed at pp. 101-105 in that publication.**




## *Penstemon pseudospectabilis var. connatifolius* (M. E. Jones) - Desert Penstemon

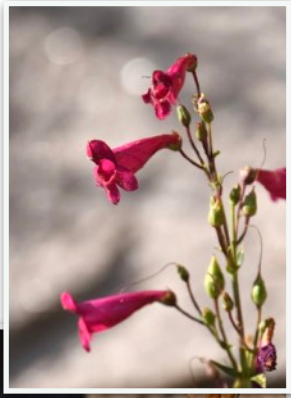
**The primary range of this species extends from south central New Mexico westward to southern California. Most observations are from Arizona - there are no reports from the Black Range.**

**Other common names for this species include Desert Beardtongue and Perfoliate Penstemon.**

**These plants are found in desert and upland habitat characterized by sandy washes and at somewhat higher elevation woodlands. It is often found near flowing water.**

**Leaves are opposite and often the two leaves completely encircle the stem, even the upper stem. It is a showy species growing to three feet and often having multiple stems.**

**The photographs below, of specimens in the Organ Mountains, were taken by Curren Frasch on 5 January 2020 (bottom) and 2 June 2020 (center). The bottom photo shows the leaf structure and habit of the species. Both are shown here under a creative commons license. These plants are at the far eastern border of this species' range.**



**Above: Desert Penstemon, photographed by "allroy1313" on 18 May 2023 in Silver City. The observation is hosted on iNaturalist and is shown here under a creative commons license.**

**Below: The iNaturalist observation of Desert Penstemon, shown below, was made by Valerie Norton on 25 April 2020 in the Pinos Altos Mountains. Shown here under a creative commons license.**

## *Penstemon rostriflorus* (Kellogg, 1860) - Beaked Beardtongue

Radha Veach took the photograph of a Beaked Beardtongue shown at the bottom of the page on 29 July 2024, in Catron County. Most iNaturalist observations of this species are to the west of our area. iNaturalist uses the common name of Bridges' Penstemon for this species.

Plants of this species are typically found at middle elevations. Vascular Plants of the Gila Wilderness describes the plant so: "lanceolate leaves. The flowers are bright red. The lower lip is strongly reflexed and the anthers are horseshoe shaped. Older plants have a "bushy" appearance, can form a hedge under optimal conditions and are woody towards the base. The capsules have a very long and twisted persistent style." That website includes several photographs of a plant at Gila Cliff Dwellings National Monument.

Plants of this species are long-blooming, often blossoming for weeks. Blooming occurs in mid to late summer into the early fall.

The flowers and foliage of this species are very similar to those of *Penstemon barbatus,* but Intermountain Flora notes that the other characteristics of the plant are notable.

Bridges' Penstemon is often used as the common name for this species. For decades, it was thought that Asa Gray had made the first description of this species in 1868. He named the species *Penstemon bridgesii* (with the common name Bridges' Penstemon) after Thomas Bridges, who collected the specimen he worked with. It is now known that Kellogg had made the original description in 1860. But many still use the common name which followed from Gray's description.

There are no iNaturalist reports of this species from the Black Range. Given the similarity to *P. barbatus* and the fact that specimens have been found fairly close, care should be taken before assuming that the plants we see are *P. barbatus*.

PENTSTEMON PALMERI (inter *P. Jamesii* et *Cobæam*): sesquipedalis; foliis lanceolato-ligulatis argute denticulatis cauleque glaucescentibus, superioribus semiamplexicaulibus, inferioribus spathulatis in petiolum attenuatis; panicula nuda racemiformi virgata laxiflora glanduloso-puberula; bracteis minimis; pedunculis 2–3-floris; pedicellis gracilibus; sepalis ovatis glabriusculis; corolla pollicari pallide purpurea supra calycem latissime campanulato-ampliata, ore hiante, labio inferiore intus hirsuto; filamento sterili leviter exserto apice incurvo insigniter flavo-barbato. — Arizona, in Skull Valley, and on Rio Verde, near Fort Whipple, Drs. Elliott Coues and Edward Palmer. A well-marked species, with sterile filament bearded in the manner of *P. cristatus*, and corolla even more dilated in proportion than that of *P. Cobæa*.

PENTSTEMON BRIDGESII (*Saccanthera*): præter inflorescentiam glaber; caule erecto 1–2-pedali; foliis integerrimis spathulato-lanceolatis linearibusque, caulinis sessilibus; panicula virgata racemosa, pedunculis 2–5-floris; sepalis ovato-oblongis acuminatis cum pedicellis æquilongis viscoso-pubentibus; corolla coccinea (pollicari) cylindraceo-tubulosa sursum leviter ampliata, fauce nuda, labio superiore erecto apice bilobo, inferiore tripartito, lobis recurvis oblongis tubo 2–3-plo brevioribus; filamento sterili nudo apice complanato; antheris quasi sagittatis apice solum dehiscentibus (rima hirtello-denticulata), loculis deorsum maxime productis diu parallelis. — No. 218 in Californian collection of the late Thomas Bridges. Yosemite Valley, very scarce, Bolander. A handsome and very interesting new species, having the anthers most distinctly of the section *Saccanthera*, but the habit and corolla of the section *Elmigera*. In cultivation it would rival *P. barbatus* and its allies.*

Above: Original descriptions of *P. palmeri* and "*P. bridgesii*" by Asa Gray, p. 379 of the *Proceedings of the American Academy of Arts and Sciences*, Metcalf and Co., 1846.

## *Penstemon strictus* (Bentham) - Rocky Mountain Penstemon

Flowers are clustered on one side of this plant's stem and are hairless, like the stem. The lower lip of the flower is deeply notched into three lobes.

This species is typically found flowering in the summer, June to August.

The lower and basal leaves of this species are often on short stems.

Typically found at higher elevations (6,500' - 10,000'), plants of this species grow in rocky, sandy soil, often on limestone. It is found in piñon-juniper habitat upward to spruce-fir.

There are no iNaturalist observations of this species from the Black Range. There are observations from the Sacramento Mountains, including that of Ilja Fescenko on 7 July 2019, shown at the top right under a creative commons license. Vascular Plants of the Gila Wilderness includes observations of this species from the San Francisco Mountains.

## *Penstemon superbus* (A. Nelson, 1904) - Superb Penstemon

The Vascular Plants of the Gila Website has multiple images of this species from the Burro Mountains. iNaturalist observations include several from that general area but mostly to the west in Arizona. In Mexico it is found in Sonora and Chihuahua but also Baja (Norte y Sur).

Eric Knight has an observation of this species from 25 May 2024 in Silver City. It is shown at center/bottom right under a creative commons license.

Other common names include Superb Beardtongue. Scientific synonyms include *Penstemon puniceus* (Gray) in *Proceedings of the Biological Society of Washington, Volume 17*, 1904.

As they age, the leaves and stems of plants in this species turn an unsaturated tone of purple.

## *Penstemon thurberi* (Torrey) Thurber's Penstemon

**This is another short penstemon species, rarely growing more than a foot and a half tall. The flowers are small and red-toned (pink to purple). They grow in pairs (flowers oppose each other on the stem) and the pairs of flowers rotate 90 degrees as they progress up the stem. This results in a stem which appears well flowered. The staminode is dark and located inside the throat of the flower; it is hairless. However, yellow hairs grow on the lower lobes of the flower near the throat. The leaves of the plant also grow opposite along the stem, are narrow, and are generally less than an inch long. The Vascular Plants of the Gila Wilderness website includes a photograph of this species in the Burro Mountains. There are no observations of this species from the Black Range at this time.**

**This species grows at lower elevations (2,000' to 5,000') in the type of soil most of our penstemons prefer, sandy with gravel and rock. This species grows in desert grasslands and can also be found in piñon-juniper woodlands where they occur at lower elevations.**

**Like other penstemon species it is also known as Beardtongue. Scientific synonyms include *Leiostemon thurberi* (Greene) and *Penstemon ambiguus* (Torrey) var. *thurberi* (Torrey) Gray. References prior to 2000 may indicate that this species (and all penstemons) are in the *Scrophulariacae* (Snapdragon) family. Studies at the turn of this century indicated that penstemons are properly placed within the *Plantaginaceae* (Plantain) family.**

**"stevocapo", an iNaturalist observer, took the photographs at right in the Florida Mountains on 28 May 2020.**

## *Penstemon virgatus* (Gray) *virgatus* - Wandbloom Penstemon

**This species is found at higher elevations, often in moist meadows.**

**The flower shown on the following page was photographed in the upper reaches of Carbonate Creek on the east slope of the Black Range, on 27 July 2015. It is typically found at slightly higher elevations. Other English common names for Penstemon virgatus include Blue Beardtongue, Upright Blue Beardtongue, Dark Blue Penstemon, Foothill Penstemon, Dark-blue Penstemon, One-side Penstemon, Tall Penstemon, and Upright Blue Penstemon. It has no scientific synonyms. There are two accepted varieties: P. v. var. asa-grayi (Upland Blue Beardtongue) which is found on the eastern slope of the Rockies in Colorado (and perhaps elsewhere), and P. v. virgatus (Upright Blue Beardtongue).**

**The Xerces Society recognizes this species as one of special value because it is a strong attractor for native bees. It is also pollinated by hummingbirds. Pollen is transferred by the plant to the top side of the pollinator.**

**The photographs on this page were taken on North Percha Creek east of FR-157 on September 24, 2023.**

**Paul Vestal (1952) notes that this species was used as "life medicine" (a panacea) by the Ramah Navajo. See p. 45 of "The Ethnobotany of the Ramah Navaho", *Papers of the Peabody Museum of American Archaeology and Ethnology* 40(4):1-94. Modern folk medicine claims that if the "fresh plant is ground and combined with vegetable oil and beeswax, to produce a salve... it is useful for skin irritations and as a lip balm."**

**The flowers shown on this page, and at the top left on the next page, were photographed on 18 September 2017 at Mineral Creek on the east slope of the Black Range. The flowers at the bottom of the next page were photographed on the east slope of Bald Hill at Forest Road 157 on the east slope of the Black Range on 18 August 2019.**

**The specimen shown on the sheet at the upper right of the next page was gathered as part of the United States - Mexico International Boundary Survey. It was "collected under the direction of Major W. H. Emory, Commissioner, chiefly in the Valley of the Rio Grande, below Doñana - by C. C. Parry, M.D., J. M. Bigelow, M.D., Mr. Charles Wright, and Mr. A. Schott."**


MEXICAN BOUNDARY SURVEY.

**The *Penstemon virgatus* shown in the left column was photographed at the Lower Gallinas Campground on the west slope of the Black Range on 22 August 2013.**

## *Penstemon whippleanus* (Gray) - Dusky Penstemon, Dark Beardtongue

**There are no Black Range observations of this species on iNaturalist (January 5, 2025). There are, however, observations from north of Gila on the Mogollon rim and from the Sacramento Mountains. This is a species of higher elevations and, given the locations of the observations made above, we should be looking for this species in the Black Range.**

**C. K. Kelly made the observation shown below on 7 July 2019 near Sierra Blanca Peak in the Sacramentos; shown here under a creative commons license.**

**Radha Veach made the observation below in Catron County on 1 August 2023, shown here under a creative commons license.**

# Bats in the Black Range

**One of the tourist attractions in the general area of the Black Range is the Mexican Free-tailed Bat, *Tadarida brasiliensis*, fly-out at their roosting site on the Armendaris Ranch (the Jornada Bat Cave). (If you wish to see this fly-out you may book a tour through this site. We do not have a commercial association with the tour operator or their agents.) A video recording of the fly-out on August 23, 2024, may be viewed at this link. The images on this page were taken on that day.**

**In the late 1800s, bat guano was mined from the cave roosting site. The workers lived in structures made from the basalt of the lava field. They blasted openings into the lava tubes to extract guano. Extraction continued into the 1980s.**

**Bat "fly-outs" interest many people. The one at Carlsbad Caverns is always a pleaser, but few are as intimate as the one shown in these two videos - Campeche, Mexico and Cueva de Murcielago.**

There are numerous bat species which are present in the Black Range during at least part of the year.

## The Order *Chiroptera* (Bats)

In "An Overview of the Mammals of the Gila Region, New Mexico", *Theryta*, 2021, Vol. 12, Number 2, pp. 213-236, Amanda K. Jones, Schuyler W. Liphardt, Jonathan L. Dunnum, Travis W. Perry, Jason Malaney, and Joseph A. Cook recorded 24 species of *Chiroptera* in the Gila Region. They are listed below, and discussed in greater detail later.

The USDA Forest Service listing for the area includes several of these species (see their checklist). If a species is listed in the USDA checklist it is indicated within parenthesis as (USDA Checklist:). Since this checklist is dated, the latin binomial may be different from that which is utilized today.

### *Phyllostomidae* (New World Leaf-nosed Bats)

*Leptonycteris yerbabuenae* (Miller, 1900)
Lesser Long-nosed Bat

### *Molossidae* (Free-tailed Bats)

*Nyctinomops macrotis* (Gray, 1840)
Big Free-tailed Bat

*Tadarida brasiliensis* (I. Geoffroy,1824)
Mexican Free-tailed Bat (USDA Checklist: Included)

### *Vespertilionidae*

*Lasiurus (Aeorestes) cinereus* (Palisot de Beauvois, 1796)
Hoary Bat (USDA Checklist: Included)

*Lasiurus frantzii* (Lesson & Garnot, 1826)
Western Red Bat (Split from *L. blosseuillii*)
Adams et al. list this species as *L. blosseuillii*
(USDA Checklist: Included - *L. blosseuillii*)

*Lasiurus borealis* (Müller, 1776)
Eastern Red Bat

*Antrozous pallidus* (Le Conte, 1856)
Pallid Bat. (USDA Checklist: Included)

*Corynorhinus townsendii* (Cooper, 1837)
Townsend's Big-eared Bat (USDA Checklist:
Included as *Piecotus townsendii*)

*Eptesicus fuscus* (Beauvois, 1796)
Big Brown Bat (USDA Checklist: Included)

*Euderma maculatum* (J.A. Allen, 1891)
Spotted Bat (USDA Checklist: Included)

*Idionycteris phyllotis* (G.M. Allen, 1891)
Allen's (Mexican) Big-eared Bat (USDA Checklist: Included)

*Lasionycteris noctivagans* (Le Conte, 1831)
Silver-haired Bat (USDA Checklist: Included)

*Myotis auriculus* (Baker & Stains, 1955)
Southwestern Myotis (USDA Checklist: Included)

*Myotis californicus* (Audubon & Bachman, 1842)
California Myotis (USDA Checklist: Included as *M. californica*)

*Myotis carissima (*Thomas, 1904)
Little Brown Bat (USDA Checklist: Included as *M. lucifiga*) Some treat these bats as a subspecies *M. lucifugus carissima*.

*Myotis ciliolabrum* (Merriam, 1886)
Western Small-footed Bat (USDA Checklist:
Included as *Myotis leibii;* that species was split.)

*Myotis evotis* (H. Allen, 1864)
Long-eared Myotis (USDA Checklist: Included)

*Myotis occultus* (Hollister, 1909)
Arizona Myotis

*Myotis thysanodes* (Miller, 1897)
Fringed Myotis (USDA Checklist: Included)

*Myotis velifer* (J.A. Allen, 1890)
Cave Myotis

*Myotis volans* (H. Allen, 1866)
Long-legged Myotis (USDA Checklist: Included)

*Myotis yumanensis* (H. Allen, 1864)
Yuma Myotis (USDA Checklist: Included)

*Nycticeius humeralis* (Rafinesque, 1818)
Evening Bat

*Parastrellus* (*Pipistrellus*) *hesperus* (H. Allen, 1864)
Canyon Bat (USDA Checklist: Included as *Pipistrellus hesperus - Western Pipistrelle*)

An older English name for bats is flittermouse, which matches their name in other Germanic languages (for example German Fledermaus and Swedish fladdermus), related to the fluttering of wings. Middle English had bakke, most likely cognate with Old Swedish natbakka ('night-bat'), which may have undergone a shift from -k- to -t- (to Modern English bat) influenced by Latin blatta, 'moth, nocturnal insect'. The word bat was probably first used in the early 1570s.

At the 9th Natural History of the Gila Symposium Mallory Davis (who at that time was a PhD candidate under Kathryn Stoner at Colorado State University) discussed her research on the diet and movement of *Leptonycteris yerbabuenae* in southwestern New Mexico. Her studies centered on the issues associated with the variability of agave nectar availability and the manner in which this species responded to those challenges.

## *Myotis*

**Taxonomic determinations can be a bear. Those relating to the bats are no exception. Which brings us to the Myotis.**

**The Family *Vespertilionidae* includes several subfamilies. One of those subfamilies is *Myotinae; Myotis* is a genus in that subfamily. Within *Myotis* there are sub-genera. One of those subgenera is *Pizonyx*. All of the *Myotis* species found in our region are in the subgenus *Pizonyx*. All of the *Chiroptera* species found in the Americas are in this subgenus.**

**On this and the following pages we include the range maps of the species reported in the Adams et al. paper (all of these range maps were sourced from Wikipedia under a Creative Commons license).**

**Below: *Leptonycteris yerbabuenae* Lesser Long-nosed Bat Photographed at Portal, Arizona by Narca Moore on 31 August 2011.**

**Cathy Pasterczyk posted a sound recording of *Nyctinomops macrotis*, Big Free-tailed Bat, to iNaturalist. The recording was made on 29 April 2024 in Truth or Consequences.**

**The observation shown below, of a Big Free-tailed Bat in the Chiracahua Mountains of Arizona, was taken by Daniel Estabrooks on 21 June 2006.**

## *Phyllostomidae* (New World Leaf-nosed Bats)

***Leptonycteris yerbabuenae***
**(Miller, 1900)**
**Lesser Long-nosed Bat**
**Range Map Attribution**

## *Vespertilionidae* (All of the remaining species)

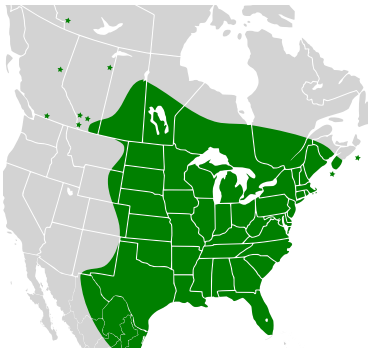
***Lasiurus (Aeorestes) cinereus***
**(Palisot de Beauvois, 1796)**
**Hoary Bat**
**Range Map Attribution**

## *Molossidae* (Free-tailed Bats)

***Nyctinomops macrotis***
**(Gray, 1840)**
**Big Free-tailed Bat**
**Range Map Attribution**

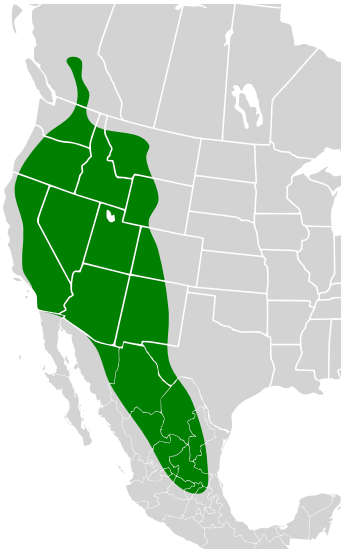
***Lasiurus frantzii***
**(Peters, 1871)**
**Western Red Bat**
**(Split from *L. blosseuillii*)**
**Range Map Attribution**

***Tadarida brasiliensis***
**(I. Geoffroy,1824)**
**Mexican Free-tailed Bat**
**Range Map Attribution**



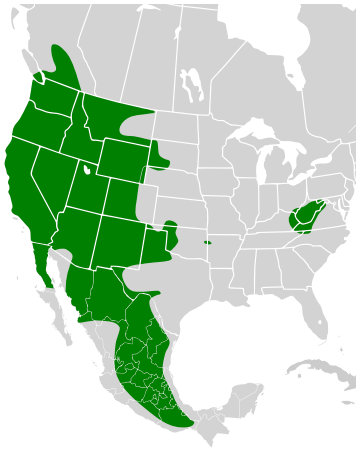
***Lasiurus borealis***
**(Müller, 1776)**
**Eastern Red Bat**
**Range Map Attribution**

***Antrozous pallidus***
**(Le Conte, 1856)**
**Pallid Bat**
**Range Map Attribution**



***Euderma maculatum***
**(J.A. Allen, 1891)**
**Spotted Bat**
**Range Map Attribution**

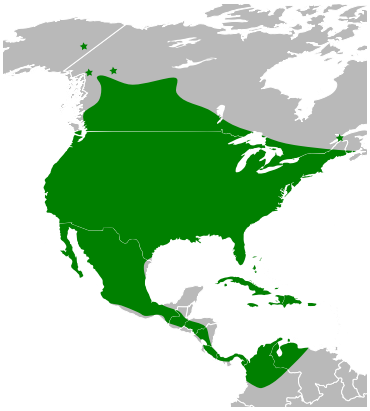
***Myotis auriculus***
**(Baker & Stains, 1955)**
**Southwestern Myotis**
**Range Map Attribution**



***Corynorhinus townsendii* (Cooper, 1837)**
**Townsend's Big-eared Bat**
**Range Map Attribution**

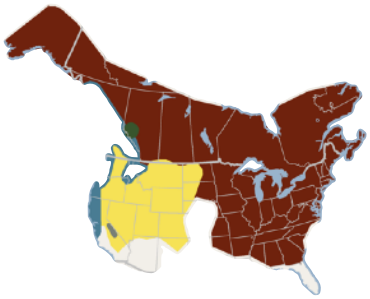
***Idionycteris phyllotis***
**(G.M. Allen, 1891)**
**Allen's (Mexican) Big-eared Bat**
**Range Map Attribution**

***Myotis californicus***
**(Audubon & Bachman, 1842)**
**California Myotis**
**Range Map Attribution**



***Eptesicus fuscus***
**(Beauvois, 1796)**
**Big Brown Bat**
**Range Map Attribution**

***Lasionycteris noctivagans***
**(Le Conte, 1831)**
**Silver-haired Bat**
**Range Map Attribution**



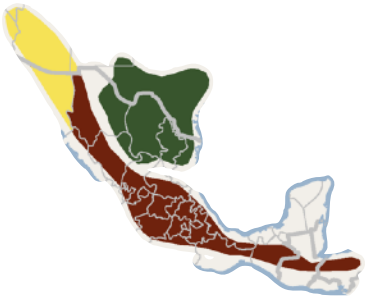
***Myotis carissima***
**(Thomas, 1904)**
**Little Brown Bat**
**Range Map Attribution**
**Yellow is range of *M. carissima*. Other colors indicate ranges of subspecies of *M. lucifugus* when the species is not split.**

***Myotis ciliolabrum***
**(Merriam, 1886)**
**Western Small-footed Bat**
Range Map Attribution

***Myotis thysanodes***
**(Miller, 1897)**
**Fringed Myotis**
Range Map Attribution

***Myotis yumanensis***
**(H. Allen, 1864)**
**Yuma Myotis**
Range Map Attribution

***Myotis evotis***
**(H. Allen, 1864)**
**Long-eared Myotis**
Range Map Attribution

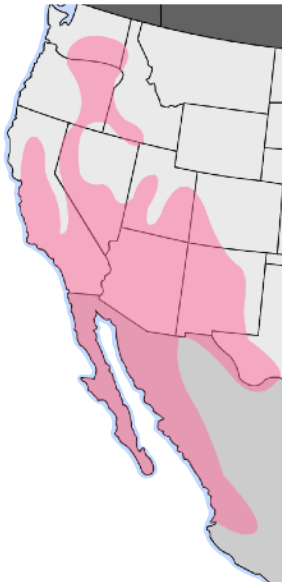


***Myotis velifer***
**(J.A. Allen, 1890)**
**Cave Myotis**
Range Map Attribution

***Nycticeius humeralis***
**(Rafinesque, 1818)**
**Evening Bat**
Range Map Attribution

***Myotis occultus***
**(Hollister, 1909)**
**Arizona Myotis**
Range Map Attribution

***Myotis volans***
**(H. Allen, 1866)**
**Long-legged Myotis**
Range Map Attribution



***Parastrellus (Pipistrellus) hesperus***
**(H. Allen, 1864)**
**Canyon Bat**
Range Map Attribution

## *Tadarida brasiliensis*
## Mexican Free-tailed Bat

**The Mexican Free-tailed Bat is a small to medium-sized bat with a tail that extends beyond the tail membrane. It has dark brown to gray fur and wrinkled lips. The opening page of this article features several images of this species. J. C. Waller photographed the individual shown here north of Hermosa on the east slope of the Black Range, on 6 June 2023. It is shown here under a creative commons license. James N. Stuart provided two images of a specimen caught at a Broad Canyon bioblitz (northwest of Radium Springs) on October 1, 2011. M. L. Watson provides the image below of a Mexican Free-tailed Bat captured by J.N. Stuart, held by Peggy Darr, at the Double E Wildlife Management Area owned by New Mexico Department of Game and Fish. The image is shown here under a creative commons license.**

**This species often roosts in caves, under bridges, and in abandoned mines. It roosts in large colonies, sometimes numbering in the millions.**

**Known for its incredible speed and high-altitude flight, the Mexican Free-tailed Bat is migratory, traveling to Mexico for the winter.**

**This species is mostly insectivorous, feeding on moths, beetles, and other flying insects. Thus it benefits agriculture by providing significant pest control.**

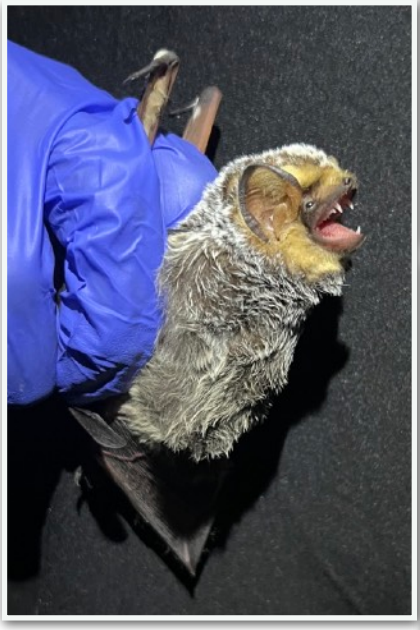
## *Lasiurus cinereus*
## (Palisot de Beauvois, 1796)
## Hoary Bat

**The Hoary Bat is a large bat with frosted or "hoary" fur, a mix of brown, gray, and white. Its wingspan can range up to 16 inches. J. C. Waller photographed the Hoary Bats shown on this page. Waller photographed the individual in the right column on 5 June 2023 near Hermosa on the east slope of the Black Range, the individual shown at the bottom of this column on 6 June 2023 near Hermosa/Winston on the east slope of the Black Range, and the individual shown immediately below near Datil on May 14, 2023. The images are shown here under a creative commons license.**

**Hoary Bats prefer forested areas, roosting in trees rather than caves. They tend to be solitary. This species is migratory, traveling long distances between summer and winter ranges.**

**Hoary Bats are insectivorous, feeding on moths, beetles, and other large insects.**

**At one time, Hoary bats were considered to be one of the most widespread bat species in the Americas, found from Canada to Hawaii. In 2015, a paper by Amy Baird et al. (*Journal of Mammalogy* 96 [6]: 1255–1274) separated the South American, North American, and Hawaiian populations into three species.**



## *Lasiurus frantzii*
## (Peters, 1871)
## Desert (or Western) Red Bat

**This is a migratory species, spending the winter in the southern part of its range - Mexico and Central America.**

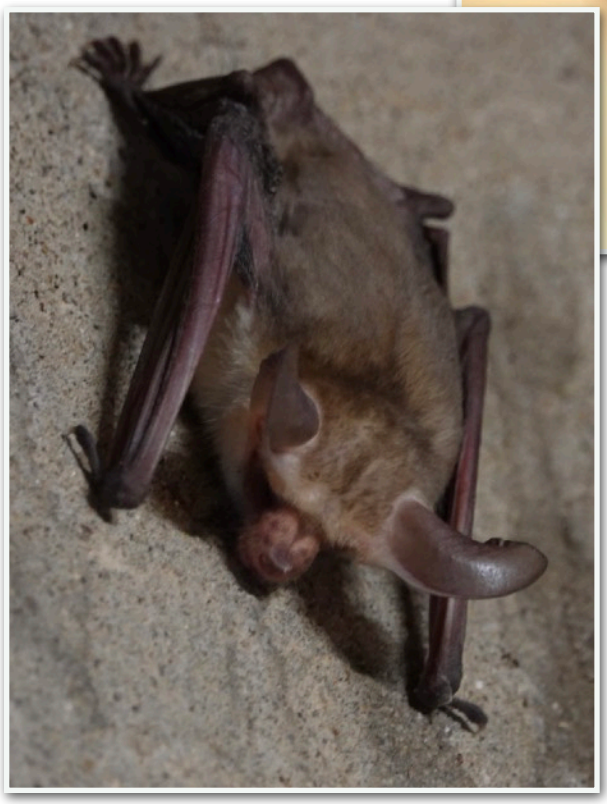
**Cathy Pasterczyk recorded the sound of a Desert (Western) Red Bat in Kingston on July 26, 2023. iNaturalist "nebraskanaturalist" photographed the Desert (Western) Red Bat shown below during May 2016, south of Faywood. M. L. Watson photographed the bat at the right south of the City of Rocks State Park on 19 May 2015. Both images are shown under a creative commons license.**

**At one time the Desert Red Bat was considered a subspecies of *Lasiurus blossevillii*. In appearance, it is very similar to the Eastern Red Bat (thus the "Western" common name). As the alternative common name indicates, this is a species of the desert. Even in "desert" environments individuals of this species (and genus) are generally found in tree foliage and they are often found hibernating in a clump of dead leaves. There are no iNaturalist observations of the Eastern Red Bat from our area.**

**A female may give birth to as many as four pups at a time, as opposed to most bats which generally birth only one. It can take up to six weeks for a pup to fledge.**

## *Antrozous pallidus* (LeConte, 1856) Pallid Bat

**Hillsboro, New Mexico**
**Above and Right: September 14, 2016**
**Below: September 6, 2019**



**Currently the Pallid Bat is placed in the monotypic genus *Antrozous* (it is the only species in the genus). At times in the past it has been placed in its own subfamily and even its own family.**

**Pallid Bats seem to be especially fond of arthropods, like scorpions and crickets, which they consume on the ground or on vegetation. They are apparently immune to scorpion venom. Pallid Bats may consume up to half their own weight in a night of foraging. During the spring they also feed on cactus flower nectar and sometimes cactus fruit later in the year.**

**Pallid Bats are often seen because of their tendency to fly low when hunting, often less than six feet off the ground.**

**This species is heterothermic, meaning that (depending on conditions) they can maintain a stable body temperature (homeothermy) or vary their body temperature based on the surrounding environment (poikilothermy).**

## *Corynorhinus townsendii* (Cooper, 1837)
## Townsend's Big-eared Bat

**The Townsend's Big-eared Bat is a medium-sized bat with enormous ears and lump-like glands on either side of its snout. It prefers caves, mines, and forests. Please note that it is sensitive to disturbance, often abandoning roosts if disturbed. During the winter it hibernates in caves. It feeds on moths, beetles, and other flying insects.**

**Top Left: M. L. Watson photographed this individual on 27 September 2012 at the River Ranch Wildlife Management Area, southwest of Faywood.**

**Top Right: Ben Thompson photographed the individual shown here near Lake Valley on 9 August 2017. Shown here under a creative commons license.**

**Bottom Left and Right: This individual was photographed during May 2015 by Brett (nebraskanaturalist) somewhere along the NM-152 corridor where it crosses the Black Range. Shown here under a creative commons license.**

Townsend's Big-eared Bat

## Spectrograms and Audio Recordings

**Bats live in the world of ultrasound, in frequencies above those which humans can hear. Spectrograms like those from the National Park Service (in the right column) can help humans understand the sound pattern. Even when audio recordings are adjusted to enable humans to hear the calls, they are often so fast that we are ill-equipped to discern what is happening. The spectrograms and audio recordings shown, or linked to, here are the work of Katy Warner/CSU from 2016. In some cases the recordings have been slowed down considerably to allow humans to hear the patterns.**

**An echolocation call sequence followed by social calls of *Antrozous pallidus,* Pallid Bat, is shown in the spectrogram at the top right. Click on the link to hear the call sequence, adjusted to enable human hearing (including slowing the recording down by a factor of 10).**

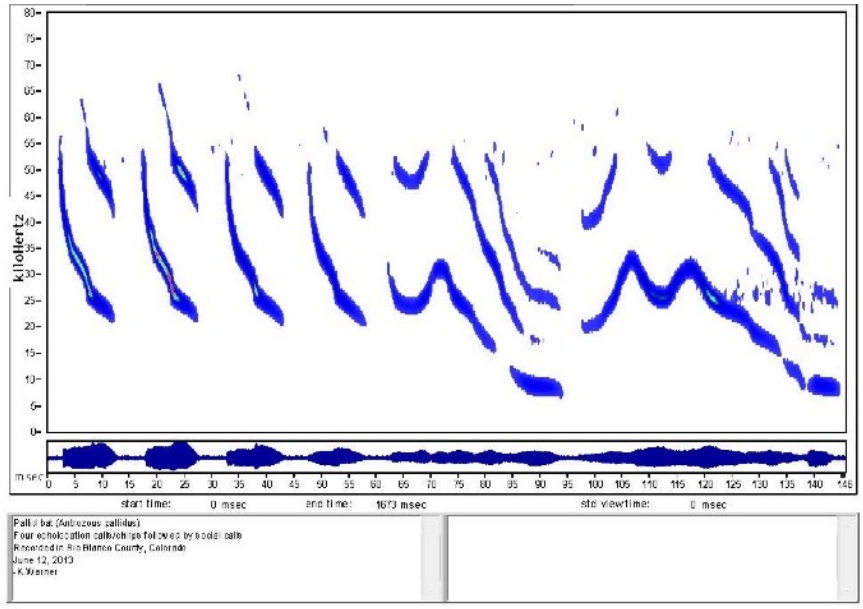
**An echolocation call sequence of *Eptesicus fuscus*, Big Brown Bat, is shown in the spectrogram at the center right. Click on the link to hear the call sequence, adjusted to enable human hearing.**

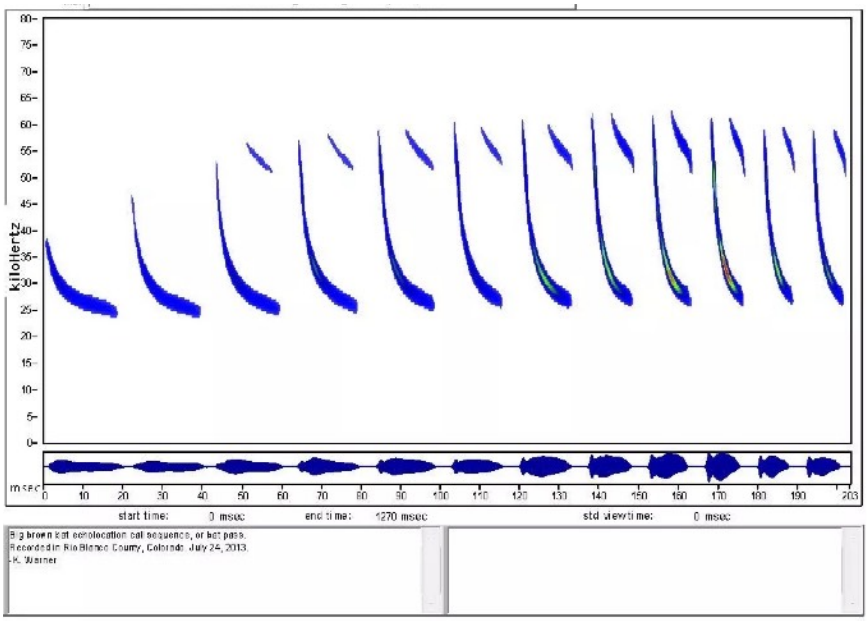
**An echolocation call sequence of *Euderma maculatum, Spotted Bat,* is shown in the spectrogram at the bottom right. Click on the link to hear the call sequence in real time (at the spectrogram). Click on this link to hear the call slowed down by a factor of 10, adjusted to enable human hearing.**

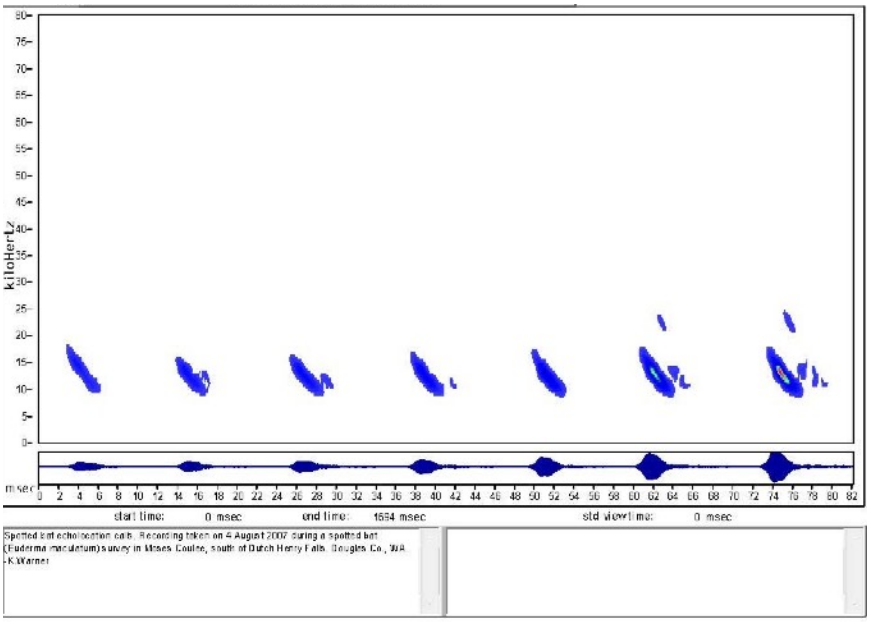
**The Montana Natural Heritage Program has produced an excellent survey of bat calls and provides an extensive discussion of spectrograms. (See Montana Bat Call Identification.) This material is so good that we provide links to it from two sources, the Montana Natural Heritage Program website (above) and The Black Range website at this link (just in case it gets dropped from the Montana site).**

### Spectrogram vs. Sonogram

**Sometimes you will see graphic presentations like those at the right referred to as sonograms. Sonograms are typically medical ultrasound images which use spectrogram instruments (it is basically a trade name). Spectrograms, which is the correct term for the images at the right, display frequency content over time.**



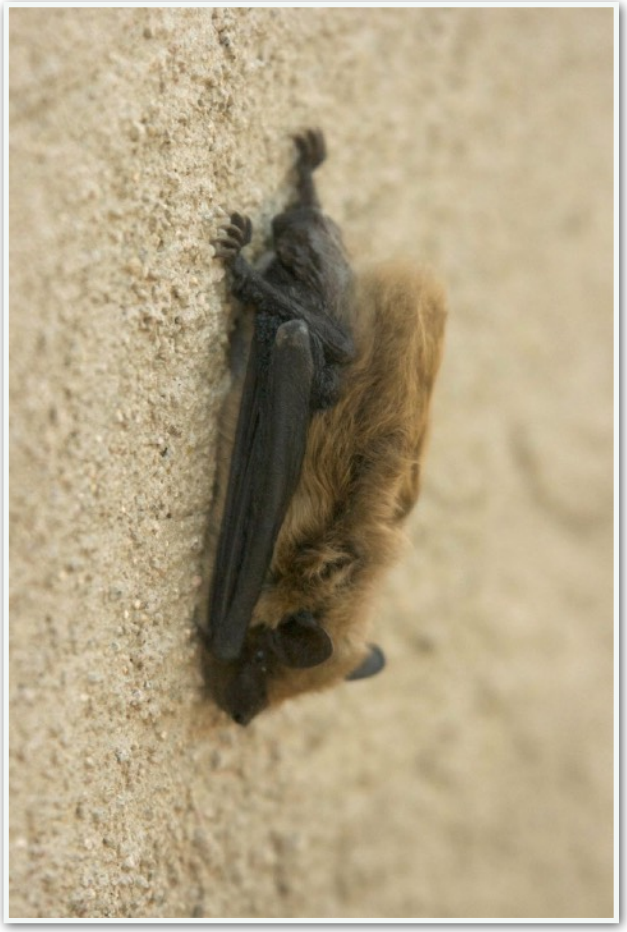



## *Eptesicus fuscus*
## (Palisot de Beauvois, 1796)
## Big Brown Bat

**Left Column: Railroad Canyon, Black Range**
**Right Column: Hillsboro, Black Range**

**The bats on this page were found during the day.**



**This species does well in a variety of habitats, so it is frequently observed.**

**The Big Brown Bat is a medium-sized bat with glossy brown fur and a wingspan of 12-16 inches. It adapts to various environments, including forests, urban areas, and agricultural lands. It roosts in trees, buildings, and caves and often hibernates in man-made structures. Its diet includes many hard-bodied insects (like beetles) and softer prey like moths. Although normally assumed, it is worth noting that this species (like nearly all bat species) is nocturnal.**

**J. C. Waller photographed the individual shown below on June 5, 2023, near Hermosa on the east slope of the Black Range. Tony Palmer photographed the individual shown at the right near Gila Hot Springs on May 13, 2024. Both images are shown under creative commons licenses.**

**Apparently, the Big Brown Bat is more resistant to white-nose syndrome than are other bat species. Its resistance may be because of its physiology but most likely because of habitat selection (conjecture by the editor).**

**From 10 to 30% of young will return to their place of birth and roost there the following year. Roughy three-quarters of females return to the same roost site year after year.**


## *Euderma maculatum* (Allen, 1891)
## Spotted Bat

**There is not an iNaturalist observation of this species from our area as of 2/28/2025. The USGS image above left was taken by Paul Cryan in New Mexico.**

## *Idionycteris phyllotis* (Allen, 1916)
## Allen's (Mexican) Big-eared Bat

**There is an iNaturalist observation of this species from the Caballo Mountains by Dillon Metcalfe. The photograph was taken on 28 January 2021. The image above was taken by Juan Cruzado Cortés in Coahuila on 14 August 2013.**

## *Lasionycteris noctivagans* (Le Conte, 1831)
## Silver-haired Bat

**"Brett" submitted this iNaturalist observation from May 2015. The individual was photographed on the west slope of the Black Range, east of San Lorenzo.**

**The photograph, above, was taken by Harley Shaw in New Mexico.**

**The Silver-haired Bat is a medium-sized bat with dark brown or black fur tipped with silver. It is generally found in forests, often near water, and roosts in tree cavities, under bark, or in buildings.**

**This species is solitary and migratory, moving to warmer areas in winter. It feeds on moths, flies, and other small insects.**

**Silver-haired Bats are slow fliers compared to other species, making them easier to observe.**

## *Myotis auriculus* (Baker and Stains, 1955) Southwestern Myotis

The photograph above was taken by Tony Palmer on May 15, 2024, near Glenwood. It is shown here under a creative commons license.

The photograph at the upper right was taken by J. C. Waller, near Hermosa, on 28 June 2023. It is shown here under a creative commons license.

In the United States this species is found in southeastern Arizona and southwestern New Mexico. From there its range extends south through Mexico to Guatemala.

In 1955, individuals of this population were first identified and thought to be a subspecies of *Myotis evotis*. Later in the same year the subspecies designation *Myotis evotis Apache* was applied to the population by Hoffmeister and Krutzsch. In 1959 Hall and Kelson changed the subspecies designation to *M. e. auriculus*. In 1960 Findley placed the population in the species *Myotis keenii*. In 1969, Genoways and Jones described the population as its own (and present) species. If you have difficulty determining the species of a bat, even when in hand, you are in good company.

This species migrates rather than hibernates. It feeds on insects (mostly moths) at night.

Two characteristics can be useful in identifying this species. Its ears are brown, instead of black as in some species of *Myotis,* and there are no microscopic hairs on its wings.

Although found in many types of locations, Ponderosa Pine forests are the preferred habitat of this species.

William L. Gannon discussed the syntopy between this species and *M. evotis* in "Syntopy Between Two Species of Long-Eared Bats (*Myotis evotis* and *Myotis auriculus*)" - *The Southwestern Naturalist,* Volume 43, Number 3, Sep. 1998, pp. 389-396. From the article: "The term sympatry has been applied to two species or populations that occupy the same geographic locality providing the opportunity to interbreed. Syntopy is the more specific situation in which species are not only sympatric but, more specifically, occupy the same locality at the same time." (In-line reference deleted.) The article references four sites where the two species are found regularly, one two

miles north of Wall Lake in the northern Black Range and another in the San Mateo Mountains to our north. Both species were found throughout the areas surveyed. "At these sites *M. evotis* was captured more frequently at higher elevations and *M. auriculus* was captured more frequently at lower elevations; both species were captured at all three stations."

## *Myotis californicus*
### (Audubon & Bachman, 1842)
## California Myotis

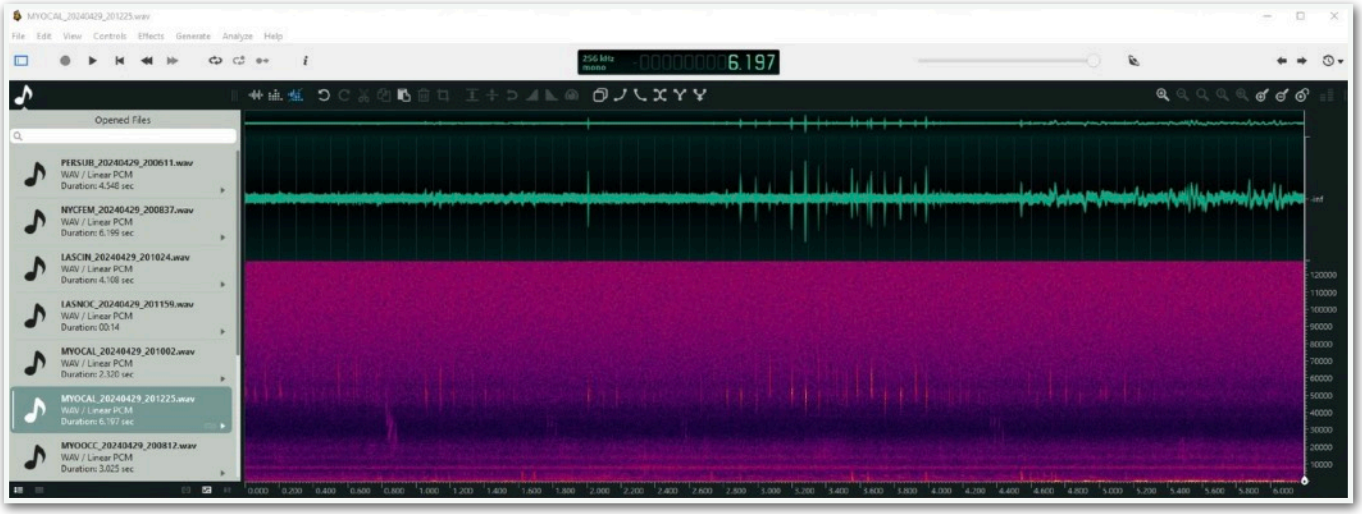
California Myotis is a small bat with brown fur and a wingspan of about 9 inches. It is found in a variety of habitats, including forests, deserts, and riparian areas. It roosts in trees, caves, and buildings.

Emerging late in the evening to hunt, it feeds on small insects like flies and mosquitoes.

The photograph at the upper right was taken by "Brett" during May 2015 west of Mimbres. It is shown here under a creative commons license via iNaturalist.

The sound recording shown below was made on 29 April 2024 by Cathy Pasterczyk at Truth or Consequences.

Matt Becker's photograph of an individual east of Radium Springs is shown at center right. The observation was made on 29 July 2024 and the image is shown here under a creative commons license.



## *Myotis carissima* (Thomas, 1904) Little Brown Bat

**The taxonomic placement of this species is in dispute. Many sources consider it a subspecies of *Myotis lucifugus* (*M. l. carissima*). This is the subspecies, or species, which is found in our area.**

**A sound recording of this species was made on 29 April 2024 by Cathy Pasterczyk at Truth or Consequences. (Listed as *M. lucifugus* in this iNaturalist observation.)**

**There are no iNaturalist visual observations of this species in our area. "jshilko" made the iNaturalist observation shown at the right on April 24, 2024, north of Tucson, Arizona. It is shown here under a creative commons license.**

## *Myotis ciliolabrum* (Merriam, 1886) Western Small-footed Bat

**J. C. Waller made the observation shown at the right on 28 June 2023 north of Hermosa. It is shown here under a creative commons license.**

**This small vesper bat is less than 4 inches in length and has a wingspan of less than 9.5 inches.**

**The face mask of this species is black, something which can be useful in distinguishing it from the California Myotis which has a brownish face mask.**

**There are two subspecies; the nominate form is found in our area.**

**This species is nocturnal and feeds mostly on small insects (flies, moths, beetles…)**

**This species hibernates, typically alone. Although males tend to roost alone, females may form small groups, especially when they are nursing young.**

## *Myotis evotis*
## (H. Allen, 1864)
## Long-eared Myotis

**See the entry for *Myotis auriculus*.**

**J. C. Waller made the observation shown at the right near Datil on 14 May 2023. It is shown here under a creative commons license.**

**The habitat preferences of this species vary significantly, everything from subalpine forests at about 9,000' to semiarid shrub, down to sea level.**

**This species generally roosts in colonies in small openings like vertical crevices. Unlike some other bat species, they seem to prefer roosts that are quite far from water sources. The colony will periodically relocate its roost, en masse.**

**Beetles appear to be a favored food source. Prey is caught in the air or while the bat is foraging on the ground or on a tree trunk.**

## *Myotis occultus*
## (Hollister, 1909)
## Arizona Myotis

**J. C. Waller also made the observation of an Arizona Myotis shown at the bottom right, in or near Hillsboro, on June 5, 2023. It is shown here under a creative commons license.**

**Waller also made iNaturalist observations of this species in the northern part of the Black Range.**

**Cathy Pasterczyk made a sound recording of this species in the southern part of the Black Range on July 26, 2023.**

**In our area, this species might be found at all elevations short of the crown of the very tallest peaks - and probably there as well.**

**The original description of this species was published in *The Proceedings of the Biological Society of Washington*, Vol. XXII, pp. 43-44, March 10, 1909.**

## *Myotis thysanodes* (Miller, 1897) Fringed Myotis

The Fringed Myotis is a medium-sized bat with long, soft fur and a distinctive fringe of hair on the edge of its tail membrane. It prefers forested areas and often roosts in caves, mines, and trees. This species hibernates in winter, often in large colonies. It feeds on moths, beetles, and other flying insects.

The Fringed Myotis is known for its slow, maneuverable flight, which allows it to capture prey in dense vegetation.

Waller made an iNaturalist observation of this species in the northern Black Range (see top right).

Cathy Pasterczyk made a sound recording of this species in the Kingston area of the Black Range on July 26, 2023.

## *Myotis velifer* (J.A. Allen, 1890) Cave Myotis

As of March 4, 2025, there were no iNaturalist observations of this species from the Black Range.

## *Myotis volans* (H. Allen, 1866) Long-legged Myotis

On September 26, 2012, M. L. Watson made the observation shown at the center right at the River Ranch in northern Luna County.

This species is a small bat with long legs and a wingspan of about 10 inches. Its fur is dark brown or black.

The Long-legged Myotis is typically found in forests and mountainous regions, often roosting in trees and rock crevices. It hibernates in winter, often in caves or mines.

This species feeds on moths, beetles, and other flying insects, sometimes flying long distances in search of them.

## *Myotis yumanensis* (H. Allen, 1864) Yuma Myotis

J. C. Waller made the iNaturalist observation of this species (shown at the bottom right of the previous page) near Hermosa in the Black Range on 29 June 2023.

This is a small species, measuring less than two inches in length with a wingspan of less than 10 inches.

## *Nycticeius humeralis* (Rafinesque, 1818) Evening Bat

As of March 4, 2025 there were no iNaturalist observations of this species from the Black Range.

## *Parastrellus hesperus* (H. Allen, 1864) Canyon Bat

*Parastrellus (Pipistrellus) hesperus* is also known as the Western Pipistrelle. It is one of the smallest bats in the U.S., with pale yellow or tan fur and a wingspan of about 8 inches.

This species is typically found in arid and semi-arid regions, often roosting in rock crevices, cliffs, and buildings.

The Canyon Bat often starts foraging early in the evening, often before sunset. It flies erratically, resembling a large moth. It feeds on small insects like flies, mosquitoes, and beetles.

J. C. Waller made the iNaturalist observation of this species (shown at the top right) near Hermosa in the Black Range on 6 June 2023.

## Photoluminescent Feet of Mexican Free-tailed Bat

Yes, the feet of Mexican Free-tailed Bats light up like neon signs when exposed to ultraviolet lights.

Fernando Gual-Suárez, Daniel Ramos-H., Falco García et al. reported their findings in "Ultraviolet-induced photoluminescent bristles on the feet of the Mexican free-tailed bat (Tadarida brasiliensis)", published in *Mammalian Biology* 104, 751–756, on 08 August 2024. (This is a Springer paywall; you can request a copy directly from the authors at this link.)

A Cave Myotis surveyed at the same time did not exhibit photoluminescent.

Surveys of museum specimens had not shown this feature, perhaps because chemicals used to preserve the bats exhibit a green glow - thus obscuring the photoluminescent of the feet. The research team was using ultraviolet flashlights to look for photoluminescent powder used to track bats when they made the initial observation reported in the subject paper.

## Can Bat Guano Be Used to Reconstruct Forest Fire History?

Maybe, and in limited circumstances. Researchers studied this question and reported their findings in "Fire in Feces: Bats Reliably Record Fire History in Their Guano", Alexandra Tsalickis, Richard S. Vachula, J. Conner Welch, Joshua W. Campbell, Matthew N. Waters, *Geophysical Research Letters, AGU*, 16 October 2024, Vol 51, Issue 19.

They found that it was possible to identify a subset of all fires by assessing charcoal which can accumulate in bat guano. The study approach worked best for prescribed burns during warmer (when bats are not hibernating) months. Charcoal from fires tended not to be deposited when the bats were hibernating, and it tended not to be deposited from wildfire events, perhaps because the bats avoided these more intense fire events.

## White-nose Syndrome

Anyone who ventures into a cave these days must be aware of a fungal pathogen called *Pseudogymnoascus destructans* which causes "White-nose Syndrome" in bats. This infection is widespread, especially in eastern North America, and can be easily spread by individuals who travel from a cave system where the fungus is present to one where it is not.

In "Pathogenic strategies of Pseudogymnoascus destructans during torpor and arousal of hibernating bats", Marcos Isidoro-Ayza and Bruce S. Klein report on their research into how and under what circumstances the infection is spread, and a possible treatment (*Science*, 385, pp. 194-200, 11 July 2024).

From the article: "Bats sustain our planet's biodiversity and ecosystems, enhancing human, animal, and economic health. White-nose syndrome (WNS) is among the most pressing threats for hibernating bats in the US and Canada. Since the first report in 2007, WNS has killed millions of North American bats, with

**>95% decline in some species and extirpation of entire populations."**

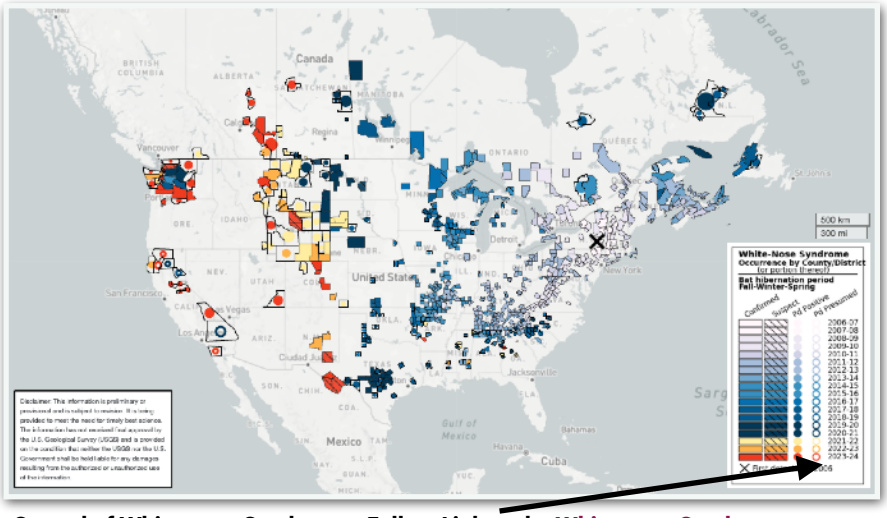
**Deb Harrison provided the following comment after reviewing the above on July 12, 2024. "Going into a hibernating or nursery colony has always been a no-no. Although I have been in for bat counts back-in-the-day with Dave J. Now, remote sensing song meters or anabat are set up and there is no need to disturb the bats. The "song" is like what we see on Merlin, species calls are unique. Maybe better identification too than old style counts?? Jeff and I did this in lava tubes for BLM in Idaho.**

**I'm just starting to cave again and did my first decon of gear. Wasn't as bad as I thought. The big caving projects also require that the caver keep a second set of gear only for that cave in lockers. So cave gear never leaves that area."**

**White-nose Syndrome and how it is linked to increases in the death rate of human babies is discussed later in this issue, see: "Inherent, But Not Obvious, Linkages in Eco-systems".**

**On 5 June 2023, the United States Bureau of Land Management and the New Mexico Department of Game and Fish reported that "For the first time, White-nose Syndrome (WNS), a disease of hibernating bats, has been confirmed in New Mexico. Samples from two live bats and two deceased bats were collected in late April from BLM-managed caves in Lincoln and De Baca counties. . . .The two dead bats were confirmed with WNS, one a fringed myotis in Lincoln County, the other a cave myotis in De Baca County. Additionally, wing biopsies from two live cave myotis at the same Lincoln Co. site revealed microscopic lesions consistent with WNS. WNS is caused by an invasive fungal pathogen named *Pseudogymnoascus destructans* (Pd). Although Pd was previously detected in New Mexico in 2021, evidence of the disease had not been confirmed in the state until now."**

**White-nose Syndrome has spread quickly across the U. S. and Canada since it was first discovered in 2006 in New York. There is no particular reason to believe that it will not spread within New Mexico.**




**Spread of White-nose Syndrome: Follow Link to the White-nose Syndrome Response Team website which has a "slider-function" on this image allowing you to see the progress of this condition since 2006 when it was first discovered in the United States.**

**Arizona Game and Fish has reported that bats, including one of the species *Myotis velifer*, Cave Bat, surveyed at Fort Huachuca tested positive for *Pseudogymnoascus destructans* during June 2024. In the five years preceding that the fungus has been found on: Fringed Bat, *Myotis thysanodes;* Southwestern Myotis, *Myotis auriculus*; and Big Brown Bat, *Eptesicus fuscus*.**

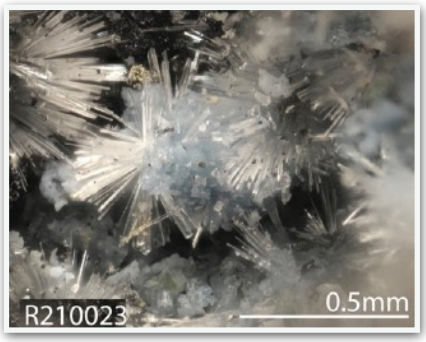
**The probable source of Pd. has been traced to caves in the Ukraine, most likely brought to North America by cavers exploring those sites. In addition, "the widespread causative agent is not a single species but two sympatric cryptic species" - only one has made it to North America. (Fischer, N.M., Dumville, I., Nabholz, B. *et al.* "Two distinct host-specialized fungal species cause white-nose disease in bats", *Nature*, 28 May 2025.)**

## Three New Minerals Discovered Near Cooke's Peak

**In 2016, Ray Demark found an "interesting" rock sample near Cooke's Peak. The International Mineralogical Association has now recognized three new minerals in that sample.**

**Two of the minerals, raydemarkite (top photo) and virgilluethite (middle photo), have the same chemical composition but their crystalline structures are different. The third mineral (bottom photo) is stunorthropite. All three are microscopic, at least in the sample collected near Cooke's Peak.**

**Photographs courtesy of New Mexico Mineral Museum at the New Mexico Bureau of Geology and Mineral Resources in Socorro.**





## 2024 Christmas Bird Count

| Species | Total Number Seen | | |
|---|---|---|---|
| | Hillsboro | Caballo | Silver City |
| Snow Goose | | 25 | |
| Canada Goose | | 438 | |
| Wood Duck | | | 1 |
| Gadwall | | 145 | |
| American Wigeon | | 2033 | 14 |
| Mallard | | 112 | 40 |
| Mallard (Mexican) | | 10 | 3 |
| Northern Shoveler | | 175 | |
| Northern Pintail | | 61 | |
| Greem-winged Teal | | 35 | 4 |
| Canvasback | | 2 | |
| Redhead | | 1 | |
| Ring-necked Duck | | 13 | |
| Bufflehead | | 1 | 8 |
| Common Merganser | | 90 | |
| Scaled Quail | 2 | | |
| Gambel's Quail | 257 | 233 | 377 |
| Montezuma Quail | | | 4 |
| Wild Turkey | | 33 | 38 |
| Pied-billed Grebe | | 6 | 4 |
| Western Grebe | | 12 | |
| Clark's Grebe | | 1 | |
| Double-crested Cormorant | | 30 | |
| American White Pelican | | 8 | |
| Great Blue Heron | | 23 | 2 |
| Great Egret | | 3 | |
| Black-crowned Night-Heron | | 4 | |
| Northern Harrier | 3 | 10 | 1 |
| Sharp-shinned Hawk | 2 | 2 | 2 |
| Cooper's Hawk | 3 | 4 | 5 |
| Red-tailed Hawk | 9 | 22 | 25 |
| Ferruginous Hawk | | 3 | |
| American Coot | | 42 | 2 |
| Sandhill Crane | | 6556 | |
| Killdeer | | 33 | 2 |
| Spotted Sandpiper | | 41 | |
| Greater Yellowlegs | | 8 | |
| Willet | | 1 | |
| Least Sandpiper | | 243 | |
| Long-billed Dowitcher | | 61 | |
| Willson's Snipe | | 9 | |
| Ring-billed Gull | | 11 | |
| Rock Pigeon | | 11 | 37 |
| Eurasian Collared-Dove | 43 | 64 | 28 |
| Inca Dove | | 6 | |
| White-winged Dove | 90 | 658 | 135 |
| Mourning Dove | 18 | 308 | 13 |
| Greater Roadrunner | 3 | 6 | 4 |
| (American) Barn Owl | 1 | 1 | |
| Western Screech-Owl | | | 2 |
| Great Horned Owl | 2 | 2 | 4 |
| Long-eared Owl | | | 1 |
| Broad-billed Hummingbird | | | 1 |
| Anna's Hummingbird | 2 | | |
| Belted Kingfisher | | 11 | 1 |

## 2024 Christmas Bird Count

| Species | Total Number Seen | | |
|---|---|---|---|
| | Hillsboro | Caballo | Silver City |
| Acorn Woodpecker | 3 | 18 | 28 |
| Williamson's Sapsucker | 1 | | |
| Yellow-bellied Sapsucker | | 2 | |
| Red-naped Sapsucker | 14 | 11 | 13 |
| Ladder-backed Woodpecker | 20 | 50 | 16 |
| Downy Woodpecker | 2 | | |
| Hairy Woodpecker | 11 | | 6 |
| Northern Flicker | 31 | 27 | 43 |
| American Kestrel | 4 | 33 | 9 |
| Peregrine Falcon | | | 1 |
| Prairie Falcon | | 1 | 1 |
| Dusky Flycatcher | | 1 | |
| Black Phoebe | | 12 | 2 |
| Eastern Phoebe | | 1 | |
| Say's Phoebe | 3 | 52 | 14 |
| Vermillion Flycatcher | | 4 | |
| Loggerhead Shrike | 4 | 16 | 3 |
| Hutton's Vireo | 1 | | 1 |
| Pinyon Jay | 2 | | |
| Steller's Jay | 3 | | 8 |
| Woodhouse's Scrub-Jay | 69 | 3 | 168 |
| Mexican Jay | | | 51 |
| American Crow | | 17 | 18 |
| Chihuahuan Raven | 10 | 17 | 22 |
| Common Raven | 39 | 58 | 69 |
| Horned Lark | 1 | | |
| Northern Rough-winged Swallow | | 2 | |
| Mountain Chickadee | 7 | | 8 |
| Bridled Titmouse | 16 | 4 | 27 |
| Juniper Titmouse | 16 | 1 | 31 |
| Verdin | 6 | 23 | 3 |
| Bushtit | 26 | 2 | 178 |
| White-breasted Nuthatch | 6 | 3 | 22 |
| Rock Wren | 13 | 8 | 6 |
| Canyon Wren | 26 | | |
| House Wren | | 1 | |
| Marsh Wren | | 5 | |
| Bewick's Wren | 5 | 10 | 11 |
| Cactus Wren | 2 | 3 | 13 |
| Black-tailed Gnatcatcher | | 2 | |
| Golden-crowned Kinglet | 1 | | |
| Ruby-crowned Kinglet | 28 | 66 | 67 |
| Western Bluebird | 72 | 107 | 411 |
| Mountain Bluebird | 4 | 2 | 27 |
| Townsend's Solitaire | | | 4 |
| Hermit Thrush | 5 | 5 | 7 |
| American Robin | 9 | 17 | 136 |
| Curve-billed Thrasher | 14 | 17 | 21 |
| Crissal Thrasher | 4 | 6 | |
| Sage Thrasher | 2 | | 2 |
| Northern Mockingbird | 4 | 7 | 2 |
| European Starling | 2 | 425 | 3 |
| American Pipit | | 65 | 1 |
| Cedar Waxwing | 6 | | 26 |
| Phainopepla | 14 | 32 | 30 |
| Common Yellowthroat | | 1 | |
| Yellow-rumped Warbler | 9 | 63 | 52 |
| Yellow-breasted Chat | 1 | | |

2024 Christmas Bird Count

| Species | Total Number Seen | | |
|---|---|---|---|
| | Hillsboro | Caballo | Silver City |
| Cassin's Sparrow | 5 | | |
| Chipping Sparrow | 41 | 62 | 25 |
| Black-chinned Sparrow | 13 | | 1 |
| Brewer's Sparrow | 6 | 13 | 11 |
| Black-throated Sparrow | 29 | 43 | 24 |
| Lark Sparrow | 4 | | |
| Lark Bunting | 2 | | |
| Dark-eyed Junco | 325 | 149 | 275 |
| White-crowned Sparrow | 376 | 779 | 345 |
| Savannah Sparrow | | 6 | |
| Sagebrush/Bell's Sparrow (Sage Sparrow) | 5 | | 4 |
| Vesper Sparrow | 1 | | 1 |
| Song Sparrow | 3 | 24 | 2 |
| Lincoln's Sparrow | 2 | 9 | 4 |
| Canyon Towhee | 79 | 3 | 109 |
| Rufous-crowned Sparrow | 14 | 1 | 7 |
| Green-tailed Towhee | 2 | | |
| Spotted Towhee | 46 | 4 | 38 |
| Northern Cardinal | 14 | 2 | |
| Pyrrhuloxia | 10 | 24 | |
| Red-winged Blackbird | 27 | 331 | 29 |
| Western Meadowlark | 73 | 70 | 35 |
| Eastern Meadowlark | | | 16 |
| Yellow-headed Blackbird | | 48 | |
| Brewer's Blackbird | 37 | 457 | 402 |
| Great-tailed Grackle | | 91 | 5 |
| Brown-headed Cowbird | 1 | 25 | |
| House Finch | 119 | 579 | 273 |
| Cassin's Finch | 2 | | |
| Pine Siskin | 4 | 3 | 49 |
| Lesser Goldfinch | 30 | 48 | 29 |
| American Goldfinch | 1 | 4 | |
| House Sparrow | 73 | 284 | 113 |
| | | | |
| | | | |
| Total Species | 82 | 115 | 96 |
| | 2303 | 15866 | 4116 |

# 2024 Christmas Bird Count - Hillsboro - Caballo - Silver City

**These are unofficial Christmas Bird Count (CBC) results for 2024. To see the full (official reports) follow the links below.**

**The Hillsboro CBC was held on December 16. Twenty observers spent 61.85 hours in the field and/or at feeders. They travelled 88.61 miles by car and 41.14 miles on foot. In all, 82 species (2303 individuals) were observe during the count.**

**The Silver City CBC was held on December 21. Thirty observers spent 62.75 hours in the field or at feeders. 96 species (4116 individuals) were observed during the count.**

**The Caballo CBC was held on December 29. Twenty-two observers spent 61.2 hours in the field or at feeders. 115 species (15866 individuals) were observed during the count.**

**These three counts have their similarities and their differences. In total, however, they provide a fair assessment of the winter birds of the Black Range.**

**Of the 146 species observed during these three counts, 57 were observed only on one count and only 54 were seen on all three counts. That distribution is a function of the very different habitats which were covered during these counts.**

**The total species seen on the various counts varied from 82 to 115; the number of individuals seen on the counts varied from 2303 to 15866. The highest number of both species and individuals was tabulated on the Caballo count. The Caballo count includes productive riparian habitat and thus high counts of waterfowl, shorebirds, etc. More individual Sandhill Cranes were seen on the Caballo count than the total (individual) birds seen on the other two counts combined.**

**The birds of higher elevations were not observed during any of the counts. So, Spotted Owl does not appear on any of the lists, for instance.**

**Northern Cardinals were observed on both the Hillsboro and Caballo counts but not on the Silver City count. It is generally assumed that the cardinals being found on the east side of the Black Range are from the Arizona population which has spread east. If that assumption is correct, and there is ample evidence that is true, then what are we to make of the absence of Northern Cardinals on the Silver City count?**

**American Crows were observed on the Caballo and Silver City counts but not on the Hillsboro count. It is likely that this species will be observed on the Hillsboro count at some point in the future.**

**Red-naped Sapsuckers were observed on all three counts. The Caballo count included observations of two Yellow-bellied Sapsuckers. The presence of two members of this superspecies is interesting, especially in light of continued angst about the species determination of some individuals which have been seen in Hillsboro and at least tentatively determined to be Red-breasted Sapsuckers. The possibility that all three members of the superspecies might be present in this area is intriguing. Should that be true, we may have the material for a master class in species identification. (At the very least we may be able to offer master classes in hybridization.)**

**Two European Starlings on the Hillsboro count and 3 on the Silver City count are reason for those areas to rejoice. Caballo with 425 - not so much.**

**A comparison of these three counts can be very useful when we try to identify species which have not been on a count but which are certainly possible. Hillsboro is always going to struggle in its efforts to add waterfowl to its count, significant bodies of water being absent in the area. The Silver City count will never match the Caballo waterfowl count either. But there are a number of species which were seen on two of the three counts (the mix varies). In such cases, it is reasonable to hope that the species may show up on the other count in the future. Ensuring that observers include habitat where such species may be found, on their routes, can add a proactive touch to our efforts. The same type of focus may increase the number of individuals, of some species, which are observed. Several species are represented by 1 or 2 total individuals across the counts.**

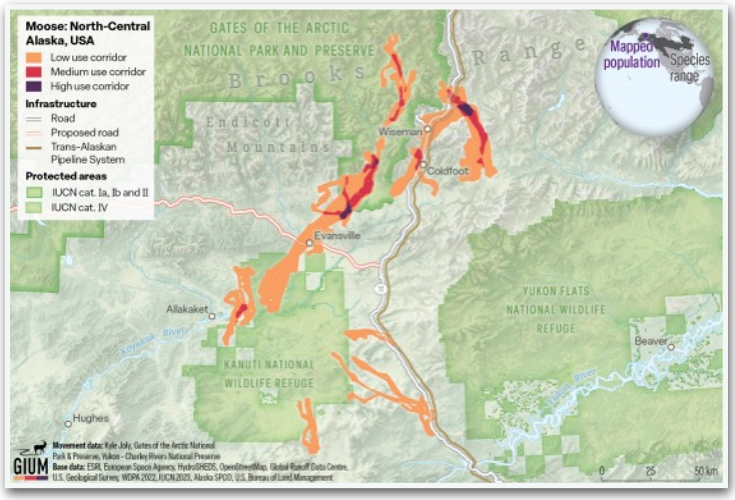
# Atlas of Ungulate Migration - Mule Deer

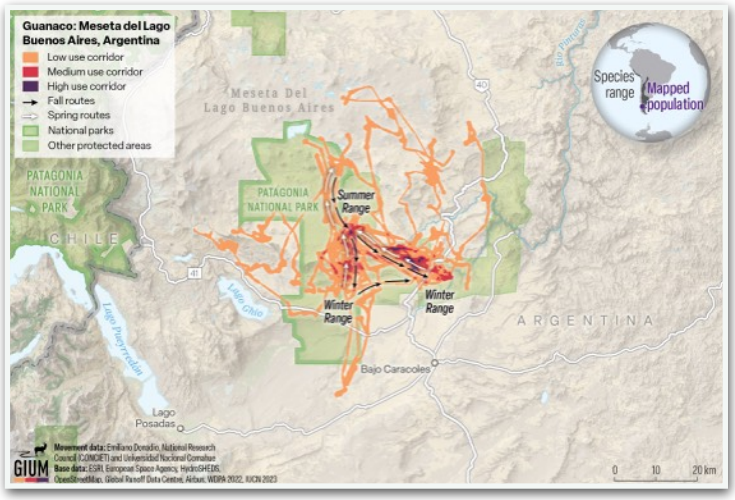
**The Global Initiative on Ungulate Migration (GIUM) is well under way and is producing significant research material. The continental (lower 48) United States is represented by the study of a Mule Deer (*Odocoileus hemionus*) population in Wyoming. In addition to the map below, the project has also produced a factsheet, and map data access is provided.**

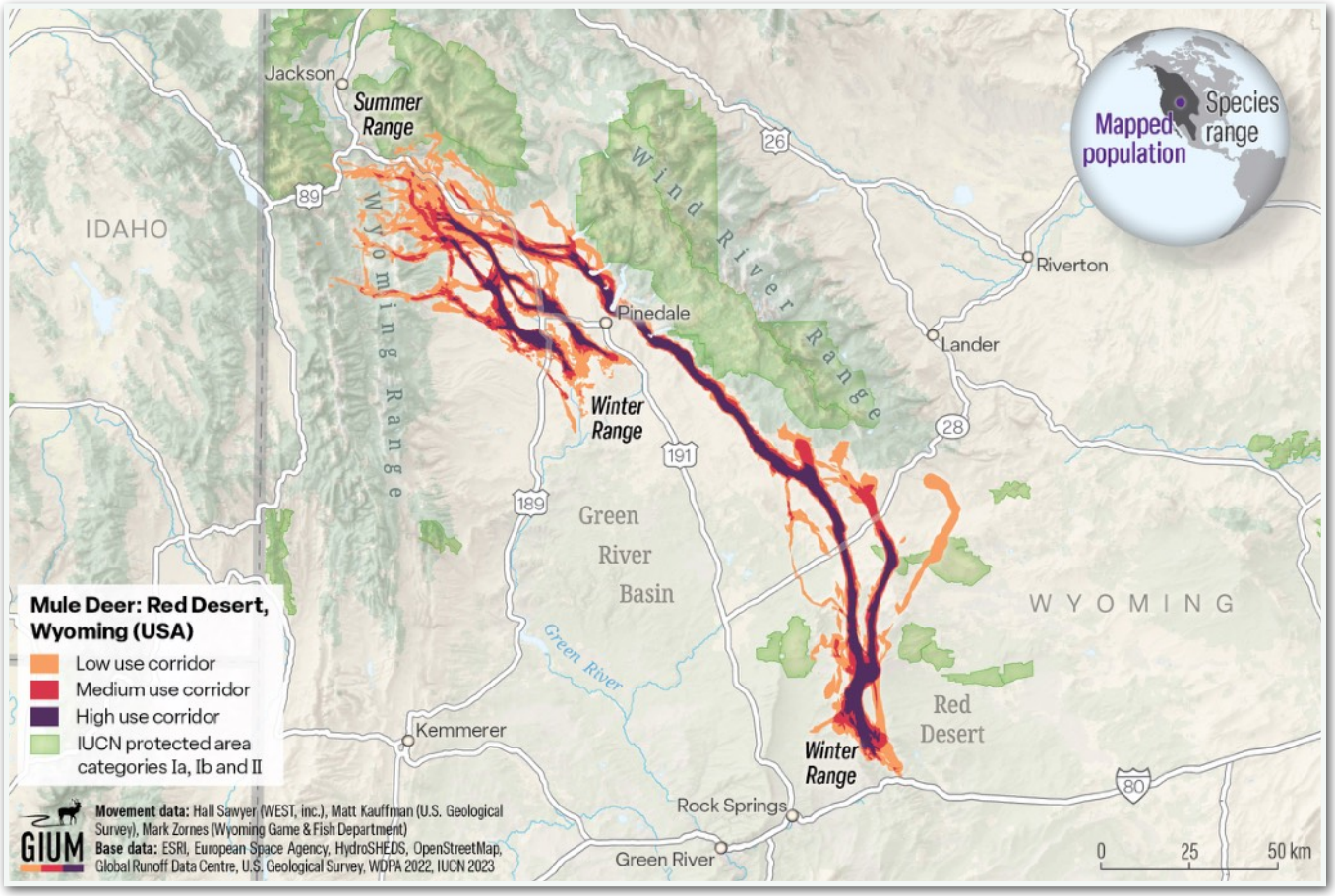
**The initiative addresses only three species in the Western Hemisphere at this time; the other two species are not found in the Black Range. Alaska is represented by a study of Moose (*Alces alces*) - map at upper right. Argentina is represented by a study of Guanaco (*Lama guanicoe*), map at center right.**

**From the CMS (Convention on the Conservation of Migratory Species of Wild Animals) website: "What is GIUM? - Most of the world's large terrestrial mammals are ungulates, and many of them migrate seasonally to sustain their massive herds on landscapes around the planet. The abundance that migration supports in turn connects systems and promotes the resilience of the ecosystems that sustain subsistence hunting, rural economies, and provides the primary prey base for almost all the world's top carnivores.**

**"Today, the slow and steady spread of our human footprint represents a common threat to ungulate migrations across the globe. The wild landscapes that migrations require are increasingly fragmented and degraded by roads, fences, agriculture, energy**



development, and human settlements. Migrations are being lost for species as diverse as bighorn sheep, elk, bison, pronghorn, springbok, Thompson's gazelle, hartebeest, scimitar-horned oryx, zebra, and wildebeest.

"New advances in migration science now make it possible to identify threats to corridors and pinpoint conservation opportunities. In North America and Europe, corridor maps are being used to target fences for modification or removal, site road-crossing structures, adjust energy development footprints, and focus conservation efforts on working lands. Such initiatives however are constrained by technological hurdles and in need of support. . . .

"For many ungulate herds around the world, conserving their migrations is constrained by a lack of detailed maps that identify key corridors or linkage areas. New analytical techniques now allow researchers to build detailed migration maps from the seasonal paths of tracked individuals. To delineate migrations, researchers first categorize all animal locations by season. In temperate regions, the key seasons are summer and winter ranges, whereas in tropical regions, most migratory herds move between dry and rainy season habitat. Statistical analyses are then used to delineate polygons representing seasonal ranges, stopovers, and corridors. A final step is to calculate high- and low-use corridors, which allows conservationists to target and conserve the most important corridor segments or linkage areas. [ed: A graphic description of this process is shown above - arrow added.] Not all migratory herds use distinct corridors, but even mapping of wide-ranging, nomadic species, can illustrate critical habitats needed to sustain seasonal movements."

This effort is noteworthy on several fronts. The utility of the outputs is immediately obvious, look at one of these maps and your mind will race with the possible uses. Especially when the granularity of data is explored - a data set based on individual GPS readings. But the process and support system is also noteworthy. The leadership team is prominent, take for example Simon Chamaillé-Jammes. In April 2015, Chamaillé-Jammes, Louise Riotte-Lambert, and Simon Benhamou published "How Memory-Based Movement Leads to Nonterritorial Spatial Segregation" in *The American Naturalist*, (Vol. 184, No. 4). On 20 October 2017 the group which published the April 2015 article was joined by Christophe Bonenfant to publish "Spatial memory shapes density dependence in population dynamics" in *Proceedings of the Royal Society B* (284: 20171411. http://dx.doi.org/10.1098/rspb.2017.1411).

Rémi Patin, Daniel Fortin, and Simon Chamaillé-Jammes are currently working on a study of memory of predator-prey interaction. A working draft - not a published document - of "A theory of the use of information by enemies in the predator-prey space race" is found here.

Knowledge of migration patterns melded with an understanding of the specifics which drive the particulars of those migrations is powerful stuff.

Recognizing that there are inherent difficulties in any study of this type there are still opportunities for all of us to participate, even if we don't know what we are participating in. Taking detailed observational data and making the data available in some form enables myriad others to use it to advance our collective understanding.

For a few decades the concept of an "Ecology of Fear" (aka landscape of fear") has been a tool used in wildlife management and conservation. The basic idea is that the actions of predators influence the actions of their prey. Major studies in Yellowstone and in Mozambique have demonstrated the validity of the idea and how it can be used in policy making and management. The Yellowstone studies and programs have recently been questioned by some, for instance, see "Does restoring apex predators to food webs restore ecosystems? Large carnivores in Yellowstone as a model system", *Ecological Monographs*, 30 January 2024 https://doi.org/10.1002/ecm.1598, by N. Thompson Hobbs, Danielle B. Johnston, Kristin N. Marshall, Evan C. Wolf, and David J. Cooper. Some summaries of this study have stated that the study is a major challenge to the "landscape of fear" hypothesis and its use as a management tool. I am more persuaded by the study than the summary of the study published in some journals. Of consequence is the authors' hypothesis "that intense elk browsing interrupted the mutualism between willow and beavers: ecosystem engineering by beavers was a critical component of willow habitat and tall willows were a critical component of habitat for beavers. This interruption made riparian communities resilient to the disturbance caused by the restoration of apex predators. . . .We found that willows grew to heights expected for restored communities only in the presence of dams and reduced browsing. . . .We conclude that the restoration of large carnivores to the food web failed to restore riparian plant communities on

Yellowstone's northern range, supporting the hypothesis that this ecosystem is in an alternative stable state caused primarily by the extirpation of apex predators during the early 20th century."

A better summary of the study (than "landscape of fear" is wrong) is "when you break things there is rarely one simple way to fix things" or "apex predators don't fix everything" or "we need some beavers in the mix as well". You need the apex predators, but you also need a lot of the other things that were in the ecological niche before it was degraded or destroyed. When thinking about reintroduction and restoration programs, more attention needs to be paid to the total ecological milieu than to single components (like wooly mammoths, grey wolves, etc.).

## In-situ Collaborative Experiment for the Collection of Hail In the Plains (ICECHIP)

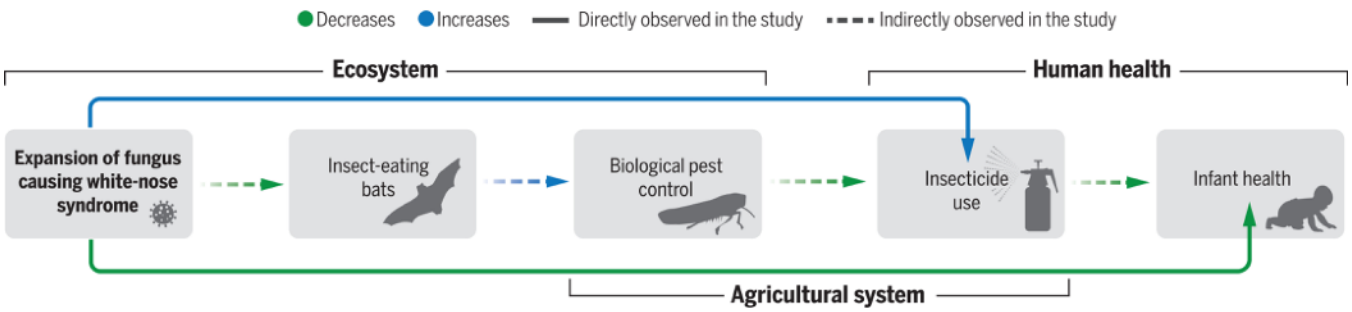
Light hailstorms are uncommon in the Black Range, but there are a few in Hillsboro every year. On October 18, 2017, one with a bit more bite occurred in Hillsboro (follow the link on the image below). The link will open a short video which was recorded from a house in that settlement. Apparently the videographer was not eager to venture into the maelstrom. At 1:20 the bottom step, which is almost completely obscured, was 4.5" tall (hail drifted into the area) and at 1:10 NM-152 is "running" or at least each side of the road is. Very little is edited out of the video; the accumulation happened very fast. Fiberglass sheeting on a greenhouse had quarter-sized holes punched out by the hail. But we do not have the very bad hailstorms which occur in other locales.

Hailstorms create a great deal of damage ($46B in the U.S. in 2023) and very little is known about the formation and dynamics of these storms. ICECHIP received a small grant from the National Science Foundation. The initial award grant noted that "The In-Situ Collaborative Experiment for the Collection of Hail in the Plains (ICECHIP) study would make use of a host of instrumentation to study hail processes in thunderstorms in the Great Plains and Front Range of the Rocky Mountains, the US locations that most commonly experience hail. The project would engage with stakeholders such as the insurance industry and operational weather forecasters to ensure broad societal impact. Significant student participation would ensure the training and education of the next generation of scientists.

"The ICECHIP field campaign would make use of research aircraft, a set of ground-based radars, unmanned aerial systems, surface and upper-air instrumentation, and ground observations of hail. The research team has identified 5 major science themes that they plan to address: 1) improve understanding of hailstone development, in storm characteristics, and fall behavior; 2) examine in-storm hail trajectory and convective updraft relationships; 3) assess the impact of differing environmental thermodynamic and kinetic regimes and geographic location on hail processes and predictability; 4) summarize surface properties of hailstones and associated impacts; 5) characterize hailstone physical properties and their relationship to radar observations."

A much larger grant followed and field work was scheduled for the summer of 2025. As results become available we will report them.

Hail researchers are already looking at how damage can be mitigated by modifying current building materials. Solar farms present a significant and newly emerging vulnerability; damage to these facilities could have significant knock-on effects. More knowledge about hailstorm causation, formation, and magnitude could be extremely valuable in the siting of solar farms.




**Schematic framework linking the ecosystem and human health as being intermediated by the agricultural system. The figure depicts the main elements in the study and the theoretical predictions made regarding how (i) bat die-offs due to an invasive fungus species lead to lower provision of biological pest control, (ii) in turn causing farmers to compensate with higher insecticide use, and (iii) resulting in negative impacts on human infant health. The two solid lines highlight the observed relationships examined in this study. (Image and caption from the study.)**

## Inherent, But Not Obvious, Linkages in Ecosystems

**In the restoration and reintroduction articles earlier in this issue we discussed the myriad issues associated with such programs. Earlier (discussion of "Does restoring apex predators to food webs restore ecosystems? Large carnivores in Yellowstone as a model system") we noted that remedies for ecosystem disruption are not straightforward. The answer to that study's question is "not by themselves".**

**Ecosystem webs are of course what is studied in ecology programs. But our understanding of those webs is increasingly disrupted by some little study that dares to say "yeah. . . .but".**

**I chose the title of this article as a heading, rather than the study by Eyal Frank, "The Economic Impacts of Ecosystem Disruptions: Costs From Substituting Biological Pest Control" because it addresses the broader question raised by the study (*Science*, Vol. 385, No. 6713, https://www.science.org/doi/10.1126/science.adg0344) . The *Science* editor's summary of the article notes "White-nose syndrome has caused declines in bat species across North America. Because bats typically prey on agricultural insect pests, this decline can be treated as a natural experiment to quantify the costs associated with the loss of an important ecosystem service. Frank used quasi-experimental methods to investigate how insecticide use can compensate for the loss of natural pest control from bats by considering both the economic and health costs of insecticides (see the Policy Forum by Larsen *et al*.). County-level insecticide use and infant mortality due to internal causes both increased after the emergence of white-nose syndrome, whereas farms' crop revenue decreased. This study provides an example of how biodiversity loss affects human well-being and presents observational methods for quantifying those costs."**

**Frank notes: "Ecologists have established, through experimental and observational studies, that insect-eating bats can limit crop pest populations. A long-standing prediction has been that if bat populations were to decline, so would their provision of biological pest control, and farmers would have to compensate with insecticides. Epidemiologists and public health experts have been concerned about the health impacts of pesticides even before Rachel Carson's seminal work in *Silent Spring*. The wildlife disease that is killing bats, with mortality rates averaging at above 70%, began spreading in the United States in 2006 as a result of an invasive fungus species. The gradual expansion of the disease provides a setting that approximates random manipulation of bat population levels, which allowed me to estimate how farm operations and human health change differentially before and after a location experiences a negative shock to biological pest control."**

**The graphic above is from the study and in a very generalized manner shows the demonstrated linkages between a disruption (White-nose Syndrome) and the increasing death rate of human babies. There are of course many other linkages, but Frank was able to avoid scope-creep and a multi-volume treatise by narrowing his focus to one human-centric example.**

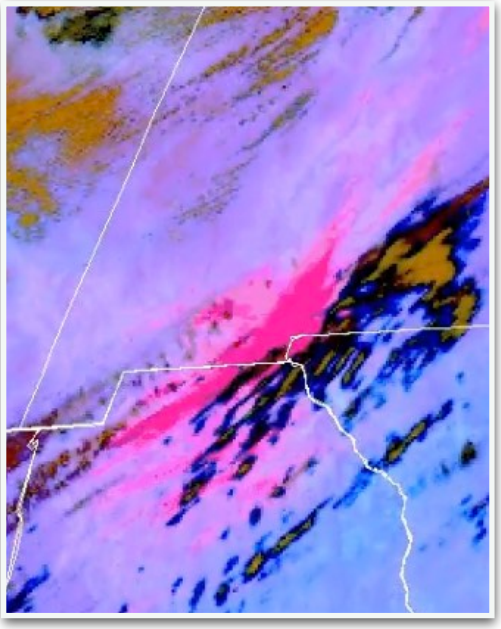
**In the abstract of this study, Frank states "Biodiversity loss is accelerating, yet we know little about how these ecosystem disruptions affect human well-being. Ecologists have documented both the importance of bats as natural predators of insects as well as their population declines after the emergence of a wildlife disease, resulting in a potential decline in biological pest control. In this work, I study how species interactions can extend beyond an ecosystem and affect agriculture and human health. I find that farmers compensated for bat decline by increasing their insecticide use by 31.1%. The compensatory increase in insecticide use by farmers adversely affected health—human infant mortality increased by 7.9% in the counties that experienced bat die-offs. These findings provide empirical validation to previous theoretical predictions about how ecosystem disruptions can have meaningful social costs."**

**The study, and several summaries, discuss the methodology and data in detail. We will not bore you with that here. Instead, we would like to note an obvious change in the simple linkage outlined at the top of the page. Change insecticides to non-lethal (deadly to humans) forms. Possible approaches were outlined in "Present status of Insecticide Impacts and eco-friendly approaches for remediation - a review", *Environmental Research*, Volume 240, Part 1, 1 January 2024, by Selvaraj Barathi, Nadana Sabapathi, Sabariswaran Kandasamy, and Jintae Lee (https://doi.org/10.1016/j.envres.2023.117432) and in "The Buzz on Insecticides: A Review of Uses, Molecular Structures, Targets, Adverse Effects, and Alternatives" by M. F. Araújo, E.M.S. Castanheira, and S. F. Sousa, *Molecules* 2023, *28*, 3641. (https://doi.org/10.3390/molecules2808364 1).**

# Haboobs and Tornados - Black Range Weather

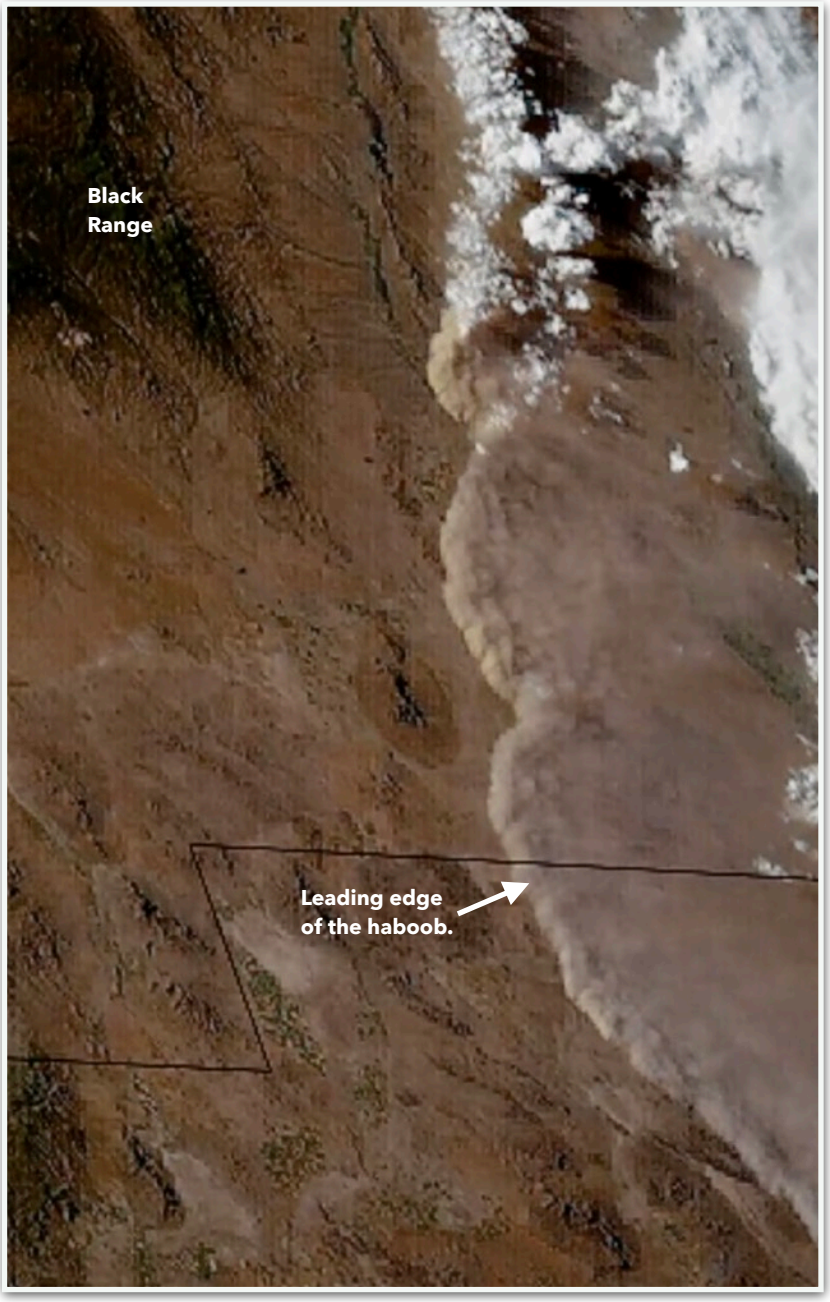
**The satellite image at top right was taken on June 19, 2024, at about 7:30 p.m. by the GOES-18 Satellite. The storm "was triggered by an outflow boundary from nearby thunder-storms". (The video at this link shows the haboob advance across southern New Mexico from the east. At the point of this framegrab, the haboob is approaching the Caballo Mountains.**

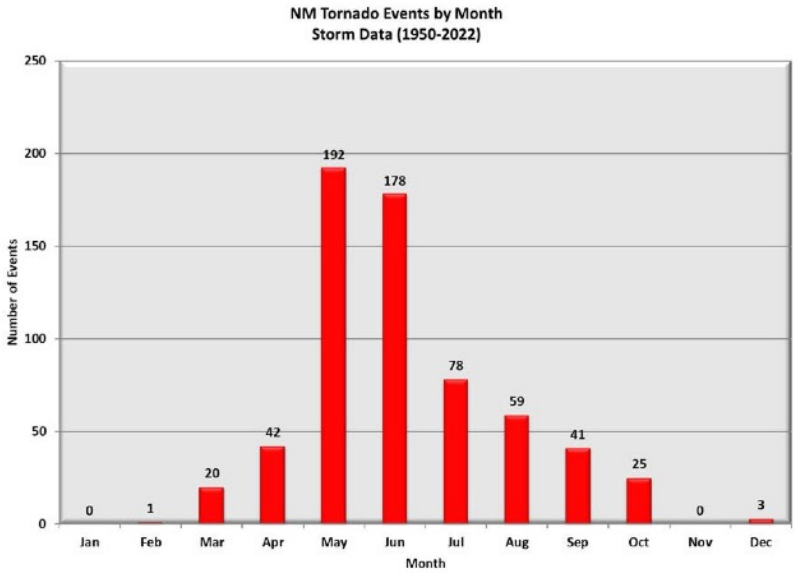
**Dust storms and in some cases haboobs are much more common in Arizona than in our area, but the Lordsburg area is notorious for "zero visibility". On March 3, 2025, a haboob swept through our area from the west. The NOAA image below shows the wall of dust sweeping through Deming/Las Cruces at about 17:46 Zulu. The bright pinkish color in the image below.**



**Although NOAA would never say it these days, events like this are likely to become more and more common due to ongoing human-induced climate change.**

**We don't often think of New Mexico and "tornado" at the same time, but we do have a few, mostly in May and June and mostly in the northern part of the state.**



## *The Odonata of Doña Ana County and the Black Range - Dragonflies.*

**We have just issued the second version of Volume 1 of *The Odonata of Doña Ana County and the Black Range - Dragonflies*. That publication was a collaborative effort which involved a number of individuals. In his review of an early draft Jonathan Batkin provided some background on Odonata Central (OC). (See the reference entry on page 3 of Volume 1, and The Dragonfly Society of the Americas.) He noted: "An account on Odonata Central is free and lets you add your records to the database. It is a valuable resource that has served as my roadmap (literally) for more than ten years. Created under the guidance of John Abbott at the University of Texas in 2004, the site absorbed the data from Thomas (Nick) Donnelly's Dot Map Project, which includes records from more than 100 odonatologists, in 2005. You can find a summary of the Dot Map Project in Bulletin of American Odonatology on the DSA website in volume 7 number 4, 8 number 1, and 8 numbers 2-3. You do not need to join DSA to see these older issues of either BAO or Argia.**

**"The Dot Map records are widely considered vetted, but that is not the case with all of them, and New Mexico happens to be a state with numerous questionable records. James N. (Jim) Stuart, who just retired from NMDGF, put a lot of time into tracking down voucher material or finding published accounts of many early DM records. He worked with John Abbott to remove some New Mexico records, including one or more species statewide, from OC. I have also worked on a few problematic records and am tracking down voucher material for several species on the state and county levels that may be incorrectly identified."**

***The Black Range Naturalist* effort is about several things, and this is one - it is about our communal efforts to make our understanding of the world better, more accurate, more comprehensive, and to enhance our enjoyment of it - and our place in it.**


Contact the Editor: Bob Barnes (rabarnes@blackrange.org) or
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**Unattributed material is contributed by the editor.**

**Front Cover: Lichen (Probably *Usnea intermedia)***
**Back Cover: *Penstemon virgatus***

**The Native Plant Society of New Mexico's annual conference will be held in Las Cruces.**

**October 2-5, 2025**

**Follow this link for details.**

Published in Hillsboro, New Mexico