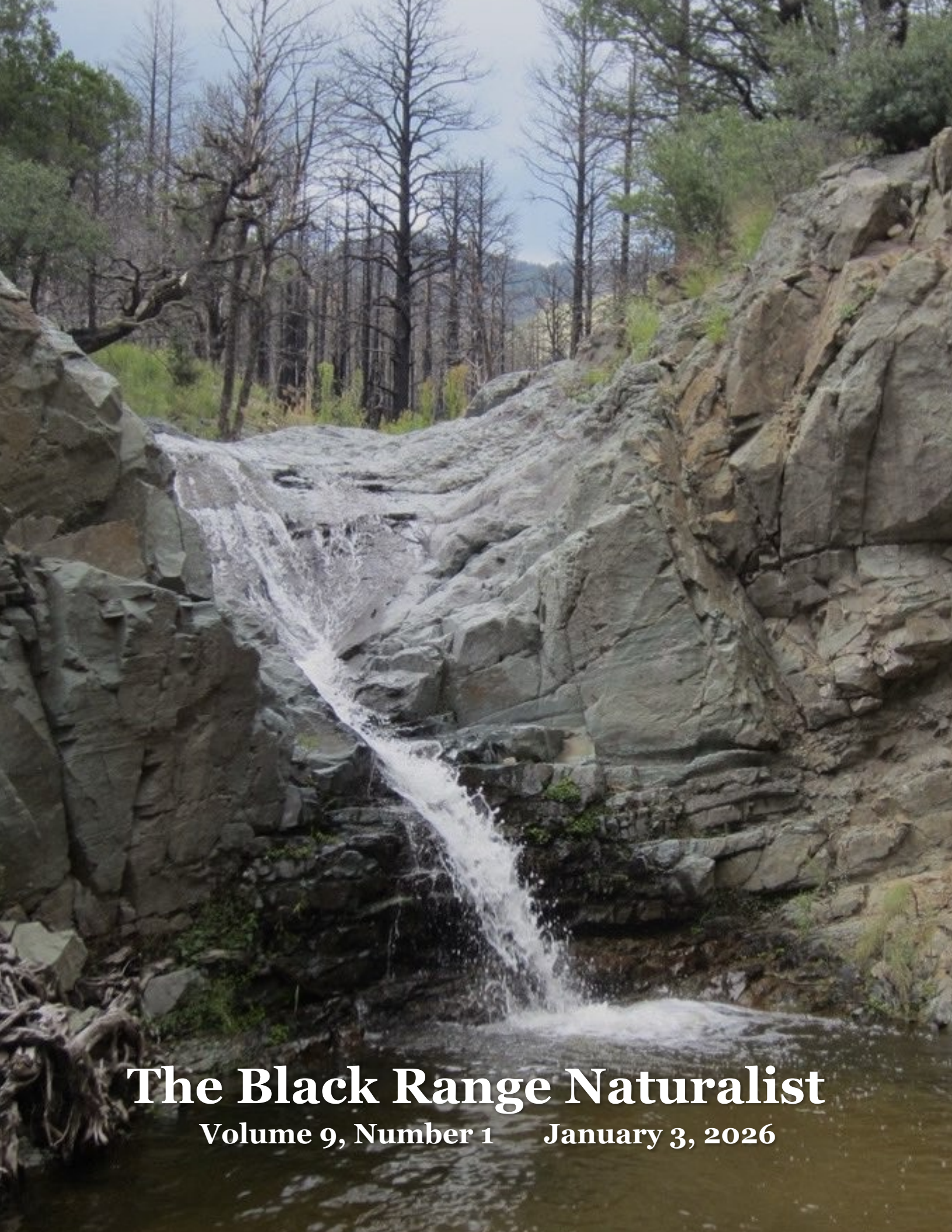

The Black Range Naturalist

Volume 9, Number 1 January 3, 2026

IN THIS ISSUE

Front Cover: Waterfall in Percha Creek, west of Kingston
Back Cover: Red-spotted Toad, *Anaxyrus punctatus*

Books for Kids

The onslaught against science and knowledge continues unabashed in our country. I recently came across a series of mini-reviews of books on scientific topics, for kids. I thought I would share those reviews, published by the American Association for the Advancement of Science. What better way to save the world than sharing a good book with a kid. Try these:

- *Turtles Heading Home* by Liza Ketchum, Jacqueline Martin, and Phyllis Root - for ages 6 to 9.
- *Nick and Tesla and the High-Voltage Danger Lab* by Bob Pflugfelder and Steve Hockensmith - for ages 8 to 12.
- *One Day a Dot* by Ian Lendler - for ages 2 to 7.
- *Women in Science: 50 Fearless Pioneers Who Changed the World* by Rachel Ignotofsky - for ages 10 to 17.
- *An Anthology of Aquatic Life* by Sam Hume - for ages 6 to 9.
- *Fever 1793* by Laurie Halse Anderson - for ages 10-12.
- *The Last Zookeeper* by Aaron Becker - for ages 4-7.
- *Who Would Win? Ultimate Showdown* by Jerry Pallotta - for ages 4-8.
- and *The Universe in your Hand* by Christophe Galfard - for "Young Adults".

- R. A. Barnes, Editor

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Unattributed material is contributed by the editor.

FIRE

I suppose that at some point we will exhaust our store of fire articles, but given the likelihood that climate change will increase the numbers and intensity of wildfires, it seems important to increase our understanding of this natural process.

It is generally understood that when insects kill stands of trees, those stands are more susceptible to fire. It seems to be true that dead wood burns more readily than live wood. But there is more to it than that.

On 15 January 2025 Zhang et al. published "Do wood-boring beetles influence the flammability of deadwood?" in *Ecology*. They found "that wood-boring beetles partly increased the flammability of coarse woody debris of both species (via promoting deadwood smoldering combustion) when their holes were parallel with the airflow. Even when accounting for the influences of wood density and cracks, these radial holes continued to have a notable impact on deadwood flammability. While these holes did not make the wildfire more intense, they significantly increased carbon loss during combustion. This suggests that wood-boring beetles will enhance carbon release from deadwood into the atmosphere during wildfire."

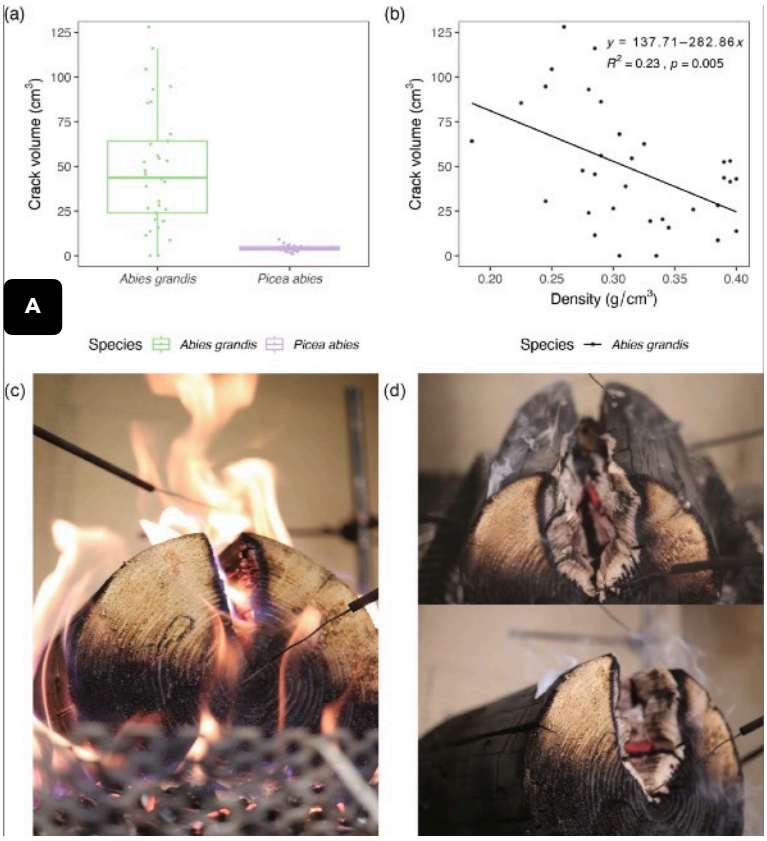
At the top left of the next page ("A") a bit of their analytics is shown as plotted data and in photographic form. At the upper right is an image from Middle Percha Creek on August 26, 2013, following the Silver Fire ("B"). We have all seen this; fire loves seams, and it seems that wood-boring beetles make seams.

Fire disasters and rating-driven news coverage make it appear that the whole world is on fire. Sean A. Parks, C. H. Guiterman, E. Q. Margolis, et al. report a different perspective in "A fire deficit persists across diverse North American forests despite recent increases in area burned", *Nature Communications* 16, 1493 (2025). https://doi.org/10.1038/s41467-025-56333-8. They write that "despite increasing area burned in recent decades, that a widespread fire deficit persists across a range of forest types and recent years with exceptionally high area burned are not unprecedented when considering the multi-century perspective offered by fire-scarred trees."

The graphic labeled "C" on the following page is from this study and displays the concept that historical fire exclusion and suppression has resulted in very severe wildfires in the current era. The study goes on to note that we have yet to work off the damage created by those earlier polices.

Corroborating, but from a different perspective, evidence of the findings in the study cited immediately above were noted by E. J. McClure, J. D. Coop, C. H. Guiterman et al. in "Contemporary fires are less frequent but more severe in dry conifer forests of the southwestern United States", *Communications Earth and Environment* 5, 581 (2024). https://doi.org/10.1038/s43247-024-01686-z. They found that "contemporary fire frequency, including recent, record fire years, is still <20% of historical levels. Since 1985, the fire return interval averages 58.8 years, compared to 11.4 years before 1880. Fire severity, however, has increased. At sites where trees historically survived many fires over centuries, 42% of recent fires resulted in high tree mortality. Suppressed wildfires tended to burn more severely than prescribed burns and wildfires managed for resource benefit. These findings suggest that expanded use of low-severity prescribed and managed fire would help restore forest resilience and historical fire regimes in dry conifer forests."

T. J. Hoecker, S. A. Parks, M. Krosby, et al. , in "Widespread exposure to altered fire regimes under 2 °C warming is projected to transform conifer forests of the Western United States", Communications Earth and Environment 4, 295 (2023). https://www.nature.com/articles/s43247-023-00954-8 found that "Altered fire regimes are now pervasive in western North America and elsewhere as a result of anthropogenic climate change, timber harvest, livestock grazing, fire suppression, criminalization of Indigenous fire stewardship and changes in human ignitions. Wildland fire is increasingly acting as a catalyst for abrupt change in ecosystem structure and composition in forests of the western U.S."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Species Abies grandis Picea abies
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A
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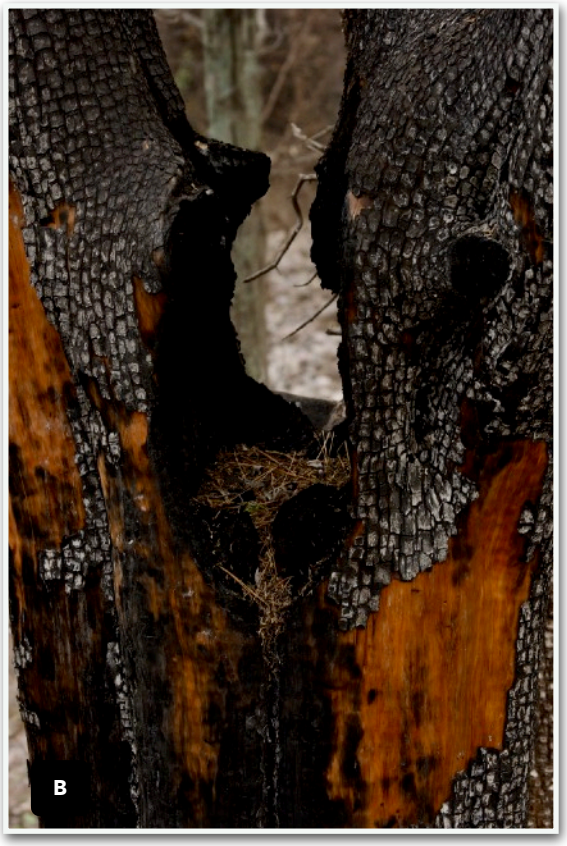
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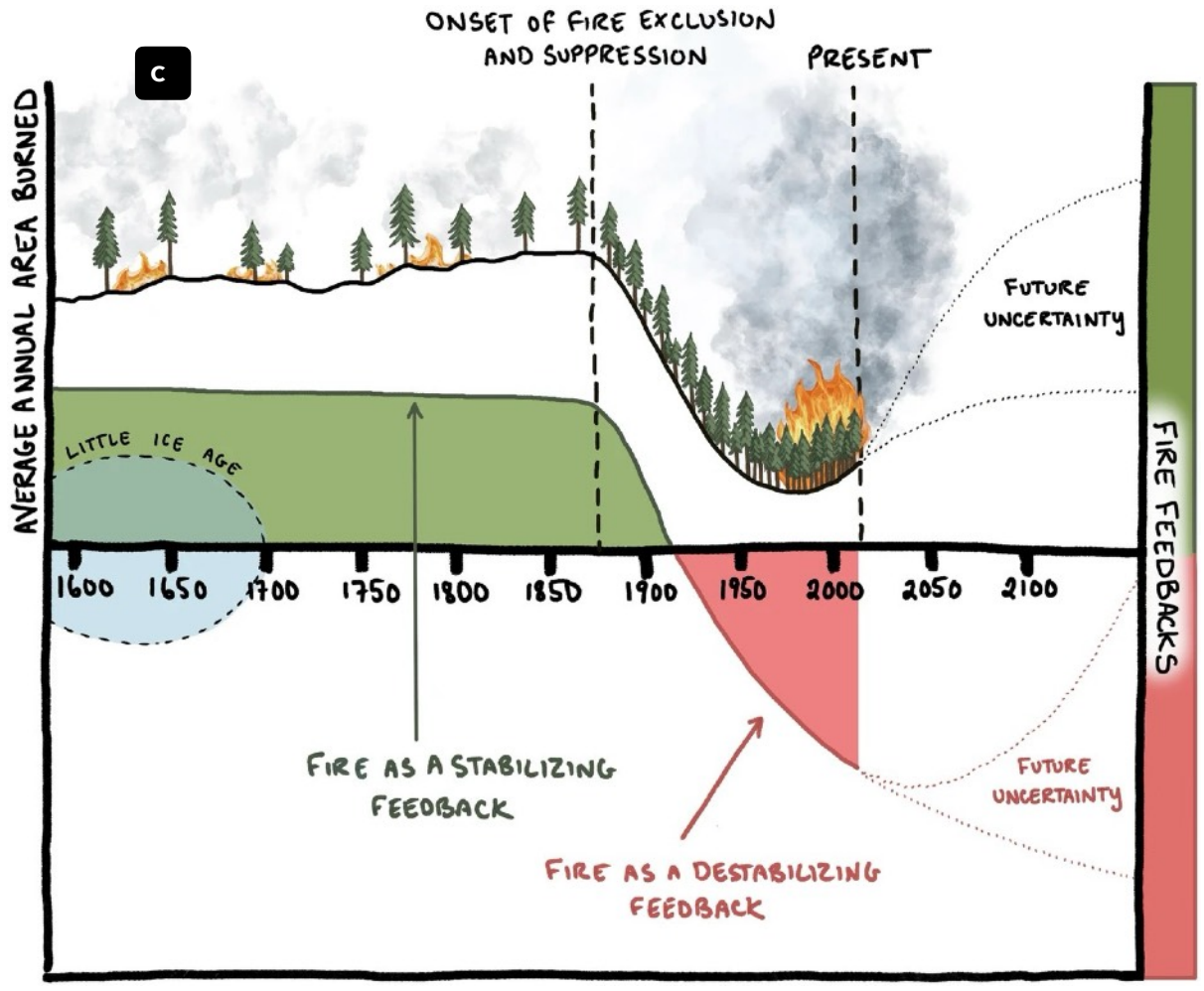
C
ONSET OF FIRE EXCLUSION AND SUPPRESSION
PRESENT
AVERAGE ANNUAL AREA BURNED
FUTURE UNCERTAINTY
LITTLE ICE AGE
FIRE FEEDBACKS
1600
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2100
FIRE AS A STABILIZING FEEDBACK
FUTURE UNCERTAINTY
FIRE AS A DESTABILIZING FEEDBACK

Hunting and Gathering
- Stories about conservation, hunting and fishing, work and play . . . about life in the Southwest by Bob K. Barsch
A review by Bob Barnes

Bob Barsch has spent most of his life in the southwest of the United States. Born and raised in Texas, he worked in game departments in Texas and Arizona and retired to Silver City and then to elsewhere.

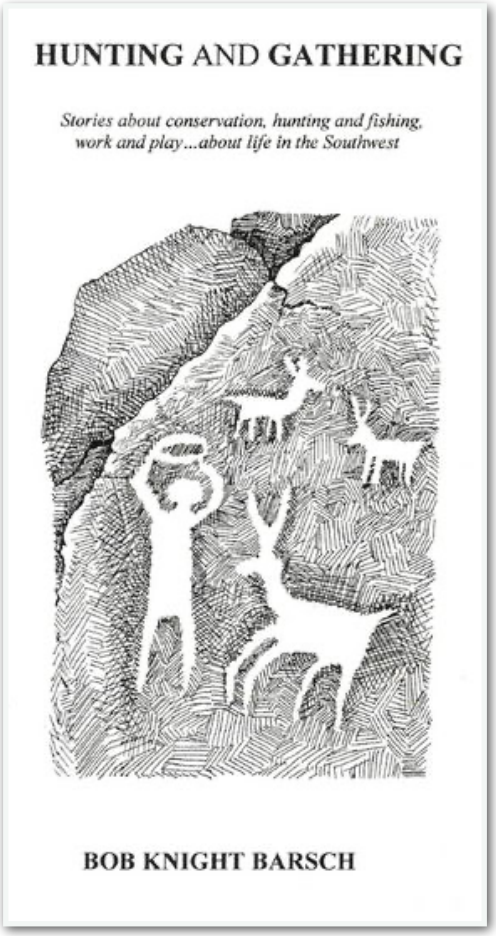
For ~28 years he worked in the Arizona Game and Fish Department and it was there that he first met Harley Shaw. In 2003 Barsch published *Hunting and Gathering*, a deeply personal account of his love of hunting, his love of a culture which may be swiftly fading, and of a land.

Harley Shaw loaned me Barsch's book last year: "Think you might find it interesting." Harley is a wise man so I read the book. And I did, indeed find it interesting, more interesting with time.

Harley has a habit of sticking correspondence from the authors of books in the books they have written. He told me once that he did not mind my reading them. It has always felt a bit voyeuristic, but I often read them anyway, or at least give them a quick skim. In *Hunting and Gathering* there was a note from Barsch dated 24 July 2004. It was a short letter about pine, oak, and juniper masting around Silver City (more on that in a later issue). Apparently the letter came with the book, with a lead sentence which got to the point; "I want to trade you this book for the one you wrote on turkeys. Here is some mast data. . . ." Straight to the point, a story within a story.

Much of this book is about the culture of hunting and fishing. I am not a hunter nor do I fish. (Although when I was young I once shot a groundhog and once went fishing for ling cod with a father-in-law whom I did not particularly like.) All of that as a way of saying that I am not part of that hunting and fishing culture. I understand it, and when it is about something other than trophy hunting or sitting around camp getting plastered, I sometimes get it. But Barsch gets it, Barsch grew up with it, it is in his pores.

To say that I am not a hunter is not quite accurate. It is just that I do not use a rifle, a bow, a howitzer, or a pocket knife to do it. My weapon of choice is the camera. I will stalk through the woods, trekking where humans are not meant to tread, for hours, looking for some critter, some plant, whatever. It is the chase rather than the killing which is the driver. A wanting to know rather than a desire to kill.



There are many in the hunting community whom I would never disparage. I am not of their direct kin, more a distant cousin, but I get it, and this book is a great introduction for those who do not. The best way to read it (if you are male) would be to sit in Frank's Barbershop in Deming waiting for your $10 haircut while listening to the tales of the latest hunt, where the prey was, and who got a tag.

The essays which Barsch includes in this book are sometimes very personal, often poignant, generally told with that candid truth and insight which can bring a faint smile to the lips and is better than Visine for the eyes.

With Barsch's permission I am reprinting one of his essays here - "Fire Species" - because it provides the insight about interconnectedness which comes from living on the ground, from spending extended periods of observation mulling how things fit together.

From the Book

Fire Species

Hundreds of millions of embryonic lives lay locked in their tiny, tough seed coats, waiting. They waited for the freedom to grow, for release from the tyranny of the suppressing pinyon, *Pinus cembroides,* that dominated and towered above them. They had waited for a long, long time, for they were the children of fire, offspring of the fire shrub, *Ceanothus greggii,* or "desert ceanothus".

It had been an inordinately long time in the chaparral, about ninety years, since white men first interrupted the fire cycle. Prior to that time, the fire species could expect reprieve at intervals of seven to ten years. That was how often lightning-caused fires once swept across much of Arizona, borne from woodland to woodland on waves of grass. But that was during all those hundreds of thousands of years before the advent of modern man, before the introduction of droves of cattle to graze away the grass, and humanized bears with shovels to propagandize against the good of fire.

In spite of man's good will and fire suppression, the pinyon that dominated the community since man's interference had overstayed its welcome. Subordinates in the plant community had taken flack and duff long enough and the buildup was staggering. The hoarding of nutrients in nature's scheme had piled up to the point of immorality.

The duff upon the ground was three inches thick, a reflection on the populations of soil bacteria slowly working to convert duff, limbs, and trunks into basic elements. Their fundamental labor progressed slowly when things were dry, and in Arizona that was most of the time. Fire suppression and climate had thereby made a logical decision: tons upon tons of combustible materials shall cover the earth. The scene was set.

One fine day in June of 1968, a puff of moisture from the balmy shores of the Gulf of Mexico rolled up one of those island mountains in southeastern Arizona. It was merely a forerunner, a token promise of the summer monsoon, but it chilled to a formidable mass as it climbed the rugged slopes. Within it, particles of dust and condensed water droplets collided. The excitement was electric.

There was a sizzle, a bolt of light, and a loud crack! The wind was high and the air was dry as the infant flame snaked down the tall pinyon on the ridge. It immediately lapped up duff and twigs, and nearby limbs and trunks. And it grew - and it grew ferocious.

The cloud that spawned the spark lingered awhile, then dissipated with a smile into nothing. Meanwhile its passionate progeny swept up canyons and leapt forty-foot rock walls with an insatiable appetite.

Along the highway six miles distant, citizens stopped their autos and gazed in wonderment and dread. It was a fire! With a grave sense of urgency and duty, a citizen thought through the dazzle long enough to act. With a warm feeling of patriotism, he contacted the proper authorities.

The authorities with a sense of purpose rushed to the scene to save what they could. They attacked the flames with airplanes, chemicals, bulldozers, and ground troops. They spent a hundred thousand dollars four times, knitted their eyebrows sternly, and clenched their teeth fighting the unquenchable flames.

One brave fire fighter lost his life in the smoke and flame. His loss justified and added value to the efforts of his fellow combatants, their leaders, and to their goals and purposes.

Nevertheless, for all their training, equipment, monies, manpower, and bravery, the fire fighters were unable to save 18,000 acres - the sum total of which contained not one board foot of merchantable timber.

On a ridge southwest of Kingston, New Mexico.

They fought the fire bravely because they were hired fire fighters, because they had a duty of good faith, and because it was a fire.

How could they know that what they saw as holocaust was little more to the fire species than the pangs of the earth giving birth to a new generation, a new regime of living things?

What the bacteria could not accomplish in ninety years, the fire returned in elemental form to the earth in a matter of hours. Over much of that blackened landscape, the ashes of the old way of life lay four inches deep.

Already, deer meandered about the edges of the forlorn-looking country, licking at the ashes here and there for salts and nutrients. A group of six coatimundis also dug enthusiastically in the blackened earth for cooked insect larvae.

The fire made an irregular path through the hills and canyons, and most of the wild creatures in the area were as concerned about the fire as ducks are about floods. Nevertheless, some individuals died. Six javelina stormed into a cave and toppled to their deaths in the anteroom. Other than that, the creatures of the field neither wept nor ground their teeth. Fire was not new. For ages, they had lived and prospered by fire.

The fire shrub *C. greggii* itself was busy playing the phoenix. After all those years of suppression by pinyon and other members of the chaparral, the fire species began its rise out of the ashes of its captors. All those nutrients held and hoarded for decades were now at its disposal, and it grew and prospered.

Six years later I set up plots and transects near and far from water in burned and unburned stands of pinyon. I merely verified on paper what people close to the land observed and believed for years. Wildfires are good in many places for many reasons.

The water table, no longer tapped by pinyon roots, rose. More surface water was available for wildlife than before the fire.

Herbaceous plants and shrubs exploded on the burn to capture soil and nutrients initially left exposed by the fire. A hydrologist with the U.S. Forest Service visited the disaster area and smiled with pleasure at the millions of organisms blindly pitching in to save the soil. The land's resilience - the density, and vibrant green of the new growth amazed him.

And the new growth? Much of it was the fire species desert ceanothus. The shrub now dominated and comprised eighty to ninety percent of vegetative cover in burned stands of pinyon. The only obvious relics of the old regime were the blackened corpses of pinyon trees protruding up through the green shrubbery of ceanothus.

I fell in love with the fire species and with the limestone soils that grew it, and subsequently launched a campaign to improve its public image. Other than deer hunters, few were interested. I found being excited about wild shrubs as publicly acceptable as pyromania.

I explained that the mass media of mankind did nothing for the plant's reputation but that the good tastes of the white-tailed deer and other herbivores placed the plant in the herbaceous hall of fame. The testimony of the deer showed that they preferred the burned stands of pinyon over unburned stands by a factor of 7.5.

It should not be said that we would have seven times as many deer in Arizona chaparral and conifer habitats if we let lightning-caused fires burn. But again, I would not be surprised. I just would not say it.

And what about the influence of water? On the burn itself, deer spent an average of twice as much time within 350 yards of water as they did at greater distances (1,300 yards) from springs.

I further realize that one should not extend himself beyond the data, but for the sake of mental exercise, I speculate. What would happen if pine and chaparral burned and water tables rose to create new water sites for wildlife? Would such areas experience a seven fold increase in deer because of the burn and a two-fold increase because of the new water source?

One evening at my camp on the study area, I pondered these questions when an idea hit me... well, like a bolt of lightning. I realized that not only was my beloved *C. greggii* a fire species but, to some extent, so was the Coues white-tailed deer that relished the plant for its taste and water content. Is not the Coues deer a secondary fire species?

And what about the lion? Does the mountain lion that preys on deer find hunting easier where there are more deer? If so, the lion could be classified as a tertiary fire species. Territoriality would limit the numbers of lions, but not the numbers of white-tailed deer. Could it be that fires in chaparral and conifer woodlands would increase the number of deer, decrease the lion-to-deer ratio, and thereby significantly reduce livestock depredations? I stopped that line of thinking with the cow.

The campfire coals glowed and the thoughts clicked fast. I recalled that out of the last thirteen black-tailed rattlesnakes I had seen in pinyon stands, twelve had been on the burn! Can it be that the black-tailed rattlesnake is also a fire species?

What do black-tailed rattlesnakes eat? "They eat white-throated woodrats, other rodents, and cottontails," I told the Arizona walnut tree rooted before me. "Yes, yes. What if fire increased the prey base in pinyon stands for black-tailed rattlesnakes? The reptiles would benefit. What else?"

Then in the black night I heard the plaintive cry of the western barking frog. Barking frogs reproduce in water, and fires in chaparral and conifers increase surface water. More fire means more water and more water means more barking frogs. The western barking frog is a fire species.

I thought of the three eagles I saw soaring over the burned area almost daily. How could golden eagles see or catch their prey hidden under the closed canopy of chaparral or pinyon? They couldn't. The birds soared over the burn because they can detect more prey items in the open. I assured the walnut tree that the golden eagle is at least a preferential, if not an obligatory fire species in certain habitat types.

Habitually talking to walnut trees can disorient anyone. I began to note aberrant changes in my responses to certain traditionalized "disasters". I smiled whenever the newscaster reported wildfire holocausts on the Mogollon Rim and chuckled when newspapers read "thousands of acres blackened" wherever. I applauded lightning and low humidity and scoffed at the slurry planes.

The Fort Apache Indians rose to unprecedented esteem in my mind for their let burn policy, while surrounding non-Indian subcultures fell to barbarous levels commensurate with, rather, inversely correlated to, their levels of ignorance.

While in that state of mental imbalance, I walked the hallowed university halls branded with such namesakes as "Firebutt" or "Pyromaniac". Now and then one would whisper: "Burn, baby, burn!"

I would bolt out of a fixed stare and apologetically retort: "Well, I think some fires are good." This was an amelioration of what I really thought: "Some fires are bad."

In my opinion, fire in riparian or desert habitats was bad and fire in chaparral and conifers was good. In a word, everything was black and white in those days, with a preference for black.

During one of my darker moments of vacant staring, a benevolent friend attempted to bring me back from the nether world with: "Where are you going archery elk hunting this fall?"

I managed to answer with a question: "Where are you going archery elk hunting this fall?"

"Oh, me?" he countered. "A bunch of us always hunt the burns. You can always find elk wherever there is a burn. Didn't you know that?"

There was a pause and then I threw my hands into the air and cried: That's it! That's it!"

"What?" he said. "You mean you didn't know that elk, like every other living thing that creeps through the pines, is a fire species?"

"Actually," I said with the innocent smile of Alfred E. Newman, "I wasn't thinking about elk."

Waterfalls of the Black Range

"Waterfalls" and the "Black Range" are not terms generally found in the same sentence. Pity.

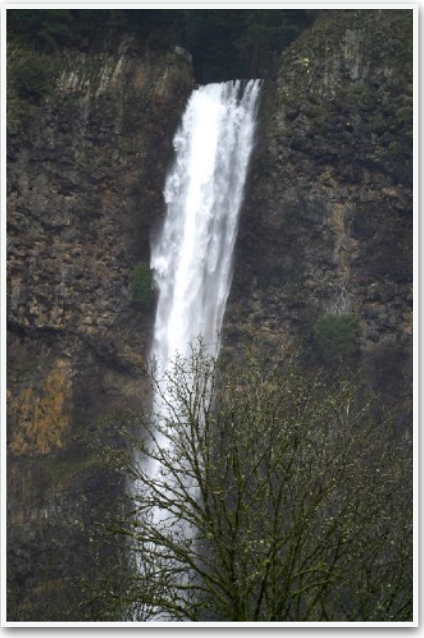
When we think of waterfalls we are inclined to think of permanence. Waterfalls are stable features of the landscape. We have a few such falls in the Black Range - at least most of the time.

We also have many ephemeral falls. Two types of falls are included in this category. The first is dependent on the rain. We all understand that when there is no rain a beautiful bluff is just a bluff. Most of the waterfalls in the Black Range fall within this category.

The other type of waterfall is best categorized as temporary. There are a fair number of such falls in the Black Range.

The photograph at top right was taken following the 2013 Silver Fire and after some of the flash flooding that followed. Huge amounts of debris (including rock, soil, sand, trees...) were deposited on the stream bed at that time. The high water dug channels into the soil, carving down through the deposits associated with these and past events. So, all of a sudden, there was a small waterfall on the Middle Percha where none had existed before. A few more high water events - and it was gone.

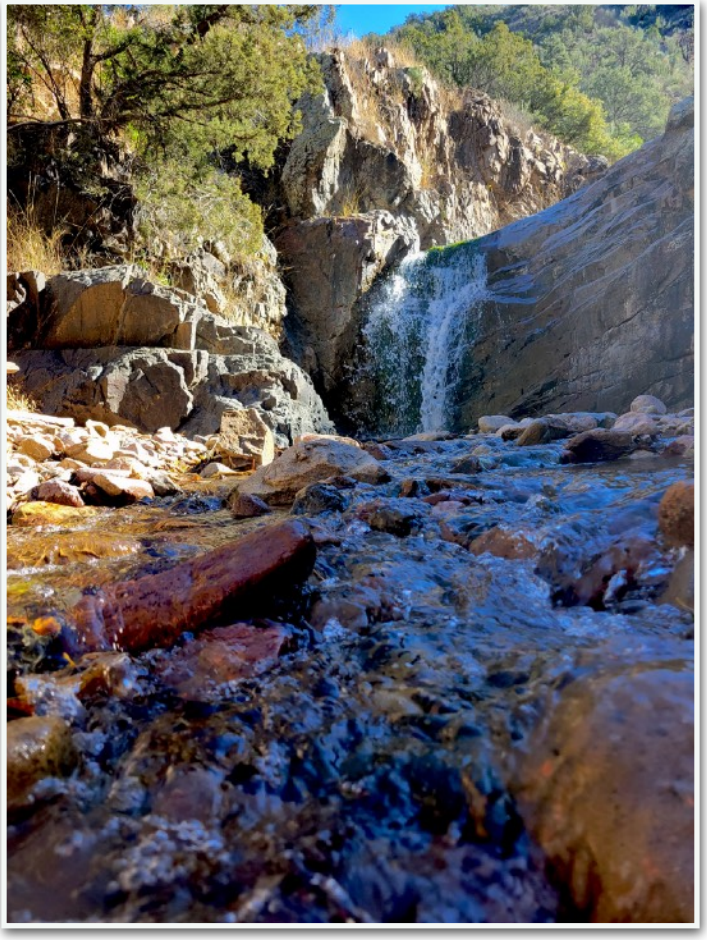
Temporary Falls on Middle Percha, following the Silver Fire high water events, August 17, 2013.



So adjust your expectations (you are not going to see something like Multnomah Falls, in northwestern Oregon, [photo left] in the Black Range) and focus on the beauty of our waterfalls.

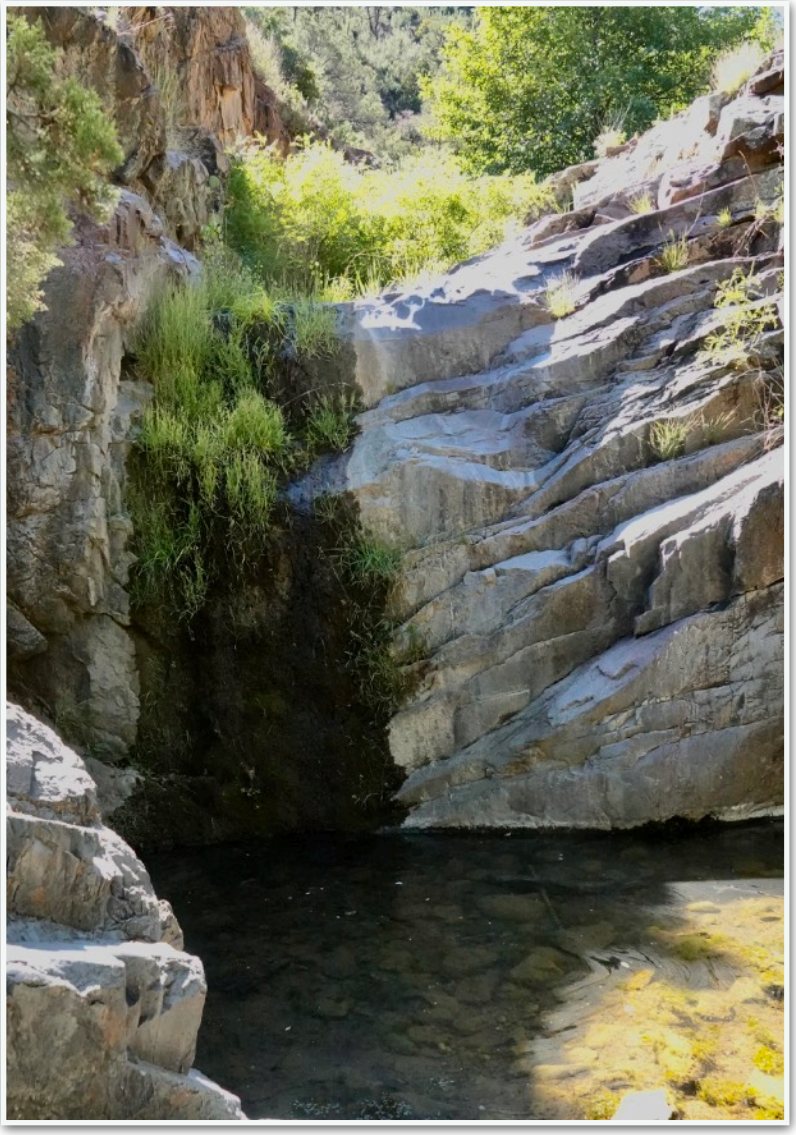
Doug Scott has published books on waterfalls, slot canyons, arches, and natural bridges in New Mexico. If waterfalls entrance you, you might visit his site. He lists several waterfalls in the Black Range in his book on New Mexico waterfalls. He also maintains several websites (see this site for a description of East Curtis Falls) in the upper Animas. This beautiful waterfall can be seen by the hardy and few others. The map above is an example of the high quality material he provides.

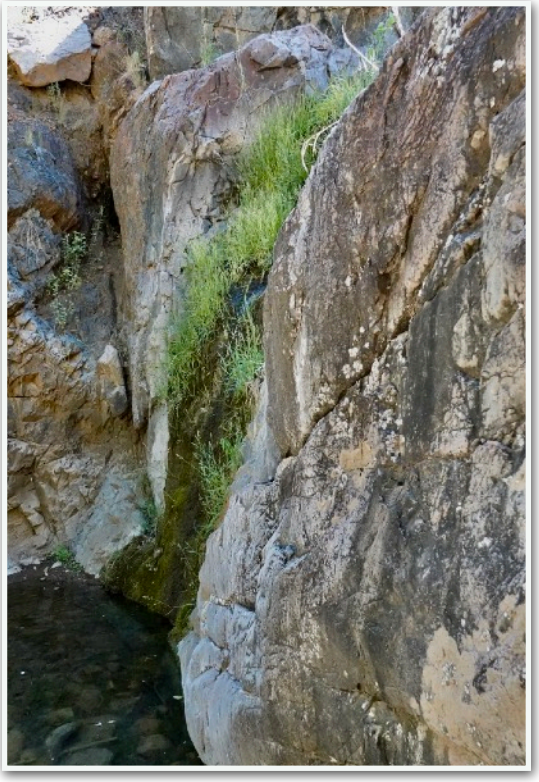
Not all of the falls in the Black Range are difficult to get to. Three of the most popular waterfalls on the east side of the Black Range are found along FR157 (also known as North Percha Road, turn north off NM-152). The first is adjacent to 157 on Carbonate Creek, see following page. The other two are on Mineral Creek, a bit farther up the road.



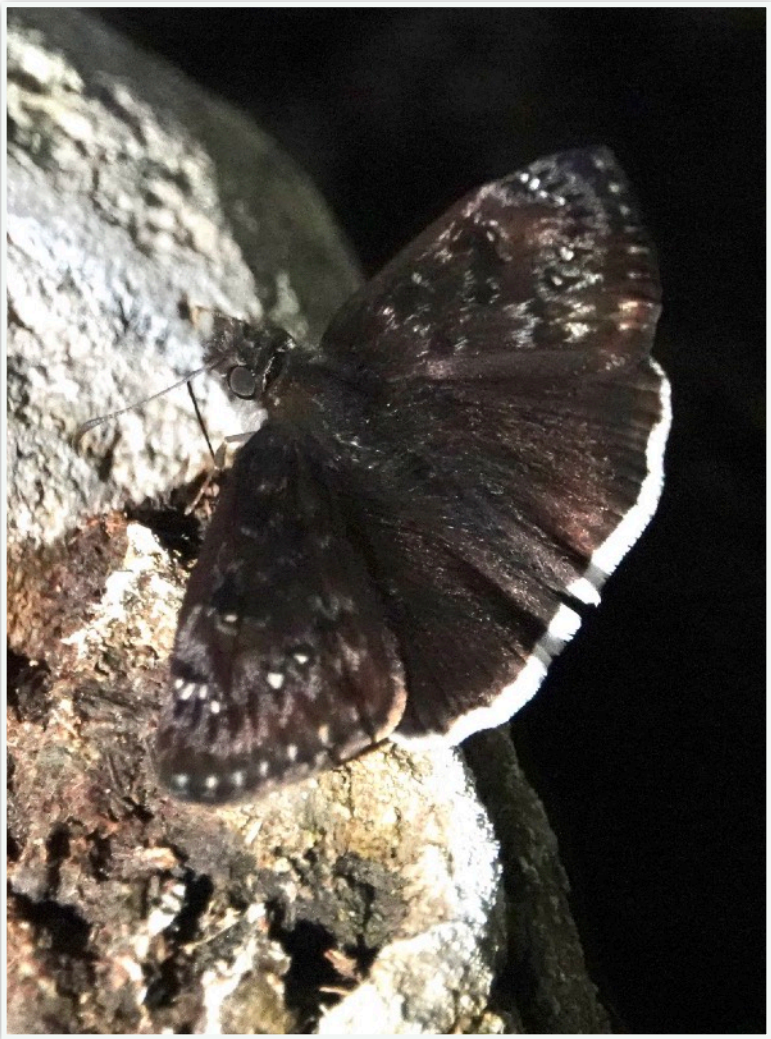
CARBONATE CREEK

At 32°57'23.4"N 107°42'37.3"W. Photograph top right by Jon Barnes, November 2023.





Carbonate Creek waterfall on July 7, 2024. The "waterfall" was a wet spot on the rock with grass cascading from the rim, taking the place of water. A pool of water remained at the base of the waterfall, attracting a few dragonflies (see Flame Skimmer, *Libellula saturata*, below) and butterflies (see following page). Otherwise a perfect example of a waterfall during the Black Range "dry".



Amblyscirtes aenus, **Bronze Roadside-Skipper (above) and *Gesta* sp. (left). While trying to identify the individual at the left (I thought either *G. tristis* or *G. juvenalis*) I reached out to Steve Cary, New Mexico's own "butterfly guy". Referring to this photograph he noted (pers. correspondence July 8, 2024) "The *Gesta*, though, is problematic. The white HW fringe gets us to either *funeralis*, *tristis tatius*, *juvenalis clitus*, or *scudderii*. We both know it is not funeralis. The last, *scudderii*, would be rather out of range (so far, Bootheel only), so we can rule that out. A ventral view would show if it were *tristis* as opposed to *juvenalis*. Lacking that, we just can't distinguish them from dorsal alone. Will have to settle for *Gesta* sp."**

Several things to note here. First of all, a photograph (or even a series of photographs) is sometimes not sufficient to identify a species. Accept that and move on. The genus *Gesta* vs. *Erynnis* is a taxonomic question I (the editor) am ill equipped to address. Suffice it to say that several species in this group of butterflies are placed in the genus *Gesta* by some authorities (and not trivial authorities) while others (equally untrivial authorities) place them in *Erynnis*. By referring to this individual as *Gesta* we are not taking a stand in this disagreement. We honor you all.

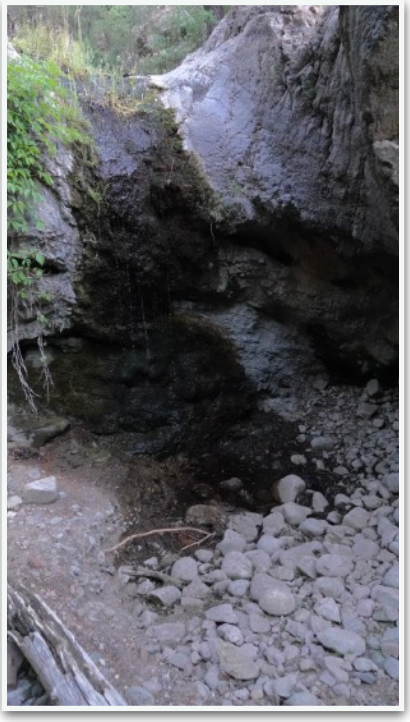
On July 10, 2024, Common Sootywing, *Pholisora catullus*, (photo top right of the next page) joined the party as did a Marine Blue, *Leptotes marina* (photograph at the upper left on the next page). Perhaps of more interest were the dozen or so

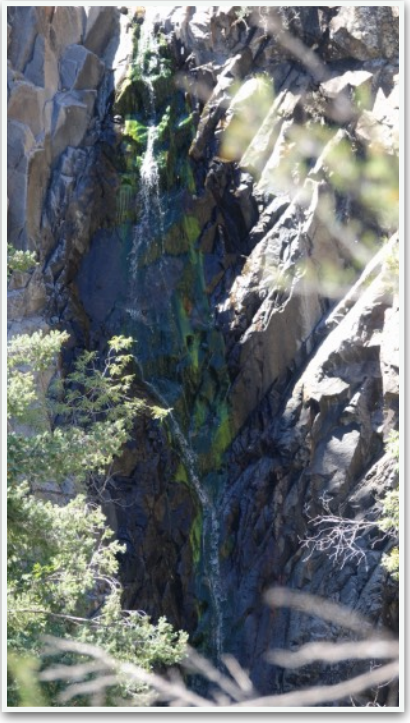
Cicindelidia sedecimpunctata, **Western Red-bellied Tiger Beetle, which were at the edge of the pool (two photos at the bottom of the page). Using iNaturalist, BugGuide, and *A Field Guide to the Tiger Beetles of the United States and Canada* I was able to determine that these individuals were either *C. sedecimpunctata* or *C. haemorrhagica*, Wetsalts Tiger Beetle. The website resources cited above kept delivering different answers, however. Instead of just accepting the first answers I kept asking questions until these individuals were identified to species. This species hunts tadpoles, which they apparently do very well. See also: "Tiger Beetles/Tiger Moths - Batesian Mimicry" in the October 2024 issue of this journal (Vol. 7, No. 4).**

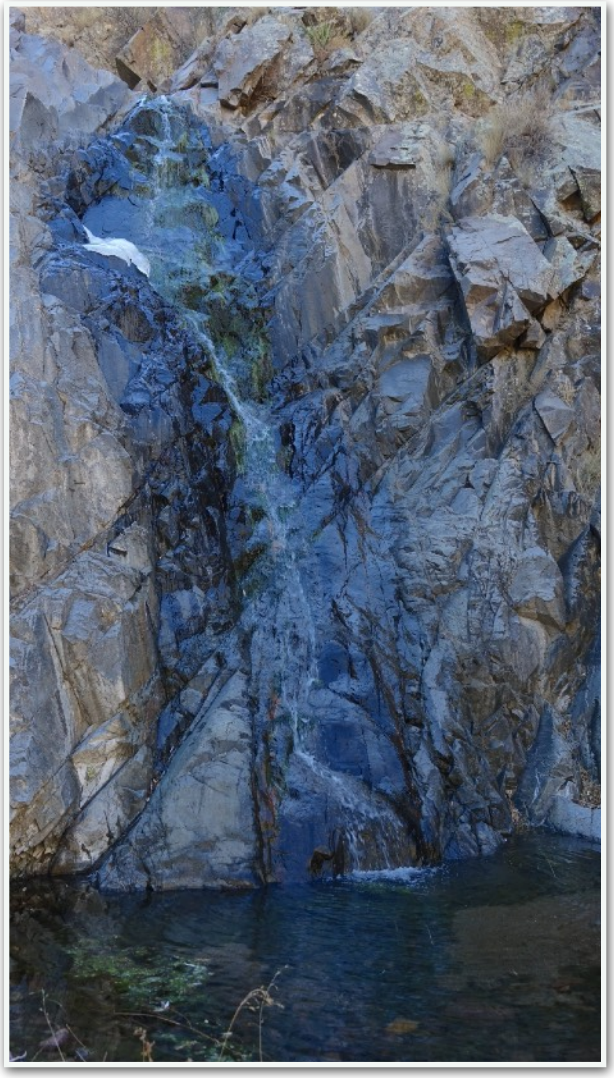
MINERAL CREEK

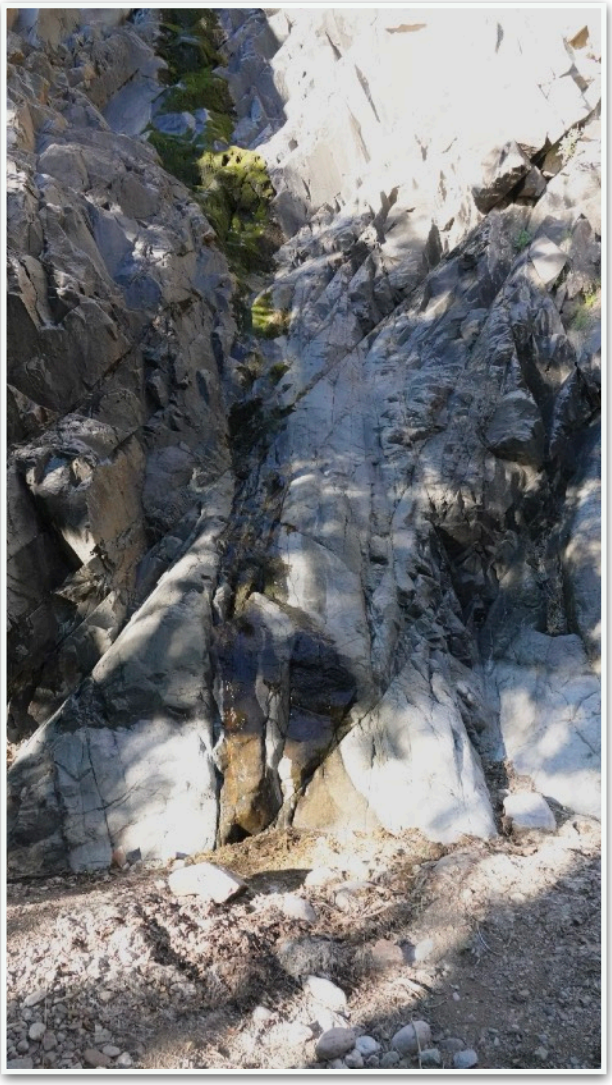
Mineral Creek on the east slope of the Black Range has two easily accessible waterfalls. Park where the creek crosses FR-157, walk upstream on the old road which follows the stream.

At roughly a mile you encounter the first small falls, pictured to the left on March 27, 2019. At this point the stream flows over bedrock and the falls is generally flowing. In very dry periods it is simply a drop, as in the photograph below from July 7, 2024.









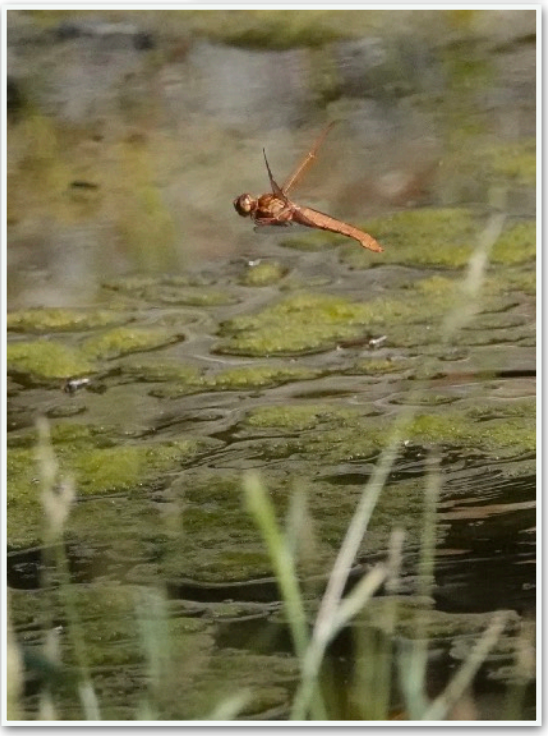
Images of the more westward, and the higher, of the two falls are shown at the bottom of the previous page (from March 27, 2019), here, and on the following page. This falls is located at 32.971537, -107.736160.

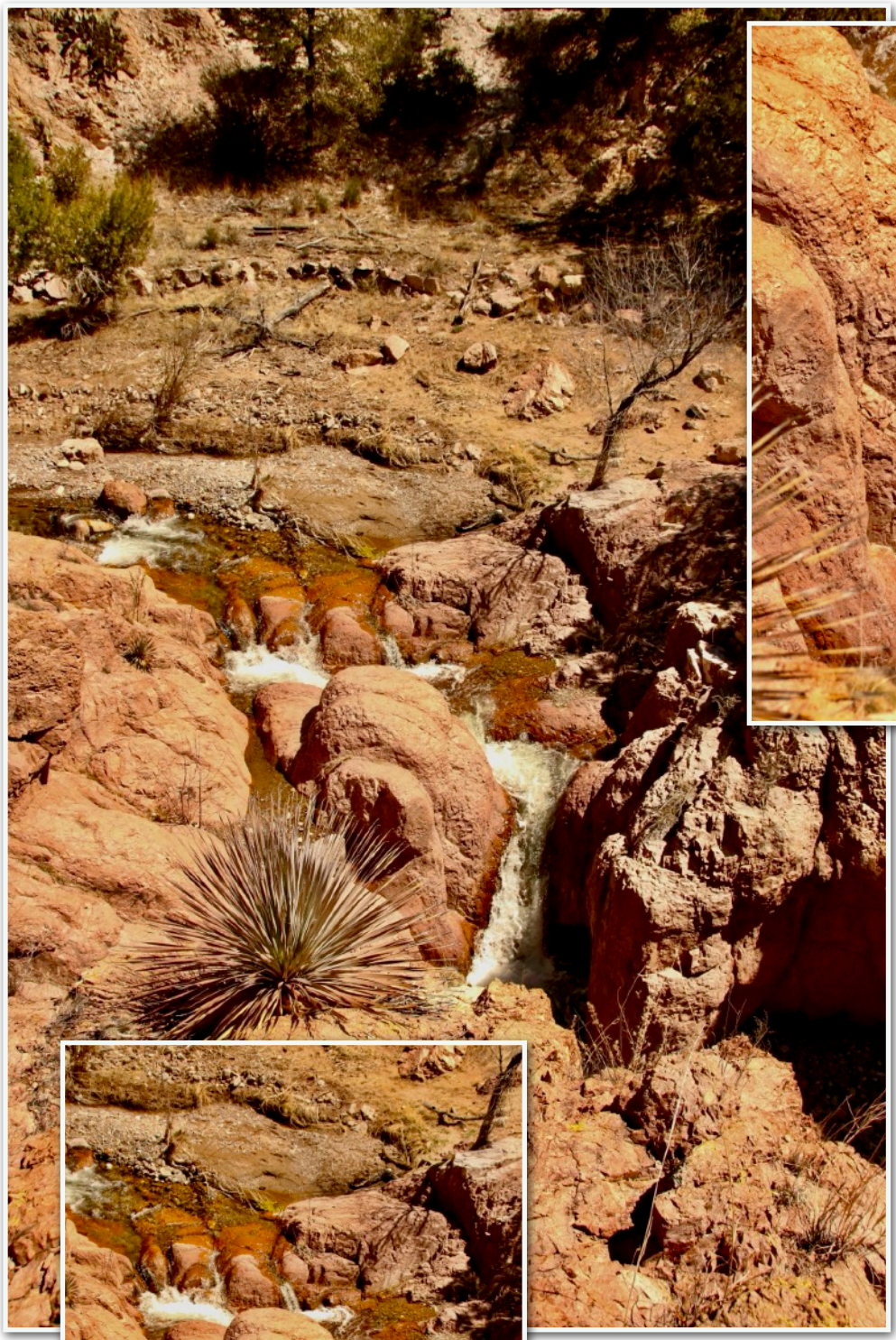
The left and bottom photographs on the this page were taken on December 29, 2017. The photograph at the top right is of the lower part of the falls and was taken on July 7, 2024, during "the dry".

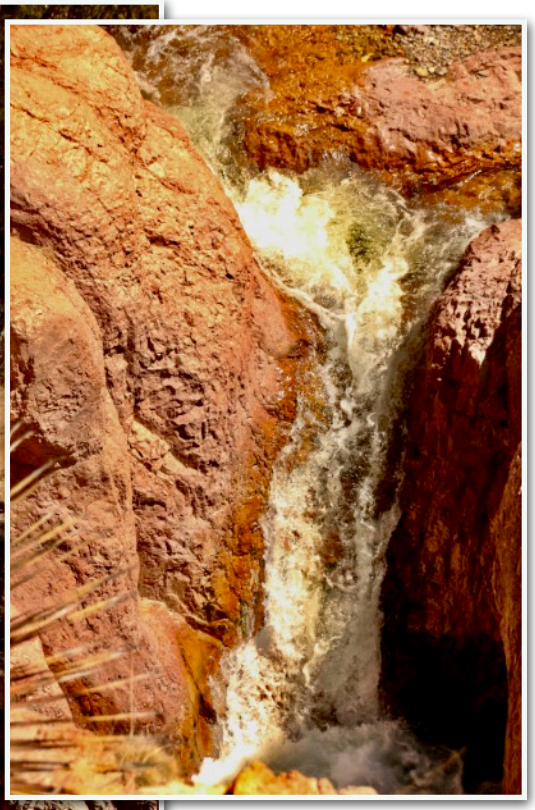
Two Above: Mineral Creek waterfall by Véronique De Jaegher, July 2013.

Photo to the immediate right and Video of the waterfall on Mineral Creek, February 10, 2023, by Véronique De Jaegher: Lots of ice at that time of year.

Above the first waterfall on Mineral Creek there is often a small pool of water where the stream runs over bedrock (right and below on July 7, 2024). Flame Skimmers were very active at this location, including ovipositing females.







PERCHA CREEK

Waterfall on Middle Percha Creek just east of the second bridge west of Hillsboro, photographs above and to the left. This small waterfall (6-7' high) can be seen, with some effort and the right angle, from NM-152.

The middle Percha is a constantly changing water-course. Photographs below and at the top of the following page were taken just past the 6th stream crossing west of Kingston, in September 2015. Photographs by Véronique De Jaegher. This waterfall is gone now.

Waterfall east of Kingston, below the second bridge west of Hillsboro. On private land, requires permission. Left photograph from January 2017. Photographs by Véronique De Jaegher. Note person for scale.

ROUNDVILLE FALLS:

Left: Roundville Falls by Henry A. Schmidt, 1890-1920. Schmidt took a lot of photographs around the Winston area and some in the communities south. We know he took this photograph in the Black Range, we just don't know where. Do you?

WALL LAKE:

Bottom and Center Right: North Star Road at the north end of Wall Lake - not natural, but sometimes you take what is available. November 5, 2015.

DRUMMOND CANYON:

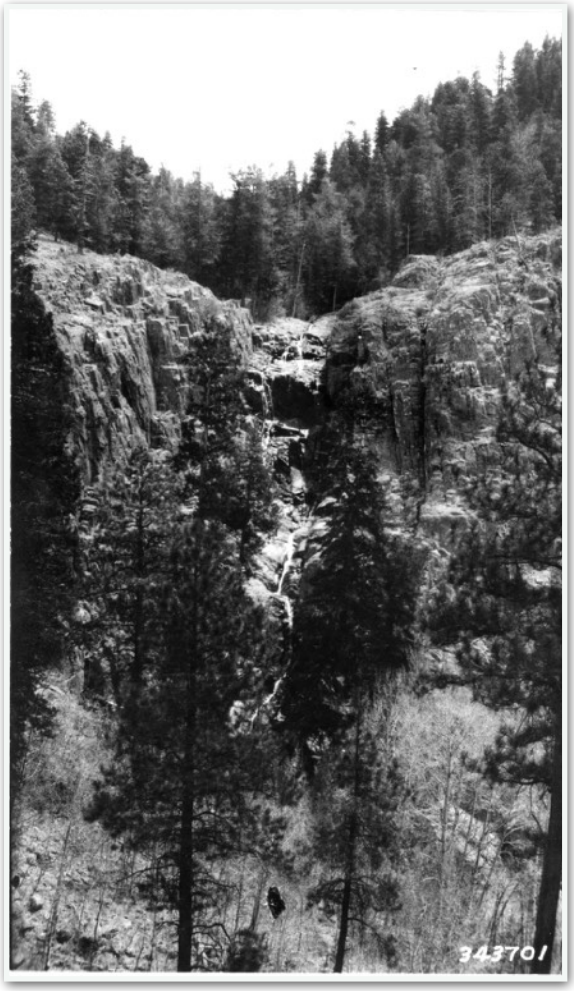
South Percha Creek can be accessed near MP 36 on NM-152. Walk south down the old mining road until you reach the south fork of Percha Creek. There are a number of old mines in this area. Drummond Canyon is directly across the creek at the bottom of the mining road. When there is water, the waterfall in Drummond Canyon is about a half mile south of Percha Creek.

The photographs in the right column were taken on May 26, 2000.

The walk into this area is described in *Volume 4 of Walks in the Black Range*. (Free download on the Black Range website.)

BLACK CANYON:

Below: Tall Canyon Falls (Head of Black Canyon), Black Range, 2 miles west of Reed's Peak.
By R.H. Lewis, 1932, USFS.



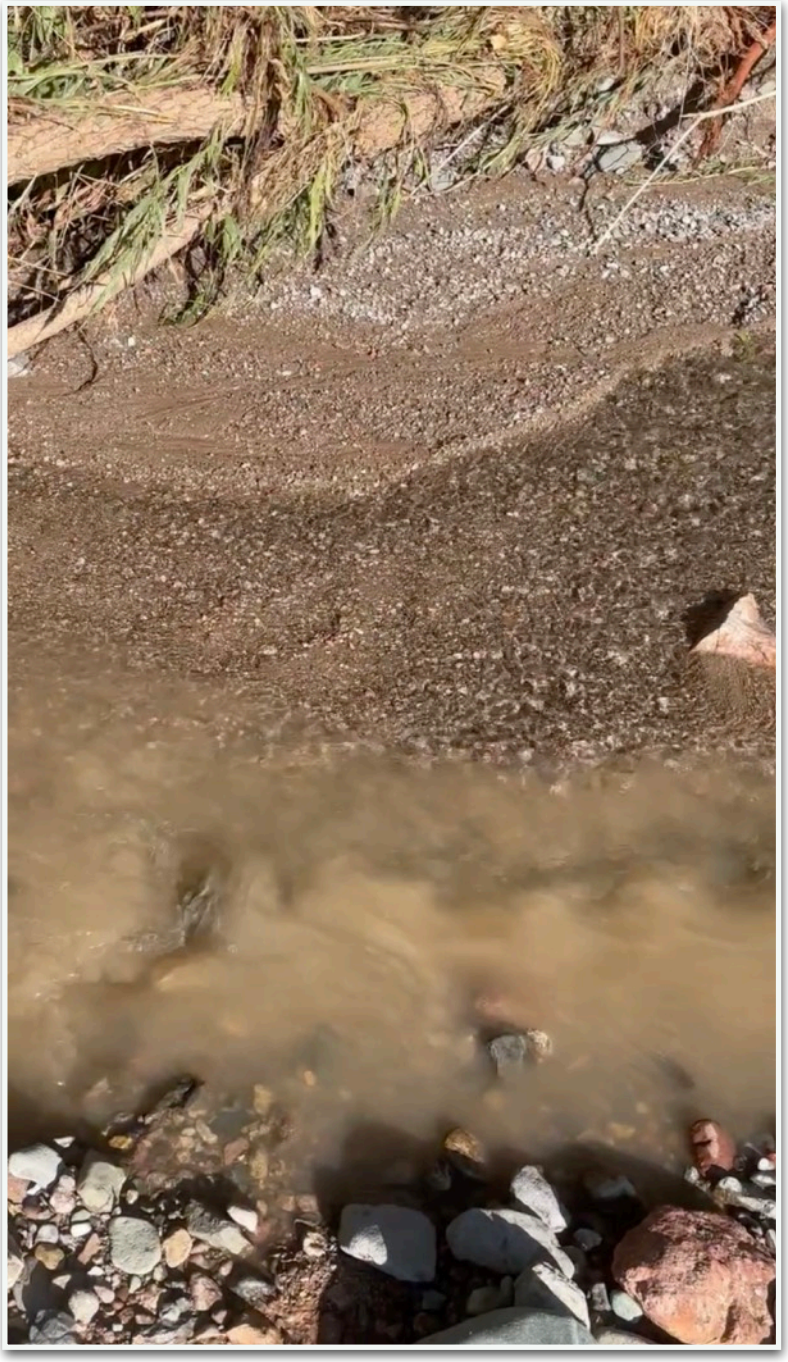
Geology and Hydrology in Real Time

Deborah Harrison took the images shown on this page in the Percha Box following a high water event in June 2025. She walked portions of the Percha Box on June 25 and June 26, 2025. Among other things she was documenting the evidence of a high water event, as shown at the bottom. The U.S. Bureau of Reclamation (US BOR) had expressed interest in the debris flows from the east slope of the Black Range in the past, and an informal work group was documenting the extent of some of the high water events which we experience.

On the 25th there was an added bonus. She found the small spring shown immediately to the right. She photographed it and shot a short segment of video (the larger image to the right is a framegrab from that video).

Most of us have seen images and references to the mingling of green and brown rivers in the Amazon, waters that flow side by side for miles and miles before merging. Harrison's video shows the phenomenon at "Black Range scale". An example, perhaps, of things we see but never think about. A great bit of natural history.

Keep those smart phones at the ready.



Watch the half-minute video at this link.

A few weeks later Bob Barnes was walking the washes in the Warm Springs area east of Hillsboro. He thought he saw a theme, something along the lines of Deborah Harrison's observation of mingling waters, and it provided a followup to the October 2025 issue of this journal, on the geology of the Hillsboro quadrangle. The two photos on this page show the confluence of a small wash with a larger wash, a wash which is "flowing" westward to Warm Springs Wash. These small washes are draining different geologic formations, something very evident in the sand and small stones which have dropped out of suspension at this junction. Rock which differs in age by millions of years remaining separate for a few lingering moments until they meld together into a muddy mass of raging water.

Real geology happening as we watch. More on the next two pages.

At the confluence of the larger wash shown here and Warm Springs Wash he noted a bit more geology in the making.

The photographs on this and the following page are at the confluence of the larger wash (shown on the previous page) and Warm Springs Wash. Sometime in the previous year a large amount of sand and rock had been deposited at this point. In the high water events of July 2025 the water in the wash had cut through this deposit and in doing so it revealed the nature of the deposition which had occurred previously.

The photographs on the following page show the layers of deposition, demonstrating clearly that not all such events are the same. Some events carried larger rock and stone. Some carried very fine sand. These depositions are stacked on top of each other in classic geologic form. If we waited a few million years for these layers to be buried and then subjected to immense pressure we could marvel at beautiful sandstone and conglomerate rock, laid out before us in intricate detail of long-ago depositions.

If we did not wish to wait that long we could go to a nearby wash and see the genesis.

Blister Beetles - A Brief Overview

by Bob Barnes

Naïveté is such a wonderful trait. I say that proudly, being so well endowed with it. So, when I was surveying some of my photographs of beetles in the genus *Megetra* I thought, "Why not do a survey article on blister beetles? When they swarm here they are always a topic of discussion." I know the issues associated with beetles and I know that the gods are apparently inordinately fond of them, but still, how many could there be here, and surely a few good photographs could help parse the population to genus and perhaps even species. Hundreds of hours later I can only say "what naïveté, what fun".

If you peruse the following article you will probably be struck by how frequently certain names crop up. If beetles are of interest, conduct a web search for any of these names and you will find a wealth of information about the distribution and natural history of beetles generally and blister beetles specifically. And, you will be amazed at what is not known. For some species, the larvae of the species are completely unknown, for instance.

Why "Blister Beetle"?

One of the names you will encounter frequently in the following article is Floyd Werner. Among other publications he wrote a technical bulletin entitled *The Meloidae of Arizona* along with Wilbur Enns and Frank Parker in August 1966. This is *Technical Bulletin 175* of the Agricultural Experiment Station of the University of Arizona, Tucson. It is referenced frequently and is a good starting point in the study of blister beetles, in our area. At page four of the bulletin he informs the question, why "blister beetle"?

> "Many, perhaps all, of the blister beetles are able to cause the formation of blisters on the skin of people who contact them. In Arizona this contact is most likely with the species that come to light at night. Several species found at lower elevations produce sizable blisters; *Epicauta tenela* and *Epicauta lauta* are the ones most often encountered. The blisters that are produced may be up to several inches long, and may spread if the fluid from a blister is allowed to touch unexposed skin. They soon disappear if the liquid is removed.
>
> The active principle is a substance called cantharidin. This material is present in the body, including the blood, and the main chance of human contact comes when the beetles are disturbed, at which time they can release blood through the joints of the legs. Cantharidin has a long history of use as a vesicant and as an aphrodisiac."

Some of Werner's other works may be accessed at the Biodiversity Heritage Library.

Solitary Bees and Grasshoppers

Blister beetle larvae use solitary bees and grasshoppers as hosts. The larvae make their way to the nests of solitary bees in various manners, sometimes spending the entire larval stage there, using the bees as hosts. They also feed on grasshopper eggs. In the adult stage, blister beetles feed on

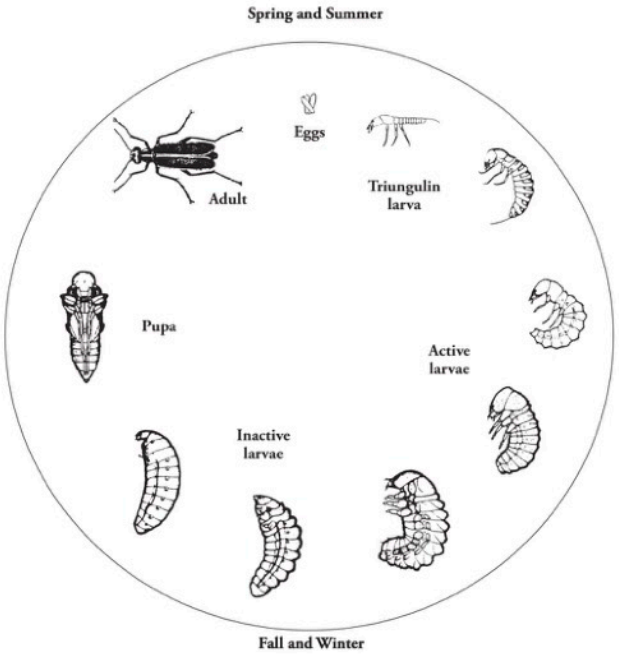


Figure 10. Typical lifecycle of an *Epicauta* sp. blister beetle. (Source: Sorensen and Baker, 1983)

Sorensen, A., and J.R. Baker (Eds.). 1983. *Insect and related pests of vegetables*. Raleigh: North Carolina Agricultural Extension Service.

a range of plant species. For numerous species, much is unknown about the particulars of the larval stage.

Blank Spots on the Map

The general range of most species is fairly well known, but the particulars are incomplete, at best. For example, many species have what appear to be disjunct populations. But given the lack of observation in the "blank areas", it is not clear in many cases how separated the populations are.

The Identification to Species

Major catalogues (iNaturalist, BugGuide . . .) include many observations in the "needs identification" category. This does not mean that the observer's original identification is incorrect, only that (in most cases) others have not verified the initial identification or not offered alternative identification possibilities. In many cases, even with high resolution images it is not possible to identify specimens to species. We include several observations in the "needs identification" category in the following article.

Disclaimer

I claim no expertise in the identification of beetles or knowledge of their natural history. Please use the linked resources to augment the information provided here.

Many Species - Few Observations

My survey has left me with the opinion that there are many species present in the Black Range which have not been reported. Hopefully this material will lead to more interest and the sharing of information about the blister beetles found here.

Blister Beetles Which Might Be Found in the Black Range

Family *Meloidae* - Blister Beetles

Genus *Tetraonyx* (Latreille, 1805)

Tetraonyx albipilosa (Van Dyke, 1929)

- A specimen from Pecos, Texas in 1929 - No iNaturalist observations. No additional information found.

Tetraonyx femoralis (Dugès 1869)

- A specimen collected by Cockerell[1] in 1898, in the Mesilla Valley, New Mexico. Closest iNaturalist observations are from central Mexico.

Tetraonyx fulva[2] (LeConte, 1853)

- An iNaturalist observation near Lake Roberts by George Pollock on 18 August 2023 is shown at the top right under a Creative Commons license.
- See also an observation by Wendy McCrady at the Gila Cliff Dwellings National Monument on 30 July 2022, shown at the center right under a Creative Commons license.
- Type specimen apparently from New Mexico.
- Cockerell (1898)[1] reported specimens from Albuquerque, Luna County, and Mesilla Valley, New Mexico.
- Fall and Cockerell (1907)[1] reported specimens from Sacramento Mountains and other NM locations.
- Werner (1966)[3] reports this species is sometimes common on flowers of *Sphaeralcea*.


Tetraonyx fulva


Tetraonyx fulva

Subfamily *Nemognathinae* (Laporte, 1840)

Tribe *Nemognathini*

Genus *Gnathium* (Kirby, 1818)

Gnathium francilloni (Kirby, 1818)

- An iNaturalist observation in the Santa Fe area by Anders Hastings on 21 July 2023.

Gnathium minimum (Say, 1823)

- See BugGuide observation by Salvador Vitanza from 30 August 2016. Observed along NM State Rte-9, Doña Ana County, New Mexico.
- See Werner et al. (1966)[3] pp 66-67 for a species description.

Gnathium nitidum (Horn, 1870)[4]

- Common names include Western Pale Rabbitbrush Blister Beetle.
- Adults are usually found on Rabbitbrush - *Chrysothamnus* (*Asteraceae*).
- Larvae have been found in the nest of the Fairy Bee, *Perdita luteola* (*Andrenidae*)
- An iNaturalist observation from near White Signal (southwest of Silver City) on 19 August 2022 by George Pollock is shown at the bottom right under a Creative Commons license. Other observations in the Albuquerque and Santa Fe areas.
- Generally found below 9,000 feet

Gnathium politum (Dillon, 1952)

- According to BugGuide: "Superficially greatly resembles *G. nitidum*, but is at once distinct in the very long maxillary filaments and in having a head of normal length. Differs from other Texan spp. in the smooth, shining elytra, which are nearly impunctate and not at all alutaceous."
- Common names include Pale Polished Blister Beetle.


Gnathium nitidum

Gnathium texanum (Horn, 1870)

- BugGuide states that range extends from Arizona to southern Texas. No images available.

Genus Hornia (Riley, 1877)[5]

Hornia mexicana (Duges) *neomexicana* (Cockerell, 1899)

- "The relationship of *H. mexicana* (Duges), from central Mexico, to *H. neomexicana* (Cockerell), from the southwestern United States, is not definitely known due to lack of specimens and to incomplete and inconsistent descriptions of the former. A previously unknown population from Chiapas is variable in the characters used to separate these species, and therefore *H. neomexicana* is considered to be a subspecies of *H. mexicana*."[6]
- The specimen shown at the right is from the University of Arizona Insect Collection. This may be the only specimen in existence. It is likely to have been collected in 1899 (see link for current location [as in cabinet 3, drawer 48] of the specimen).
- Knaus (1924)[7] notes, at page 172, that ""*Leoanidia neomexicana* was described by Professor T. D. A. Cockerell in 1898 from specimens reared from bee cells at Mesilla, New Mexico. In 1911 Professor Creighton Wellman described specimens collected in Logan and Grove Counties by the Kansas University entomological expedition in 1910 as *Hornia gigantea*. Specimens of *Hornia gigantea* placed in the hands of H. C. Fall at Tyngsboro, Massachusetts, in the latter part of 1922, and compared by him with specimens of *Leonidia* in his colleciton showed that *Hornia gigantea* was a synonym of *Leonidia neomexicana*."
- Linsley[8] provides the crosswalk between *Leonidia* and *Hornia*.
- "Adults of these two genera (*Allendesalazaria* and *Hornia*) have a unique life history, spending their entire life within the cells of host bees and with phoretic first-instar larvae that do not move to vegetation to encounter hosts . . ."[9]
- *Hornia (Leonidia) neomexicana* was collected in the Mesilla Valley and at Las Vegas by Cockerell[1]
- This (sub)species is included here in an attempt to be as complete as possible in our survey. Given its life history[9] it is very doubtful that a casual observer will ever encounter an individual of this species.

Genus *Nemognatha* (Illiger, 1907)

- Per BugGuide: "Separation from *Zonitis* remains problematic; species are very difficult to identify, our spp. are separated by aedeagus structure." The aedeagus is a reproductive organ.
- In this genus, eggs are laid on flowers. When the larvae hatch they attach themselves to visiting bees and are carried to the bee nest. The larvae feed on the bees. Adults feed on nectar and pollen.

Subgenus *Meganemognatha* (Enns, 1956)

Nemognatha lurida (LeConte, 1853)

- There are two subspecies. The subspecies most likely to be found here is the nominate form, *N. lurida lurida*. Images may also be seen at this link.

- See number 101 in the drawing at the top left of the following page, by Martha L. Noller, from *The Meloidae of Arizona* by Floyd Werner.[3]
- Fall and Cockerell (1907)[1] report several collected specimens, mostly from the northern part of the state.
- See page 78 of Werner[3] for species description.

Nemognatha lutea (LeConte, 1853)

- See page 78-79 of Werner[3] for species description.
- There are three subspecies; the one most likely found in our area is the nominate form - per BugGuide.

Nemognatha macswaini (Enns, 1956)

- See page 79-80 of Werner[3] for species description.

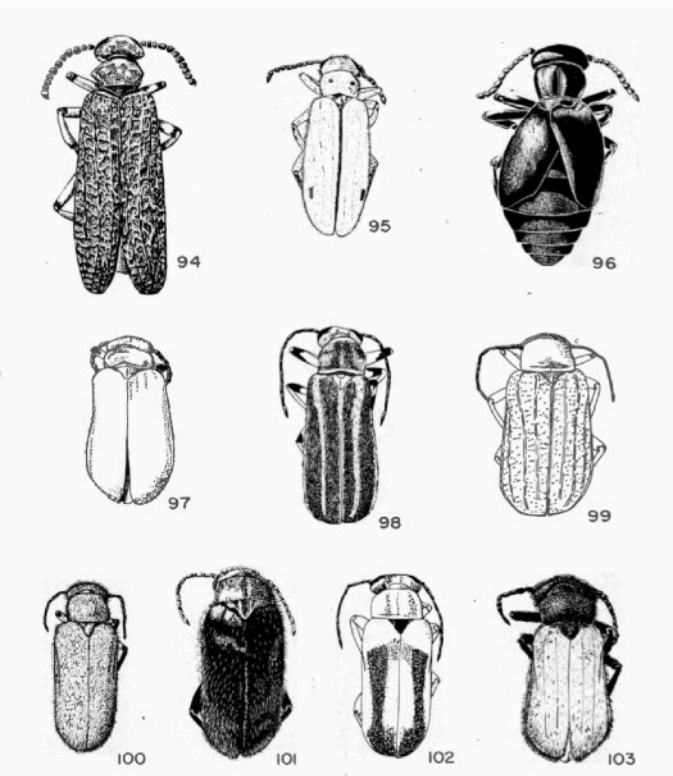


PLATE IX — Fig. 94, *Lytta magister*. Fig. 95, *Lytta biguttata*. Fig. 96, *Meloe laevis*. Fig. 97, *Tetraonyx fulvus*. Fig. 98, *Pseudozonitis vaurieae*. Fig. 99, *Zonitis dunniana*. Fig. 100, *Nemognatha nigripennis*. Fig. 101, *Nemognatha lurida*. Fig. 102, *Nemognatha nitidula*. Fig. 103, *Tricrania stansburyi*.

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Nemognatha nitidula **(Enns, 1956)**

- **iNaturalist observation by Andrew Meeds near Cliff on 1 September 2018 (requires further review as of 1 December 2025). See image below, shown here under a Creative Commons license.**
- **See number 102 in the drawing above by Martha L. Noller, from *The Meloidae of Arizona* by Floyd Werner[3].**

Subgenus *Nemognatha* (Illiger, 1807)

Nemognatha bifoveata **(Enns, 1956)**

- **See page 75-76 of Werner[3] for species description.**
- **Flower host of adults various species of *Monarda*.**
- **See species description at Enns (1956)[10] pp. 786-789.**
- **See range map from Enns (1956) p. 789, below.[10]**

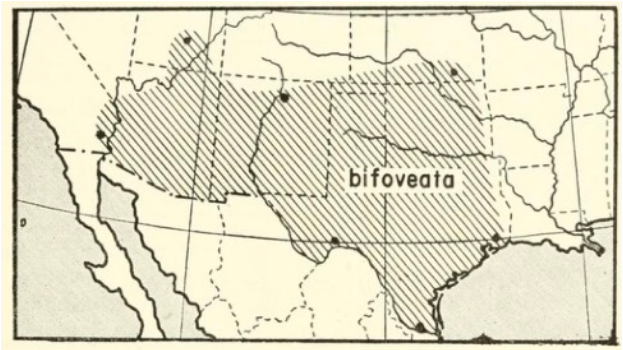


FIG. 12. Map showing the distribution of *Nemognatha (Nemognatha) bifoveata*.

Nemognatha piazata **(Fabricius, 1798)**

Nemognatha piazata bicolor **(LeConte, 1853)**

- **See page 76 of Werner[3] for species description.**
- **See species description at Enns[10] (1956) pp. 794-795.**
- **See range map from Enns[10] below.**
- **Bee host of larvae: Anthrophora occidentalis; flower host of adults includes various thistles.**

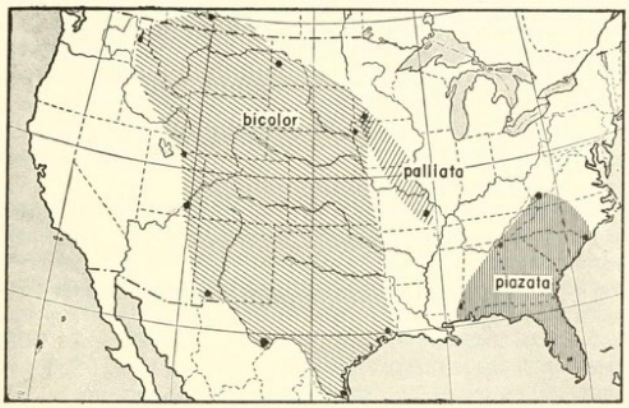


FIG. 13. Map showing the distribution of *Nemognatha (Nemognatha) piazata*. The zone of intergradation between the subspecies is indicated by the overlapping of types of shading.

Subgenus *Pauronemognatha* (Enns, 1956)

Nemognatha cribraria **(LeConte, 1853)**

- **See page 77 of Werner[3] for subspecies description (*N c. cibraria*).**
- **See species description at Enns[10] (1956) pp. 768-770.**
- **See range map from Enns[10] at top left of following page.**

Nemognatha nigripennis **(LeConte, 1853)**

- **iNaturalist observation (requires further review as of 1 December 2025) by Colin Dunn at Hillsboro on 10 May 2020.**
- **iNaturalist observation by Grigory Heaton west of Doña Ana on 5 April 2024 (requires further review as of 1 December 2025). See image center left on the following page, shown here under a Creative Commons license.**

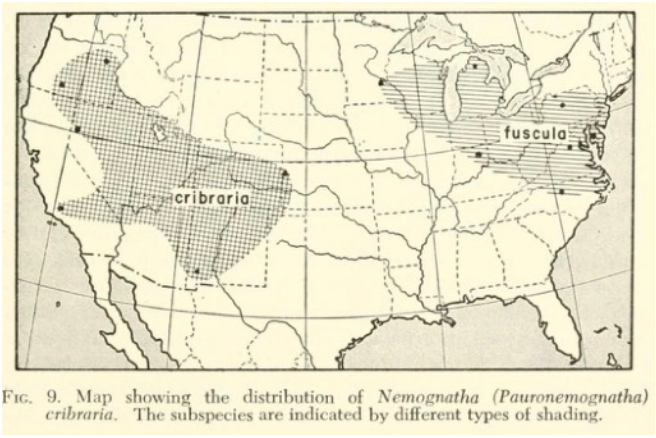


Fig. 9. Map showing the distribution of *Nemognatha (Pauronemognatha) cribraria*. The subspecies are indicated by different types of shading.

Nemognatha nigripennis **(LeConte, 1853) (con't.)**

- **See page 76-77 of Werner[3] for species description.**
- **See number 100 in the drawing by Martha L. Noller, from *The Meloidae of Arizona* by Floyd Werner, page 94, at the top left on the previous page.[3]**
- **See species description at Enns[10] (1956) pp. 777-779.**
- **See range map from Enns[10] below.**

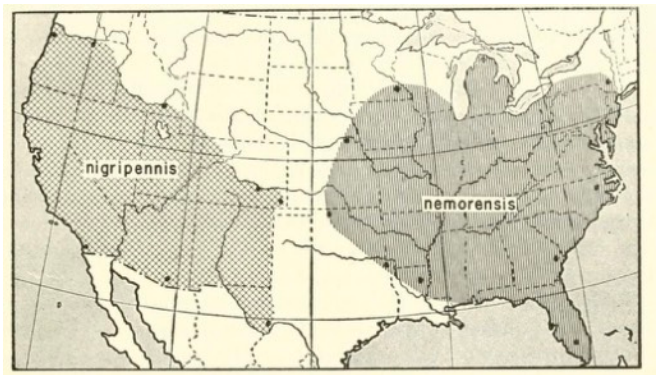


Fig. 10. Map showing the distribution of *Nemognatha (Pauronemognatha) nigripennis* and *N. (Pauronemognatha) nemorensis*.

- **William Harmon observed the individual shown at the top right at Silver City on 16 May 2024. Shown here under a Creative Commons license.**

Subgenus *Pronemognatha* (Enns, 1956)

Nemognatha selanderi **(Enns, 1956)**

- **See page 75 of Werner[3] for species description.**

- **See species description at Enns[10] (1956) pp. 718-721.**
- **See range map from Enns[10] below.**
- **See image at BugGuide.**

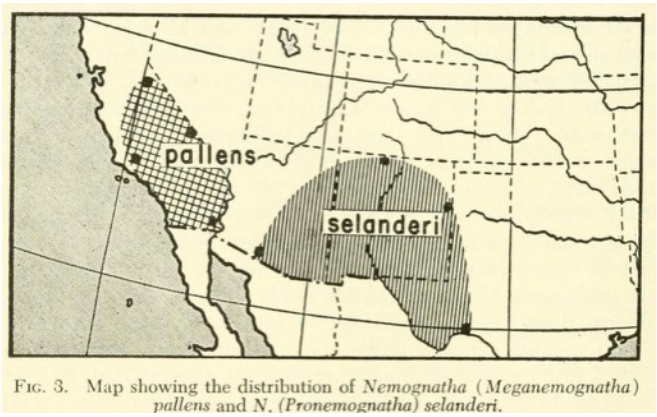


Fig. 3. Map showing the distribution of *Nemognatha (Meganemognatha) pallens* and *N. (Pronemognatha) selanderi*.

Nemognatha sparsa **(LeConte, 1868)**

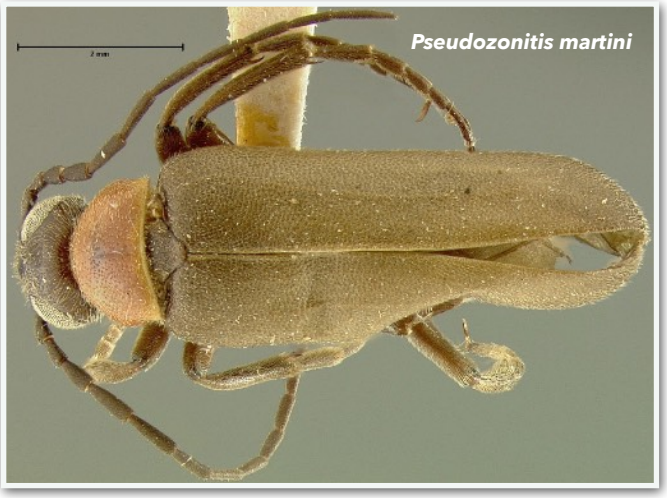
- **See page 74 of Werner[3] for species description.**
- **See Enns (1956) for species description, pp. 714-716.[10]**
- **Enns (1956) reports examining species from several locations in New Mexico (incl. Luna and Socorro Counties) as part of his study.[10]**
- **See image at BugGuide (from Sandia Mountains)**

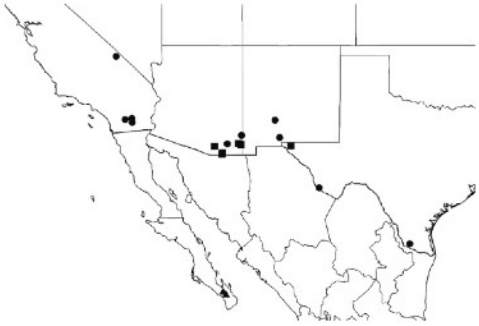
Genus *Pseudozonitis* (Dillon, 1952)

- **See Pinto (2018)[11] for genus and species descriptions, identification key, and range maps.**
- **Apparently nocturnal.**

Pseudozonitis martini **(Fall, 1907)**

- **The male holotype specimen is from Engle (Sierra County) and is housed at Harvard University's Museum of Comparative Zoology. (Mislabeled in data base as collected at "Eagle".) "In the original description Fall states that it was taken by Miss Nora Newberry and sent him by Prof. Cockerell."[10] One image of this specimen is shown at the top left of the next page. Shown here under a Creative Commons license.**
- **See range map from Pinto[11] (2018) in the left column of the following page.**
- **See Werner[3] (2016), p. 68.**
- **Fall (1907)[1] lists specimens from Alamogordo and Mesilla Park as well. Listed as *Zonitis*.**

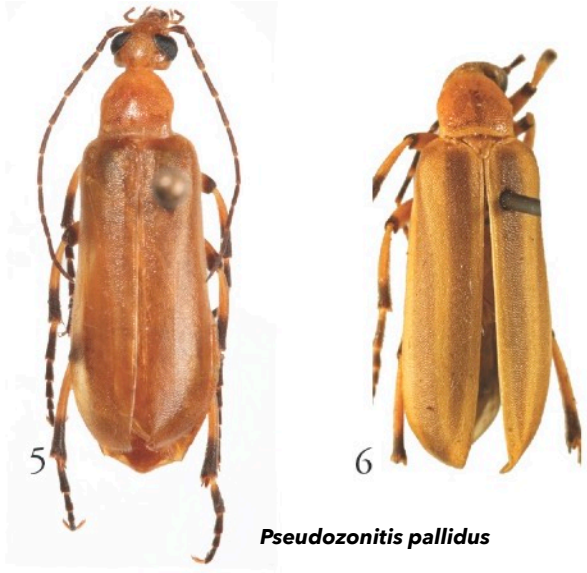




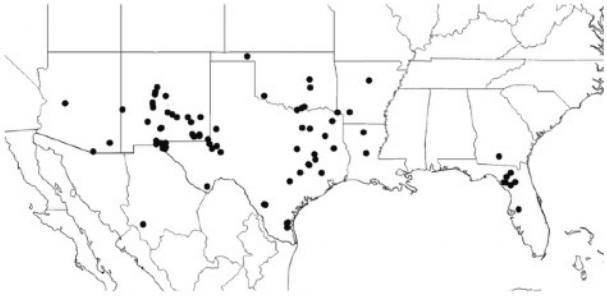
Map 3. Geographic distribution of *Pseudozonitis dianae* (squares), *P. martini* (dots), and *P. huetheri* (triangles).

***Pseudozonitis pallidus* (Dillon, 1952)**

- **Range map from Pinto[11] (2018) shown at the top right.**
- **The two forms of the species *P. pallidus*, listed as *P. pallida*, shown below are from Pinto[11] (2018). The pallid form in listed as "5" and the vittate form is listed as "6" - see Pinto species descriptions.**
- **Many New Mexico specimens were reviewed by Pinto[11] in support of this 2018 article, including a specimen from Luna County, several from near San Antonio (Socorro County), and at least two from Truth or Consequences (Sierra County).**
- **Enns (1956)[10] pp. 866-868.**



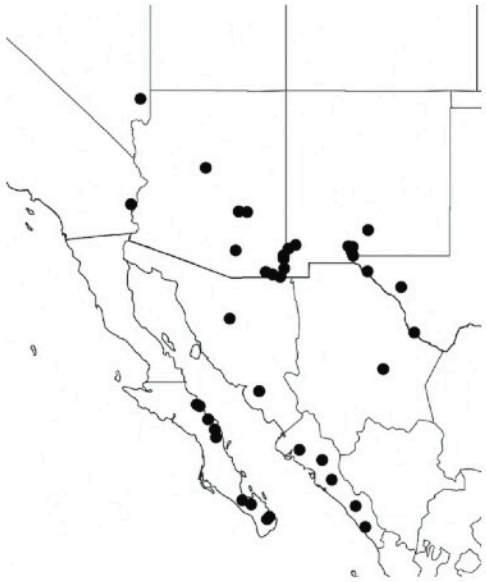
Pseudozonitis pallidus



Map 9. Geographic distribution of *Pseudozonitis pallida*.

***Pseudozonitis stroudi* (Enns, 1956)**

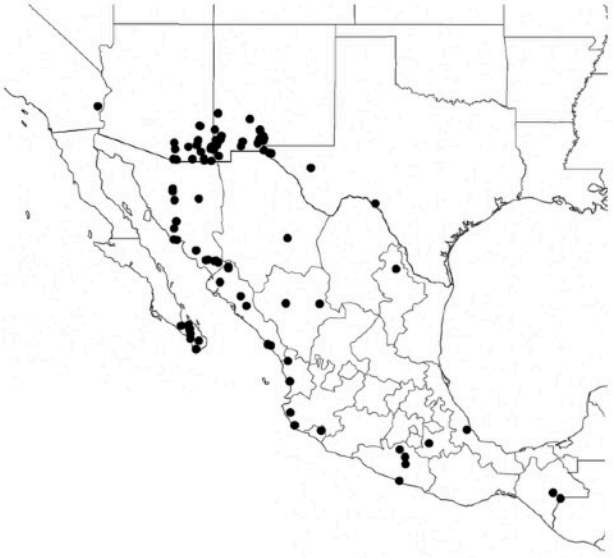
- **Many New Mexico specimens were reviewed by Pinto[11] in support of his 2018 work, including specimens from Las Cruces, Lordsburg, and Pyramid Peak (Doña Ana County).**
- **Range map from Pinto[11] (2018) shown below.**
- **See Werner[3] (2016), p. 69.**
- **Enns (1956)[10] pp. 868-871.**



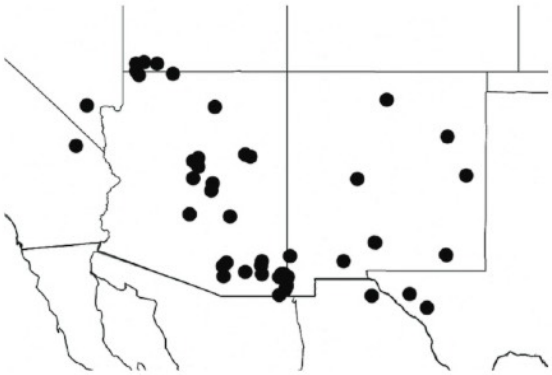
Map 12. Geographic distribution of *Pseudozonitis stroudi*.

***Pseudozonitis vaurieae* (Enns, 1956)**

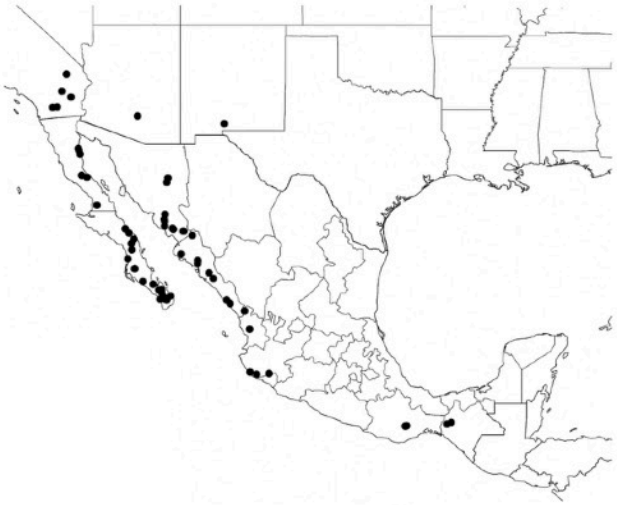
- **Range maps from Pinto[11] (2018) are shown in the left column of the next page.**
- **The taxonomy systemics of this species are unresolved. At present, there are two forms: "A" which is found mostly in the United States, and "B" which is found mostly in Mexico. In Mexico the forms have been found together and they are considered sympatric (divergent evolution of a species while the populations are living in the same area).**
- **New Mexico specimens of Form A collected as part of the Pinto[11] (2018) research included those from Afton (the very southeastern part of Doña Ana County), Columbus and Deming (Luna County), Las Cruces,**



Map 13. Geographic distribution of *Pseudozonitis vaurieae*, Form A.



Map 16. Geographic distribution of *Pseudozonitis vittipennis*.



Map 14. Geographic distribution of *Pseudozonitis vaurieae*, Form B.

iNaturalist, shown below under a Creative Commons license. Note his observational comments. See also his 13 September 2018 observation from Las Cruces.

- **Enns (1956)[10] pp. 871-876.**

Pseudozonitis vaurieae

***Pseudozonitis vittipennis* (Horn, 1875)**

- **Range map from Pinto[11] (2018) shown at the top right .**
- **New Mexico specimens collected as part of the Pinto[11] (2018) research included those from Lordsburg and Luna County.**
- **The specimen shown at the right is from Pinto[11] (2018).**
- **See Werner[3] (1966), p. 69.**
- **Enns (1956)[10] pp. 852-855.**

9

Pseudozonitis vittipennis

the Jornada, Truth or Consequences. . . . Form B was collected in Las Cruces.

- **The specimen shown at the right is from Pinto[11] (2018).**
- **See number 98 in the drawing by Martha L. Noller, from *The Meloidae of Arizona* by Floyd Werner[3] (1966) page 94 - image page 26 of this article.**
- **See Werner[3] (1966), p. 69.**
- **Joel DuBois posted a 25 July 2020 observation of this species from Doña Ana County on**

Pseudozonitis vaurieae

7

Genus *Rhyphonemognatha* (Enns, 1956)

***Rhyphonemognatha rufa* (LeConte, 1854)**

- **Originally described in *Zonitis*, sometimes listed as *Nemognatha*.**
- **See Werner[3] (1966), p. 80.**
- **Originally assigned to *Zonitis*. Fall (1907)[1] lists the collection of a *Zonitis rufa* specimen in Gallinas Canon, Sierra County (p. 209). Gallinas Canon may refer to the drainage on the west slope of the Black Range in Grant County.**
- **The closest iNaturalist observation of this species was on 14 July 2018 in the Sacramento Mountains, by CK Kelly. Shown below under a Creative Commons license.**
- **Enns (1956)[10] - species description pp. 796-799, range map, shown below, p. 799.**

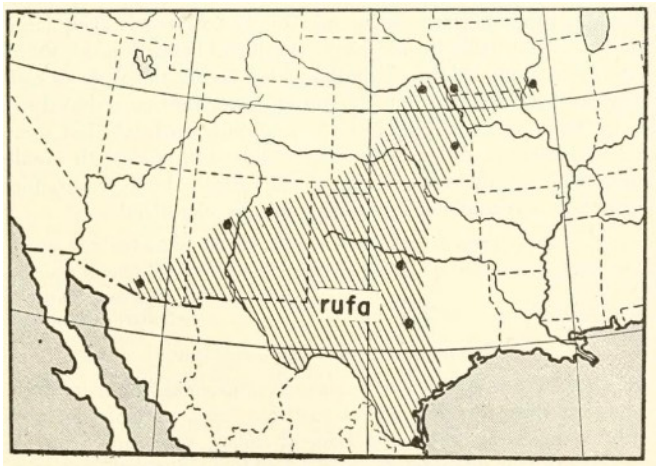


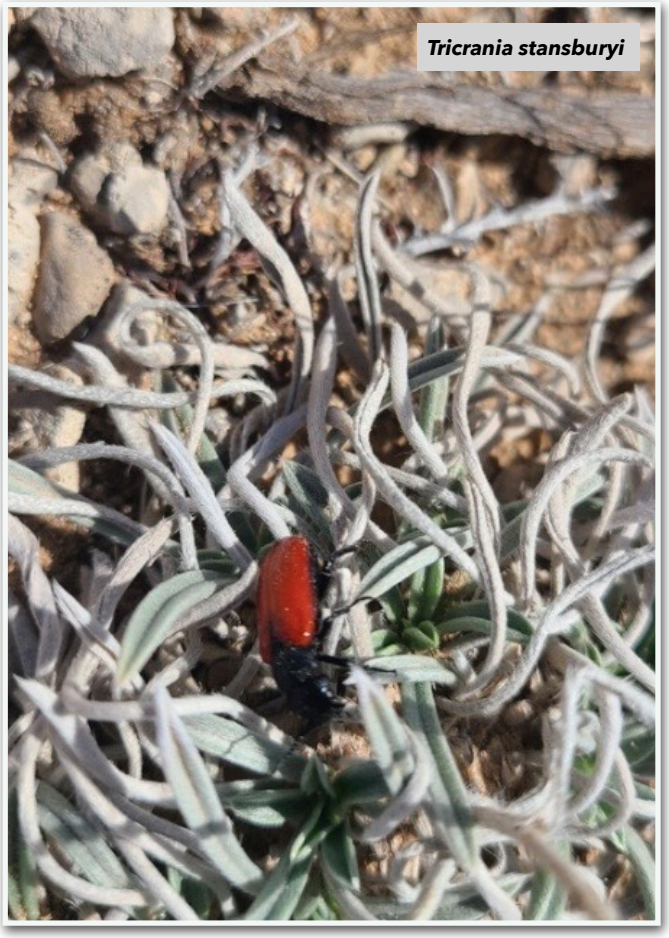
Fig. 14. Map showing the distribution of *Rhyphonemognatha rufa*.

Genus *Tricrania*

***Tricrania stansburyi* (Haldeman, 1852)**

- **Celia Cook's iNaturalist observation of 11 March 2024, from Socorro County, is shown at the top right under a Creative Commons license.**
- **See number 103 in the drawing by Martha L. Noller, from *The Meloidae of Arizona* by Floyd Werner[3] (1966) page 94 - image at upper right on page 26 of this article.**
- **See Werner[3] (1966), p. 81 - "The eggs are probably laid in masses outside the nest of the host bee . . . the first instar larvae attaching themselves to bees resting near the nest. Has been bred from the cells of bees of the genera *Hoplitis, Osmia, Anthidium* . . ."**

Genus *Zonitis* (Fabricius 1775)



- **BugGuide notes that "telling apart *Zonitis* and *Nemognatha* from dorsal shots is often impossible".**
- **See Enns (1956)[10] for a full description of this genus.**
- **The image at the top left on the following page has been identified to genus on iNaturalist. It is shown here under a Creative Commons license and is an observation by Wendy McCrady on 3 August 2022 near the Gila Cliff Dwellings.**
- **Enns (1956)[10] – Genus description starts at p. 800.**

Subgenus *Neozonitis* (Enns 1956)

***Zonitis atripennis* (Say 1823)**

- **See Werner[3] (1966), pp. 71-72.**
- **A report by Salvador Vitanza from Doña Ana County on 30 August 2016. See BugGuide where he noted "It was challenging to photograph this beetle because it pretended to be dead at the slightest touch and remained in that position for a long time; then suddenly get up and try to escape quickly. This sequence of events was repeated over and over.**


Zonitis sp.


Zonitis bilineata

Zonitis atripennis **(Say 1823) (con't.)**

Interestingly, while feigning death, it pretended to convulse in a rhythmic fashion that reminded me of a beating heart."

- **Enns (1956)[10] - Species description at pp. 806-813, includes descriptions of various subspecies. Range map shown below indicates that *Z.a. flavida* (LeConte 1853) is the expected subspecies. Enns[10] studied specimens from Las Cruces and from Socorro County as part of his research.**

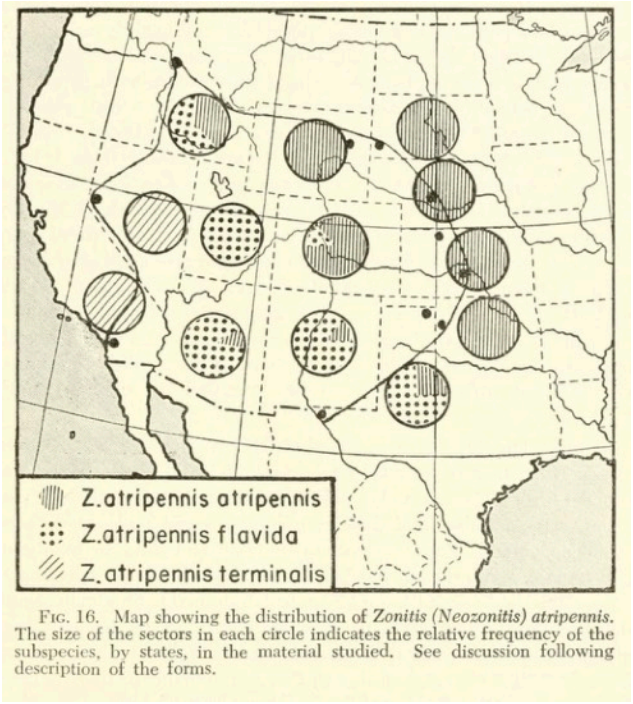


FIG. 16. Map showing the distribution of *Zonitis (Neozonitis) atripennis*. The size of the sectors in each circle indicates the relative frequency of the subspecies, by states, in the material studied. See discussion following description of the forms.

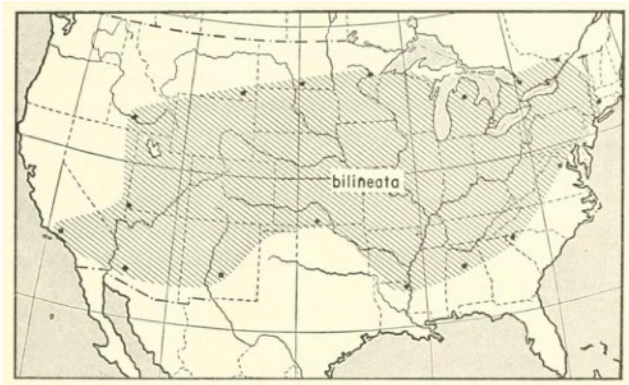


FIG. 15. Map showing the distribution of *Zonitis (Neozonitis) bilineata*.

Zonitis bilineata **(Say 1817)**

- **See Werner[3] (1966), p. 72.**
- **An observation at La Cienega (Leonora Curtain Wetlands), Santa Fe County, New Mexico, on 7 August 2023 by "tjay13" on BugGuide.**
- **An observation by Sue Carnahan on BugGuide is shown, top right, under a Creative Commons license. From Apache County, Arizona, on 26 July 2021.**
- **Enns (1956)[10] - Species description at pp. 801-805. The range map from his article is shown at center right.**

Zonitis interpretis **(Enns 1956)**

- **See Werner[3] (1966), p. 70.**
- **West Texas to Arizona (one specimen only)**
- **Enns (1956)[10] - Species description at pp. 817-819.**

Zonitis vermiculata **(Schaeffer 1905)**

- **See Werner[3] (1966), p. 70.**
- **Likelihood in this area is uncertain, Enns (1956).[10] Range map at p. 815 indicates that this species would not be found here.**
- **Enns (1956)[10] - Species description at pp. 813-815.**

Subgenus *Parazonitis* (Enns 1956)

Zonitis dunniana **(Casey 1891)**

- **Photo at the top left of the next page is an observation by James Von Loh on 29 August 2019 in Mesilla, New Mexico. Shown here under a Creative Commons license via iNaturalist.**

Zonitis dunniana **(Casey 1891) (con't.)**

- **See Werner[3] (1966), p. 73.**
- **Enns (1956)[7] - Species description at pp. 832-834. His range map (p. 834) is shown below. Specimens examined as part of his study included those from Doña Ana County and from Las Cruces (separate from the county).**

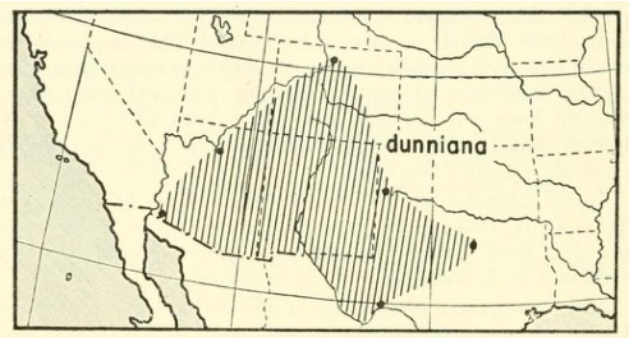


FIG. 22. Map showing the distribution of *Zonitis (Parazonitis) dunniana*.

Zonitis punctipennis **(LeConte 1880)**

- **See Werner[1] (1966), pp. 72-73.**
- **Reports from southeastern Arizona near NM border.**
- **Enns (1956)[10] - Species description at pp. 834-838. His range map (p. 831) is shown below. His study included a specimen from Doña Ana County.**

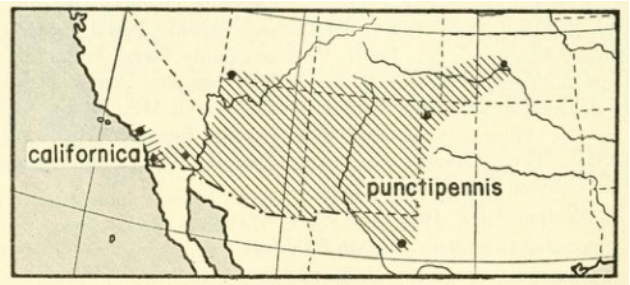


FIG. 23. Map showing the distribution of *Zonitis (Parazonitis) punctipennis* and Z. (*P.*) *californica*. The zone of intergradation of the subspecies is indicated by the overlapping of types of shading.

Zonitis sayi **(Wickham 1905)**

- **See Werner[3] (1966), p. 73.**
- **Enns (1956)[10] - Species description at pp. 829-832. His range map (p. 831) is shown at the top right.**

Zonitis vittigera **(LeConte 1853)**

- **See Werner[3] (2016), p. 72. Werner reports a specimen from Garfield in Doña Ana county.**

FIG. 21. Map showing the distribution of *Zonitis (Parazonitis) sayi*.

- **Enns (1956)[10] - Species description at pp. 820-824. His range map (p. 824) indicates that it is the subspecies *Z. v. propinqua* (MacSwain 1951) which is expected here, see below.**

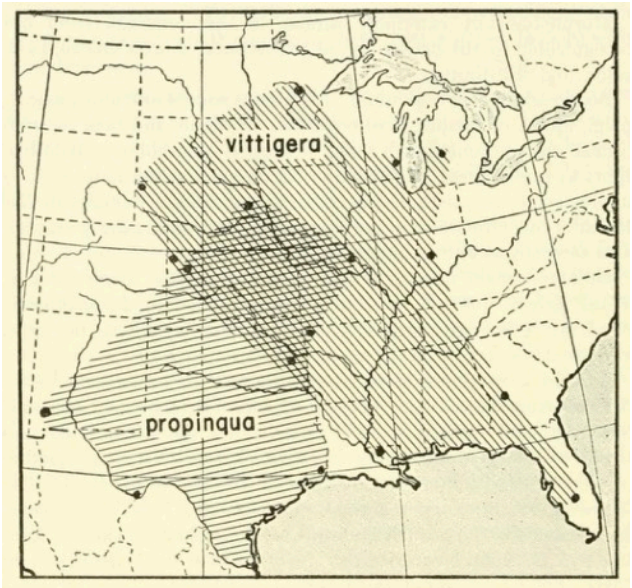


FIG. 19. Map showing the distribution of *Zonitis (Parazonitis) vittigera*. The zone of intergradation of the subspecies is indicated by the overlapping of types of shading.

Subfamily Meloinae

Genus *Lytta* (Fabricius 1775)

- **BugGuide notes that the genus name is "From Greek *lytta, lyssa* (λυττα, λυσσα) 'madness, rage' (refers to the toxic properties of these beetles)."**
- **As in most (all?) members of this family, the larval hosts are bees. Adults in this genus are vegetarians eating pollen, fruit, flowers, and plant foliage.**
- **See Selander[12] for a complete treatment of this genus.**

Subgenus *Adicolytta* (Selander 1960)

***Lytta mutilata* (Horn 1875)**

- **Originally described as *Cantharis mutilata*.**
- **The type specimen is at the Museum of Comparative Zoology, Harvard University.**
- **See BugGuide images from Otero County.**
- **See number 93 in the drawing by Martha L. Noller, from *The Meloidae of Arizona*[3] by Floyd Werner, page 93, top right.**
- **See Werner[3] (1966), pp. 59. Werner notes that the adults of this species feed on *Kallstroemia grandiflora, Tribulus* (goat's head), *Euphorbia*, and *Cuscuta* (dodder).**
- **See Selander[12] (1960) pp. 152-155. He notes specimens from 10 miles north of Columbus, Deming, Mesilla, Mesilla Park, and Socorro.**

Subgenus *Paralytta* (Selander 1960)

- **See Selander[12] (1960) for information on this subgenus, starting at page 49.**

***Lytta biguttata* (LeConte 1853)**

- **Enns (1956)[10] - Species description at pp. 820-824.**
- **See Werner[3] (1966), p. 62.**
- **See number 95 in the drawing by Martha L. Noller, from *The Meloidae of Arizona*[3] by Floyd Werner, page 94 (see page 26 in this article).**
- **See Selander[12] pp. 86-90. A species from near Hot Springs (Truth or Consequences).**
- **Common names included Two-spotted Lytta.**
- **See observation by Ted C. MacRae on iNaturalist shown below under a Creative Commons license. An observation on 22 July 2021, at Deming.**

***Lytta puberula* (LeConte 1866)**

- **See Selander[12] pp. 68-70. A specimen from Cloudcroft.**
- **See Werner[3] (1966), p. 61.**

***Lytta agrestis* (Fall 1901)**

- **See Werner[3] (1966), p. 60.**
- **Your guess is as good as anyone else's, see Werner discussion.**
- **Fall, H.C. and Cockerell, T.D.A.[1] attribute the species identification to Kirby and note that specimens were collected between Santa Fe and Ft. Wingate and at Pescado as part of the Wheeler Survey. Werner believes this species is found only in a limited area in northern Arizona.**

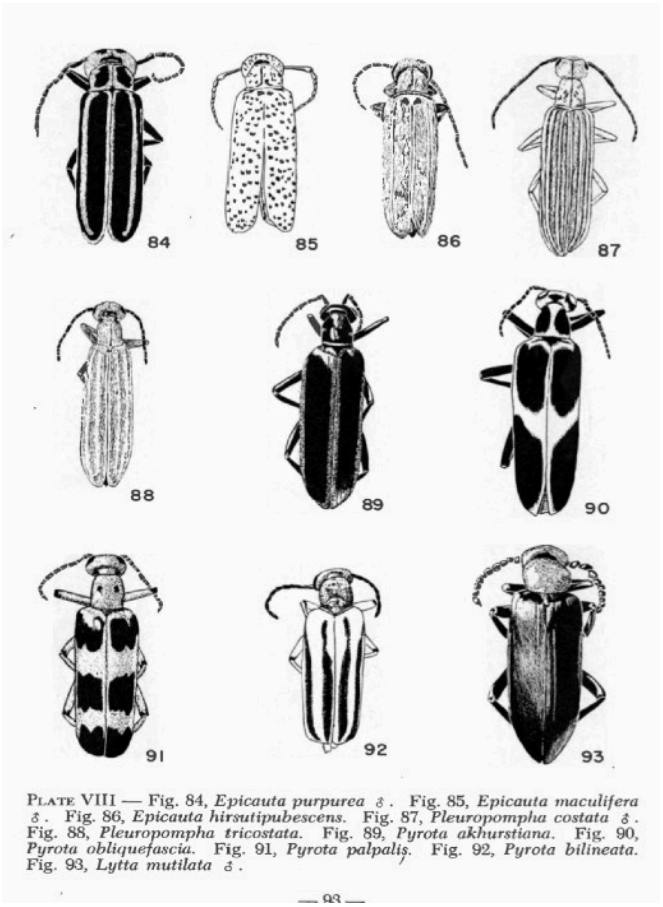


PLATE VIII — Fig. 84, *Epicauta purpurea* ♂. Fig. 85, *Epicauta maculifera* ♂. Fig. 86, *Epicauta hirsutipubescens*. Fig. 87, *Pleuropompha costata* ♂. Fig. 88, *Pleuropompha tricostata*. Fig. 89, *Pyrota akhurstiana*. Fig. 90, *Pyrota obliquefascia*. Fig. 91, *Pyrota palpalis*. Fig. 92, *Pyrota bilineata*. Fig. 93, *Lytta mutilata* ♂.

— 93 —

***Fulvipennis* Group**

***Lytta fulvipennis* (LeConte 1853)**

- **See Werner[3] (1966), p. 60.**
- **Common name of Prickly Poppy Blister Beetle.**
- **Per Selander[12] this is mostly a species of central Texas to Kansas, but there are specimens which bracket this area, one from Artesia, New Mexico, to the east and one from Portal, Arizona, to the west. (p. 58)**

Reticulata Group

***Lytta arizonica* (Selander 1957)**

- **See Werner[3] (1966), p. 60. Very unlikely here.**

***Lytta deserticola* (Horn 1870)**

- **See Werner[3] (1966), p. 60.**
- **See Selander[12] pp. 111-112. Reports specimens from Cooney (Black Range), Socorro County, and Walnut Creek (Silver City by Cockerell in 1898).**

***Lytta mirifica* (Werner 1950)**

- **See Selander[12] pp. 105, 107. Reports a record from Anthony, New Mexico. See photograph by Mike Quinn, TexasEnto.net, of the Anthony specimen (shown at top right of the next page under a Creative Commons license). The specimen was originally collected by R. H. Crandall on 21 June 1941.**

Magister Group

Lytta magister **(Horn 1870)**

- **See number 94 in the drawing by Martha L. Noller, from *The Meloidae of Arizona*[3] by Floyd Werner, page 94 (see page 26 earlier).**
- **See Werner[3] (1966), p. 59.**
- **Common name of Master Blister Beetle.**
- **See image from Selander[9] at lower right. This group is expected to the west of the Black Range.[9 Page 33]**
- **The photograph below was taken by Tyger Gilbert on 23 March 2023 on Picacho Peak, northwest of Tucson. Shown here under a Creative Commons license.**

Lytta mirifica

Lytta vulnerata **(LeConte 1851)**

- **See Werner[3] (1966), p. 59.**
- ***Lytta vulnerata cooperi***
- **Selander[12] posits that "Cockerell's (1898) record (also listed by Fall and Cockerell, 1907)[1] of *vulnerata* from the Mesilla Valley, New Mexico. . . (is) . . . unacceptable on geographic grounds." p. 132**

Subgenus *Poreospasta (Horn* 1868)

- **See Selander[12] (1960) for information on this subgenus, at pp. 157-161.**

Stygica Group

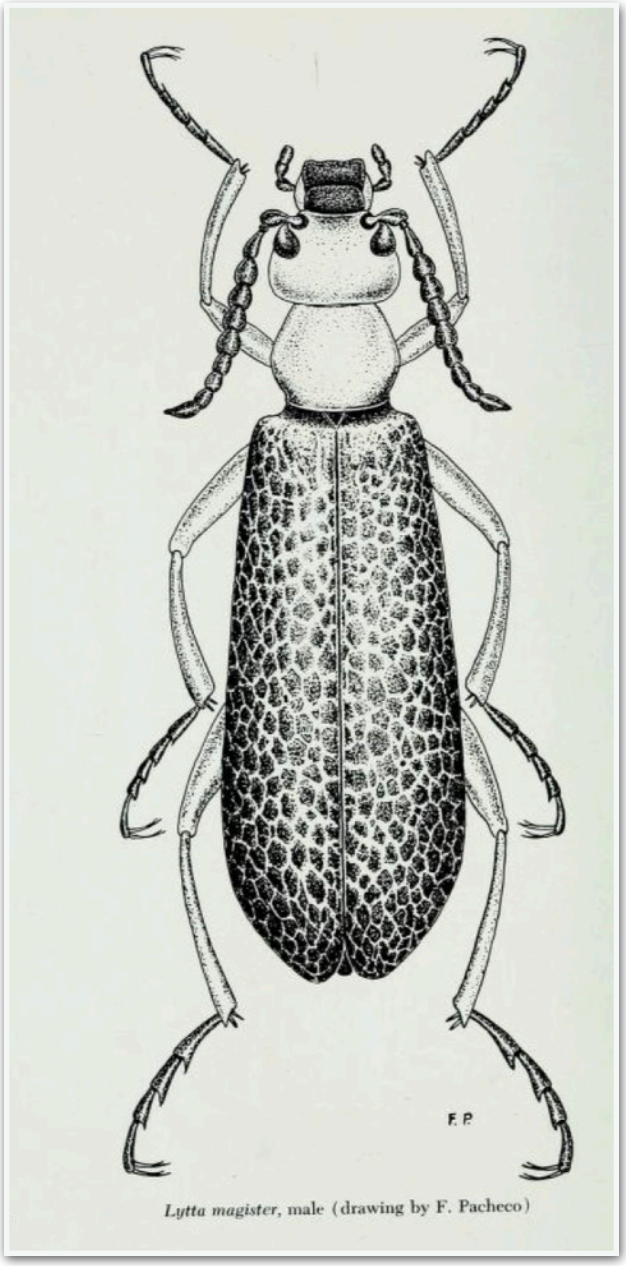
- **See Selander[12] (1960) for information on this group, starting at p. 161.**

Lytta stygica **(LeConte 1851)**

- **Selander[12] (1960) identifies no specimens from New Mexico, p. 185-192.**

Lytta auriculata **(Horn 1870)**

- **See Werner[3] (1966), pp. 62-63.**
- **Common names include Red-eared Blister Beetle.**
- **See an observation by Cecelia Alexander from the Florida Mountains (Luna County) on 29 March 2020 at the top left of the following page. Shown here under a Creative Commons license. Also an observation in Las Cruces on 25 April 2019.**
- **See an observation by Dave Suszcynsky from the Florida Mountains (Luna County) on 31 March 2023 at the top right on the next page. Shown here under a Creative Commons license.**
- **Selander[12] (1960) does not list this species from New Mexico.**



Lytta magister, male (drawing by F. Pacheco)

Lytta auriculata **(Horn 1870) (con't.)**

- **The two photographs at the center are most likely this species. Photographed by James Von Loh. These beetles were seen on Tortugas Mountain on 25 March 2022. In the center right photograph the elytra is extended.**

Moerens Group

- **See Selander[12] (1960) pp. 193-194.**

Cyanipennis **Subgroup**

- **See Selander[12] (1960) pp. 204-205.**

Lytta nuttalli **(Say 1824)**

- **See Werner[3] (1966), pp. 61-62.**
- **Common names include Nuttall's Blister Beetle.**
- **See Selander[12] (1960) pp. 205-209. Specimen listed from near "Hot Springs" (Truth or Consequences) p. 208.**

Lytta viridana **(LeConte 1866)**

- **See Werner[3] (1966), p. 62.**
- **See Selander[12] (1960) pp. 213-215. New Mexico records are from the northern part of the state.**

Genus *Meloe* (Linnaeus 1758)

- **Common name of "Oil Beetles" refers to the "oily liquid exuding from the joints".**
- **See Pinto and Selander (1970)[13] esp. pp. 99-100.**

Subgenus *Meloe*

- **See Pinto and Selander (1970)[13] pp. 193-199 for photographs of heads and pronota of Meloe shown on this and the next page.**
- **See the (iNaturalist - needs id) observation by "elvistcat" in July 2020 from north of Silver City at the center right on the following page.**

***Meloe impressus* (Kirby 1837)**

- **See Werner[1] (1966), p. 63.**
- **See Pinto and Selander (1970)[13] range map at p. 162 which shows several specimens from northern New Mexico and Ruidoso.**

***Meloe niger* (Kirby 1837)**

- **See Werner[3] (1966), p. 63.**
- **Common names include Black Meloe.**
- **See Pinto and Selander (1970)[13] range map at p. 137. There is a specimen recorded from Las Cruces.**

***Meloe nebulosus* (Champion 1891)**

- **See Pinto and Selander (1970)[13] range map at p. 156 which shows two specimens from southern New Mexico. GBIF does not show these specimens.**

Subgenus *Treiodous* (Dugès 1869)

***Meloe laevis* (Leach 1815)**

- **See Werner[3] (1966), p. 64.**
- **See number 96 in the drawing by Martha L. Noller, from *The Meloidae of Arizona*[1] by Floyd Werner, page 94 (see page 26 earlier).**
- **The drawing at upper right is from Pinto and Selander (1970)[13] p. 39.**
- **See Pinto and Selander (1970)[13] pp. 111-114. Specimens recorded from Deming, Las Cruces, Luna County, Silver City, Socorro, and other locations.**
- **See the iNaturalist observation by Jan Richmond on 31 July 2024 in Hillsboro, bottom left on the following page.**
- **See iNaturalist observation (needs id) from July 2020 from north of Silver City by Emily Pollom.**
- **See iNaturalist observation by George Pollock on 8 August 2023 near White Signal, Grant County, below left.**

***Meloe afer* (Bland 1864)**

- **See Pinto and Selander (1970)[13] range map at p. 118 which shows a specimen from near Albuquerque.**

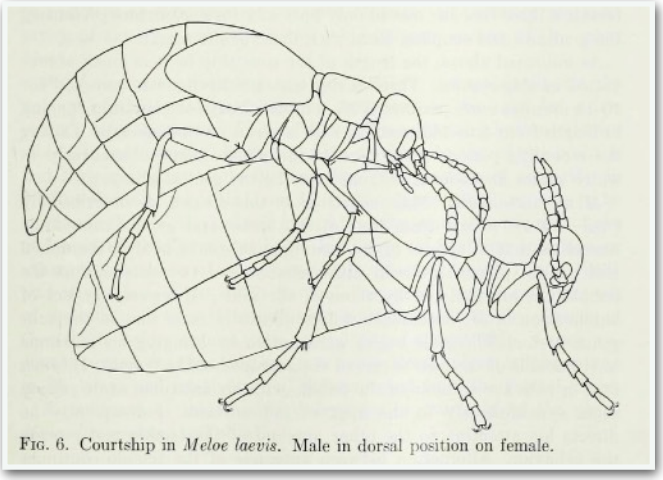
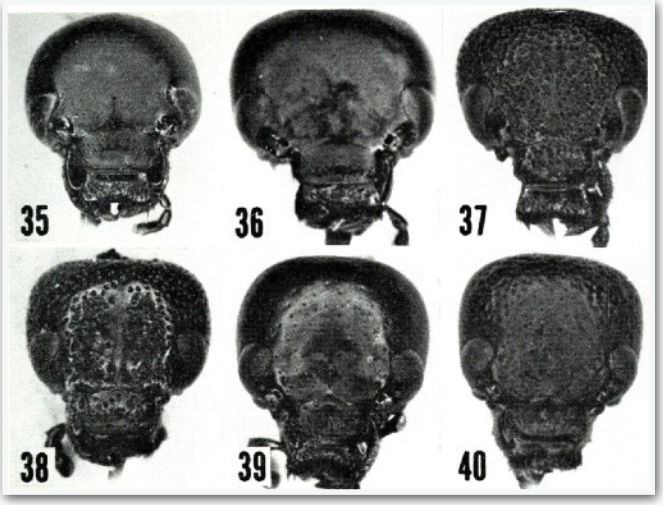
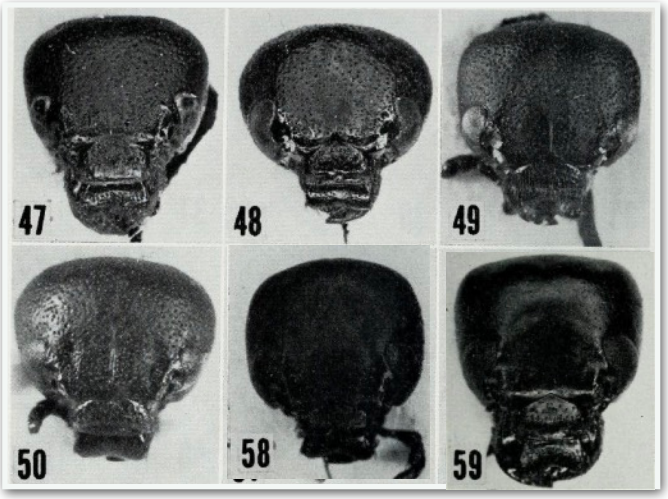


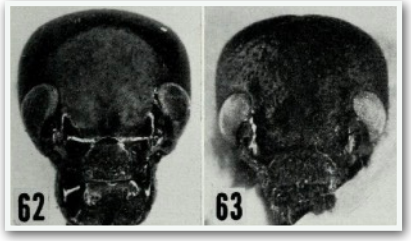
FIG. 6. Courtship in *Meloe laevis*. Male in dorsal position on female.



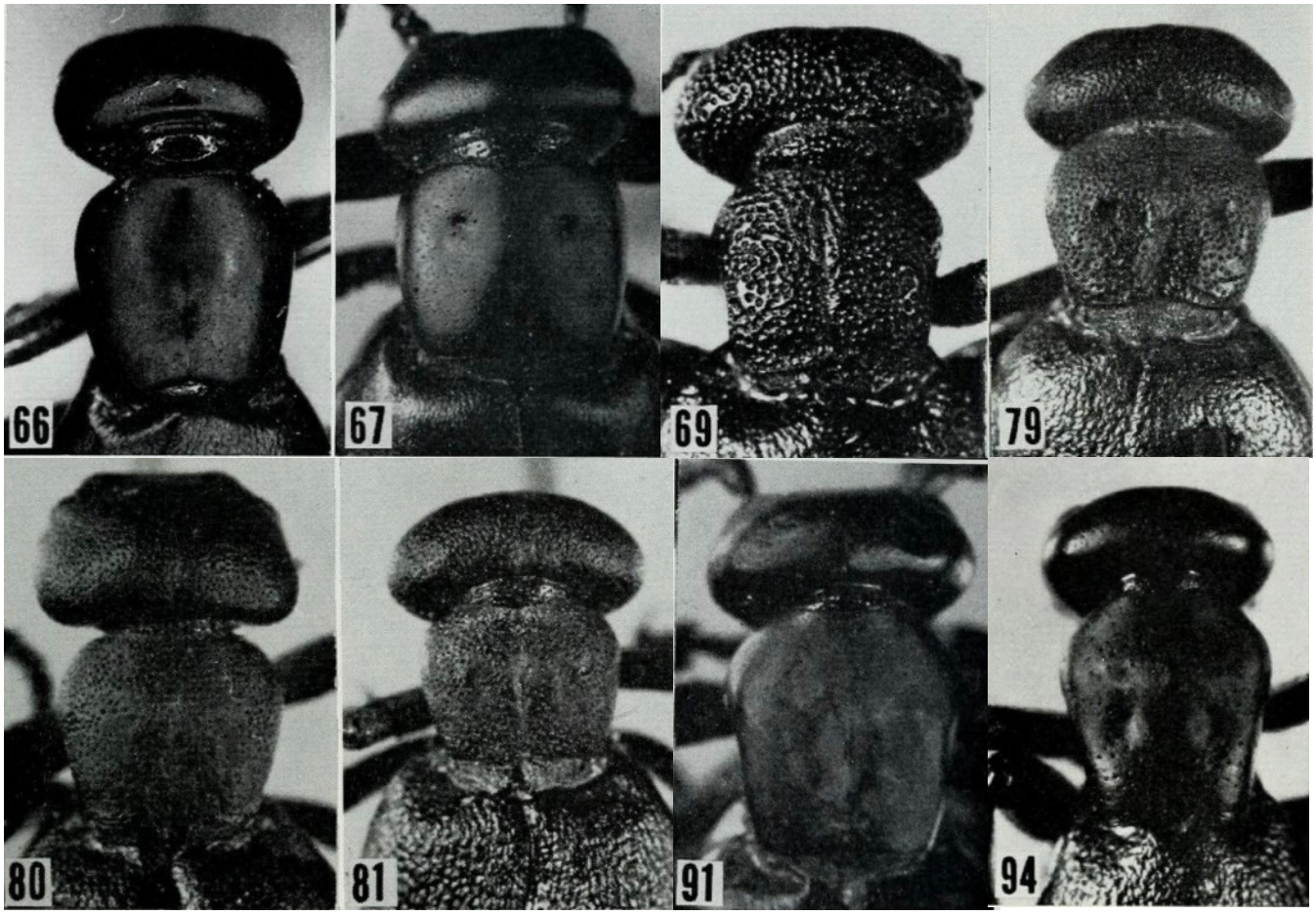
Heads of *Meloe* sp.. Number 35 - *Meloe laevis*; Numbers 37 and 38 - *Meloe afer*. Pinto and Selander (1970)[13] p. 193



Heads of *Meloe* spp. Numbers 47-50 - *Meloe niger*; Numbers 58-59 – *Meloe nebulosus*. Pinto and Selander (1970)[13] p. 194-195.



Left: Heads of *Meloe* impressus. Pinto and Selander (1970)[13] p. 195.



Pronota of *Meloe* spp. Numbers 66-67 - *Meloe laevis*; Number 69 – *Meloe afer;* Numbers 79-81 - *Meloe niger;* Number 91 - *Meloe nebulosus*; and Number 94 - *Melo impressus* (also number 95 not shown. Pinto and Selander (1970)[13] pp. 196-199.

Genus Pyrota (Dejean 1834)

- **Werner[3] (1966), p. 54, notes that "several of the species of *Pyrota* are abundant and conspicuous insects; it is remarkable that the larval host is not known for any of them . . . it seems likely that the larvae live in the nests of solitary bees. A likely host for such a large and abundant species as *Pyrota akhurstiana* is difficult to imagine."**

***Pyrota akhurstiana* (Horn 1891)**

- **See Werner[3] (1966), p. 55 and number 89 (page 93) in the drawing by Martha L. Noller shown on page 33 earlier in this article.**

***Pyrota akhurstiana* (con't.)**

- **Common on mesquite.**
- **See Pierce[14]**
- **Common names include Southwestern Red-lined Blister Beetle.**
- **An image of the type specimen (from New Mexico) at the Museum of Comparative Zoology, Harvard University, is shown at the top of this page.**
- **See iNaturalist observation by Shaun M. McCoshum at the right, shown here under a Creative Commons license. An observation from northeast of Deming in August of 2023.**
- **See iNaturalist observation by Emily Pollom, directly above, shown here under a Creative Commons license. An observation from north of Deming on 27 July 2022.**

Pyrota bilineata **(Horn 1885)**

- **See Werner[3] (1966), p. 58.**
- **See iNaturalist observation from Elephant Butte State Park by Jared Shorma on 19 September 2019. Shown at the bottom left on the following page under a Creative Commons license.**
- **Photographs on this page, and the top of the following page, are by Gordon Berman. The beetle is on *Palafoxia* and was photographed in Las Cruces.**

Pyrota concinna **(Casey 1891)**

- **See Werner[3] (1966), p. 56**
- **See iNaturalist observation by Steven Mlodinow at the center right of the next page, shown here under a Creative Commons license. An observation from north of Bosque del Apache NWR on 19 August 2023.**

Pyrota fasciata **(Selander 1963)**

- **See Werner[3] (1966), pp. 56-57.**
- **See iNaturalist observation from Deming by Jennifer Miller on 22 July 2019. Shown at the bottom right of the next page under a Creative Commons license.**

Pyrota mylabrina **(Chevrolat 1834)**

- **An iNaturalist observation in Placitas (northeast of Albuquerque). Shown at the top left on page 41 under a Creative Commons license.**


Pyrota bilineata


Pyrota bilineata


Pyrota bilineata


Pyrota concinna


Pyrota fasciata

Pyrota obliquefascia **(Schaeffer 1908)**

- **See Werner[3] (1966), p. 55 and number 90 (page 93) in the drawing by Martha L. Noller shown on page 33 earlier in this article.**
- **No iNaturalist observations from New Mexico.**

Pyrota palpalis **(Champion 1892)**

- **See Werner[3] (1966), pp. 55-56 and number 91 (page 93) in the drawing by Martha L. Noller shown on page 33 earlier in this article.**
- **Common names include Charlie Brown Blister Beetle.**
- **See iNaturalist observation by "chelleporras" at the top right, shown here under a Creative Commons license. An observation from north of Salem on 29 August 2024.**
- **See iNaturalist observation by Jared Shorma at the bottom left, shown here under a Creative Commons license. An observation from west of Deming on August 14, 2021.**

Pyrota plagiata **(Haag-Rutenburg 1880)**

- **See Werner[3] (1966), pp. 56-57.**
- **No iNaturalist observations from New Mexico.**

Pyrota postica (LeConte 1866)

- **See iNaturalist observation from Hermosa by "leach" on 4 September 2019. Shown at the middle right above under a Creative Commons license.**
- **See Werner[3] (1966), p. 57.**
- **Common names include Creosote Blister Beetle. It is often found on Creosote Bush.**

Pyrota punctata (Casey 1891)

- An iNaturalist observation in Luna County east of the southern end of the Floridas, by "swdesertnaturalist" on 17 September 2020, is shown below under a Creative Commons license.
- Common names include Ivory-winged Blister Beetle.
- Observations on BugGuide from Dog Canyon, Otero County, and a few other New Mexico locations.


Pyrota punctata

Pyrota terrestris (Selander 1963)

- See Werner[3] (1966), p. 56.

Pyrota trochanterica (Horn 1894)

- See Werner[3] (1966), p. 57.
- Common names include Arizona Trochanter Blister Beetle. Often found on nightshades.
- Closest iNaturalist observation is from the Peloncillo Mountains Wilderness on 31 July 2021 by M. K. Hoover.

Tribe *Eupomphini* (LeConte, 1862)

- Twenty-eight species in seven genera (some of which are divided into subgenera) in the United States and Canada.

Genus *Cysteodemus* (LeConte 1851)

- Common names include Desert Spider Beetles.

Cysteodemus wislizeni (LeConte 1851)

- Common names include Black Bladder-bodied Meloid
- The photographs in the right column are from Ready Pay Gulch, East of Hillsboro, NM. They were taken on 16 April 2015 by RABarnes. *Cysteodemus armatus* (LeConte) is the other species of this genus found in the west. It is not found here.

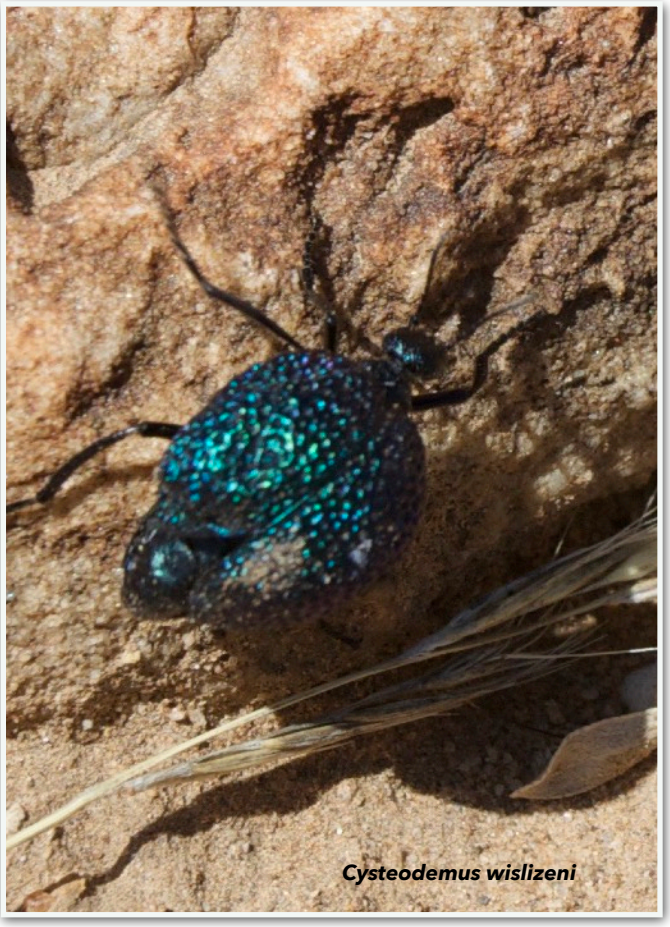
Genus *Eupompha* (LeConte, 1858)

- There are 8 species in the United States and Canada. The range of this genus is mostly within the south-western United States and Mexico.

Eupompha fissiceps (LeConte, 1858)

- Common names include Cleft-headed Blister Beetle.
- Photographs on the following page were taken on Tortugas Mountain (Las Cruces) on 19 July 2021 by James Von Loh. At the time he took these three photographs he found two of the beetles "moving very rapidly while foraging from the leaves and stems of a Creosotebush, *Larrea tridentata* (D. C. Coville) shrub canopy, growing from the east-facing lowslope." (Personal correspondence date 25 April 2025.) The bottom left photograph shows the exposed abdomen when the beetle is flying (an unusual photograph) while the bottom right photograph shows the unique thorax depressions of the species.


Cysteodemus wislizeni


Cysteodemus wislizeni

Eupompha fissiceps

Eupompha fissiceps

Eupompha fissiceps

Genus *Megetra*[15] (LeConte 1859)

- **There are few iNaturalist observations of this genus in our area, and they are typically *M. cancellata*. *M. punctata* is usually found in the Bootheel and *M. vittata* found to our north.**

***Megetra cancellata* (Brandt and Erichson, 1832)**

- **Found from Arizona and New Mexico south to Hidalgo.**
- **The photos in the right column were taken on 15 October 2024 in the Pony Hills in far northern Luna County, west of Massacre Peak and southwest of Cooke's Peak by RA Barnes.**

***Megetra punctata* (Selander, 1965)**

- **This species is found in southern Arizona and New Mexico, south to Durango.**
- **The photograph at the top left column on the following page is this species, taken on 22 August 2016 in Hillsboro by RABarnes.**

***Megetra vittata* (LeConte, 1853)**

- **The photograph at the center left on the following page was taken on 3 September 2015 in Chaco Culture National Historical Park, New Mexico by RABarnes.**
- **Selander (1965)[16] considers *M. vittata* and *M. punctata* to be allopatric and "similar ecologically". That is, they were one species at some time in the past but the geographically separate populations evolved into separate species.**

Before venturing into the *Epicauta* it is worth noting that many of the images shown in this article are quite striking. Beetles are not just little black bugs which crawl around on the ground. They can be intricate and nuanced as shown in the photograph of an *Epicauta lauta* ssp. *lauta* (Horn 1885) shown above, by Paul Langlois, Museum Collections: Coleoptera, USDA APHIS PPQ, bugwood.org. And, by the way, the link will take you to another resource which can be used to study these creatures.

Megetra cancellata

Megetra cancellata

Megetra cancellata

Megetra punctata

Megetra vittata

Tribe *Epicautini* (Parker & Boving, 1924)

- **~180 species in two genera in our area.**

Genus *Epicauta* (Dejean 1834)

- **See Werner[3] (1966), p. 3. "All of the members of the genus *Epicauta* and probably all of the *Epicautini* feed on the eggs of grasshoppers in the larval stage; all the other groups probably feed on the stored food and eggs of wild bees."**
- **A very large genus with ~173 species in the Americas and ~400 worldwide.**
- **Pinto[15] notes that "*Epicauta are simply difficult to identify from photographs*. At BugGuide he responded to the question: "What angles/details are necessary to get an Epicauta identified from photographs?" with "There is no general recipe. For species ID of some we need to see palpi; for others its tibial spurs; for others it may be hind coxae. For the Caviceps Group the head capsule may be important. These features are not easily documented in field photos. In general, for the subgenus *Macrobasis* which includes many southwestern species we should have males. Males for all groups are generally best unless the species has a unique color pattern or a unique shape. Fortunately genitalia are of little to no use in *Epicauta*. Many common *Epicauta* are simply difficult to identify from photographs - field photos are poor substitutes for having a specimen in hand. It seems that it would eventually be worthwhile to photograph authoritatively identified material in museums – virtually all the US species of *Epicauta* could be done rather easily. Field photos seem to be an inefficient way to get our fauna documented for the non-specialist."**
- **The genus is split into two subgenera, *Epicauta* and *Macrobasis,* and various groups. BECAUSE OF THE COMPLEXITY CREATED BY THIS TAXONOMY AND THE LARGE NUMBER OF SPECIES, WE LIST ALL SPECIES IN THIS GENUS IN ALPHABETICAL ORDER WITHOUT REGARD TO SUBGROUPS WITHIN THE GENUS.**

***Epicauta abadona* (Skinner 1904)**

- **See Werner[3] (1966), p. 37. See figure "74" in the graphic at the top left of page 52 in this article, from Noller in Werner[3] (1966), page 92.**
- **The closest iNaturalist observation appears to be that of Sequoia Janirella Wrens on 13 August 2023 from the west side of the Chiricahua Mountains, Arizona. It is shown at the top left of the following page under a Creative Commons license.**

***Epicauta alastor* (Skinner 1904)**

- **See figure "82" in the graphic at the top left of page 52 in this article, from Noller in Werner[3] (1966), page 92.**
- **iNaturalist observations mostly in Arizona.**
- **A specimen from El Paso, Texas (17 July 1927) by P. A. Readio is maintained by the University of Arizona Insect Collection.**

***Epicauta albolineata* (Dugès 1877)**

- **See Werner[3] (1966), p. 33, and figure 67 in the drawing by Martha L. Noller at the upper right (from p. 91 of Werner), page 49 of this article.**
- **Closest observation appears to be on the San Carlos Apache Reservation in Arizona.**

***Epicauta alpina* (Werner 1944)**

- **An iNaturalist observations by Andrew Meeds from a few miles northeast of Las Cruces on 2 August 2018 still requires verification (12/6/25). It is shown at the bottom left on the following page under a Creative Commons license.**

***Epicauta andersoni* (Werner 1944)**

- **See Werner[3] (1966), p. 40.**
- **iNaturalist observations include that by Raven Myers on 11 May 2022 at White Signal, shown at the upper right on the following page under a Creative Commons license.**

Epicauta andersoni **(Werner 1944) (con't.)**

- **An observation of a beetle in Hillsboro is generally thought to be of a individual in the Maculata species group. There are 9 species in this species group in the Western Hemisphere north of Mexico. It is most likely *Epicauta andersoni* (Werner) or *E. pardalis* (LeConte).**

Epicauta arizonica **(Werner 1944)**

- **iNaturalist observation on 5 August 2024, by Eric Hough, just over the border in the Apache-Sitgreaves National Forest, Arizona (requires verification). Shown immediately above under a Creative Commons license.**

Epicauta aspera **(Werner 1944)**

- **See Werner[3] (1966), p. 41.**
- **The photograph at the bottom right on the following page was taken near Hermosa on the east slope of the Black Range on 19 September 2019 by "Leach". It is shown under a Creative Commons license.**
- **The photograph at the top on the following page was taken by James Von Loh on 31 August 2021 in Fillmore Canyon in the Organ Mountains.**
- **The photograph at the bottom left on the following page was taken by "jahansen" on 29 October 2023 along the Bar Canyon Trail in the Organ Mountains. An iNaturalist observation shown here under a Creative Commons license.**

Epicauta aspera

Epicauta aspera

Epicauta aspera

Epicauta atrivittata (LeConte 1854)

- An iNaturalist observation by "phhbrown" from near Palomas Creek on the east slope of the Black Range, during May 2024, is shown immediately below under a Creative Commons license.

Epicauta bispinosa (Werner 1949)

- See Werner[3] (1966), p. 39.
- Observations from southeastern Arizona, southern Colorado, and northwest Texas - apparently none from New Mexico.

Epicauta brunnea (Werner 1944)

- See Werner[3] (1966), p. 33.
- An observation from the foothills of the Organ Mountains, Doña Ana County by Jim McClarin on August 6, 2006.
- An observation by Katja Schulz at Portal, Arizona, on 22 August 2022 is shown at the top right. Shown here under a Creative Commons license.

Epicauta callosa (LeConte 1866)

- The range of this species is generally considered to be east of us (as in Texas) but there are iNaturalist observations (both of which require verification) from El Paso and Albuquerque. The observation from Albuquerque, on 28 September 2024 by "jwanderer6", is shown at the right. The red circle on the smaller image appears to show "the two glabrous callosities on the pronotum". These swellings are apparently diagnostic. The El Paso observation by "sillyfella" on 28 September 2024 (yes the beetle is on a human finger) is shown at the lower left in this image group.

Epicauta cinctipennis (Chevrolat 1834)

- **Fall, H.C. and Cockerell, T.D.A.[1], page 155, report a specimen from Gallinas Canyon, collected by Snow. (See *Early Naturalists of the Black Range*, pp. 95-96.)**
- **Among observations on iNaturalist is one by CK Kelly on 5 August 2019 from the Sacramento Mountains, shown below under a Creative Commons license.**

Epicauta cinctipennis

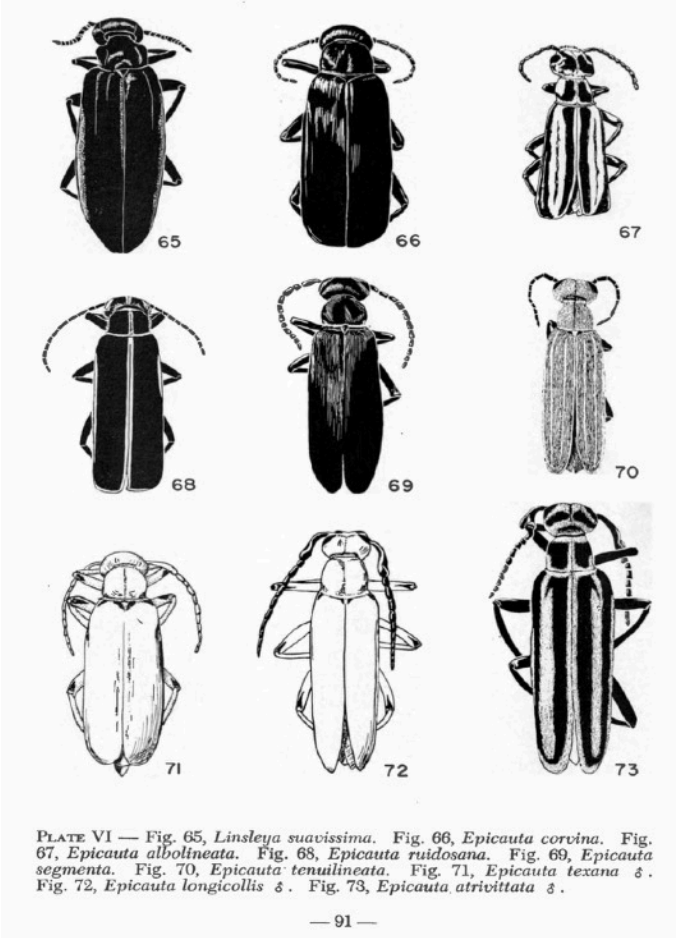


PLATE VI — Fig. 65, *Linsleya suavissima*. Fig. 66, *Epicauta corvina*. Fig. 67, *Epicauta albolineata*. Fig. 68, *Epicauta ruidosana*. Fig. 69, *Epicauta segmenta*. Fig. 70, *Epicauta tenuilineata*. Fig. 71, *Epicauta texana* ♂. Fig. 72, *Epicauta longicollis* ♂. Fig. 73, *Epicauta atrivittata* ♂.

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***Epicauta corvina* (LeConte 1858)**

- **See Werner[3] (1966), p. 32 and figure 66 in the drawing by Martha L. Noller at the upper right (from p. 91 of Werner).**
- **See Werner[3] (1966), p. 32, noting that "*Solanum elaeagnifolium* seems to be the preferred food plant . . . also recorded on *Kallstroemia* and *Tribulus* blossoms. . ."**
- **An iNaturalist observation from Hillsboro on 22 August 2022 requires verification (as of 12/25).**
- **An iNaturalist observation from Animas, New Mexico, on 28 August 2019 by Damon Tighe also needs verification. It is shown at middle right under a Creative Commons license.**

***Epicauta costata* (LeConte 1854)**

- **BugGuide observations include those by Salvador Vitanza on 9 September 2016 at Columbus, Luna County.**
- **iNaturalist observations include that of Ted C. MacRae on 22 July 2021 southwest of Nutt on NM-26. Shown bottom right, under a Creative Commons license.**
- **See Werner[3] (1966), pp. 53-54, where the species is listed in the genus *Pleuropompha*.**
- **See figure 87 in the drawing by Martha L. Noller, in Werner[3] (1966) (page 33 in this article).**

***Epicauta diversipubescens* (Maydell 1934)**

- **A BugGuide observation from Dog Canyon, Otero County, on 23 September 2014, by Bob Barber is shown under a Creative Commons license at the top left on the following page.**

Epicauta corvina

Epicauta costata

Epicauta fabricii **(LeConte 1853)**

- **Range extends through this area. There is an iNaturalist observation from Albuquerque.**
- **Common names include Ashgray Blister Beetle.**

Epicauta ferruginea **(Say 1824)**

- **We are apparently within the range of this species but iNaturalist and BugGuide do not have images of observations from this area. The specimen shown above is housed in the University of Arizona Insect Collection.**
- **See Werner[3] (1966), p. 43.**

Epicauta fortis **(Werner 1944)**

- **See Werner[3] (1966), p. 43.**
- **The population of this species found in southwest Texas is disjunct from the population in California and Arizona. The closest iNaturalist observation in Texas is from Ft. Davis. The closest iNaturalist observation in Arizona is from north of Tucson. The populations have different characteristics. There are no observations from New Mexico.**

Epicauta gissleri **(Horn 1878)**

- **An observation by Ken Schneider on 15 May 2011 in Bernalillo County, New Mexico, is shown at the top right under a Creative Commons license (via BugGuide).**

Epicauta hirsutipubescens **(Maydell 1934)**

- **An iNaturalist observation from west of Hatch by "jaymurter" on 6 August 2020 is shown under a Creative Commons license at the bottom right.**

Epicauta hirsutipubescens (Maydell 1934) (con't.)

- See figure 86 in the graphic on page 33 in this article, from Noller in Werner[3] (1966), page 93.

Epicauta immaculata (Say 1824)

- Common names include Immaculate Meloid and Brown Blister Beetle.
- Selander and Mathieu (1969)[17] report that "E. immaculata are known to form nonfeeding aggregations on plants, including species that are apparently never utilized as food sources. The functional significance of this behavior has not been determined, but it seems likely that temperature regulation is involved."
- An iNaturalist observation by C. K. Kelly is shown at the upper right, under a Creative Commons license.

Epicauta ingrata (Fall 1907)

- We are apparently within the range of this species but there are no iNaturalist or BugGuide images from this area.

Epicauta lauta (Horn 1885)

- See figure "83" in the graphic on page 52 in this article, from Noller in Werner[3] (1966), page 92.
- See Werner[3] (1966), pp. 47-48. This species was previously placed in *Gnathospasta*.
- Fall and Cockerell (1907)[1] report that W. Knaus collected a specimen from Alamogordo.
- An iNaturalist observation by Emily Hjalmarson from Deming, on 6 July 2018, is shown at the middle right under a Creative Commons license.

Epicauta longicollis (Horn 1885)

- An iNaturalist observation by C. K. Kelly, from Deming on 2 June 2018 is shown at the bottom right under a Creative Commons license (yes, the dead beetle lies in the palm of someone's hand).
- Fall and Cockerell (1907)[1] report that Cockerell collected a specimen from Mesilla Valley.

Epicauta maculata (Say 1824)

- See Werner[3] (1966), p. 38. See figure 75 in the graphic at the top left of the following page, from Noller in Werner[3] (1966), page 92.
- See J. D. Pinto (1980), *Behavior and Taxonomy of the Epicauta maculata Group,* for the natural history and identification of this species (as well as *E. andersoni, normalis, pardalis,* and *ventralis* [all included here] and others) University of California Press.
- Common names include Spotted Blister Beetle, a name applied to other species as well.

Epicauta mimetica (Horn 1875)

- Fall and Cockerell (1907)[1] do not report this species; there are no iNaturalist or BugGuide observations from New Mexico. So why is it here? There are observations from southern Arizona and southern Texas. The absence of observation does not mean the absence of presence.

Epicauta normalis (Werner 1944)

- See Werner[3] (1966), pp. 38-39.
- BugGuide gives the range as the West, east to western Texas. iNaturalist has one observation in Roswell and another in California.
- The specimen shown at the center left on the following page is part of the Northern Arizona University - Arthropod collection.


Epicauta immaculata


Epicauta lauta


Epicauta longicollis

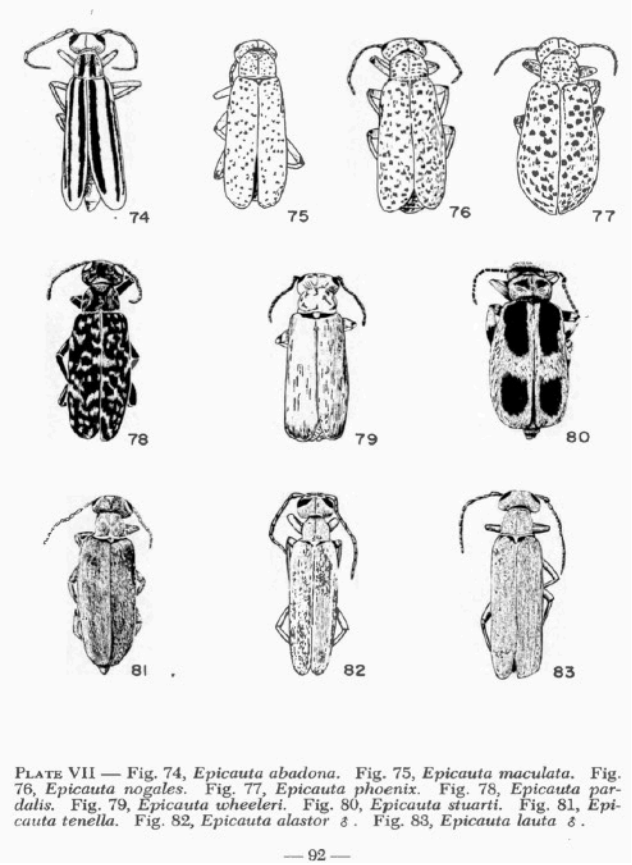

PLATE VII — Fig. 74, *Epicauta abadona*. Fig. 75, *Epicauta maculata*. Fig. 76, *Epicauta nogales*. Fig. 77, *Epicauta phoenix*. Fig. 78, *Epicauta pardalis*. Fig. 79, *Epicauta wheeleri*. Fig. 80, *Epicauta stuarti*. Fig. 81, *Epicauta tenella*. Fig. 82, *Epicauta alastor* ♂. Fig. 83, *Epicauta lauta* ♂.

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Epicauta ochrea **(LeConte 1853)**

- **See Werner[3] (1966), p. 52.**
- **Fall and Cockerell (1907)[1] report that Snow collected a specimen from Walnut Creek (Silver City).**
- **Common names include Ochre Beaded Blister Beetle.**
- **iNaturalist observations include that by Wendy McCrady from Catron County on 8 July 2022. It is shown at the bottom left under a Creative Commons license.**

Epicauta oregona **(Horn 1875)**

- **See Werner[3] (1966), p. 34.**
- **The closest iNaturalist report appears to be one from northeast of Grants in June 2021 by "firelilysackett", shown below under a Creative Commons license.**

Epicauta pardalis **(LeConte 1866)**

- **See Werner[3] (1966), p. 40. See figure 78 in the graphic at the top left, from Noller in Werner[3] (2016), page 92.**
- **Common names include Spotted Blister Beetle.**
- **BugGuide images include that by Jeff Gruber from Bosque del Apache National Wildlife Refuge on 9 June 2018.**

Epicauta parvula **(Haldeman 1852)**

- **New Mexico observations from Santa Fe and Union Counties (BugGuide)**
- **iNaturalist observations include one by Tom Kennedy on 1 May 2023 at McIntosh, south of Moriarty, and one by Roger Rittmaster at La Cienega, northeast of Albuquerque, on 9 May 2019. Shown below under a Creative Commons license.**
- **Note how it could be mistaken for a species in the genus *Meloe* (see page 36 earlier).**

Epicauta rehni **(Maydell 1934)**

- **See Werner[3] (1966), p. 41.**
- **Most observations are in Arizona but BugGuide indicates the range extends into New Mexico.**

Epicauta pennsylvanica (De Geer 1775)

- See Werner[3] (1966), p. 33.
- Common names include Black Blister Beetle and Black Aster Bug.
- BugGuide observations include those of Salvador Vitanza on 17 October 2016 from Columbus.
- iNaturalist observations include that by "erstadh", on 15 November 2021 at City of Rocks State Park and that by Joel DuBois on 24 October 2018 in Mesilla.

Epicauta polingi (Werner 1944)

- An iNaturalist observation at the north end of the Florida Mountains (Luna County) by Wendy McCrady on 13 June 2023 is shown to the right under a Creative Commons license.
- Common names include Poling's Two-toned Blister Beetle. Werner named the species in honor of Otho C. Poling, who collected extensively in the American Southwest during 1900-1906 and again during 1922-1929. Poling collected all sorts of fauna, and his efforts are recognized in the names of a number of species, but little is known about him.

Epicauta pruinosa (LeConte 1866)

- See Werner[3] (1966), pp. 44-45.
- There is an iNaturalist observation from Cloudcroft.
- There is an iNaturalist observation from Apache County, Arizona by "paulswitzer" on 18 June 2024, (needs verification) shown at the center right under a Creative Commons license.

Epicauta purpurea (Horn 1885)

- See figure 84 in the graphic on page 33 in this article, from Noller in Werner[3] (1966), page 93.
- See Werner[3] (2016), p. 50. This species was previously placed in *Gnathospasta*.
- B. J. Stacey's observation from the Chiricahua Mountains is the closest one posted on iNaturalist, from 13 August, 2016. It is shown at the bottom right under a Creative Commons license.

Epicauta rileyi (Horn 1874)

- See Werner[3] (1966), p. 42.
- The closest iNaturalist observation ("needs id status" as of December 6, 2025) appears to be that of "erstadh", on 16 October 2021, from near Portal, Arizona, shown at the top left on the following page under a Creative Commons license.

Epicauta segmenta (Say 1823)

- See figure 69 in the graphic on page 49 in this article, from Noller in Werner[3] (1966), page 91.
- See Werner[3] (1966), p. 35.
- Common names include White-necklace Blister Beetle.
- The photograph taken in Hillsboro by pwhyder (iNaturalist) on July 24, 2020, at bottom left on the following page, is shown here under a Creative Commons license. See also an observation by Jessica Griffin from Hillsboro in 2022.
- BugGuide notes that this species generally has "white on hind margin of the pronotum and often along the margins of the abdominal sterna."
- This species is apparently quite fond of Silverleaf Nightshade, *Solanum elaeagnifolium*. It is pictured on this species in the photo at the bottom left on the following page. This blister beetle will form "nonfeeding aggregations on plants, including species that are apparently never utilized as food".
- Look for it during the summer months, June to October.


Epicauta polingi


Epicauta pruinosa


Epicauta purpurea

Epicauta rileyi

Epicauta segmenta

Epicauta stuarti

Epicauta sericans **(LeConte 1866)**

- **See Werner[3] (1966), p. 44.**
- **Range appears to be to the east and north of us.**

Epicauta stuarti **(LeConte 1868)**

- **See Werner[3] (1966), pp. 42-43.**
- **See figure 80 in the drawing by Martha L. Noller, in Werner[3] (1966) on page 52 of this article.**
- **The iNaturalist observation by "dbugs", shown above, was made west of Socorro on 1 September 2022. Shown here under a Creative Commons license.**

Epicauta subglabra **(Fall 1922)**

- **See Werner[3] (1966), p. 47.**
- **There are iNaturalist observations of this species just across the Arizona border (Apache-Sitgreaves National Forest) and in the Sacramento Mountains, reason enough to look for something in between. The observation in the Sacramento Mountains, by Dawn Carrie, on 20 July 2019, is shown at the top left on the following page under a Creative Commons license.**
- **Common names include Caragana Beetle.**
- **BugGuide notes that "This species appears to have a preference for *Fabaceae*. Many observations on iNaturalist and on BugGuide show the beetles on *Vicia cracca*, *V. americana*, *Medicago sativa*, *Melilotus arvensis*, *Astragalus agrestis*, *Lathyrus* spp. and *Caragana arborescens*. However, the species also occasionally feeds on plants in other families."**

Epicauta tenella **(LeConte,1858)**

- **Fall and Cockerell (1907)[1] report that Cockerell collected a specimen from Mesilla Park in Doña Ana County.**
- **BugGuide notes that this is "one of the few species in which the elytra are darker than the head and pronotum." (From Dillon 1952 - see link.)**
- **An iNaturalist observation by Shaun M. McCoshum, from northeast of Deming, in August 2023, is shown at the bottom left on the following page under a Creative Commons license.**

Epicauta subglabra

Epicauta tenella

Epicauta tenuilineata (Horn 1894)

- An iNaturalist observation by Steven Mlodinow is shown at the top right under a Creative Commons license. It is a 20 August 2023 observation from Lordsburg.
- Common names include Thin-lined Blister Beetle.

Epicauta texana (Werner 1944)

- See Werner[3] (1966), p. 36.

Epicauta tenuilineata

- See figure 71 in the graphic on page 49 in this article, from Noller in Werner[3] (1966), page 91. Werner notes (p.36) that this species feeds on *Solanum elaeagnifolium*.
- The iNaturalist observation by James Bailey south of Animas (Hidalgo County, New Mexico) was made on 28 August 2019 and is shown under a Creative Commons license at the bottom right.

Epicauta tricostata (Werner 1943)

- See Werner[3] (1966), p. 54, where this species is listed as *Pleuropompha tricostata*.
- See figure 88 in the drawing by Martha L. Noller, in Werner[3] (1966), at page 33 in this article.
- No iNaturalist observations in New Mexico. BugGuide indicates a range from Arizona to west Texas, south to northern Mexico. One of the closest observations with an available image is one from Wilcox, Arizona, from 22 August 1954, collected by D. K. Duncan. This pinned specimen is part of the University of Arizona Insect Collection and shown at the top left on the following page under a Creative Commons license.

Epicauta ventralis (Werner 1945)

- Range apparently extends through our area, but there are no local iNaturalist observations. One of the closest is that by "Tegan" near Bitter Lake National Wildlife Refuge (near Roswell) on 6 June 2024 (needs identification). Shown at center left on the following page under a Creative Commons license.

Epicauta texana

Epicauta tricostata


Epicauta ventralis


Linsleya suavissima

Genus *Linsleya*[18] (MacSwain 1951)

Linsleya convexa (LeConte 1853)

- See Werner[3] (1966), p. 31. Werner gives the range of this species as Central Chihuahua, West Texas, and New Mexico. BugGuide lists range as Texas. There are no iNaturalist observations in New Mexico (closest appears to be in Big Bend).

Linsleya sphaericollis (Say 1824)

- See Werner[3] (1966), p. 31.

Linsleya suavissima (Wellman 1910)

- See Werner[3] (1966), p. 31.
- See figure 65 in the graphic on page 49 in this article, from Noller in Werner[3] (1966), page 91.
- An observation by Nate Marchessault from the Florida Mountains (observed 26 October 2021), listed as *Linsleya suavissima*, is shown at the bottom left under a Creative Commons license.

Summary

Reporting observations of this beetle group can significantly add to our knowledge of the natural history of the Black Range, because when it comes to blister beetles there are a lot of gaps.

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A portion of Charles Darwin's library, etched by Axel H. Haig in 1882. A digital copy of his library is located at Darwin Online. A copy of Riley's article[5] was part of Darwin's library.

Broad-billed Hummingbirds

Although we would see Broad-billed Hummingbirds on occasion in the past, there has been a notable increase in frequency of the species in our area over the last three years. It is not possible (birds are unbanded, etc.) to determine the number of individuals involved. We may be talking one or two birds which stay for long periods, for instance. The video at this link was recorded in early July 2025, but the bird in question had been seen for several weeks prior.

The image below is a framegrab from the video linked to above.

Explosive Seed Dispersal

Thermogenesis in plants and explosive seed dispersal are two very different concepts. Sometimes the former is the mechanism used to accomplish the latter. Sometimes thermogenesis is associated with other processes.

Thermogenesis is the term used to describe how living creatures create heat. In organisms heat is created in two ways: by some type of physical activity (whether vigorous like exercise or shivering or simply by routine living processes [eating, sleeping, thinking, etc.]) or chemically. Plants use only chemical processes to create heat.

When we think about life forms which create heat we usually think "fauna". But "flora" can do it as well. This capability was not reported until J. B. Lamarck described it in 1778 (*Flore française* Vol. 3, Paris, France, L' Imprimerie Royale) when he reported on the Arum Lily. The vast majority of plant species are (apparently) not capable of thermogenesis. And not all plants create heat in the same way, or for the same purpose[1].

The Corpse Flower, *Amorphophallus titanum*, is a plant of legend. The flower is huge (see the next page), it emits the odor of dead animals, and it blooms rarely. The plant was not recorded by Europeans until 1878, on Sumatra.

Do we write about it because the source of the odor has now been identified (putrescine)? Or because the combination of putrescine and two sulfur compounds (dimethyl disulfide and dimethyl trisulfide) is apparently why the horrid smell permeates everything around us so easily? Humans, and possibly many other animals, smell sulfides at very low concentrations; is that the root of our interest? Or is it that a few have been blooming recently?

No, it is none of those reasons. Although all are interesting. No, it is because of some other findings in a study by Zulfiqar[2] and colleagues. Findings about how thermogenesis works in the Corpse Flower.

Recent close encounters with the Corpse Flower, by people of the Black Range, led to interest in the article and the concept of thermogenesis. That article also led to an

inquiry about explosive seed dispersal and that leapfrogged to the question of "what other plants?" and "are there any around here?". The answer is yes.

I don't always think about mistletoe as a wonder of nature. Surely, there is a love-hate relationship to be had, and that always makes life interesting. It serves as the food source for various bird species and other creatures and it kills trees. It is part of an integrated system - and humans always think they can tinker with integrated systems, and they do, unsuccessfully. Yes, mistletoe is like most things - but a wonder of nature? I am not willing to give them that status, nor anything that status, as a matter of fact. I know of no species which is more outstanding than all the others.

But interesting? Yes, very interesting.

Mistletoe species use structures called haustoria to extract water and nutrients from plants. They, however, are not complete parasites; all mistletoe species perform some photosynthesis (sometimes nil) at some point during their lives.

There are many species of mistletoe. Here we focus on those in the genus *Arceuthobium*, the dwarf mistletoes. There are 21 species of dwarf mistletoe which are endemic to the United States.

Hydrostatic pressure builds up in the fruit (drupes) of dwarf mistletoes, and when the seed pod erupts the seeds shoot out at significant speeds (50-60 mph has been reported). In the species *A. americanum*, Lodgepole Pine Dwarf Mistletoe, the hydrostatic pressure is created by thermogenesis.[3] We do not have Lodgepole Pine in the Black Range, but the study is full of interesting facts which may apply to our dwarf mistletoe species as well. For instance, prior to discharge the surface temperature of the dwarf mistletoe fruit increases by ~2.1° C over a period of only ~103 seconds, causing the fruit to split open. DeBruyn et al.[3] report that this was "thermogenesis-triggered seed discharge, never before observed in a plant". (Some assessments of this study have generalized the study findings to all dwarf mistletoes, which may be accurate, but which is not demonstrated by the study).

All dwarf mistletoe species disperse seed by forcefully ejecting them from the fruit. In all species, the seeds shoot outward, sometimes for significant distances, and because of the sticky goo (term of art, here) attach to whatever they land on; if it is their host species the cycle of life continues. Generally, dwarf mistletoe tend to spread from the top of a tree downward in that tree or nearby trees, because of gravity (note, however, I am not aware of any study which explores the magnitude of the gravitational effect). Although other dwarf mistletoe species may use thermogenesis to disperse seeds via hydrostatic pressure that (apparently) has not been proven, but is quite possible.

There are a number of dwarf mistletoe (*Arceuthobium)* species found in our area including:

- *A. camplypodium* (Engelmann) subsp. *apachecum* (Hawksworth & Wiens) - Apache Dwarf Mistletoe. The common name for the species-level plants is Western Dwarf Mistletoe. The species uses Ponderosa Pine (and a few other species) as host plants;
- *A. campylopodium* (Engelmann) subsp. *microcarpum* (Engelmann) Nickrent - Spruce Dwarf Mistletoe;
- *A. divaricatum* (Engelmann) - Piñon Pine Dwarf Mistletoe;
- *A. douglasii* (Engelmann) - Douglas Fir Dwarf Mistletoe; and
- *A. vaginatum* (Willdenow) Presl subsp. *cryptopodum* (Engelmann) Hawksworth & Wiens - Southwestern Dwarf Mistletoe or the Pineland Dwarf Mistletoe.

A Corpse Flower and a ten-year old human, for scale. The corm (underground stem) of this species weighs much more than the human who is pictured beside the flower.

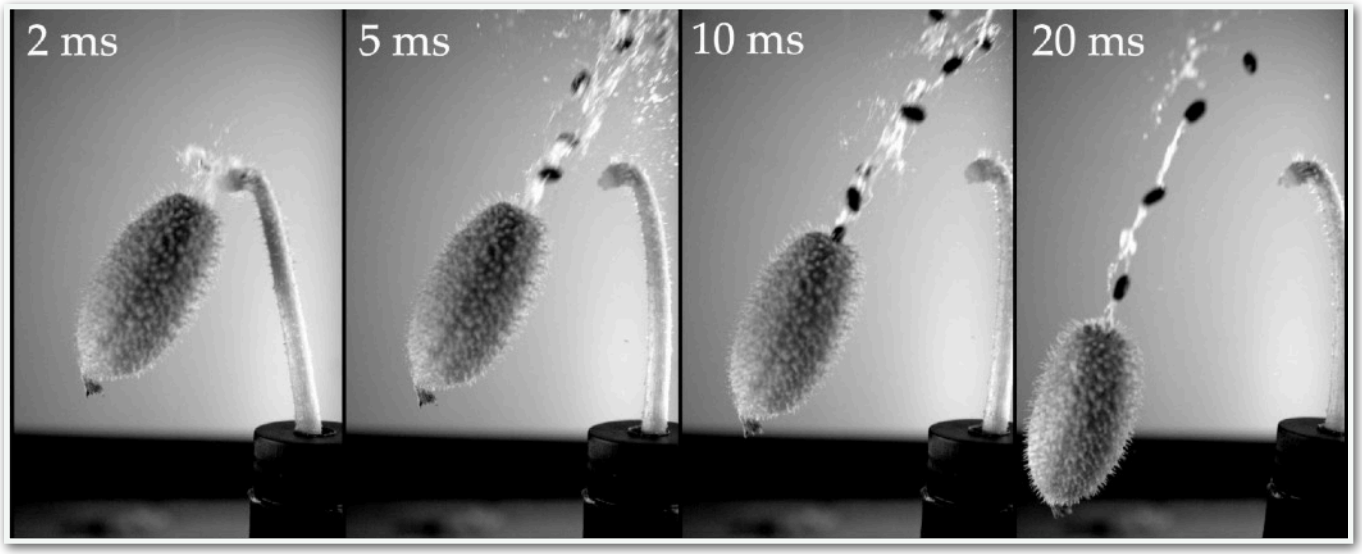
These sometimes-associated concepts - thermogenesis and explosive seed discharge - have been the source of interest for several decades. For instance, T. E. Hinds et al.[4] studied the dynamics of seed dispersal in the dwarf mistletoes in the early 1960s. But the active processes which enable such seed dispersal systems are only now becoming known.

Note, however, that thermogenesis need not be utilized in explosive seed dispersal.

Another Example of Explosive Seed Dispersal

The seed dispersal system of *Echinopepon coulteri* (A.Gray), Coulter's Wild Balsam Apple, is similar (but not really very similar); well, it looks like it could be related, but apparently it is not. Bear with me here. *E. coulteri* is in the family *Cucurbitaceae* ("the gourds"), and so is *Ecballium elaterium* (A. Rich), the Squirting-Cucumber.

The Squirting-Cucumber is not native to our area. Seed dispersal from the fruit of this species is shown in a series of photographs at the top of the next page. Seed dispersal is measured in milliseconds. These images are from a study by Box et al.[5]



If we were discussing the use of imagery in scientific study, which we are not, we would probably be citing the Box study as a fine example of the use of still imagery, scans, and videography.

Box et al. note, "Despite its apparent simplicity, the specifics of the seed ejection process – combining mechanical, hydraulic, and ballistic phenomena – remain largely unexplored. By integrating experiments, high-speed videography, and advanced mathematical modeling, we uncover unique facets of this strategy, including an unusual decrease in fruit volume prior to ejection which stiffens the stem and orients the fruit to an improved angle for dispersal. Our study reveals how the delicate interaction of mechanical components contributes to dispersal efficiency, thereby influencing plant distribution and population dynamics, and offering insights into evolutionary adaptations related to explosive fruit mechanisms. . . *Arceuthobium* (Loranthaceae) disperse seeds in a stream of mucilage following the build-up of osmotic pressure and thermogenesis-induced dehiscence. This shows striking parallels with the squirting cucumber, and an apparent example of convergent evolution."

But back to our wonderment. Does *Echinopepon coulteri* perform the same seed dispersal process? Apparently not. Box et al. state that "*Ecballium* is unique in the family because of its remarkable mechanism of seed dispersal. When the fruits are ripe, detachment of the stem from the cucumber body (abscission) occurs via a fracture, regulated by ethylene, that has been reported as one of the most rapid motions in the plant kingdom, close to the physical limit of plant movement. Following abscission, the ripe fruit rapidly ejects both the fluid and seeds contained within its shell in a unidirectional stream. . . .within a time period of approx-.imately 30 ms. Remarkably, the ballistic seeds attain speeds around 20 m/s and reach distances of 10 m from the plant."

And More

Several plant species use explosive dehiscence (dehiscence is the term used to describe the splitting of a plant part, along a line of weakness, when it is mature) to disperse their seeds. When the seed pods of these species dry out, the energy which has been stored in the structure of the pods is released and the seeds are flung outward, sometimes widely. Plants in the genus *Impatiens* are well known for this process of seed dissemination, and *Sphagnum* (peat moss) uses the process to spread its spores[6]. Although *Sphagnum* sp. are not found in the Black Range, some have been found in the northern part of the state.

Within the United States, *Echinopepon coulteri* is known only from Doña Ana, Grant, Hidalgo, Sierra, and Socorro counties. In Mexico, its range extends south to Oaxaca. The fruit shown here was photographed in Railroad Canyon, Black Range on 16 September 2020 by RABarnes.

Cardamine hirsuta, Hairy Bittercress, is an introduced species in the United States and has established populations as close

to the Black Range as Doña Ana County. *Cardamine cordifolia* (A. Gray 1849), Heartleaf Bittercress, is found natively in the western United States and has established populations in Catron, Otero, and Lincoln counties. In the United States, other members of the species are found in the wetter areas. These two species are mentioned here because 1) a recent study has explored seed distribution in *C. hirsuta* and 2) there is a general question about the attributes that the various species of a genus share or don't.

Gabriella Mosca[7] and others sought to understand the mechanism through which *C. hirsuta* distributed its seeds so widely. In the summary of their *Current Biology* (part of the *Cell* network of publications) article they note: "Exploding seed pods of the common weed *Cardamine hirsuta* have the remarkable ability to launch seeds far from the plant. The energy for this explosion comes from tension that builds up in the fruit valves. Above a critical threshold, the fruit fractures along its dehiscence zone and the two valves coil explosively, ejecting the seeds. A common mechanism to generate tension is drying, causing tissues to shrink. However, this does not happen in *C. hirsuta* fruit. Instead, tension is produced by active contraction of growing exocarp cells in the outer layer of the fruit valves. Exactly how growth causes the exocarp tissue to contract and generate pulling force is unknown." In the course of their study the researchers found an intriguing and complex system of creating energy which ultimately led to the explosive discharge of seeds: differential growth rates, the realignment of biological structures (microtubule orientation), and more. The variety of techniques and equipment used in this study highlights how limiting our inherent abilities are when it comes to understanding the world. If you wish to be humbled by a weed, this study is a must read.

In writing this article I continually came across the question of whether or not explosive seed distribution was shared widely in a genus. This attribute is not something which is routinely referenced in botanical literature, either because it is not the area of focus or because it is not known. All I can say, at this juncture, is that it is not safe to assume that if explosive seed distribution exists within one species in a genus, it will exist in any other species in the genus - much less be a commonly shared trait. The evidence simply seems incomplete.

As frustration mounted I discovered that in *C. cordifolia*, "Seed pods grow to over two inches long and then explode, flinging seeds in all directions. . . The plant flowers all summer, and its seed pods provide fun along the trail, for they burst open with a squeeze of the fingers." (As an aside, the type for this species was collected by Augustus Fendler near Santa Fe in 1847.) The reference for these statements is Intermountain Flora, the monumental series by Cronquist and others.

The Vascular Plants of the Gila Wilderness website notes that *Viola canadensis*, Canadian Violet, is the "most common white violet in the Gila National Forest". *Viola nephrophylla*, Streambank Violet, is also found in the Gila. Other species of *Viola* are found in or near our area, including *V. adunca* (Hookedspur Violet or Western Dog Violet) and *V. missouriensis* (Missouri Violet).

The Native Plant Network - Propogation Protocol Database page for *V. canadensis* notes that "seed capsules are explosive and seed is difficult to collect." The entry for *V. nephrophylla* says only that "capsules dehisced and spread seed on the soil surface". No seed dispersal information is available for *V. adunca* or *V. missouriensis* at this site.

The Jepson Manual (1993) notes that plants in the Violet family are "generally explosively dehiscent".

It is not safe to assume that the mechanical/biological mechanisms which create the explosive discharge of seeds is the same in all plants that use such a mechanism. For instance, *Oxalis*[8] species have developed a mechanism which allows the explosive ejection of one seed at a time.

Seed dispersal is a critical activity for plants, and the manner in which that is accomplished varies markedly. Small areas, like the Black Range, contain plant species with a variety of dispersal profiles. Here we have dealt only with explosive seed dispersal, and as a subset, the role which thermogenesis is now known to play in some species. There are, of course, many other mechanisms for seed dispersal, and once seeds are dispersed there are numerous and varied processes which must occur before they can germinate. All of this simply means that the growth of a plant from seed is much more complex than many imagine.

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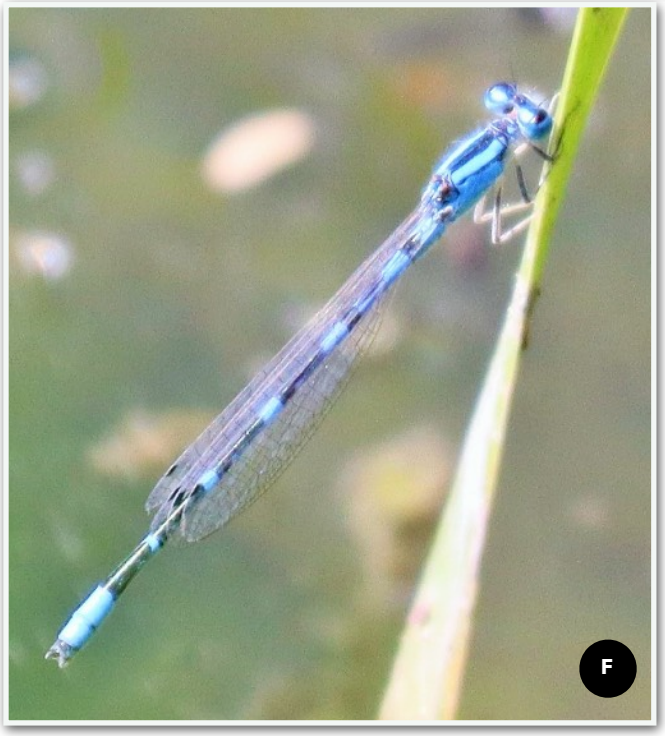
A Few More Odonata and Notes from the 2024 Field Season

The second edition of *The Odonata of Doña Ana County and the Black Range* was issued in 2025 (Volume 1 in June and Volume 2 in September). We had to leave out many images to keep the volumes at a manageable size. Many of the images were informative and of excellent quality; some are shown here.

A. *Argia apicalis (Say, 1840)* Blue-fronted Dancer, Female - photograph by James Von Loh. 2024 Field Season.
B. *Erythrodiplax basifusca* (Calvert, 1895) Plateau Dragonlet, Male - Photograph by James Von Loh. 2024 Field Season.
C. *Argia apicalis (Say, 1840)* Blue-fronted Dancer, Male - Photograph by James Von Loh. 2024 Field Season.
D. *Argia moesta* (Hagen, 1861) Powdered Dancer, Male - Photograph by James Von Loh. 2024 Field Season.
E. *Argia moesta* (Hagen, 1861) Powdered Dancer, Female - Photograph by James Von Loh. 2024 Field Season.
F. *Enallagma praevarum* (Hagen, 1861) Arroyo Bluet Male - Photograph by James Von Loh. 2024 Field Season.
G. *Enallagma civile* (Hagen, 1861) Familiar Bluet, Male and Female in tandem, Female depositing eggs. Photograph by James Von Loh. 2024 Field Season.


D


E


F


G

H. ***Enallagma civile*** **(Hagen, 1861) Familiar Bluet, Female - Photograph by James Von Loh. 2024 Field Season.**

I. Next Page. ***Pachydiplax longipennis*** **(Burmeister, 1839) Blue Dasher. Female. Photograph by James Von Loh at the La Mancha Wetland Restoration Project Site. May 2024.**

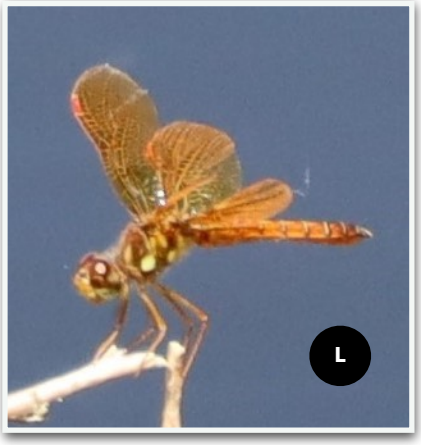
J. Next page. ***Perithemis intensa*** **(W. F. Kirby, 1889) Mexican Amberwing. May 31, 2024. Rio Grande at Las Cruces. Photograph by James Von Loh who noted: "thorax muted yellowish areas between darker orangish-brown 'stripes'; stigma orange...Wings have prominent yellowish-white veins". Apparently remained through at least June 2.**

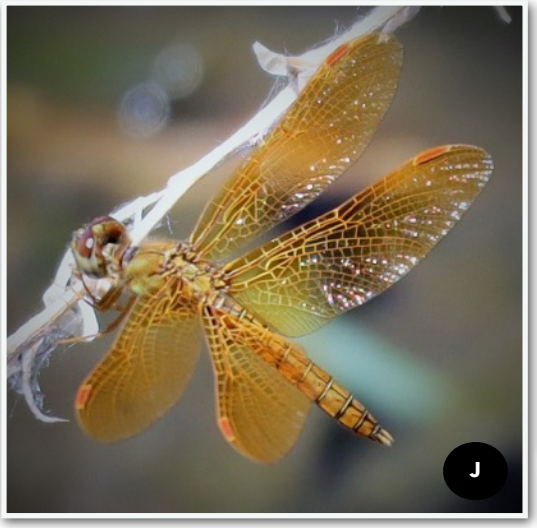
K. Next page. Same as "J". Von Loh notes: "abdomen with dark narrow midline mark between prominent rings, minor diagonal stripes (but no prominent whitish triangles), cerci yellow."

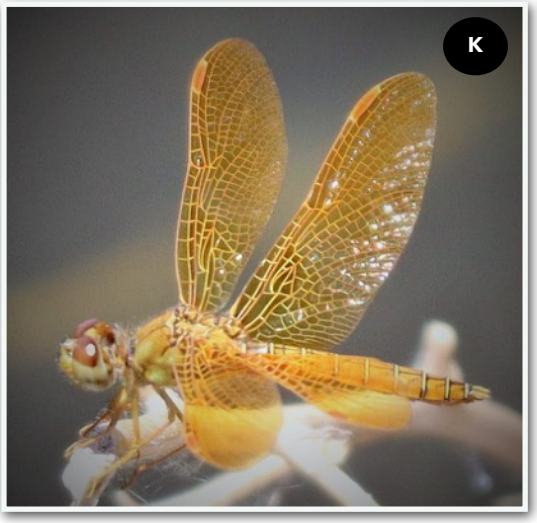
L. Next page. ***Perithemis tenera*** **(Say, 1840) Eastern Amberwing. June 7, 2024. Rio Grande (Las Cruces wastewater outlet). Photograph by James Von Loh, who noted: "Typically, spring/summer amberwings perch a few inches to a foot above the waterline on emergent twigs and stems surrounded by water; many such perches were available in the outfall channel prior to June1st. This is the last floating tumbleweed mat perch remaining in the outfall channel, as all others were floated and carried/blown to the Rio main channel/ downriver, beginning 06/02/24. Note the distinct, bright yellow spot and line pattern amid dark brownish-orange 'stripes' on the lower, lateral thorax."**

M. Next page. Same as "L". Von Loh writes: "Note the sly smile, the bright yellow thorax antehumeral 'stripes', the rows of whitish triangles along the dorsal abdomen midline, and the less pronounced wing veins."

N. Next page. Same as "L". Von Loh notes: "Compare the size of the Amberwing with a Familiar Bluet Damselfly." And further: "What changed from late May to early June: 1) on 06/01 the Rio Grande flow elevated to bankfull to deliver irrigation water to fulfill contracts with local farmers; 2) a bankfull Rio Grande forced the outfall flow to also elevate, which floated tumbleweed mats used by amberwings and other species (and aided by wind gusts common at this time of year) to the Rio Grande main channel and downriver; 3) a single tumbleweed still provided a perch; and 4) arriving amberwings likely began to use smaller irrigation canals/ ditches which (were carrying) water and have had ample emergent perches (as in past years)."







In the October 2024 issue of this journal we discussed differences in coloration, within a species. Observations of a Red-rock Skimmer in Hillsboro generated the discussion which focused on structured research and field observations by several experienced field practitioners.

On June 20, 2024, James Von Loh provided the following insight on this topic:

> **"In the summer of 2023, I began seeing male Blue Dashers that reflected black color in-flight (backlit abdomen and thorax); and when processing a few images of individuals perched in the shade, the color presented as a shiny, dark-to-medium blue (versus the whitish-blue, somewhat powdery reflection of typical males with pruinose/waxy coating, when photographed under direct sunlight). I posted an image to iNaturalist describing this color as unusual to me, where the image was identified to Blue Dasher.**
>
> **"Similarly, my first images of Plateau Dragonlets were of perched males, obelisking and backlit with their head and thorax pointed downward and shaded from the sun; their face was metallic blue, but their eyes and**

thorax presented as shiny, jet-black in color (Paulson describes the male eye color as dark brown and thorax as very dark brown). It wasn't until 2022 when I collected images of males perched in full afternoon sun that I could see their dark reddish-brown eyes and bright brownish-red thorax (but the face was metallic blue); at the time, I thought this observation resembled the Red-faced Dragonlet (until I posted an image to iNaturalist where it was confirmed as the Plateau Dragonlet).

"I have other examples of Odonate color muting (darner species eyes, etc.) and my confusion due to when photographs collected in the shade, under cloud cover, or backlit. With Jonathan's (ed.: Jonathan Batkin) concise/informative summary, I now have a better understanding of the likely cause/effect."

Responding to Von Loh's email on June 21 Batkin noted:

"I have had several experiences with color along the lines of what you describe, Jim. I think some of those perceived colors that are not what we expect or not what is published are in fact correct under the circumstances. I've tried to capture some in photos but not very successfully.

"One variable which strongly influences the photographic record is the cameras we use. The color rendition of one company's cameras may vary across their models, and may vary even more from other companies' cameras; the software we use may magnify the differences.

"While photographing insects here in AZ over the past three years, I have often been with other enthusiasts who are photographing. Our photos of the same specimen are often different. I see a difference between my photos taken with a Canon and Pierre Deviche's photos taken with an Olympus. And I see differences between my photos and those taken with a Sony, Nikon, Fujifilm, or other brand. Many people who review cameras on the Internet talk quite plainly about the differences in color rendition between brands.

"Here is a good example. Photographs "O" and "P" are cropped photos of the abdomen of the exact same specimen of Sabino Dancer, shot in September 2022 in Sycamore Canyon, Santa Cruz County, AZ.

O. The upper photo is mine, shot with a Canon DSLR and processed using Canon software.
P. The lower photo was shot with a Canon SX70; I don't know what software was used. They were shot from different angles but were both sunilt. (Descriptors of where the photographs are located on the page have been modified by the editor.)

"Both cameras rendered the thorax as blue, though the blue from my camera was deeper. These details of the abdomen are quite different. Dennis Paulson describes the species as a 'Blue-violet species of southwestern rock pools' and describes the male body as 'somewhat purplish blue.' In my photo, the abdomen is clearly purplish, and that is obvious in the RAW file. The other camera rendered the abdomen blue, not purplish. The difference is not subtle".

The physiological changes which can cause color change, referenced in the October 2024 issue, are only one of many possible explanations for the differences we see when observing in the wild and when observing our photographs. Clinal variation in genetics is also a contributing factor. With field experience we can all attain a degree of competence with which we can reliably put an observed species into a "species box". Exploring and understanding the causal factors of perceived differences is a step beyond and adds both pleasure and excitement to field observation.

The 2nd edition of "*Odonata*" has an extensive study of the Band-winged Meadowhawk. James Von Loh was able to add to this study during the 2024 season. His photographs and notes follow. He wrote that the "Mesilla Valley Bosque State Park is a haven/preferred habitat for this small dragonfly species, which is commonly observed in the riparian habitats supported by the Rio Grande. Only the Variegated Meadowhawk, *Sympetrum corruptum* (Hagen, 1861) is present in greater numbers along this river reach and generally throughout Dona Ana County."

Q. Next Page: Male typically perches in open sites on lower branches to hunt for small flying insects and to defend an area of territory; he is immediately recognizable due to his bright red abdomen and orange wing bands which strongly reflect in the sun's rays; note also his reddish-brown over greenish eye color and the reddish-brown thorax with a bright yellow spot. 07/01/24
R. Next Page: Females tend to perch much higher on tall shrubs and small trees to hunt for small flying insects; their brown wing patches are smaller and fainter but still quite recognizable in the field. 07/01/24
S. Next Page: The female's overall color is yellow with narrow brown stripes on the thorax and abdomen. This pattern and the high perch selection often results in images with a ventral view and bright sun reflections. 07/01/2024

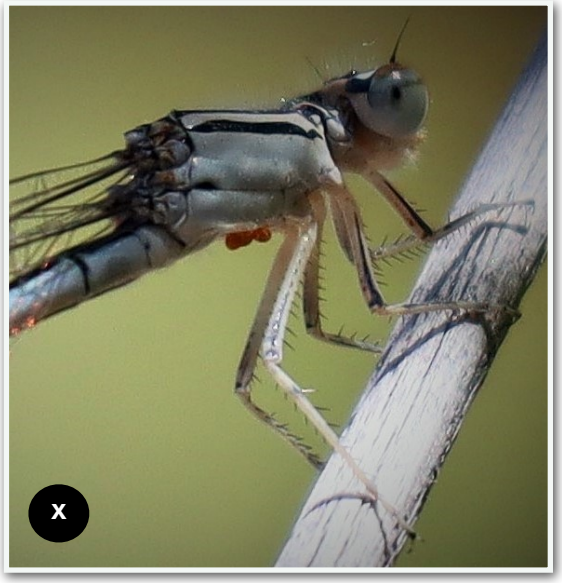
T. Female has brown over yellow eyes, the thorax front is brown with black lines on the sides, and the abdomen is yellow with black markings along the lower side; this individual has larger and darker wing patches than most. 07/19/24

U. With wings 'drooped' low, possibly to deflect sun's rays, the female's yellowish-white face and brown over yellowish-green eyes are prominently displayed. 07/19/24

V. With wings 'drooped' low, possibly to deflect sun's rays, the male's reddish-yellow face and brown over greenish eyes are prominently displayed; note also his brown thorax front and the greater size and color saturation of his wing patches. 07/19/24

W. Next Page: Male (U) and female (L) linked in a mating wheel to transfer the male's sperm to fertilize the female's eggs; the male selected a perch high upon the leaves of a Coyote Willow tall shrub to perform this important behavior in relative safety along the Rio Grande. 07/08/24

X. **An immature female Familiar Bluet, *Enallagma civile* (Hagen, 1861), may have collected three sticky fruits on its ventral thorax, may be a host for round, red parasites, a harvester ant? James Von Loh took this photograph on 15 June 2024 and is open to suggestions about the features.**



Follow-ups and Tidbits

Decentralized Thought

It is difficult for us to imagine what it is like to perceive the world as other creatures do. Sometimes it seems impossible to visualize the mechanics of how their systems of perception work.

In "Neuronal segmentation in cephalopod arms" C. S. Olson, N. G. Schulz, and C. W. Ragsdale describe how the octopus controls the actions of its arms - how it is that a creature is able to exercise such finesse without a centralized nervous system. They note, "The octopus has a motor control challenge of enormous complexity. Each of its eight arms is a muscular hydrostat, a soft-bodied structure that lacks a rigid skeleton and moves with near infinite degrees of freedom. Moreover, the arms are packed with hundreds of chemo-tactile suckers which can change shape independently. Even with this complexity, octopuses control behaviors effectively along the length of a single arm, across all eight arms and between suckers." (*Nat Commun* 16, 443, 15 January 2025 https://doi.org/10.1038/s41467-024-55475-5)

If we take a step beyond the mechanics, as amazing as they are, and try to understand how such a creature perceives the world, well . . .

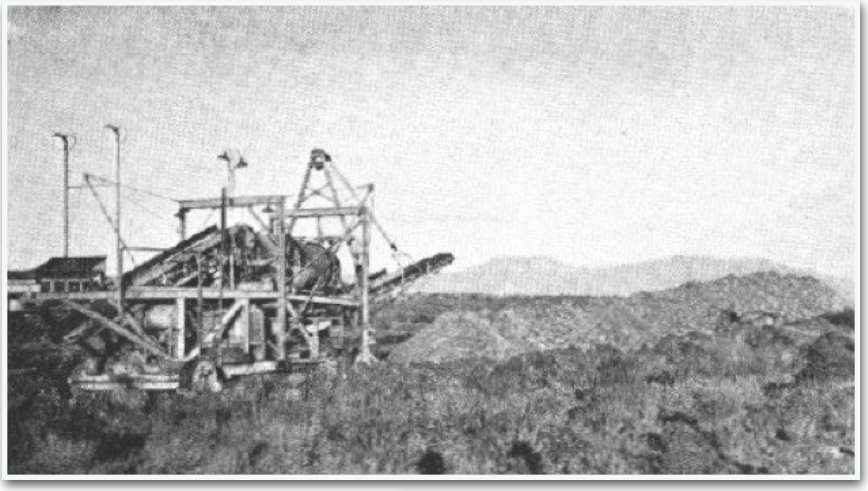
Gold

Many people who live in and visit the Black Range seem to have an interest in gold. Gold is a noble element, meaning that it rarely is found in compound with another element. It is resistant to most acids, for instance. Note, however, that it is sometimes found in a compound, usually halides and chlorides. So when you find gold it is almost always pure, generally an extremely small flake, but pure.

As a heavy metal (atomic number 79) and a density of 19.3 grams per cm^3, gold is a product of late stage star formation.

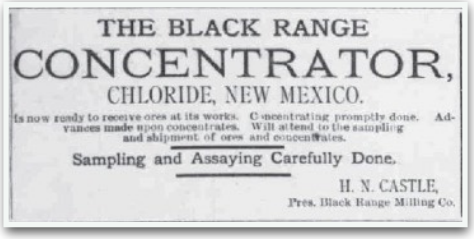
The market value of gold is human derived. The element is soft and malleable, making it fairly easy to work with, and it is frequently used in works of art because of that. But its market value? It is valuable because people say it is. If people stop saying it is valuable, it stops being valuable (other than its inherent value derived from utilitarian uses). Something like bitcoin.

But market value it has and, therefore, there are many people who look for it in the ground. Given that it is often found in very small flakes, that can be problematic. Chemicals are often used to separate gold from the rock within which it is found. Mechanical systems, to include those which use water



in some form, were used widely in the Black Range. In the plains east of Hillsboro, the Hillsboro Placer Mining District, dry land dredges, like that shown above, were used to physically separate gold from its "matrix". Even in the east plains, water was used extensively to separate gold from rock - because of one of its atomic/physical properties: it simply weighed more than just about everything else.

Usually the matrix, like the sample of gold from the Bigelow Mine, Hillsboro Mining District, Sierra County shown above (specimen at the Mineral Museum, New Mexico Institute of Mining and Technology, Socorro, New Mexico) had to be crushed first so that other processes could be used to separate the gold. The Black Range newspaper was full of news about the new concentrator in Chloride during late 1883 and early 1884. When the concentrator was up and running, (see ad above from the March 21 issue), Chloride was coming into its own. Concentrators grind up the rock matrix and make sought-after minerals, like gold, accessible.


THE BLACK RANGE
CONCENTRATOR,
CHLORIDE, NEW MEXICO.
Is now ready to receive ores at its works. Concentrating promptly done. Advances made upon concentrates. Will attend to the sampling and shipment of ores and concentrates.
Sampling and Assaying Carefully Done.
H. N. CASTLE,
Pres. Black Range Milling Co.

Getting the gold out of the ground and getting it ready for shipment was a big effort, but how did miners find the gold in the first place? First, they looked for quartz. Most gold nuggets are found in association with quartz. There is a lot of quartz in the Black Range. It is lying all over the ground, having been dug up by miners.

But why hard rock miners find gold in quartz veins has been a mystery and a bit of a controversy (controversies often arise when money is to be had).

The most plausible, and in this case, probable, reason gold is found in association with quartz has been advanced by C. R. Voisey, N. J. R. Hunter, A. G. Tomkins, et al. in "Gold nugget formation from earthquake-induced piezoelectricity in quartz", *Nature Geoscience*, 2 September 2024, Vol. 17, 920-925. https://doi.org/10.1038/s41561-024-01514-1.

Anyone who has ever taken a geology class knows that the specific gravity of quartz is 2.65 (actually I recall being taught that it is 2.7, but mineralogy profs sometimes round). What I do not recall learning (as opposed to being taught) is that quartz is the only abundant piezoelectric mineral on earth. (Something is "piezoelectric" when it generates electricity when pressure is applied, or will deform when an electric field is applied.)

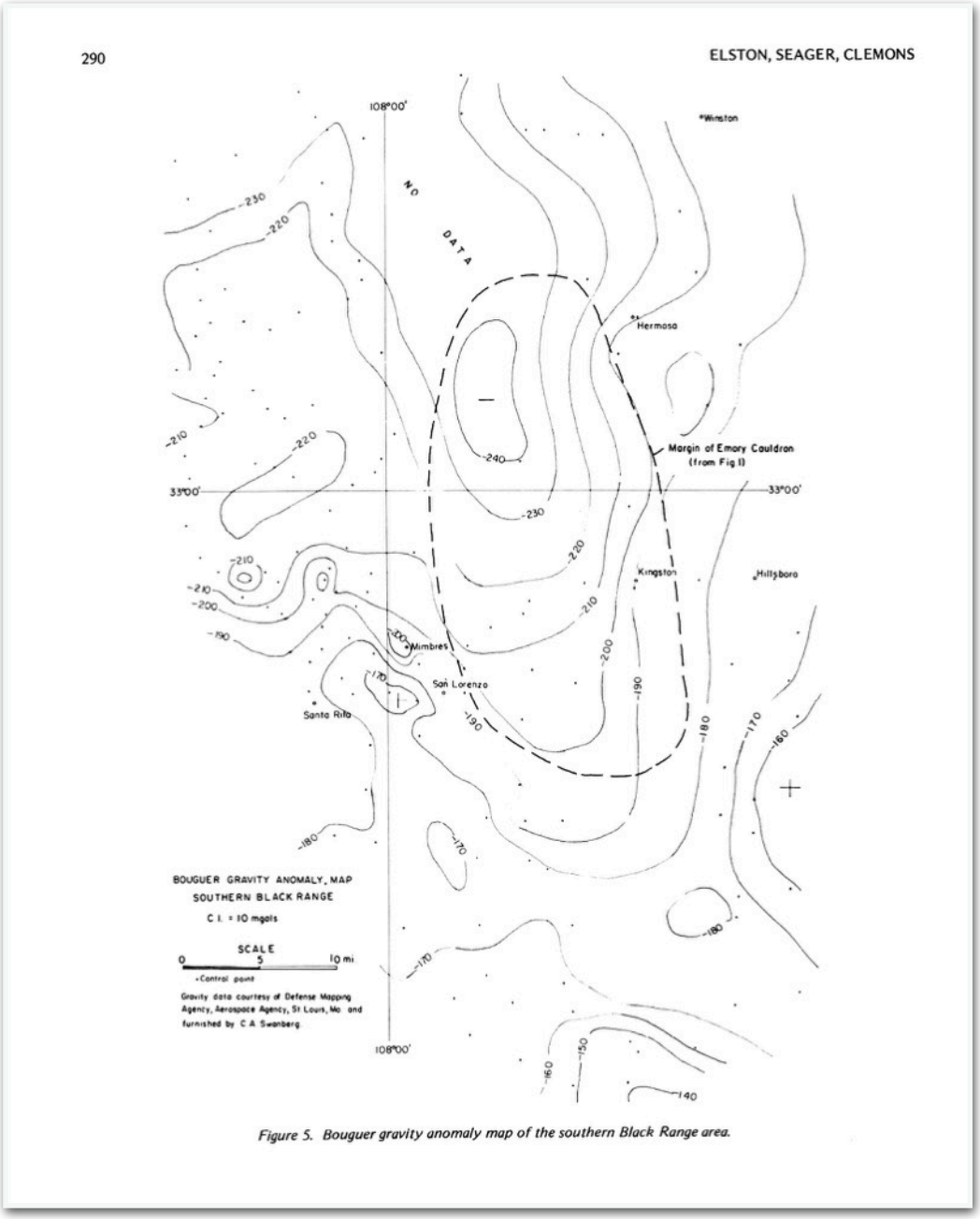


Figure 5. Bouguer gravity anomaly map of the southern Black Range area.

From the study abstract: "We find that stress on quartz crystals can generate enough voltage to electrochemically deposit aqueous gold from solution as well as accumulate gold nanoparticles. Nucleation of gold via piezo-driven reactions is rate-limiting because quartz is an insulator; however, since gold is a conductor, our results show that existing gold grains are the focus of ongoing growth. We suggest this mechanism can help explain the creation of large nuggets and the commonly observed highly inter-connected gold networks within quartz vein fractures."

The Black Range is pretty calm geologically these days but in the past there was a lot of volcanic activity, up to and including huge volcanic eruptions - really huge volcanic eruptions, like the one which created the Emory Caldera 34.9 million years ago. The map above shows the size of the caldera (from: "Emory Cauldron, Black Range, New Mexico, source of the Kneeling Nun Tuff", Wolfgang E. Elston, William R. Seager, and Russell E. Clemons, 1975, pp. 283-292. https://doi.org/10.56577/FFC-26.283 in: *Las Cruces Country, New Mexico Geological Society 26th Annual Fall Field Conference Guidebook*.)

And of course, there were lots of other eruptions and faulting. That equates to a substantial amount of pressure, and given the quartz which flows through the Black Range, a great deal of electricity was formed.

Other processes which can explain gold deposits were outlined in "Mantle oxidation by sulfur drives the formation of giant gold deposits in subduction zones" by D. He, K. Qiu, A.C. Simon, G.S. Pokrovski, H. Yu, J.A. D. Connolly, S. Li, S. Turner, Q. Wang, M. Yang, J. Deng, (*Proc. Natl. Acad. Sci. U.S.A.* 121 (52) e2404731121, https://doi.org/10.1073/pnas.2404731121 (19 December 2024). The researchers found that "sulfur is the key agent causing Au enrichment in the fluid upon its

reaction with the mantle, by forming the soluble Au(HS)S3- complex. This species concentrates in fluid up to 1,000 times more Au than its average mantle abundance. This gold enrichment in fluid is a key condition for forming Au-rich melts by fluid-present mantle melting."

These research findings are not necessarily contradictory and may even be complimentary.

Want to find some gold in hard rock? Look for some rock that has that distinctive feel of quartz, that instantly recognizable specific gravity of 2.7 (some things are hard to unlearn).

Demon-toothed Fish

A new genus of prehistoric fish has been excavated near Socorro, New Mexico. *Daemodontiscus harrisae* (Demon-toothed Fish is the English translation of *Daemodontiscus*) lived about 305 million years ago in the Late Pennsylvanian. The specimen was found by New Mexico Museum of Natural History and Science research associate Susan Harris (note that she is recognized in the species name). The skull of the specimen is on exhibit at the Ancient Life Hall of the New Mexico Museum of Natural History and Science.

The genus/species was first described in "A New Genus and Species of Large Macrodont Actinopterygian From the Pennsylvanian (Kasimovian/ Missourian) Atrasado Formation of New Mexico" by Matt Friedman, Rodrigo Tinoco Figueroa, John-Paul M. Hodnett, Spencer C. Lucas, Robert Higgins, Stephanie Pierce, and Sam Giles (Deep Blue Documents, Museum of Paleontology, the University of Michigan, Vol. 36, No. 2).

The formation in which it was found is composed of mudstone and sandstone and was previously known as the Wild Cow Formation and/or the Guadelupe Box Formation. Lest anyone think that all the rock in New Mexico is volcanic.

The paper referenced above uses detailed imagery as part of its species description, as shown to the right.

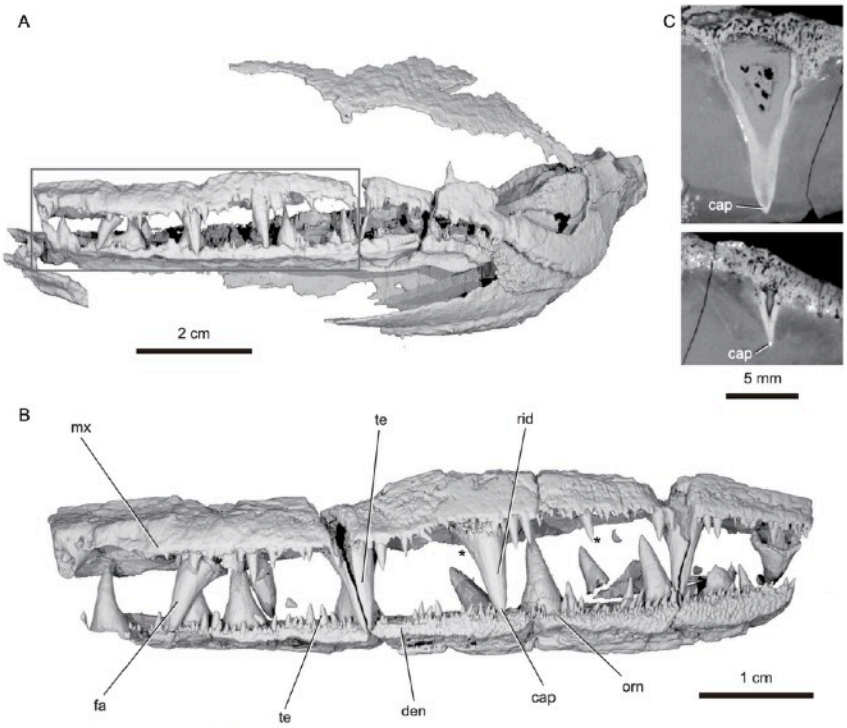


FIGURE 14 — *Daemodontiscus harrisae*, NMMNH P-77557, late Pennsylvanian (Kasimovian/Missourian) Tinajas Member of the Atrasado Formation, New Mexico. Renders of jaws. **A**, left maxilla and mandible in lateral view. **B**, area of maxilla and dentary indicated by enclosed region in A scanned at higher resolution. **C**, tomograms through maxillary fang (upper) and tooth (lower), indicated by asterisks (*) in panel B. Abbreviations: *cap*, acrodin cap; *den*, dentary; *fa*, fang; *mx*, maxilla; *orn*, dermal ornament; *rid*, ridge on dentine; *te*, teeth.

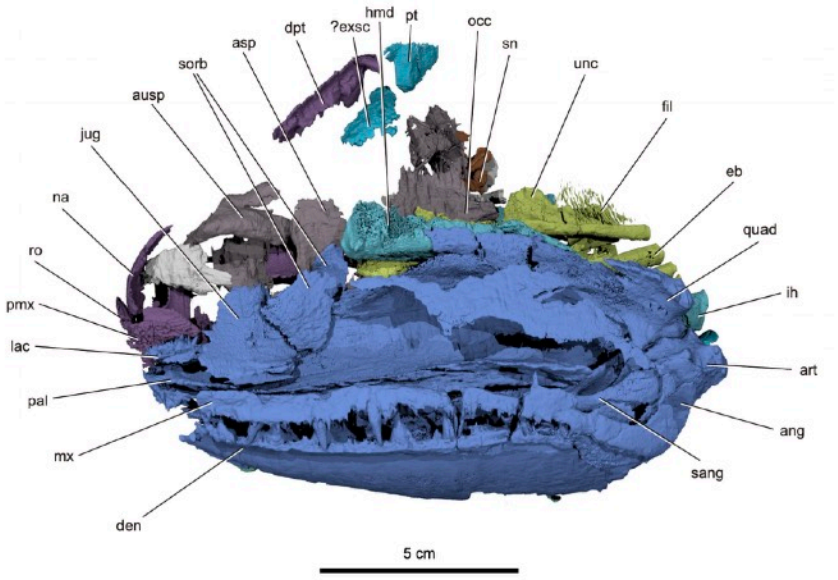


FIGURE 2 — *Daemodontiscus harrisae*, NMMNH P-77557, late Pennsylvanian (Kasimovian/Missourian) Tinajas Member of the Atrasado Formation, New Mexico. Renders of entire specimen in left lateral view. Color-coding of skeleton: blue, cheek and jaw; gray, unknown; light blue, hyoid arch; light green, operculogular system; mauve, braincase; orange, axial skeleton; purple, snout, skull roof and sclerotic ossicle; turquoise, shoulder girdle; yellow, gill skeleton. Abbreviations: *ang*, angular; *art*, articular; *asp*, ascending process of the parasphenoid; *ausp*, autosphenotic; *den*, dentary; *dpt*, dermopterotic; *eb*, epibranchials; *?exsc*, extrascapular; *fil*, filaments; *hmd*, hyomandibula; *ih*, interhyal; *jug*, jugal; *lac*, lacrimal; *mx*, maxilla; *na*, nasal; *occ*, occipital; *pal*, palate; *pmx*, premaxilla; *pt*, posttemporal; *quad*, quadrate; *ro*, rostral; *sang*, surangular; *sn*, supraneural; *sorb*, suborbital; *unc*, uncinate process.

Reports of declining insect populations have received widespread media attention, but evidence for declines has been variable across regions and taxonomic groups. Edwards *et al*. examined trends in the most surveyed taxon: butterflies (see the Perspective by Inouye). Combining data from 35 citizen science programs across the continental US, the authors found declines in overall butterfly abundance over the past 20 years across almost all major regions. Two-thirds of studied species showed declines of more than 10%. Many insects have the potential for rapid population growth and recovery, but habitat restoration, species-specific interventions, and reducing pesticide use are all likely needed to curb population declines. —Bianca Lopez

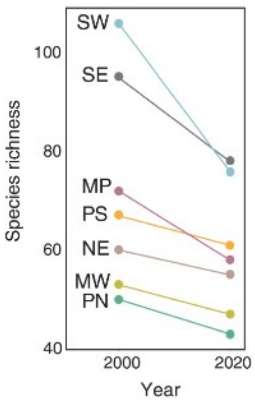
The Massive Decline of Butterflies

Collin B. Edwards et al. in "Rapid butterfly declines across the United States during the 21st century" (*Science* 387, 1090-1094 [2025] DOI:10.1126/science.adp4671) report on the devastating decline of butterflies in the continental United States. The *Science* editor's summary is shown above.

The authors used 12,600,000 records from 76,000 butterfly surveys to assess changes in population from 2000 to 2020. They found "total butterfly abundance fell by 22% across the 554 recorded species. Species-level declines were widespread, with 13 times as many species declining as increasing."

The charts to the right and below summarize some of the author's findings. In twenty years some species have lost a third of their population. This is bad news for humans. Butterflies and other pollinators are critical for human food production... (note the dramatic decline in the south-west [SW on the chart]).

There are multiple causes for this decline, including human-induced climate change.



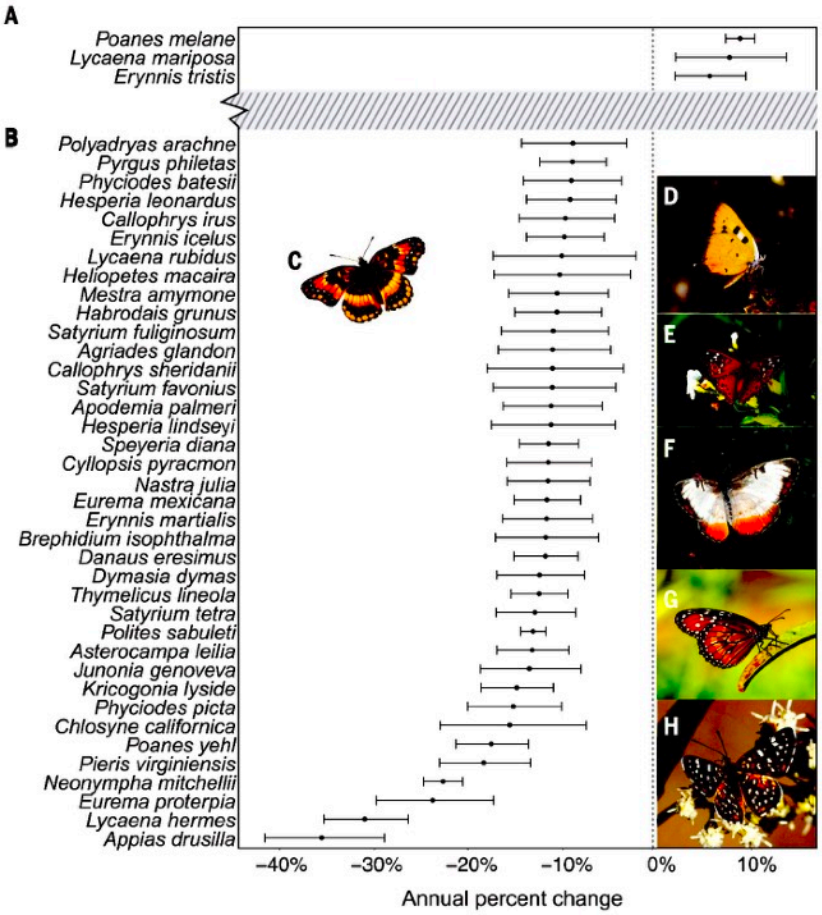
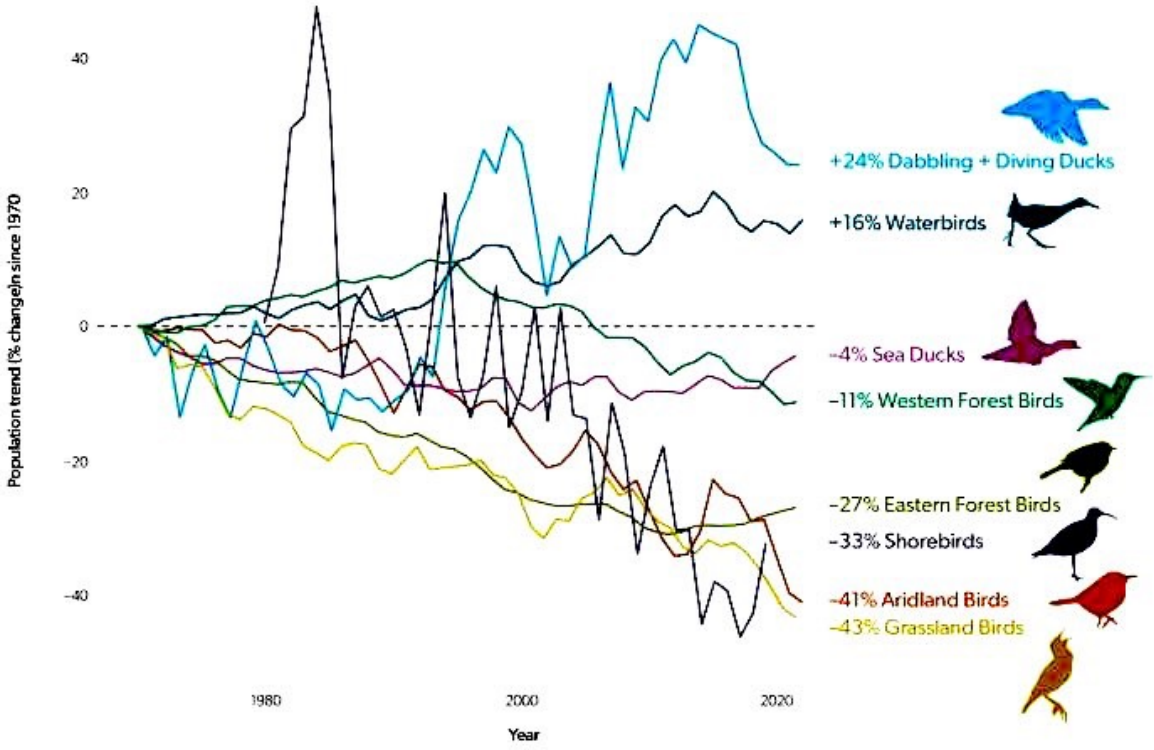


Fig. 3. Species with significant changes in abundance were predominantly declining. Of the increasing and declining species (significant annual change, $P < 0.05$), we show (**A**) the most extreme one-third of increasers (three of nine species) and (**B**) the most extreme third of decliners (38 of 114 species). Solid black points show the estimated annual change in abundance; intervals show 95% confidence intervals. The gray bar represents the remaining 301 (of 342) species fit with species-level models (results not shown), which had intermediate growth rates. (**C** to **H**) Photos of six of the most rapidly declining species: (C) *Chlosyne californica*, (D) *Lycaena hermes*, (E) *Asterocampa leilia*, (F) *Mestra amymone*, (G) *Danaus eresimus*, and (H) *Apodemia palmeri*. [Photo credits: J.G.]

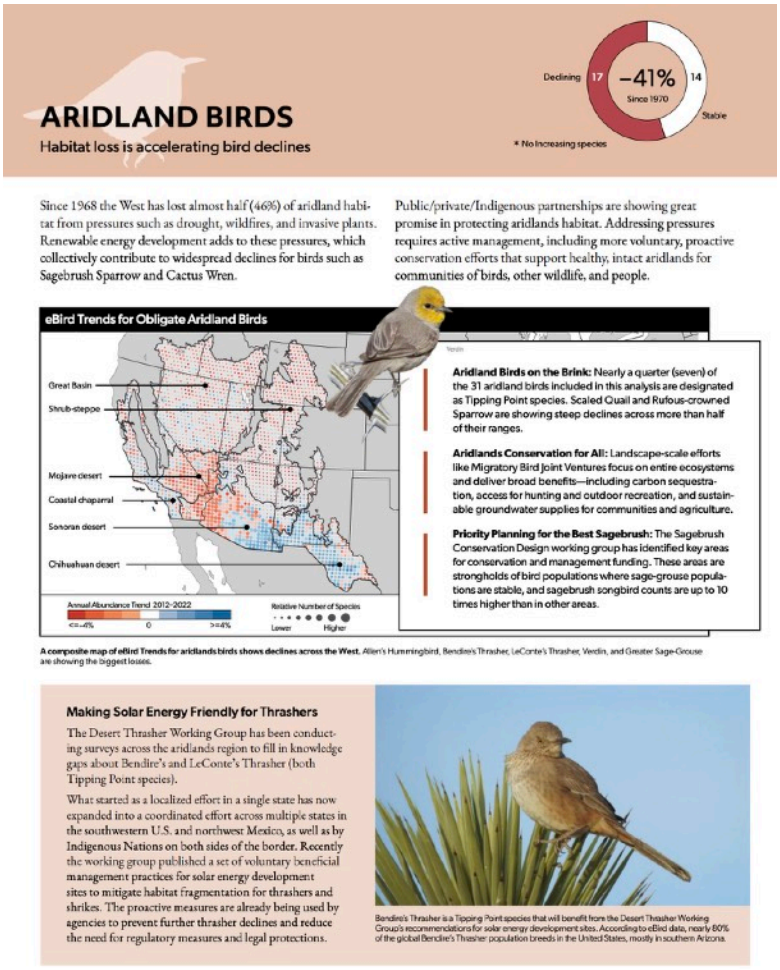
From the paper: "Insecticides have been identified as leading causes of butterfly declines in recent analyses in the midwestern US and California." Eating organic may be good for you in myriad ways.



The Massive Decline of Birds

The chart above documents some of the findings reported in the [State of the Birds Report - United States of America - 2025.](#) Page 7 of the report is shown to the right and a portion of page 16 below.

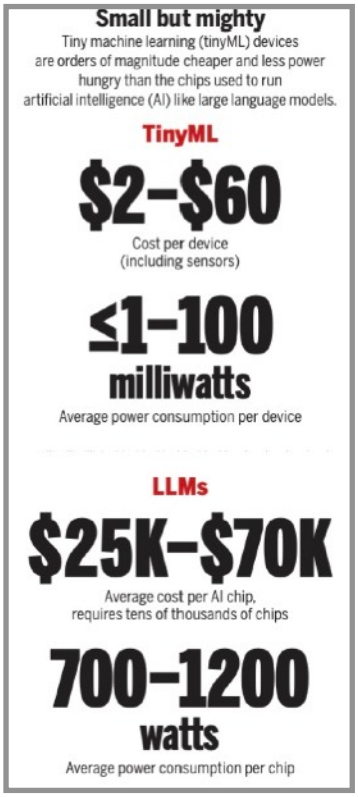
Among other assessments, the report identifies those species which are in need of special attention, and special effort, because their numbers have dropped so dramatically.



Tiny Machine Learning Models (TinyML)

In past issues we have reported on the benefits and potential pitfalls associated with the widespread integration of LLMs (Large Language Models) into everyday society. Two of the major downsides to LLMs are their costs (both developmental and operational) and energy usage (although certainly a cost factor, here we speak to resource availability and utilization). Associated with the latter is the significant environmental degradation associated with such usage.

The February 21, 2025, issue of *Science* (Volume 387, Issue 6736) included a report on the usage of much smaller machine learning models, TinyMLs. In "Cutting AI Down to Size" Sandeep Ravindran reported on the increased usage of much smaller models running on much smaller, and less expensive, machines in the Global South. The author's cost assessment of this usage is shown to the right.

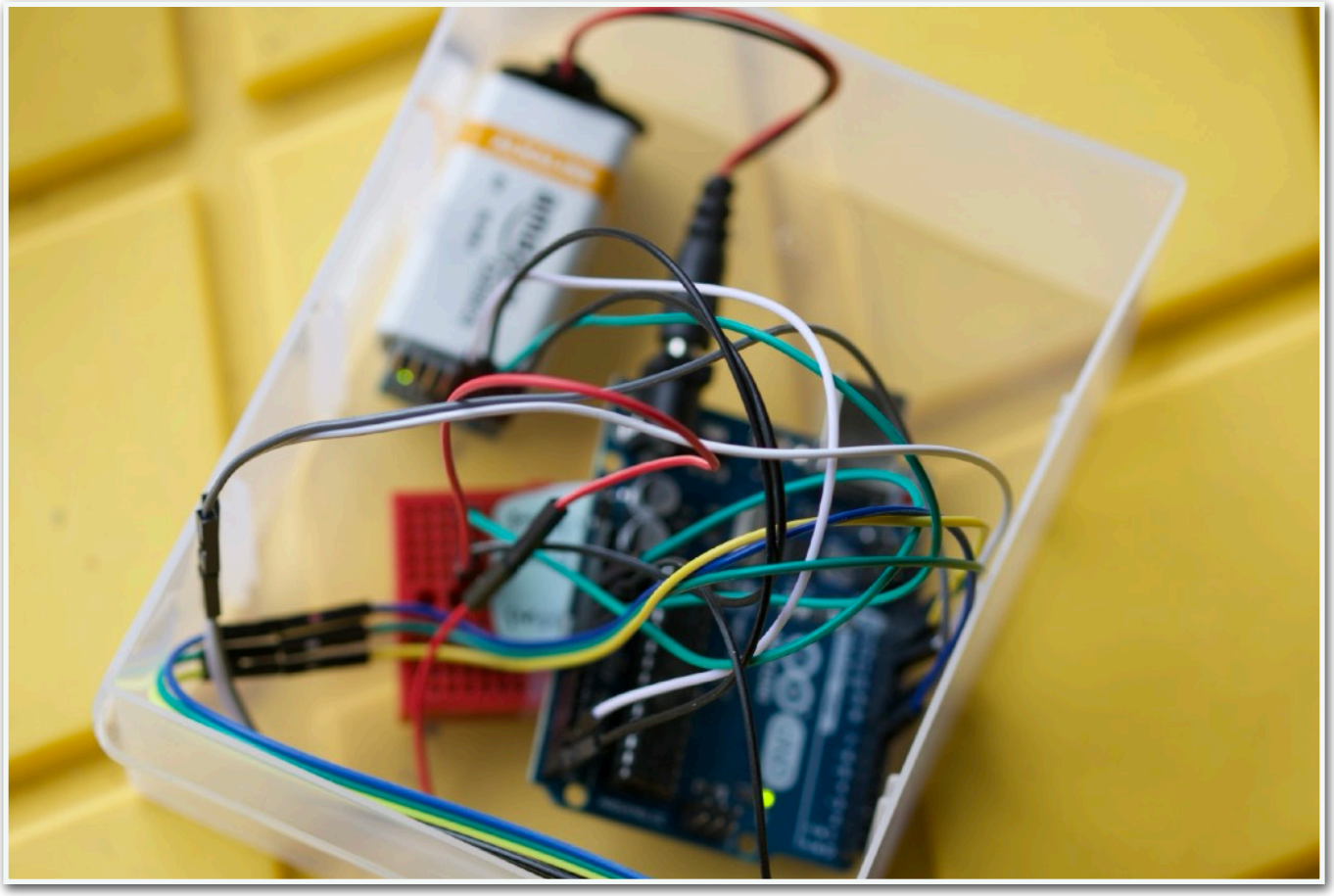


The secret to TinyML success is defined functionality. These systems are used for very specific tasks; they don't try to create a universal knowledge base or an all-knowing AI. They are simply used to determine if the plants on a plantation are diseased or not and efforts of that ilk.
A key component of these systems is an integrated sensor. The type of sensor varies with the task, of course.

The search for low-cost but highly effective defined-use systems has been ongoing for some time. The system below is an information retrieval and storage system designed by Jon Barnes in 2019 to monitor earth slippage. Systems like this, designed for a very specific purpose, require minimal hardware (when compared with LLMs) and are thus much less expensive to deploy.

Extreme Weather Events

As I write this, in early May, the wind is gusting to 60 mph and it is in the mid 60's. A couple of days ago we had snow, bringing our total precipitation over the last six months to just under 2". Tomorrow the high is forecast for the mid 40s. This is a trivial amount of variation in weather given some of what we have experienced in the recent past. We have a pretty good idea of how it affects us. How does it impact plant and insect phenology? That is the



question that D. Li, M. Belitz, L. Campbell et al. set out to determine in a recent research effort. The results, published as "Extreme weather events have strong but different impacts on plant and insect phenology" in *Nature Climate Change* 15, 321–328 (2025) indicate that extreme weather events (EWE) "which are predicted to increase in their severity and frequency with climate change, are also probably strong proximal phenology cues."

In their study they utilized "expansive community science resources to determine how EWEs affect plant flowering and insect flight beginning, termination and duration for 581 angiosperm species and 172 *Lepidoptera* across the contiguous United States."

They found that "plant and insect phenology is highly responsive to EWEs after accounting for seasonal and annual average climatic variables. The impact of EWEs on phenology varies depending on climatic context, and plant and insect responsiveness, while often similar, can be in the opposite directions. This suggests that EWEs may be key drivers of multitrophic phenological mismatches."

The bad news just keeps coming.

The Evolutionary Process

In Volume 7, Number 4 (October 2024) of this journal we mused on the manner in which large language models (LLMs) were changing, wondering about evolutionary processes as a way of characterizing change ("Large Language Models [LLM] and Evolutionary Change").

In November 2024, *Science* (Volume 386 Issue 6772) published an essay on this topic under the heading of Complexity Theory. In "Life evolves. How about everything else? - Support grows for 'natural law' that applies evolution to mineralogy, chemistry, and fusion", Paul Voosen discusses the work of Robert Hazen and Michael Wong.

In "On the roles of function and selection in evolving systems" (*Proceedings of the National Academy of Sciences*, Volume 120, Number 43) Wong, Hazen, et al. outline their thoughts, and "suggest that all evolving systems – including but not limited to life – are composed of diverse components that can combine into configurational states that are then selected for or against based on function. We then identify the fundamental sources of selection – static persistence, dynamic persistence, and novelty generation – and propose a time-asymmetric law that states that the functional information of a system will increase over time when subjected to selection for function(s)."

Their concepts and arguments are gaining more acceptance as knowledgable readers plow through their material. We note the controversy such thinking is likely to engender and do not wish to engage on one side or the other. We simply wish to note that what many would consider sacrilegious, or perhaps it is sacritraditionalscience, is worthy of consideration.

The Evolution of Evolution

"That all the diversity of life constitutes what Erasmus Darwin called 'a single living filament' – an unbroken chain of descent from the last universal common ancestor – is evidence of life's fundamental adaptability. However, the evolutionary processes that shape this ability to adapt (evolvability) remain elusive because of the required resolution and timespan of observations. Using evolving, self-replicating computer programs, we find that multiple pathways to increased evolvability emerge concurrently and distinctly aid adaptation. One pathway (evolved mutational landscapes) allows rapid adaptation to previously seen environments, while the other (higher mutation rates) allows rapid adaptation to entirely new environments. This multifaceted picture of evolvability helps us understand how organisms deal with ever-changing conditions and relentlessly explore nature's opportunities for innovation."

This quote from their article is how Kumawat, Lalejini, Acosta, and Zaman describe the significance of their research - "Evolution takes multiple paths to evolvability when facing environmental change", *Proceedings of the National Academy of Sciences U.S.A.*, December 31, 2024.

The idea that evolution occurs through a variety of processes is not new, nor is the idea that natural selection is not a static process but rather very dynamic. The authors explore the implications of the various processes of natural selection and evolution and find that the very nature of the processes contributes significantly to their operational success.

Bat Migration

In Volume 8, Number 3 (July 2025) of this journal we surveyed the bat species found in the Black Range.

In the 3 January 2025 issue of *Science* (Volume 387, Number 6729) Edward Hurme et al. reported on their findings that bat species in Europe utilize weather fronts while migrating ("Bats surf storm fronts during spring migration") . The authors report that "we tracked the daily location, temperature, and activity of female common noctules (*Nyctalus noctula*) during spring migration across central Europe up to 1116 kilometers. Over 3 years, 71 bats migrated tens to hundreds of kilometers per night, predominantly with incoming warm fronts, which provided them with wind support. Bats also showed unexpected flexibility in their ability to migrate across a wide range of conditions if needed. However, females leaving toward the end of the season showed higher total activity per distance traveled, a possible cost for their flexible migration timing."

Their findings, that this species of bat considers multiple factors to determine its migration pattern, including the availability of weather fronts to help them along, underlines the complexity of migratory movement. It is not known if the findings reported are applicable to other bat species, including those found in the Black Range.

Bat Echolocation Used To Map Long Distances

None of us need to be told about the echolocation capabilities of bat species. Maybe not. I for one wondered about the capabilities of these creatures as they surveyed their nearby environment via echolocation. Whether it is not running into walls or catching a moth on the wing, bats excel.

But wait. There is more to the story.

In "Acoustic cognitive map-based navigation in echolocating bats" Aya Goldshtein et al. (*Science*, Vol. 386 Issue 6721, pp. 561-567, 1 November 2024) the authors state that "We show that bats can identify their location after translocation and conduct several-kilometer map-based navigation using solely echolocation. This proposition was further supported by a large-scale echolocation model disclosing how bats use environmental acoustic information to perform acoustic cognitive map–based navigation. We also demonstrate that navigation is improved when using both echolocation and vision."

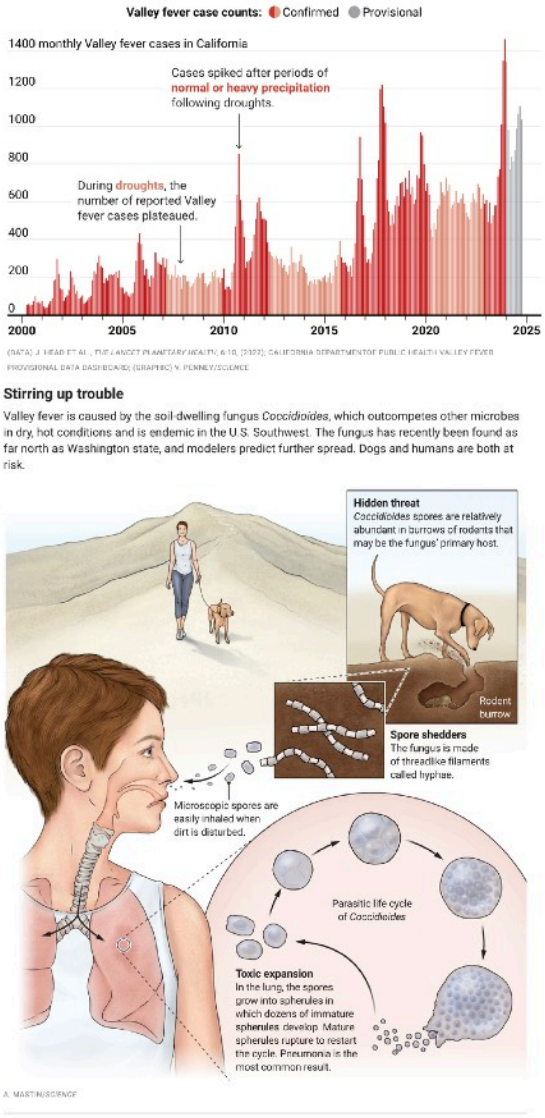
Debris Flows

In various past issues of this journal we have discussed the debris flows we have experienced in the Black Range following the Silver and Black fires. The greater Gila region has also suffered from large scale debris flows and flooding associated with significant rainfall following forest fires.

In May 2024, a conference (Establishing Directions in Postfire Debris Flow [PFDF] Science Conference) of researchers and practitioners was held to identify the steps needed to deal with these events (mitigation, avoidance, prediction, etc.). As was noted in "Confronting Debris Flow Hazards After Wildfire" (*EOS*, 19 February 2025), "During the past 2 decades, areas at risk from PFDFs have increased as wildfires have become larger, more severe, and more frequent worldwide because of climate warming and as homes, businesses, and infrastructure have expanded into the wildland-urban interface." Given the priorities of the current administration it is unlikely that there will be any significant follow-through on this topic. But given its importance, everyone should become familiar with the topic and the referenced article is a good start.

Valley Fever and Climate Change

In Volume 8, Number 1 (January 2025) we reported on evidence that changes in our climate cycle seemed to be increasing the likelihood of Valley Fever infections.



The two graphics shown here are from "DUST DEVIL - Climate change may be driving an expansion of Valley fever, a deadly fungal infection spread by airborne spores" by Meredith Wadman. This article appeared in *Science*, Volume 387, Issue 6731, on 17 January 2025.

The top graphic indicates the relationship between periods of drought and periods of precipitation. The cases cited in the graph are the number of cases, per month, in California. The number of cases in the United States was slightly over 20,000 in 2023. The graph indicates that the total US figures in 2024 and 2025 were much higher.

Both wind and rodents are known to spread the fungus which causes the disease.

Time as a Controlling Factor in Forest Carbon Storage

Supporting the soapbox about how complex the world is, comes a bit of evidence for that notion.

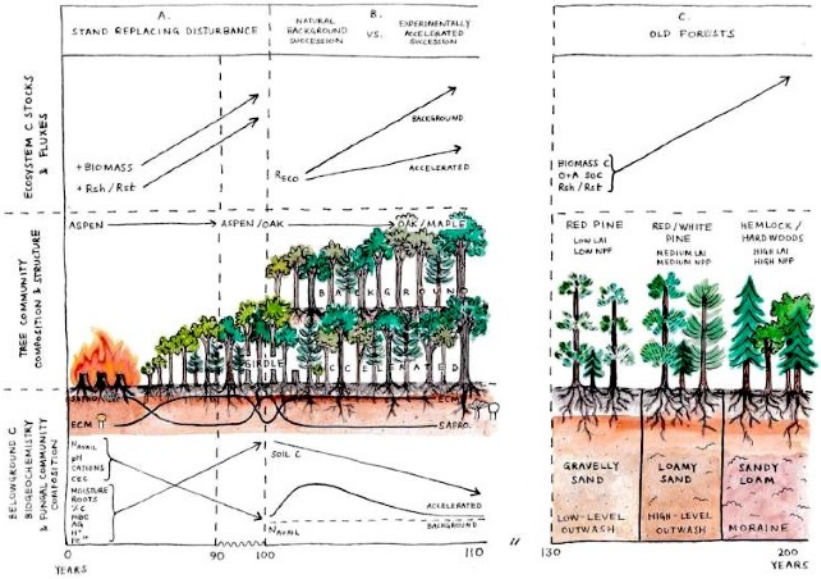
In "Carbon Cycling across Ecosystem Succession in a North Temperate Forest: Controls and Management Implications" Nave, Gough, Clay, Santos, Atkins, Benjamins-Carey, Bohrer, et al. (*Ecological Applications* 35[1]: e70001, 24 February 2025) explored the controlling factors in how much, and when, carbon is stored in forests.

Some have assumed that the primary, indeed the controlling, factor in how much carbon forests are able to store is the amount of elapsed time. The authors demonstrate that there are many other factors at play. Their studies of a plot over the last two centuries "show that some other ecosystem components have effects on C cycling that are not consistent over the course of succession. For example, canopy structure does not influence C uptake early in succession but becomes important as stands develop, and the importance of individual structural properties changes over the course of two centuries of stand development. Third, we show that in

recent decades, climate change is masking or overriding the influence of community composition on C uptake, while respiratory emissions are sensitive to both climatic and compositional change. In synthesis, we emphasize that time is not a driver of C cycling; it is a dimension within which ecosystem drivers such as canopy structure, tree and microbial community composition change. Changes in those drivers, not in forest age, are what control forest C trajectories, and those changes can happen quickly or slowly, through natural processes or deliberate intervention."

The graphic at the upper right is from the cited paper and was created by Jennifer Kalejs.

"Time is not what drives carbon cycling," Nave said. "Time is more of a playing field, and the rules of the game on that field are things like canopy structure, tree and microbial community composition, and soil nitrogen availability. That means that changes in things like structure, composition and soil nitrogen are what control forest carbon trajectories, whether those changes happen quickly or slowly, and whether we are influencing those changes through management or letting them happen on their own terms."



North American Beaver

In the April 2024 issue (Vol. 7, Number 2) of this journal we featured a series of articles about the North American Beaver. At page 13 we reported on the expansion of beaver habitat into the arctic. At the December 2024 American Geophysical Union's Annual Conference in Washington, D. C., Emily Graham et al. (Geophysical Institute, University of Alaska, Fairbanks) presented research entitled "Analysis of Beaver Pond Impacts on Adjacent Permafrost Stability". The research used radar instrumentation to determine the effect beaver ponding has on adjacent permafrost (it causes it to subside).

Canyon Tree Frog

Center Right: Canyon Tree Frog, *Hyla arenicolor*, Railroad Canyon, August 12, 2018.

Rose-breasted x Black-headed Grosbeak

The individual shown at the right was photographed in Hillsboro on October 27, 2024. Note the bi-colored bill and coloration typical of both species.

Finch - Partial Albinism

The finch at the right, displaying some partial albinism around the face, was photographed in Hillsboro on October 30, 2024. It was not possible to identify the individual to species or to determine if it was a hybrid.

Sunflower Parthenogenesis

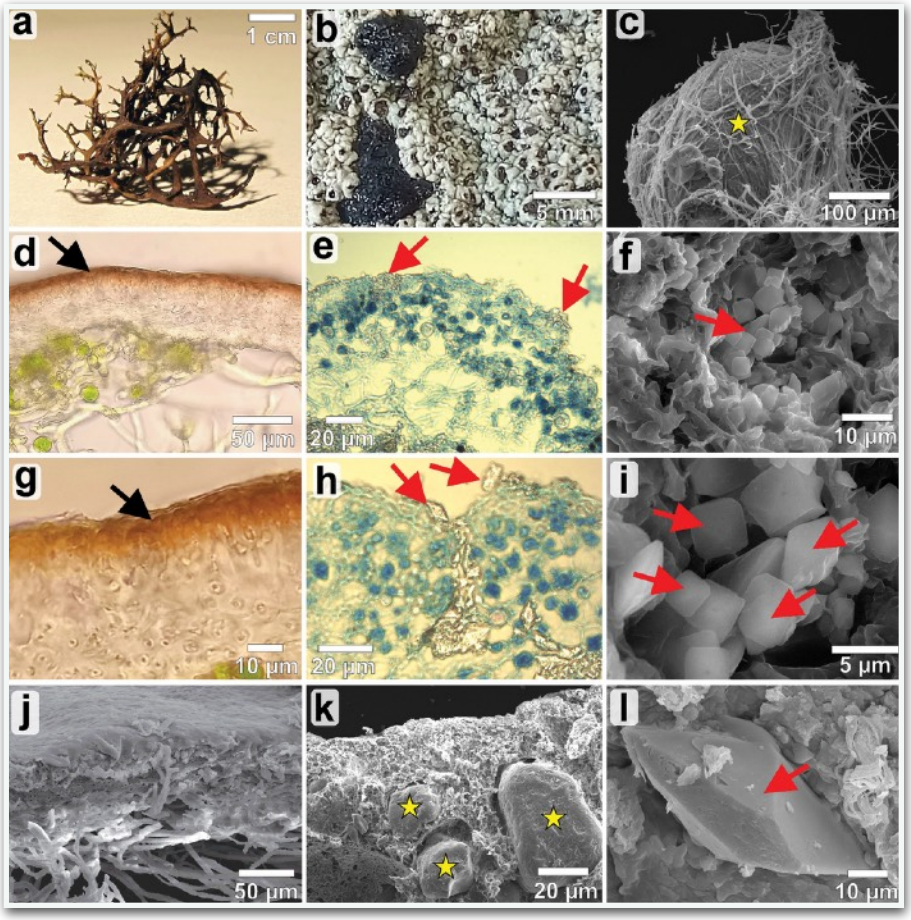
The flowers of the Common Sunflower, *Helianthus annus*, do not need to be pollinated to produce seeds. See Lv, J., Liang, D., Bumann, E. *et al*. "Haploid facultative parthenogenesis in sunflower sexual reproduction". *Nature* (2025). https://doi.org/10.1038/s41586-025-08798-2.

This is the species of sunflower generally raised to produce snack foods, sunflower oil, and bird seed.

Lichens on Mars

As a follow-up to our follow-up on lichens (see Vol. 8, No. 3) we note that recent research has shown that at least one lichen, *Diploschistes muscorum*, can probably withstand the environmental conditions on Mars. That should not be surprising given that they survive some of the most harsh conditions on Earth. See Skubała K, Chowaniec K, Kowaliński M, Mrozek T, Bąkała J, Latkowska E, Myśliwa-Kurdziel B (2025) "Ionizing radiation resilience: how metabolically active lichens endure exposure to the simulated Mars atmosphere". *IMA Fungus* 16: e145477. https://doi.org/10.3897/imafungus.16.145477

The image at the upper right is from the study and shows structural features of the two lichens which were evaluated in this study.

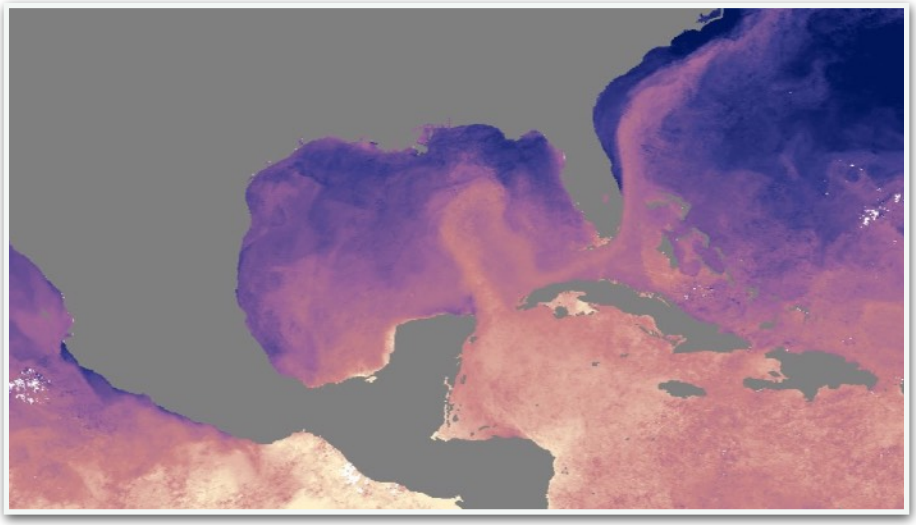


Caption from the Study: Morphological and anatomical characteristics of Cetraria aculeata (a, d, g, j) and Diploschistes muscorum (b, c, e, f, h, i, k, l): a, b lichen thallus; d, e, g, h thallus cross sections in light microscope; j, k thallus cross-section in SEM; c grain of quartz sand surrounded by fungal hyphae; f, i, l calcium oxalate crystals on thallus surface. Black arrows indicate melanin pigments, red arrows indicate calcium oxalate crystals and yellow asterisks indicate grains of quartz sand trapped inside the thallus.

Changes in Gulf of Mexico Currents

Much of our weather originates off western Mexico but a substantial amount is heavily influenced by the ocean currents of the Gulf of Mexico.

Austin et al. in "Ocean Current Affairs in the Gulf of Mexico", *Eos*, 19 May 2025, report on the warming of the Gulf and the changes which are likely to occur as a result. We are already seeing hurricanes increase in intensity, sometimes very quickly. (Hurricane Milton increased from a tropical depression to a category 5 hurricane in just over two days, for instance.) Predictions about the collapse of the Atlantic Meridional Overturning Circulation are dire. All of this means change; what those changes might be for us is yet to be determined with any level of significant predictability.



The Loop Current flows northward into the Gulf of Mexico through the Yucatán Channel and then exits eastward through the Straits of Florida. The current can be seen in this image from May 2010, which shows infrared observations from the Moderate Resolution Imaging Spectroradiometer on NASA's Terra satellite, with warmer temperatures indicated by pink and yellow hues. Credit: NASA Earth Observatory image created by Jesse Allen. Caption and graphic are from the referenced article.

Close Encounters With Geese

by Don Precoda

Don Precoda returns with this description of a memorable natural encounter. In the very first issue of this journal, he shared his "Experiences of a Hillsboro Peak Lookout" and followed that up, in the April 2019, issue with "More Memories From Hillsboro Peak".

One starry fall night in Cornucopia Canyon, New Mexico, I was stretched out on the roof of my car. Around midnight and half asleep I heard geese far off and heading south. When I woke again I could plainly hear something above me, closer, louder, and circling. But all I saw were a million stars. Soon I heard the slow rhythmic, pphht, pphht, pphht of flapping wings. Awake and alarmed now I sat up and saw for a beat, a blink, a second or two this memory outlined against the Milky Way:

> Three geese in a close vee formation, the two in front huge, the last much smaller. They were silent, gliding and motionless, with feet forward just in front of me. One goose honked warning. Two answered in unison and all three beat the wind with wings, while I felt the turbulence on my face. Their wings flap, flap as they pass inches over my head, spiral upward and disappear into darkness. Then hearing only as they resume course, their calls fading southwest toward El Paso one hundred miles away.

The same thing happened every twenty minutes for the next hour or so. Four times in all. By the third time I knew what to expect. They were in families of four, flying three and one. The separate single goose was a gosling, not matured or mated yet, migrating south for the second time in life. The mom and dad flew in vee formation with the season's small newbie between them. The parents mistook shiny car metal for water in that dry desolate country so would turn off their southward course, fly over, circle and descend from a great height while talking the whole time. And what talking they made as I listened unseen! Wild and strange with tones, inflections and pauses. No honking. Honk is for shouting, warning or locating. These geese spoke with low throaty clicking sounds. Like scolding squirrels in a hollow tree. By now I can distinguish leader and follower, adult and gosling, question and answer. A youngster's peep answered with adult reassurance. I heard whole conversations, saw nothing but stars, and then:

> The single gosling's last pass, just ten feet above, moving south to north. I see the bird. A soft call saying all clear. A soft answer. Seconds later three come silently downward, gliding west to east. Huge floating birds, wings spread wide, closer, closer, with feet forward for landing. Shouting and pounding on the car roof has no effect. Only movement at eye level and less than twenty feet. I sit up and cringe, wave my arms, anything. Once I almost touch a wing. Twice we almost collide. Each time a small newbie is last in the vee. Each time now memory.

With moonrise all became quiet. I slept and dreamed: Tomorrow the Guadalupe Rim.

Visual Survey Technologies

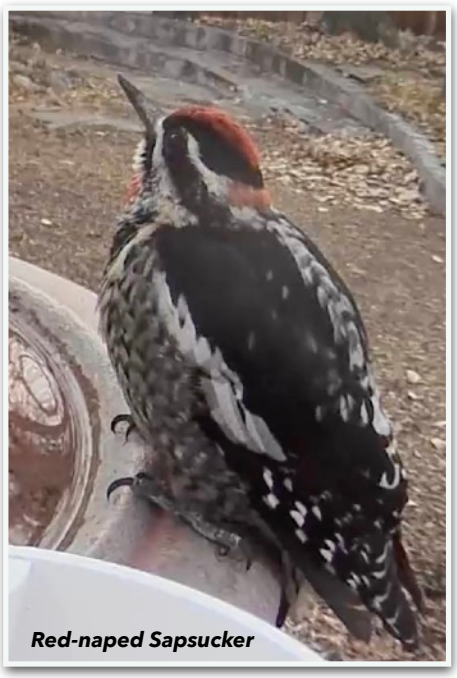
The video framegrabs on the following pages depict some of the species seen at a bird bath in Hillsboro during 2025 (late Jan - early Nov).

In the July 2024 issue of this journal we included a product review of "feeder bird cameras". Here, we thought we would give you a "different" perspective of that type of technology.

First of all, as you will see in the following few pages - it ain't art. Don't expect artistic, crystal clear, high definition images from these systems. They are based on home surveillance technologies which are not meant to produce art. But, they work well for survey work.

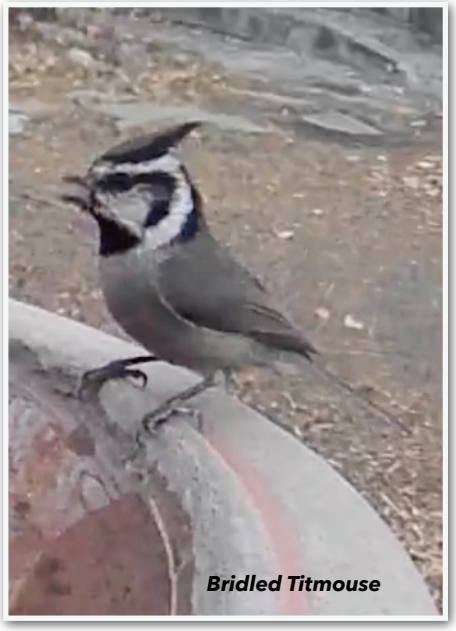
The images shown here are not a complete summary of what came to this bird bath during this period.

(Continued at the end of the photo series.)



Red-naped Sapsucker

Western Screech-Owl



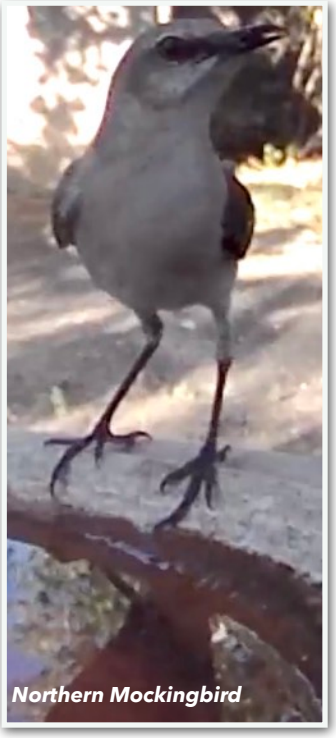
Bridled Titmouse

Western Screech-Owl

Northern Cardinal

Eurasian Collared-Dove

White-winged Dove



Northern Mockingbird


Western Bluebirds and Pine Siskins

White-crowned Sparrow
and Lesser Goldfinches


Lesser Goldfinches


Canyon Towhee


Canyon Towhee


American Robin


Western Bluebirds and Pine Siskins

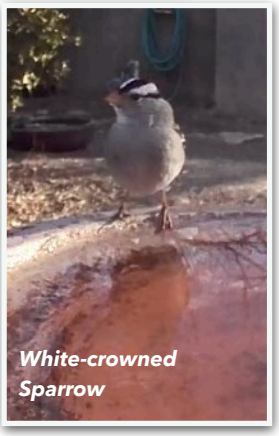

American Goldfinch


House Sparrow


House Finch


Dark-eyed Junco


Pine Siskins & Sparrow


White-crowned Sparrow

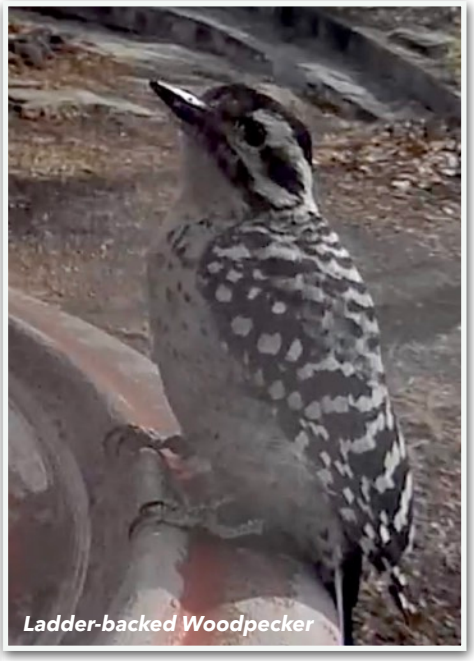

Pyrrhuloxia


Lincoln's Sparrow


Pine Siskin

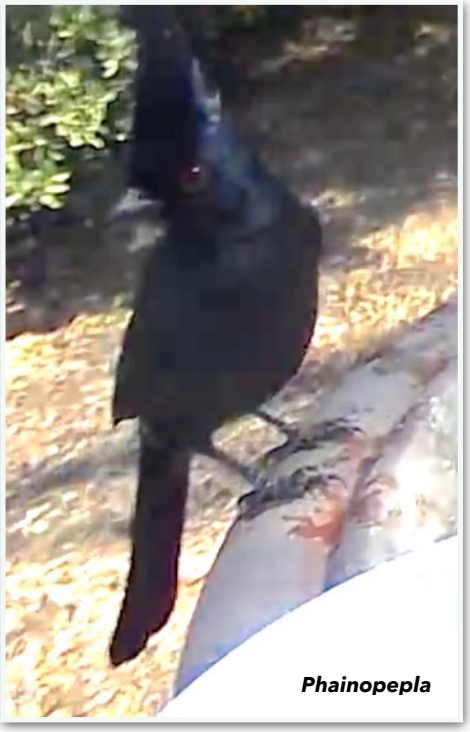

Lincoln's Sparrow

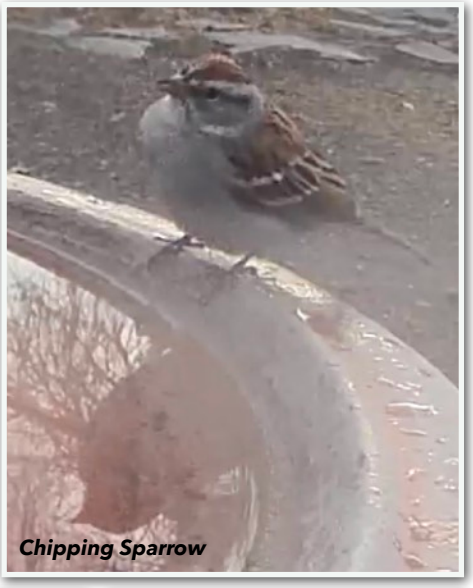

Song Sparrow


Ladder-backed Woodpecker


House Sparrow

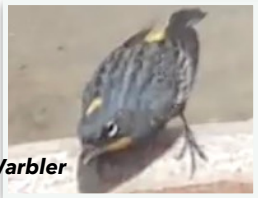

Sharp-shinned Hawk


Phainopepla


Chipping Sparrow


American Goldfinch


Yellow-rumped Warbler



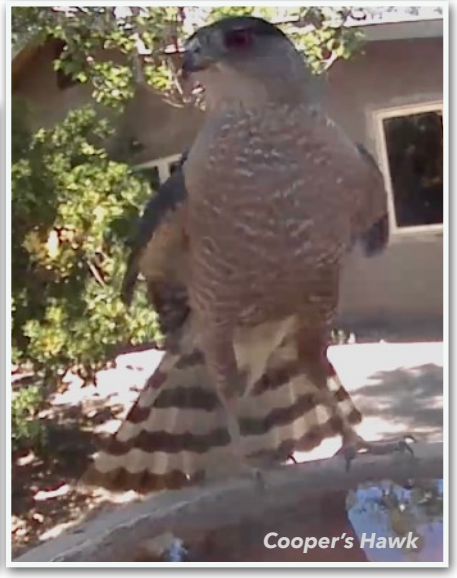

Yellow-rumped Warbler

Cooper's Hawk

Cooper's Hawk

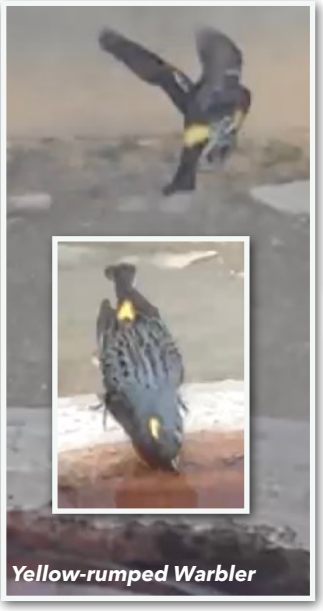
Cooper's Hawk

Yellow-rumped Warbler



Cooper's Hawk


Yellow-rumped Warbler

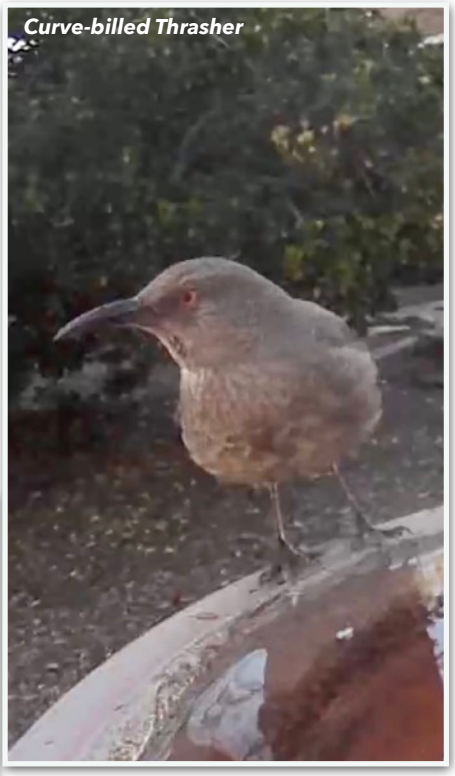

Yellow-rumped Warbler


Yellow-rumped Warbler


Yellow-rumped Warbler


Orchard Oriole


Phainopepla


Curve-billed Thrasher


Chipping Sparrows

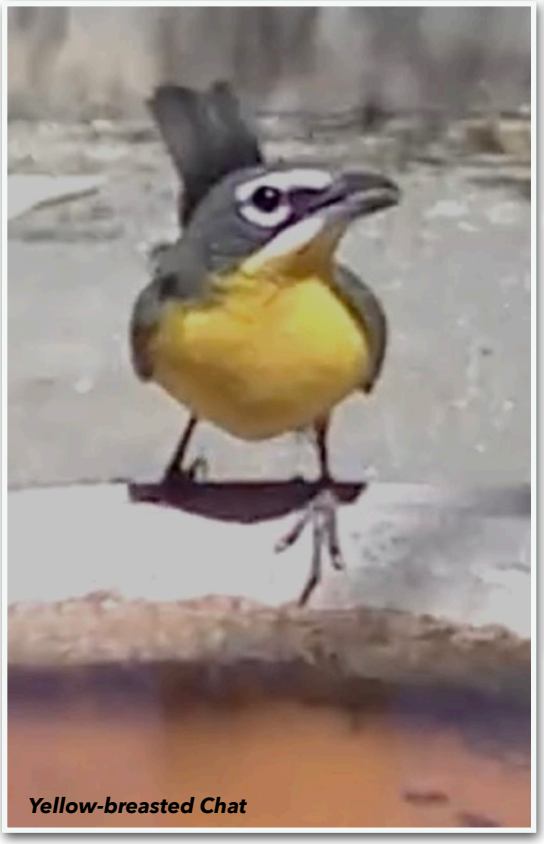

Brown-headed Cowbird


American Robin

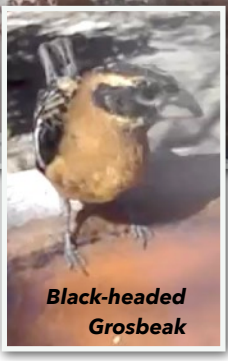

Cassin's Kingbird


Phainopepla


Lazuli Bunting

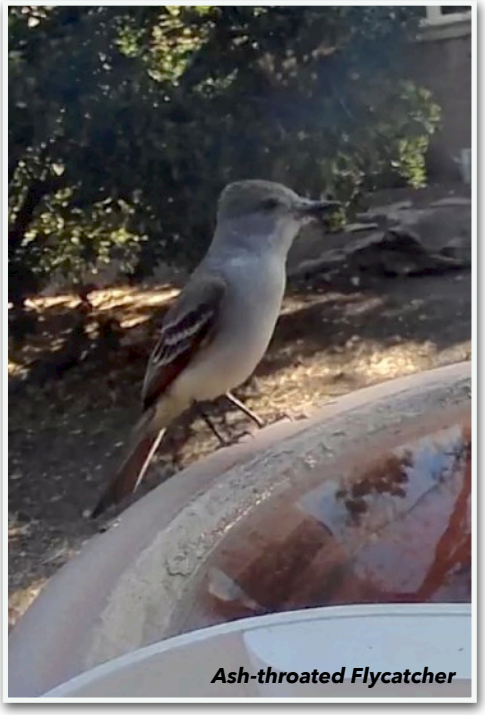

Yellow-breasted Chat


Yellow-breasted Chat


Black-headed Grosbeak


Green-tailed Towhee


Summer Tanager



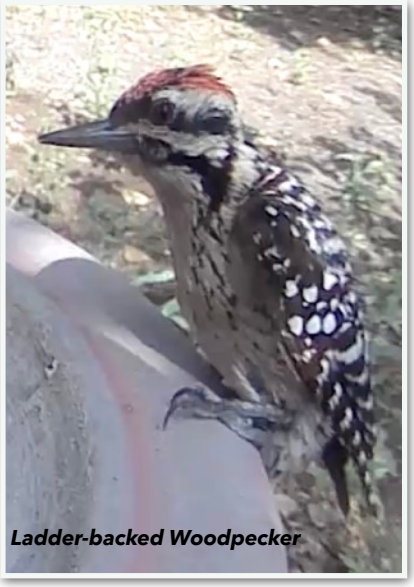
Ash-throated Flycatcher

Summer Tanager

North American Raccoon

North American Raccoon

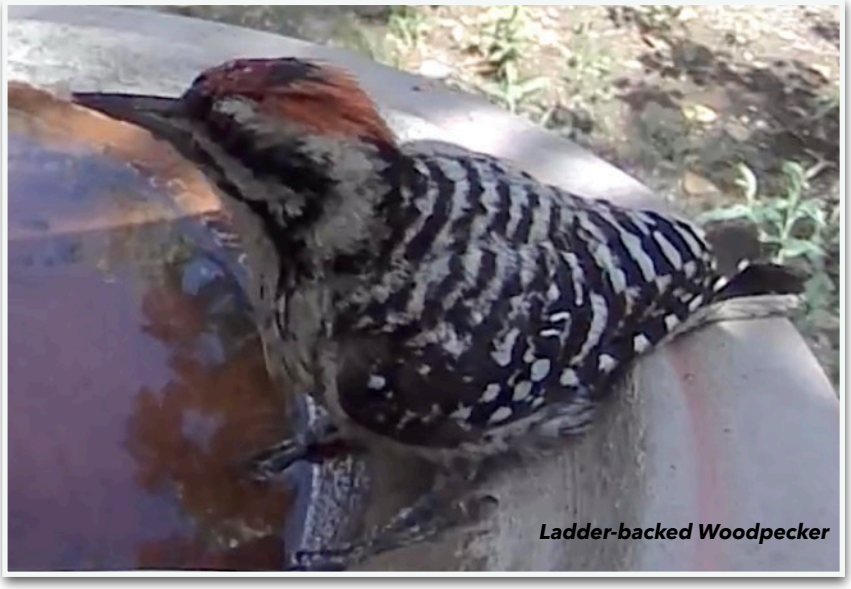
Tennessee Warbler



Ladder-backed Woodpecker

North American Raccoon

Orange-crowned Warbler



Ladder-backed Woodpecker


MacGillivray's Warbler


Virginia's Warbler


Wilson's Warbler


Western Tanager


Blue Grosbeak

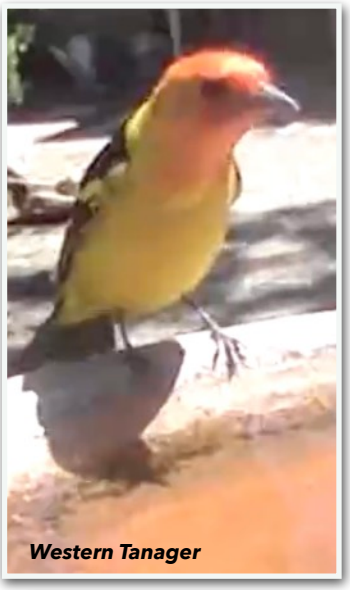

Wilson's Warbler


Blue Grosbeak

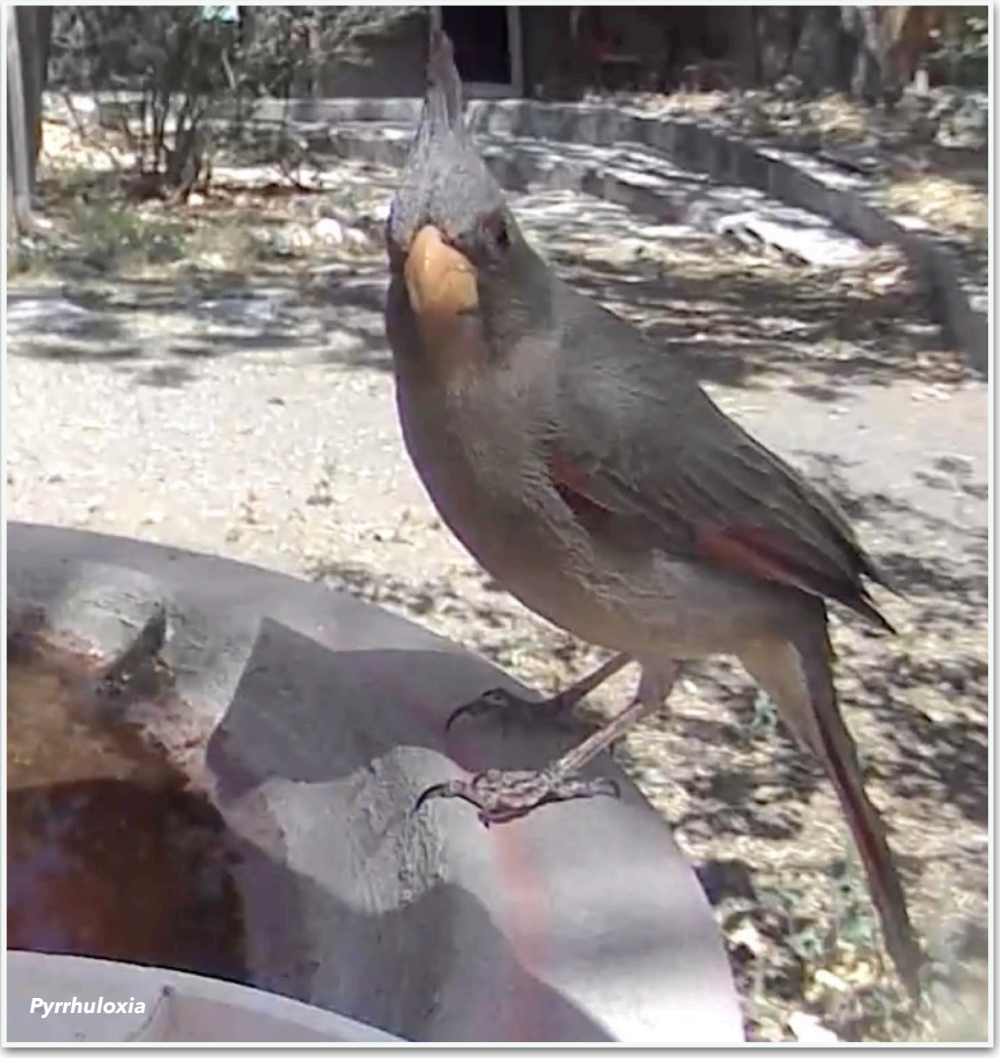

Blue Grosbeak


Blue Grosbeak


Green-tailed Towhee

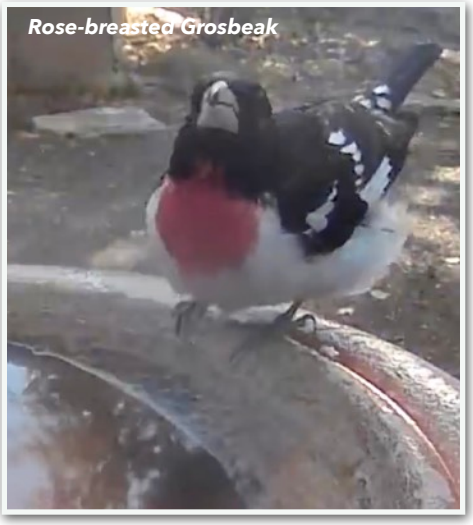

Western Tanager


White-winged Dove

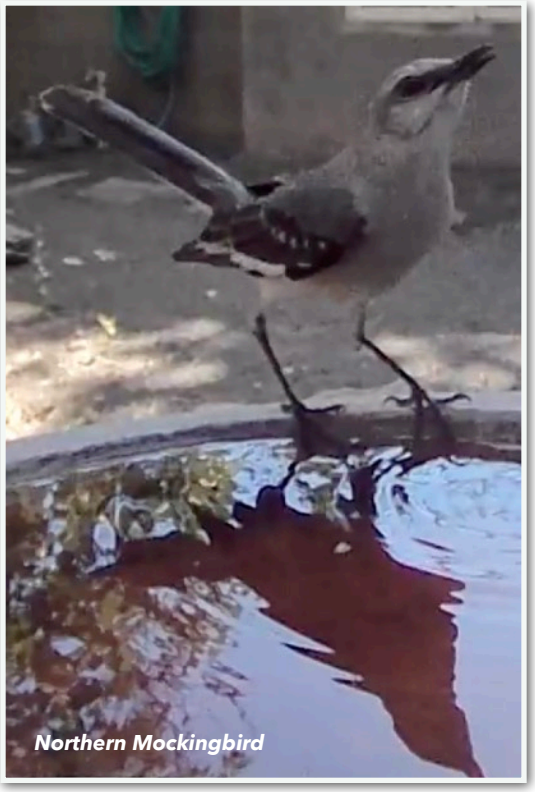

Pyrrhuloxia

Black-headed Grosbeak

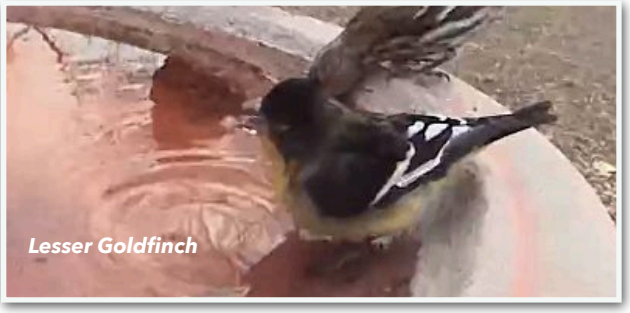
Rose-breasted Grosbeak



Rose-breasted Grosbeak



Northern Mockingbird



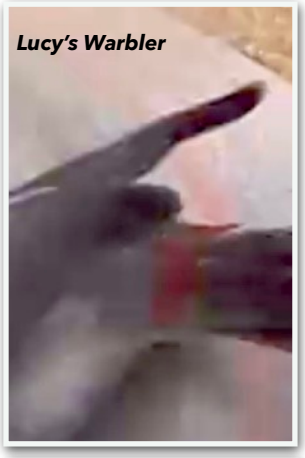
Lesser Goldfinch

Northern Parula


Cedar Waxwing


Lucy's Warbler


Bronzed Cowbird

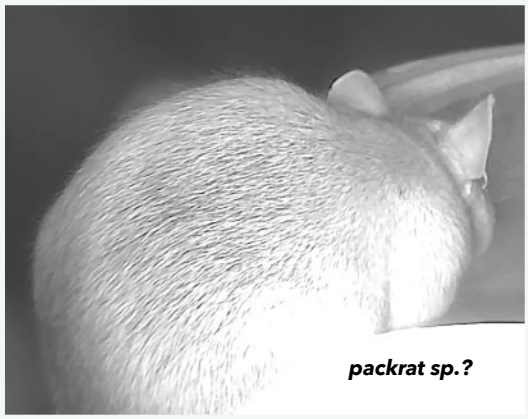

Lucy's Warbler

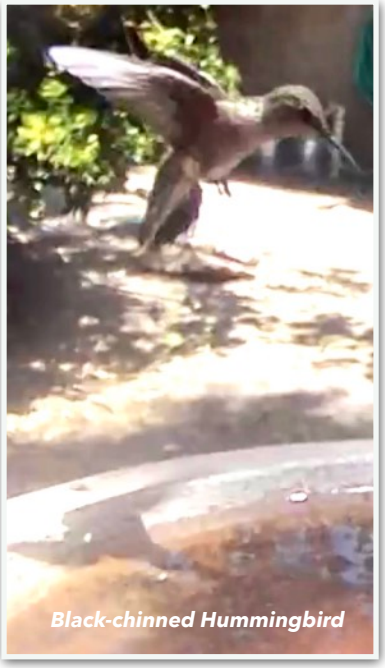

Hepatic Tanager

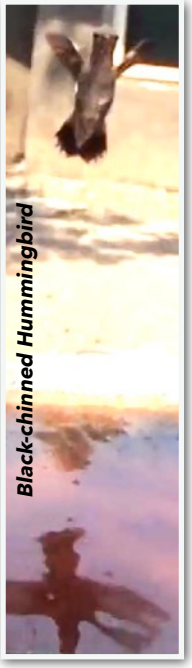

Hepatic Tanager


Western Kingbird

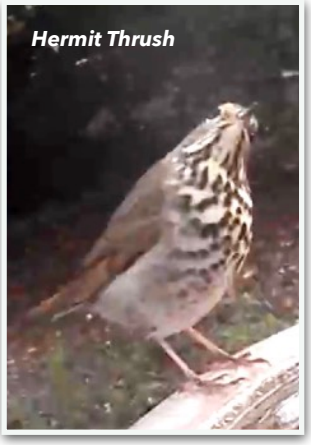

Western Kingbird


packrat sp.?


Black-chinned Hummingbird


Black-chinned Hummingbird


Brown-crested Flycatcher


Hermit Thrush


White-throated Packrat?


Warbling Vireo


Western Wood-Pewee

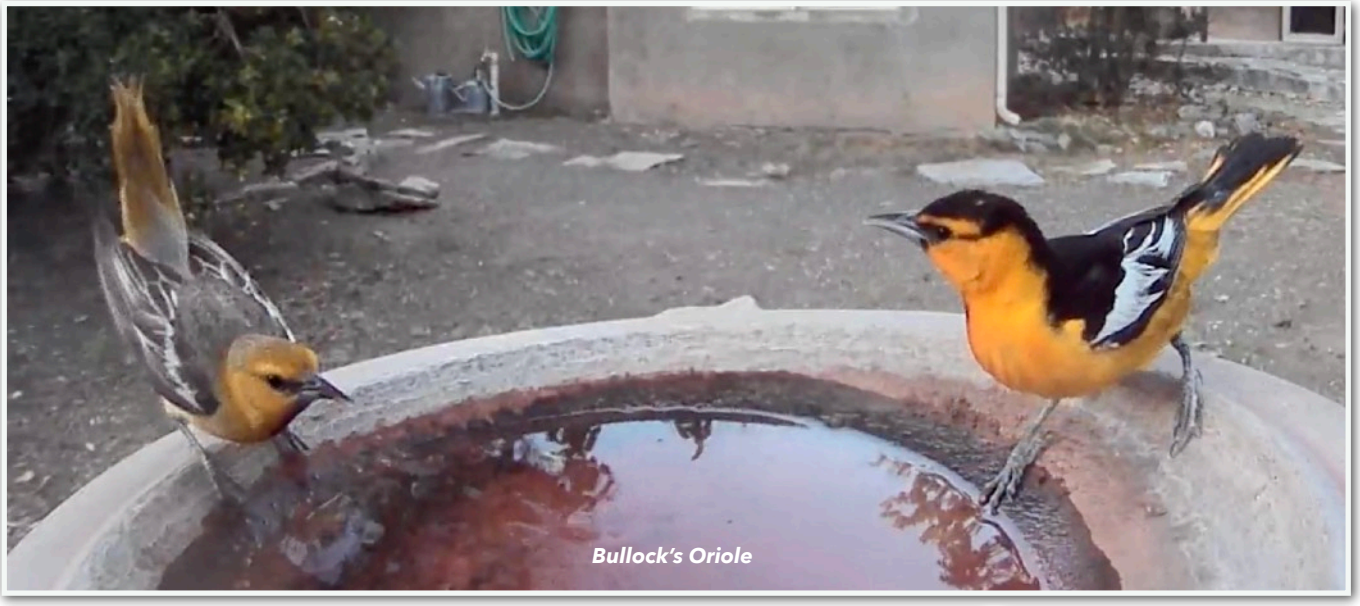

Western Wood-Pewee


Very wide angle lens, so subject is much smaller than it appears.

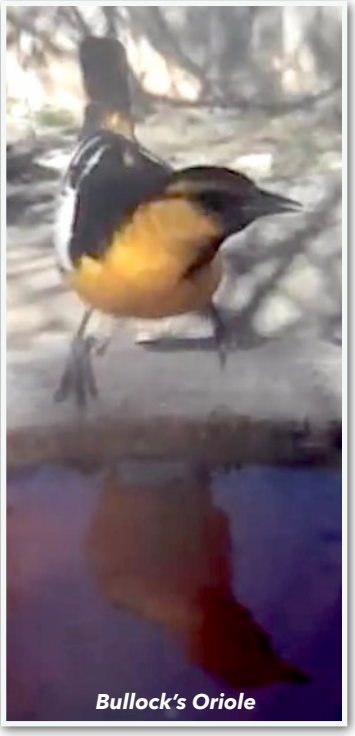
White-throated Packrat?


White-throated Packrat?


White-throated Packrat?

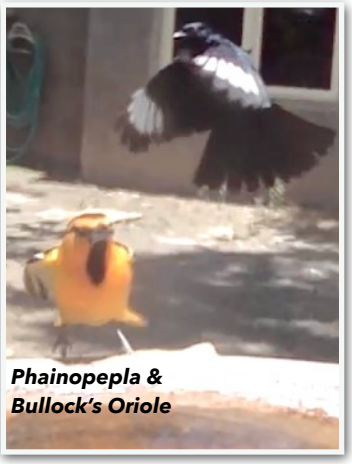

Bullock's Oriole


Hooded Oriole


Bullock's Oriole


Hooded Oriole

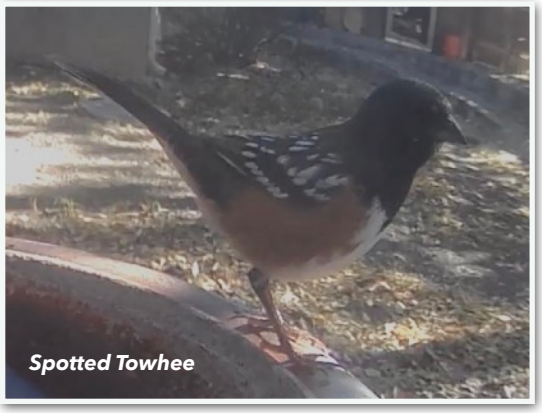

Hooded Oriole


Phainopepla &
Bullock's Oriole


Bullock's
Oriole


Bullock's Oriole


Woodhouse's Scrub-Jay


Spotted Towhee

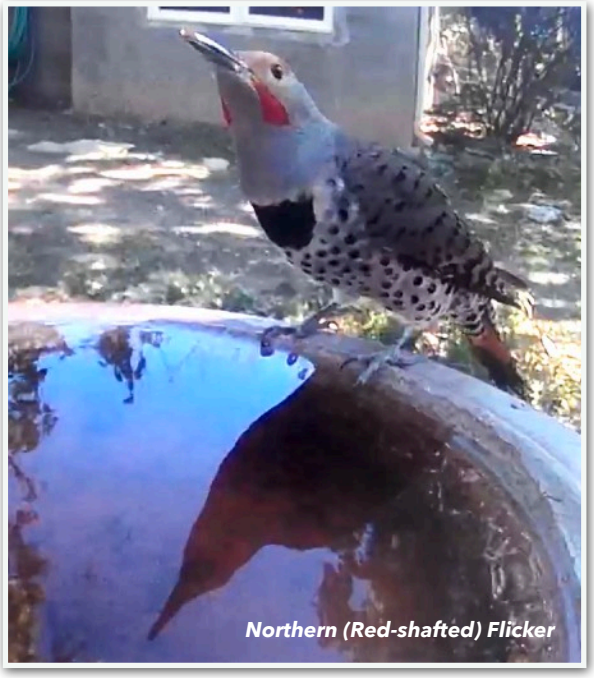
There were numerous images which were of such poor quality that we were not able to determine the species of the bird visiting the bath. There were many videos of birds visiting the bath, generally in the range of 100-400 a day. That is pretty cool; it is also a lot of work. Reviewing the material became a chore.


Hermit Thrush

Even with a large daily data set, the camera did not "capture" all of the species which were in the yard. Some species simply did not visit the bath, sometimes they would prefer another water feature in the yard, sometimes they simply did not go to water.

Jewelflower Study

The Arizona Jewel Flower, *Streptanthus carinatus arizonicus*, which is found in our area, blooms early in the year. The photograph at top left on the following page was taken on Apache Hill (featured in the Lake Valley Mining District video) on April 14, 2020. Why is this worth mentioning? In a recent study Megan Bontrager et al. found that jewelflower species in California which "appear to have


Northern (Red-shafted) Flicker


Dark-eyed Junco

diverged in their climate niches based on highly differentiated annual conditions are actually tracking very similar seasonal climate conditions". (M. Bontrager, S.J. Worthy, N.I. Cacho, L. Leventhal, J.N. Maloof, J.R. Gremer, J. Schmitt, & S.Y. Strauss, "Herbarium specimens reveal a constrained seasonal climate niche despite diverged annual climates across a wildflower clade", *Proceedings of the National Academy of Sciences* U.S.A. 122 (28) July 1, 2025, e2503670122,, https://doi.org/10.1073/pnas.2503670122.) This finding may turn out to be a signifi-cant point in our understanding of how plant species evolve to live in new habitats.

Streptanthus carinatus arizonicus was not one of the 14 species included in the study but the researchers found that the characteristics cited above were common across the members of the genera they studied.

The Arizona Jewel Flower shown in the right column was photographed in the Pony Hills (southwest of Cooke's Peak) in late March, 2015. The species is called Lyreleaf Jewelflower (the subspecies is called Arizona Jewelflower). The species has a range limited to Arizona, New Mexico, and Texas (one record) in the United States and into Baja California and Chihuahua in Mexico. There are two subspecies, the one shown here and the nominate form.

This flower blooms early (February to April) in well drained sandy and rocky soils (which this area abounds in). The subspecies was first described by Serano Watson (1826 to 1892) in 1890 as *S. arizonicus* and later as *Disaccanthus arizonicus* by Edward L. Greene. Still later it was designated as the subspecies by Kruckeberg, Rodman, and Worthington. At that time it was lumped with *S. carinatus*, described by Charles (Carlos) Wright from a specimen he collected in March 1852. When Wright collected the specimen he was serving as the surveyor and botanist on the Mexican Boundary Survey (1851-1853).

The researchers note that: "Our results highlight how occupation of a subset of seasonal conditions can be conserved across diverse species, resulting in less climate niche evolution than expected. Restricted climate niches imply that species may be less adaptable than we expect based on annual climates, and have implications for conservation, management, and persistence under hotter climates."

What People Are Reading and Listening To

40 Years of Evolution

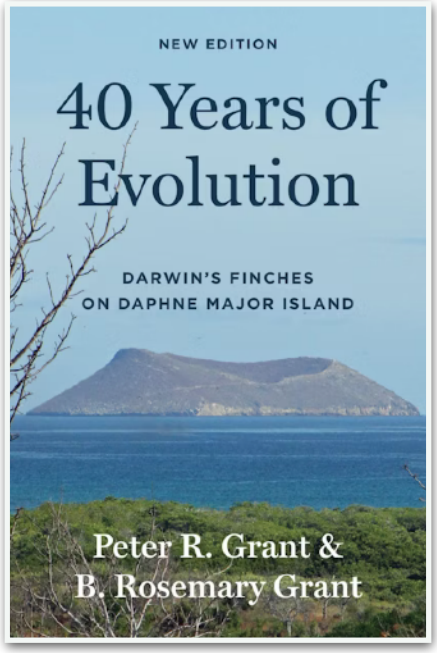
A review by Bob Barnes.

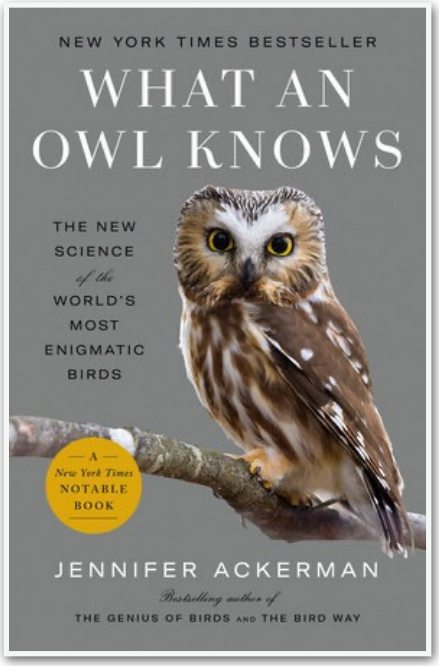
This book by the Grants is a primer on the concepts of evolution through natural selection and the research methodologies used to explore it. Their work has been ground breaking, but this book does more. It uses their research to explain knotty little questions that researchers sometimes face and to explain basic aspects of natural selection and the evolutionary changes which result. Want an introduction to this aspect of evolution? Want to read an intriguing history of how and why their research, research which shook up the study of natural history, developed? Read the book!!

> **"Those forms which possess in some considerable degree the character of species, but which are so closely similar to some other forms, or are so closely linked to them by intermediate gradations, that naturalists do not like to rank them as distinct species, are in several respects the most important to us." Darwin, *Origin of Species*, 1859, p. 47**

The book begins with this quote, a quote which summarizes my fascination with speciation. The difference between an Osprey and an American Goldfinch is not as significant to me as that between a Dark-eyed (Oregon) Junco and a Dark-eyed (Pink-sided) Junco. Give me superspecies, give me clinal variation of caterpillar species, tell me about where the line is drawn, or not, and why - that is of interest. And that is a good part of the research the authors conducted over decades in the Galápagos, especially Daphne Island.

In an initial discussion of the speciation process the authors note "it is individuals that interbreed, not species", a small bit of factoid which is all to often overlooked in discussions of the boundaries (geographical or biological) between species. What happens when individuals mix it up is significant in any discussion of speciation. Quotes like this are found throughout the book and provide context to the development of thought on this topic.





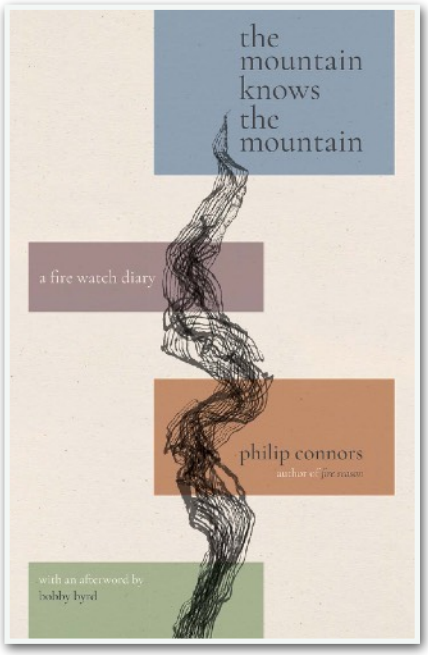
Although not a book, "Supplemental Feeding as a Driver of Population Expansion and Morphological Change in Anna's Hummingbirds" (Alexandre et al., *Global Change Biology*, 21 May 2025), reported significant bill changes in Anna's Hummingbirds over just a few decades. The authors were able to correlate those changes with the introduction of hummingbird feeders in California. Evolution over short periods driven by food supply, in this case hummingbird nectar.

What An Owl Knows

Jennifer Ackerman's exploration of the behavior, physiology, and general natural history of owls is well done, comprehensive, thoughtfully integrated, and presented in an accessible manner. A good way to learn a lot about owls, without expending a lot of effort.

We live in an owl-rich environment. On the following page we highlight a Flammulated Owl encounter south of Hillsboro, and in May 2025 Mexican Spotted Owl duets were being heard in Kingston, reported by Linda Sweanor.

The Mountain Knows The Mountain



Follow the link to the publisher's review of this book.

Our review is a bit more to the point. Buy the book, read the book, share the book with those you care about. That is what we have done.

Philip Connors is a master of descriptive nuance and he excels in that art in this book. His description of the return of the Rufus Hummingbirds to the summit of Hillsboro Peak is great descriptive natural history and unerringly captures our epoch of human history.

Support knowledge, support insight, support a local writer.

Flammulated Owl

***Psiloscops flammeolus*, May 2025**
Photographs by Bruce and Frances Chudy
South of Hillsboro, Black Range

Window strikes are never fun, for the bird or for the homeowner. In our area such strikes generally result in dazed birds (sometimes the strikes are lethal). Varied techniques are used to ensure that windows are not "fly-through", but even with the best, accidents happen.

Such an event happened in late May 2025 south of Hillsboro. The bird recovered after a bit and flew away. Although it was an unfortunate event, we are treated to unusually good views of a Flammulated Owl as a result.

As you can see, Flammulated Owls are very small. What you may not see immediately is that this is a disruptive little fellow. A breaker of stereotypes and common knowledge. This bird was in the foothills, desert landscape. Common knowledge says that it should have been in the mountains, hunting insects in the tops of tall pines. It has been posited that this bird of the western United States/Canada migrates into the mountains of Mexico, south to Honduras and El Salvador, because the availability of insect prey drops off in its northern habitat during the winter. There are myriad rabbit holes to go down when trying to explain why it was out of its elevational/habitat range. Here are a few - none can be proven (something that people who go down rabbit holes sometimes forget): The historical significant drought we are experiencing may have reduced the number of insect prey found higher in the mountains; it was a (late) migrator and was just passing through; common knowledge is wrong (of the set, this could be proven); it was a disoriented bird (because of illness, colliding with a tall pine, etc.); or small owls experience "das Fernweh".

Red-spotted Toad

***Anaxyrus punctatus*, September 1, 2024**
Photographs by Bob Barnes
East of Hillsboro, Black Range

Toads in the desert? Before we react to this question let us take a step back and discuss toads versus frogs. In general toads have dry warty skin as opposed to the smooth moist skin of frogs. Frogs tend to be aquatic while toads prefer land. And, perhaps, lastly, the legs of toads tend to be shorter (reflecting their more sedate gait) and those of frogs tend to be longer (suitable for great leaps). The coloration of frogs tends to be brighter and more vibrant than that of toads, which tend to the earthy tones - but bright red spots, not the most subdued coloration in the world. The small oak leaves in the top left image provide scale. These are very small toads which would fit comfortably in the palm of your hand.

Of interest is the fact that toads have parotoid skin glands on their backs, including the neck and shoulder region. These glands contain bufotoxins, neurotoxin alkaloids. These glands are wart-like in appearance and the bufotoxins they contain are the reason you should not eat toads - sickness and death are possible. These glands are not the same as the parotid glands of mammals, which are salivary.

Two individuals of this species were photographed on this day, the one pictured at the bottom right and all the others on this page. Both were found in a dry wash with no water nearby.

"Edible?" he asked.

***Neolentinus sp.?*, May 2025**
Photographs by Frank Hogg
Kingston, Black Range

Frank made a general identification inquiry to "the community" in May, wanting to know the species and edibility of the mushroom shown here. The consensus was that this was a mushroom in the genus *Neolentinus*. The most easily accessible information matched it to *N. ponderosus* ([O.K.Mill., 1965] Redhead & Ginns [1985]). However, that species' published range is restricted to the Pacific Northwest. "Edible?" I ask.