

The Black Range Naturalist

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Front Cover: Bordered Mantis, *Stagmomantis limbata*
Back Cover: Probably *Hemaris thetis*, Rocky Mountain Clearwing. "Probably" because in 2009 *Hemaris diffinis* was split to form this species and one in the east (east of the Continental Divide but with some overlap of range). This individual was photographed in Hillsboro.

Harley Shaw is probably best known for his research on Mountain Lions - or perhaps Wild Turkey or Bighorn Sheep, but he has had a long history of contemplating the less mobile species of the genus *Juniperus*. He is shown below in a photograph by Matilde Holzwarth, from 1/29/2014.

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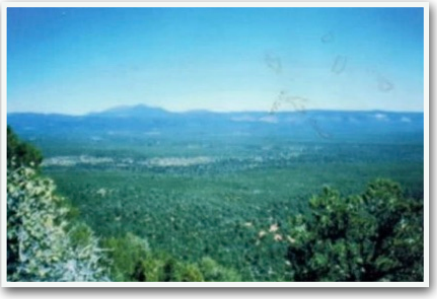
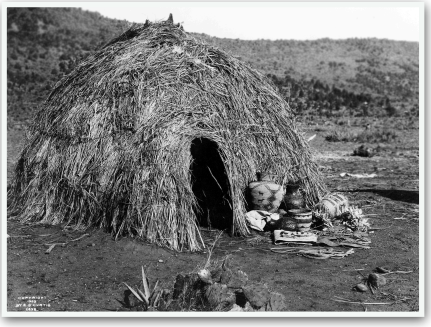
How Juniper Grows - A Picture Essay
by Harley G. Shaw

When the early expeditions came over the west edge of the Mogollon Rim in the mid-1800s, they viewed a landscape variously covered with junipers and scattered with open spaces of grassland. The area around what is now called Drake held a stand of juniper dense enough and extensive enough for Whipple and Mollhausen to name it the "Black Forest." This name held for at least two decades, but the area eventually became known as 'the cedars" by the late 1800s. John Marion (1870s) and Edgar Mearns (1880s) both used the latter name on trips through the area. We have no photographs of it from those early times, but today, it looks as shown below.



This photo was taken looking back across the "Black Forest" area from a butte above Ruin Tank. The photo point is actually an Indian ruin. We might imagine that the density of juniper was similar in 1850. However, investigation within this area shows that it has been modified in many ways since the area was settled by whites. For one thing, it has been heavily cut in many places. Such cutting apparently began at the time of first arrival of whites. No doubt the Pais living in the area also cut and burned juniper. However, until very late, they had only primitive tools to work with and probably broke off more than they actually cut down. The branches used in their wickiups would support this idea. Whatever the case, much evidence of cutting (post settlement) is visible within the understory of the woodland. An array of stumps is present from very early ax cut to more recent chainsaw cut. A few trees show signs of cross cut



An Apache wickiup
by Edward Curtis, 1903.

saws, but this method was apparently rarely used.

This is an example of an early ax-cut stump. I have no way of aging it. It was probably cut shortly after the



Peavine Railroad came down Limestone Canyon. It may have provided wood for the limestone kiln in Limestone Canyon or could have been cut for firewood at Prescott or mines further south.

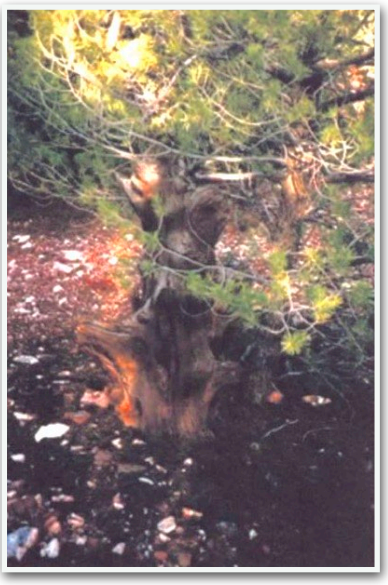
Cutting of firewood with axes probably lasted into the 1950s, when portable chainsaws finally became available at low enough prices for woodcutters to begin to use them. Chainsaws were developed by the 1920s, with Stihl of Germany making most innovations and capturing major patents. During World War II all German patents were invalidated in the United States, and Homelite, McCulloch, and others began to incorporate Stihl design characteristics into their saws. New lighter materials have made them lighter and more durable, and post-war affluence allowed widespread use of saws by the general public. Stumps showing sign of chainsaw cutting are now abundant throughout the jumper woodlands.

In addition to these stumps, other variations exist that are more difficult to classify. Some appear to be old saw cuts, possibly with hand cross cuts. Others may be caused by natural juniper mortality or fire. The following sequence shows a variety of stumps that arouse curiosity.



Above: The very flat top of this stump, along with its apparent early cutting date, suggests that it may have been cut with a hand crosscut saw. It has since been hollowed out by fire. The picture below is a more recently cut tree, possibly cut for fence posts and stays.







Above: This is another multi-limb cut that may have been cut with a hand crosscut. It, too, may have been used for posts or stays.



Above: This stump was burned, probably after the tree died.

Below: The stump below may have been killed by fire.



At the top of the next column, a burned stump alongside a fairly mature, unburned juniper, suggesting that this stump burned many years ago. The age of the living jumper is unknown, but it could be >100 years.



Below: An array of ax-cut stumps that apparently burned after being cut.





Above and two below: One interesting category is the old stump rings showing signs of being burned to ground level. The one above is a very distinct one.





My surveys of the area surrounding the "Black Forest" have disclosed only a few sites with evidence of fire in wetland. At least two of these have an abundance of these stump rings, suggesting that a very old mature stand of juniper burned. We have not found stump rings like this without signs of fire, so fire is apparently a part of their formation. One old stand of juniper we have found north of Interstate 40, near the Monte Carlo exit, has provided insight into how these rings come about. They apparently are a result of juniper stands that live to very old age and become decadent. The trees begin to die at the base, and the large basal limbs split off and fall to the ground in "rosettes" around the base of the tree. These old stands are often relatively dense, hence the dying and falling limbs create a heavy fuel load scattered over the ground within the woodland. When this woodland burns, the fire is hot and scorches everything in the area, leaving only below-ground wood "rings" of the stumps. Probably any remaining trees are also killed at this time, because the fire would be extremely hot.

The photo below is an old stand of juniper approaching decadence. The photos following this one show the fallen limbs and rosettes of heavy fuel.





Above: An aging stand of juniper and a dying old juniper with limbs on the ground.



Above: Old rosette showing fuel load under newer tree growth.

Below: A dead juniper that matured and created "rosette" of fuel.





Above: Another rosette of long-dead limbs providing a heavy fuel load.

Thus we can see that if stands of Utah juniper go to maturity and decadence, they die in a way that probably guarantees a future hot killing fire. This phenomenon explains the burned root rings found in some places. It does not tell us about other aspects of juniper life history and growth. Nor do we know how old junipers must be before they go into such decadence. Unfortunately, junipers cannot be easily aged by growth rings.

Junipers assume a variety of growth forms as they develop. We know little about how the trees grow and why they assume such a variety of shapes. When young, they are often bush-shaped, and may or may not have a dominant central stem. As they age, they usually develop a central stem or trunk, but lateral limbs may be very large. Based upon the rosette phenomenon shown above, I suspect that the lateral limbs on many large trees with low large diameter stumps, actually maintain their identity within the trunk of the tree. Thus the ''splitting out" during decadence.



Above: This is a typical young Utah juniper. It apparently germinated after the heavy spring rains of 1993. The photograph was taken July 1,1999, so the tree is about 6 years old. The cap provides a perspective of size. At this stage, the trees already have a dominant central stem and the lateral stems are much smaller.

Below: Another young tree, about same age as above, but with central stem more visible.



Top of the next column: An older juniper, perhaps 20 years old. Central stem still dominates, but lateral stems are growing. This is typical Utah juniper growth form and will evolve to classic "ball" shaped canopy with large lateral limbs near ground level.

Center Right: Somewhat older tree. Age unknown In this one; the central stem is losing dominance and the lateral stems are enlarging near base.



They converge into a single "trunk" at ground level.

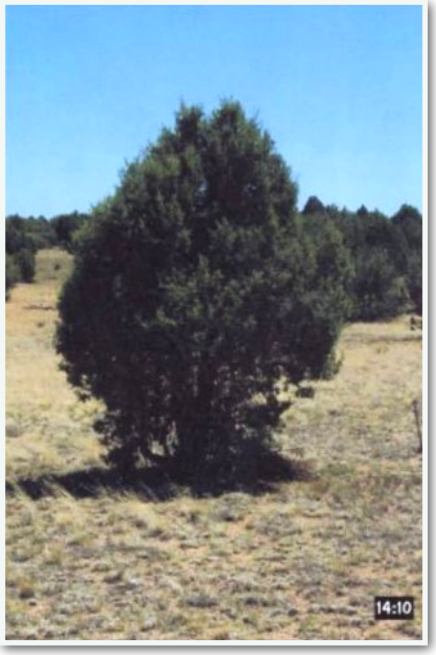


Below: Older tree, with lateral branches well-developed. Some pruning on basal stems.



Below: Another maturing juniper with longer, multi-stem, trunk developing. These longer stems, with limbs further from the ground, develop from pruning at various stages of the tree life.

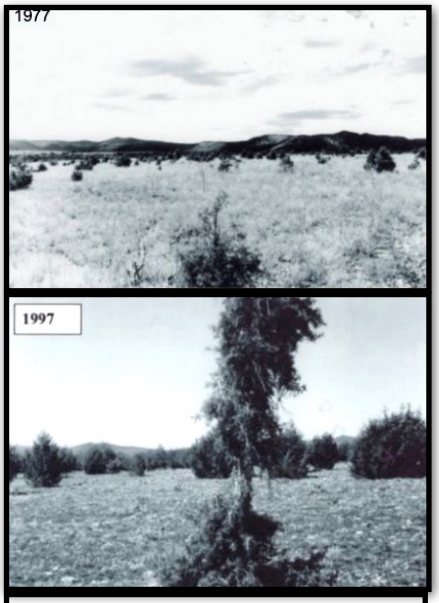




Above: A young juniper showing signs of pruning.

The two photographs that follow are included to show that crown damage to Utah juniper is retained through the life of the tree. The tree in the foreground had been damaged when very young. It shows the results of this damage 20 years later. Thus pruning around the base of the tree at an early age will permanently eliminate the lateral limbs that would, if left alone, ultimately dominate the central stem and create the round bole going to the ground. Early pruning, therefore, is apparently the factor that creates the stands of single-stem Utah junipers (or isolated individuals, for that matter). Such pruning may be done by small animals, such as rabbits or rodents, by low-level, low intensity fire through a stand of young trees, by drought (I have limited observations that suggest that the lower limbs of young trees die first under drought stress), or, possibly, by persistent snow covering of the lower limbs. Also, heavy use by domestic stock will also create such pruning, and results of such use can be seen on old sheep ranges south of Ash Fork. As a result, a stand of single-trunk Utah juniper trees in an area probably reflects an earlier event that brought about such pruning.

This, of course, has management implications in that careful pruning of young trees could shift a stand toward



Two photos above: Top -1977 photo by Jerry Elson and Tom Johnsen. Below - a 1997 repeat photograph at the same location. Note tree in foreground.

a more open savanna-like structure, potentially with an understory. This might lead to greater diversity of understory species, with different grasses and forbs growing beneath the open crowns than those that grow away from the trees. Such stands would provide protection from snow or extreme heat for many wildlife species.

This following sequence of photographs shows that Utah junipers retain the effects of crown damage or modification through life.



Center Bottom: A young tree showing extensive early pruning. This tree will grow a long, slender, single trunk.

Below: A stand of junipers that have been pruned by animals. This is within a ranch pasture with long use by livestock.





Above: Within a mid-age stand. Showing dominant central stem in some of the young trees.

Below: A mid-aged juniper stand with scattered young and mid-age trees. Round, bush shape is typical of many such stands, and is the normal growth form for Utah juniper, given no crown damage or modification.

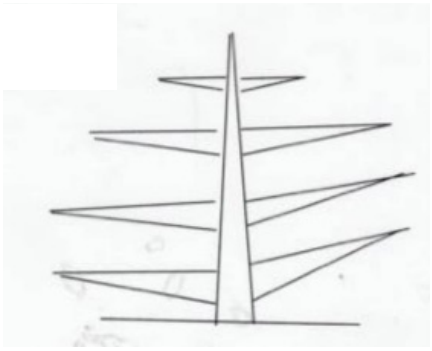


So we have a glimmering of variation and growth within stands, but much more work will be required if we are to understand the life history of junipers. The crude sketches which follow provide a hypothesis regarding formation of juniper growth forms.

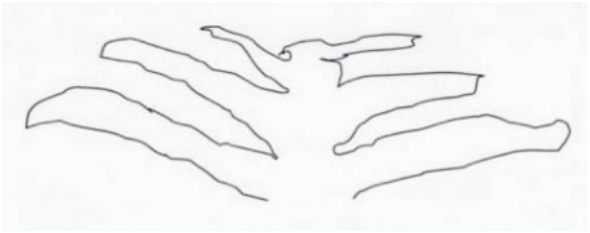
Normal Growth Pattern



As seedling/sapling, tree has dominant central stem with small lateral stems.



With age, lateral limbs gain in dominance, tree assumes round shape with limbs near ground.

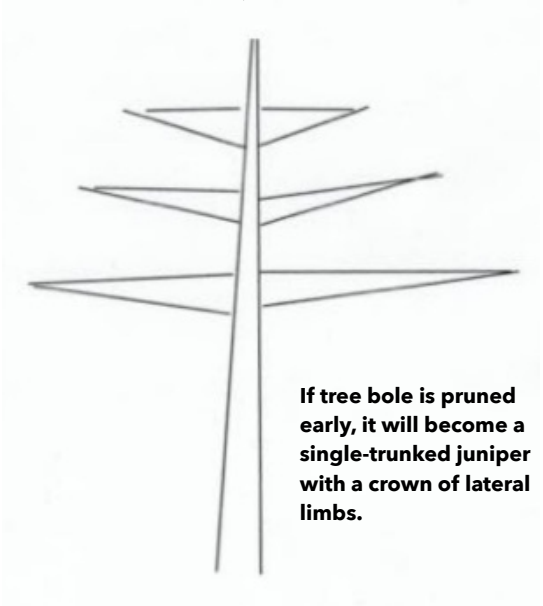


Normal Growth Pattern: In old age and decadence, the lower lateral limbs dominate and the central limb becomes entangled. These heavy lower limbs then die from the base, break off, and ultimately create a heavy fuel load. This, I believe to be the normal life history of a juniper left alone.

When Early Pruning Occurs







If tree bole is pruned early, it will become a single-trunked juniper with a crown of lateral limbs.

Smarter'n a Stump
by Harley G. Shaw

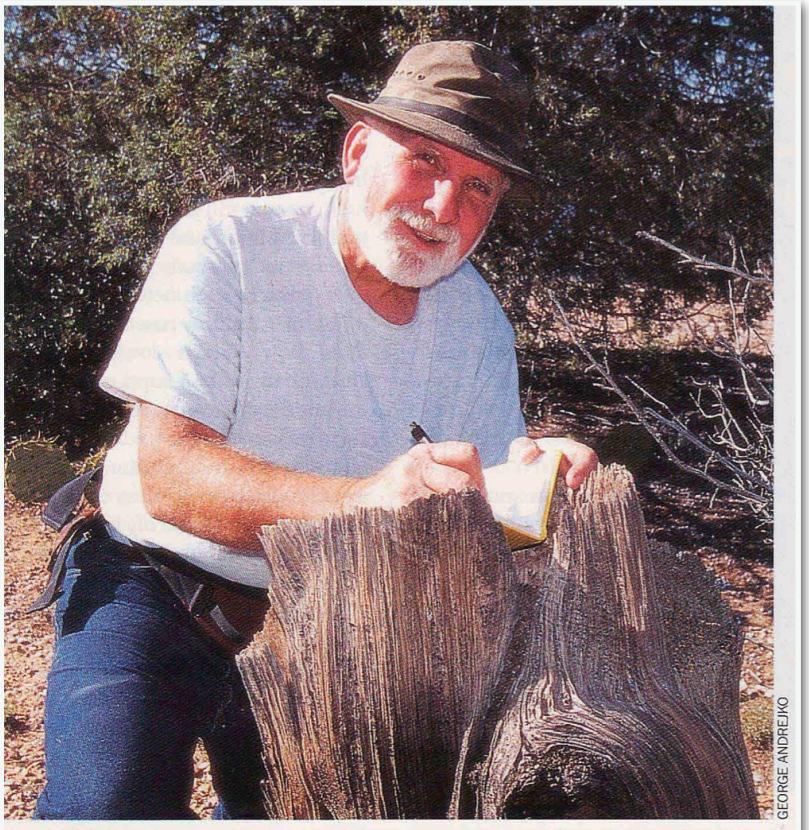
This is a reprint, with the permission of the author, of an article which originally appeared in the January-February 2000 issue of *Wildlife Views*. Photographs from the original article.

The other day, in an uncharacteristic rush of anxiety, Patty asked me if I was beginning to find her boring. We've now hung around each other for 18 years; been married for 16, so I didn't think boring was even an issue. Nevertheless, I tried to reassure her. "Nothing," said I, hoping to be kind, wise, yet masculine, "Nothing or nobody can be boring to someone whose hobby is studying stumps."

I won't describe her reaction, but my words did change her mood. She instantly ceased to care if I was bored with her. Wife psychology isn't my forte. Psychologist or not, the part about stumps is true. Over the past decade, I've developed a fascination for dead trees. If that's not specialized enough, I can narrow it down to one species of juniper. It's called *Juniperus osteosperma* by us sophisticated biologists, Utah juniper by folks who can't remember scientific names, shaggy bark juniper by newcomers who can't tell one juniper from another, and cedar by old-timers who dislike the plant too much to allow it a name of its own.

For this article, it's Utah juniper, or just juniper. Other junipers exist; more than I can name. Several of them have shaggy bark and look a lot like Utah. But here, when I just say juniper, I mean Utah juniper. Now juniper isn't exactly exciting, even when it's alive. It isn't charismatic megafauna, like grizzly bears, or awesome megaflora like redwoods. Here in the Southwest, we call it a tree, but my Idaho friends enjoy noting that our junipers wouldn't make respectable bushes in the big woods of the Northwest. Even some Flagstaff natives raise an eyebrow when I call junipers trees. But I grew up with mesquites and paloverdes, so junipers look like pretty good trees to me. Anyway, exciting or not, the object of my current obsession is junipers. Actually, dead junipers. Actually, stumps of dead junipers. So, why?

I think it's partly due to my basically noncompetitive nature. Hardly anyone else is interested in juniper stumps (hereafter, JS). No turf wars here; no rush to publish for fear of being scooped; no critical attacks from jealous peers trying to destroy my credibility. I can study JS at my leisure. No one cares if I publish my findings in a botanical journal. No one will read them if I do. Such freedom from peer pressure is truly a joy.


GEORGE ANDREJKO

The author, shown above with a *Juniperous osteosperma stumpa,* has found a meaningful retirement occupation in stump studies.

Then there's my advancing age, experience, and wisdom. In my serious days with the Arizona Game and Fish Department, I studied deer, wild turkeys, and mountain lions. I even tried to study bighorns for a while, but that was toward the end of my career, when ennui was exceeding enthusiasm. By then, experience had acquainted me with the steepness of the mountains where sheep live, and I couldn't imagine any new facts worth the climb. Besides, the world was already overloaded with bighorn biologists, all butting heads to establish territories. Sheep biology was a world of publish or perish, and – looking at the competition, the terrain, and the low-level chopper time – perishing seemed eminently more likely than publishing.

So coming into retirement, JS looked pretty good. They gave me a reason to go to the woods, but I didn't have to trail them for hours with hounds or wrestle them out of trees the way we did lions. I didn't have to sit in a cold blind on snowy February mornings the way we did with turkeys. And I didn't have to endlessly pursue will-o-the-wisp radio pulses in hope of learning where JS go, what they eat, or how successfully they reproduce. I could just walk out and look at them. They aren't afraid. They don't try to hide. They just sit there, like a stump. I could even join them. Or lean against them for a nap. They are truly a companionable research subject.

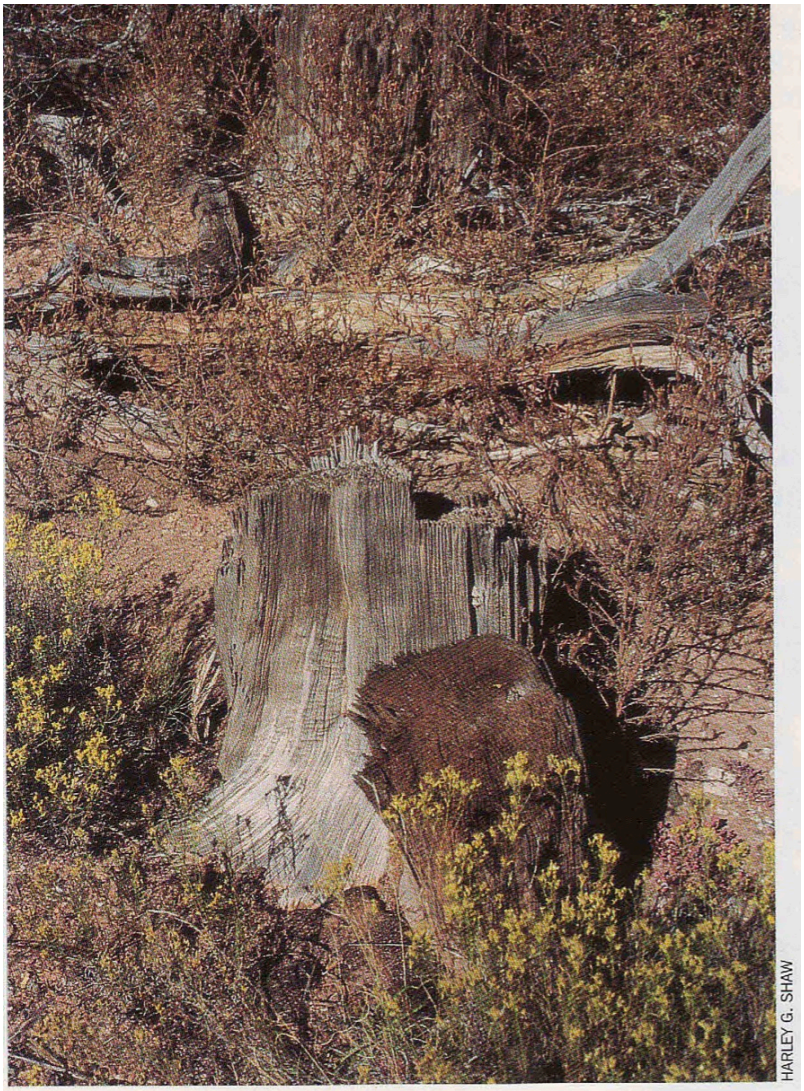
I can plot the home range of a JS instantly. One point on a map does the job. If I need to mark a JS for future identification, a small nail and a metal tag does it. No expensive

radio-collars. And, as stumps, they're long-past eating or pollinating. They just sit there, placidly rotting, giving their nutrients back to the soil. They are benevolent souls.

Of course, some obnoxiously practical body is bound to ask what JS research is good for (meaning value to people). So let me say up front that what I'm doing is pure research – in the sense that the results are likely to amount to purely zero. I consider studying stumps akin to Thoreau's chosen occupation of watching snowstorms; I'd do it whether it had value or not. In fact, I consider lack of value to people an asset. In our consumption-driven society, only things with no value to humans are likely to persist. With luck, no one will find a use for juniper stumps, and my studies will remain undisturbed.

In spite of such newly acquired detachment in my research, a few facts about JS have slowly seeped through my hide. I suppose it's inevitable. JS, as it turns out, are the archivists of the mid-elevation landscapes – the recorders of woodland history. Unless consumed at some point by a truly hot fire, they endure indefinitely, holding tenaciously onto their scars – the marks of burns, axes, saws. Or they may fail to exhibit any of these, and this, too, is important to a watcher of stumps. Such remnants tell much of how and when stands of trees died and what has happened in the woods since. JS record past natural events such as drought, fire, flood, and erosion. They record human activities such as fence building and fire wooding. And they speak to the needs of living junipers, as well.

So, in spite of my efforts to maximize leisure and minimize thought, JS piqued my curiosity, and I began to gather data – that is, to measure or count something. Biologists can't look at anything, even JS, without classifying and counting. It's a habit, such that I've begrudgingly allowed my JS notebooks to accumulate numbers. In the case of JS, though, the exercise is fairly safe because it doesn't yield new truths – no vital bits of information deemed noteworthy by the press or threatening to corporate CEOs, politicians, fundamentalist preachers, or litigious greens. What I've found, however, is pleasantly interesting to me, so I'm pleased to present it here.


HARLEY G. SHAW

Juniper stumps are not only the archivists of Arizona's mid-elevation landscapes, they also make companionable research subjects, according to the author.

Over the past two years, I've classified some 228 juniper stumps (some with trees still attached) across much of the upper Verde River watershed. I intentionally stayed out of the areas where juniper has been chained or pushed by the Forest Service, looking only at dead trees within relatively dense woodlands. There, more than half the dead junipers show no sign of fire, ax, or saw. You might say they died of natural causes – old age, disease, drought; I mainly suspect drought.

About a fourth of the stumps, however, were created by humans wielding axes, suggesting that the heaviest cutting of juniper in my area occurred before World War II. I've seen little sign that hand crosscuts were used for cutting firewood or fence posts, so, until chain saws became common, axes were the tool of choice. Before the war, a German inventor named Stihl held virtually all the patents on light-weight (relatively speaking) chain saws, so one-man power saws were uncommon in North American woodlands. When World War II broke out, German patents in the U.S. were negated, freeing American companies to exploit the German designs. These companies took a while after the war to get into production, so chain saws weren't used much before the 1950s. For the first half of this century, most juniper was cut with axes.

Many of the ax-cut junipers I inspected were probably harvested before 1920 (many before 1900). The wood was hauled to railheads by wagons or burros, then shipped via rail to



Woodcutters near Hillsboro, New Mexico, ca. 1900. Photograph was not in the original article.

mines at Jerome, Crown King, etc., or to settlements like Prescott. Some was hauled as far as Phoenix and Los Angeles. Tom Perkins, of Perkinsville, tells of seeing solitary burros laden with firewood trotting between Perkinsville and Jerome. The Jerome-based woodcutters would lead their burros to remote woodcutting camps, then, when a burro was fully loaded, release it to trot home on its own. The cutter's wife and children unloaded the wood at the other end of the trip and fed and corralled the burros. The cutter came home when he ran out of burros.

The third highest category of dead junipers in my counts were those cut by chain saws, presumably after 1950. These, too, were cut for firewood, with fence posts coming second. Juniper fencing is used less now, but firewood is still an important forest product. Of course, now it is loaded into four-wheel-drive pickups, and the woodcutters spend their nights at home. Woodcutting on national forests is closely regulated and often used to clear juniper stands, thereby enhancing growth of grasses and shrubs.

I'm astonished, on trekking through the upper Verde woodlands, that dense stands of juniper still exist. From settlement times on, the woodlands have obviously provided large volumes of firewood and fence posts. They've been pushed by bulldozers, toppled by chains dragged between bulldozers, cut en masse and left to lay, killed by herbicides, and burned. Yet old photographs and early journals told us that, before the arrival of Anglos, juniper wasn't as dense in many places as it is now. Why?

Range scientists, ranchers, and foresters still speculate on causes, but current consensus attributes increased juniper densities to two main factors: livestock grazing early in this century reduced the competition from grasses; and land management policies protected woodlands from fire. Grazing, in fact, can itself double as a form of fire protection by preventing accumulation of dry herbaceous growth. With reduced fire frequency in grasslands, survival of juniper seedlings presumably increases. Once established in an area, junipers screen out sunlight, suck up water, and prevent reestablishment of grasses. Long-lived woodlands then become permanent, decreasing habitat for grassland wildlife, such as pronghorn, harriers, and larks; perhaps increasing habitat for deer, javelina, pinyon jays, solitaires, and certain bats. In Arizona, we are converting our remaining grasslands to subdivisions, and grassland wildlife species are declining. Hence, management efforts to favor prairie over woodland are probably justified.

If all this is known, why do I meddle with JS? I guess it stems from my skeptical nature. Anytime I repeatedly hear a complex story, such as the one above about grazing and fire effects on junipers, I look for the story's factual basis. Where did it originate? Who validated its truth? How? When? Is it well-documented? Or is it simply a "myth agreed upon" as so often occurs with history? Has anyone ever really questioned the story? Or has it gone unchallenged and embedded in our land management lore merely because it seems reasonable.

For that matter, how much has juniper actually increased? All my life, I had heard that juniper invaded grasslands, but had found no one who could

actually describe conditions as they were 150 years ago, before Anglos and their cattle displaced the Native Americans. So I decided to do some snooping on my own, using inexpensive and technologically simple tools. I compared early photographs with current conditions at the same locations; and I read, on-site, landscape descriptions in early diaries, journals, and reports. Needless to say, pre-settlement photos of the woodlands are scarce. Cameras were extremely cumbersome 150 years ago and northern Arizona's junipers about as far from civilization as one could get. Also, juniper landscapes didn't arouse the aesthetic senses of the few early photographers who passed through northern Arizona. They preferred to shoot grandiose mountains and big canyons.

Journals and diaries are available, but seldom provide much detail. To envision the vegetation as they saw it, one has to read between the diarists' lines. All of the pre-settlement writings come from the period between 1829, when the Taos trappers first traveled up the Verde, and about 1871, when ranchers finally felt safe to occupy remote areas. The trappers didn't write much, so good landscape descriptions had to await 1851, when Army topographical engineers passed through the woodlands. What we really see, then, is an inadequate glimpse through a very short window of time. In an undisturbed wild landscape, usually not much happens in 20 years.

So, we have no way to clearly envision grasslands and woodlands earlier than about 1850. Descriptions simply don't exist. And, for that matter, the landscapes that explorers described in the 1850s may have been quite different 50, 100, or 200 years earlier. As a result, "pre-settlement conditions" means what things looked like when someone arrived on the scene who was literate enough to write about or, rarely, skilled enough to photograph them.

Historical accounts must therefore be used with caution.

With such caveats in mind, I began by reshooting any old photos I could find and reading old diaries and reports at the sites they described. My efforts ultimately led me to accept the notion that juniper is denser over much of the area than it was in 1850. However, some fairly large areas held dense stands of juniper even then, and distribution of juniper probably hasn't changed all that much. It has just filled in openings within its 1850's range. The landscape has certainly changed, but perhaps not as drastically as some folks think.



GEORGE ANDREJKO

Juniper remnants tell much of how and when stands of trees died and what has transpired since.

While rambling over the juniper-covered hillsides, repeating antique photos and reading old journals, I was struck by the scarcity of evidence of fire. I began to wonder if it truly had been important in holding juniper out of the grasslands. This is when I began to look more closely at stumps, thinking that they, perhaps, would confirm the importance of fire. Instead, the deadwood told an unexpected story that I found fascinating.

To force myself to look closer, I used a standard field scientist's ploy. I and a fellow skeptic (who prefers anonymity) selected randomly 35 sites scattered over much of the upper Verde River watershed. We used these sites as destinations for our wanderings through the winter of 1998, and on them we counted and classified JS. We found evidence of fire, but mostly in two kinds of places. One was along the rims of mesas or on high points of hills, where lightning consistently struck (no surprise). These locations invariably held scattered individual or small clusters of burned trees in a limited area displaying no evidence that the lightning-caused fires had spread.

The other place where we found evidence of fire was much more interesting and more difficult to explain. At some sites, usually on relatively deep, tight soil in grassy areas or in relatively open juniper savannas, we found acreages with burnt, ground-level remnants of very large juniper stumps. These locations appeared to have burned sometime in the distant past, although so far I know of no way to accurately estimate the dates. Fire had gone through the stands of large juniper leaving only a ring of charcoal-marked wood at ground level. When and how had such devastating fires occurred?

While we don't have the "when" worked out, I think we do understand the how. At one of our sample points, we found a stand of large, old, decadent junipers that evidently had been neither cut nor burned since pre-settlement times. These trees were in their last stages of life, and their heavy, spreading limbs were dying at their bases, then breaking and falling to the ground. This pattern of tree death left a massive rosette of dead wood around the dying stump. The process had been occurring throughout the stand, and over a decade or two had created an accumulation of dry juniper wood on the ground that was interconnected in a network of potential fuel which, if ignited, would become an inferno. Here, then, was a situation that left large ground-level stumps surrounded by wood ready to burn. Once started, fire would destroy everything but the woody stumps.

This, I think, is the natural fate of any juniper stand that grows through maturity and into decadence. The result is a periodically scorched landscape where plant growth must start anew. Cryptogamic plant crusts (lichens and mosses) first cover the scorched soil surface, then make way for grasses and weeds. Later, after a grassland has again developed, periodic, low-intensity fires might kill any young junipers. Only after decades will juniper seeds, spread by coyotes, foxes, sheet flooding, and birds, be stimulated by a suitably wet winter and germinate. If no grassland fires follow germination, the junipers may become established. Grazing, which removes dry herbaceous fuel for ground fires, or human prevention of grassland fires might help the juniper seedlings to persist. Whatever the case, given time, the woody vegetation returns over portions of the range, centuries later becoming the dense, decadent form that could fuel another conflagration.

This scenario seems to make sense, but I have seen many large, obviously very old junipers of a growth form that would not lead to such a heavy accumulation of fuel. In some places Utah junipers have large, single trunks and treelike boles starting well above the ground, more like fruit trees. These trees die with single standing stumps and only a few smaller limbs on the ground. What creates this difference in form?

At least part of the answer came fairly easily. As I looked closer, I realized that most of the single-trunk junipers grew in areas of disturbance: holding pastures surrounding ranches, fenced areas around stock tanks, old sheep bedding grounds. These single trunks, then, were the result of early pruning of the lateral lower limbs of the trees, possibly a result of browsing when the trees were young or of actual physical damage by livestock rubbing against the central stem of adolescent junipers.

Without such early pruning, the Utah juniper typically develops into a sapling with a relatively dominant single stem. It retains this stem over a few decades as the tree grows through the"Christmas tree" form and begins to grow outward instead of up. As the trees reach maximum height, the older lateral limbs near the ground begin to enlarge, and ultimately reach a size equaling or exceeding the central stem. The central stem may, in fact, die away, leaving the relatively round, flat-topped bole reaching to the ground that is common in most juniper stands. If this "normal" growth form survives to decadence, all the while producing seed and filling in the woodland interstices with young trees, the dense, decadent woodland ready for a conflagration ultimately develops.

So where has all this led? Perhaps nowhere beyond my own enjoyment of discovery and understanding. What good is it? Maybe none, but that's okay. Frankly, I'd just as soon not have more people nosing around the woodlands, anyway; and I'm certainly not going to promote any practical uses of my "discoveries." My pleasure lies in studying something just because I find it interesting. If no one else cares, so much the better. I won't be harassed by competition. If juniper suddenly becomes popular for research, or worse yet, an important forest resource, I'll simply move on – I hate a crowded field. Other insignificant things are out there to study. For example, mud. Mud's not well-understood in the dry Southwest. No one pays much attention to it unless they get their pickup stuck. So if the day comes that a lot of other folks start trying to be smarter'n stumps, maybe I'll shift over to being prettier'n mud. Shouldn't be hard, should it?

Arizona's Arboreal Alligator

by Harley G. Shaw

This is a reprint, with the permission of the author, of an article which originally appeared in the September 1974 issue of *Outdoor Arizona*. The original photographs in the article have been replaced with an image from the Black Range.

I've heard of alligators swimming in the Colorado River, but have never confirmed the reports to my own satisfaction. Maybe I've never talked to the right people. For now, at least, I'll leave such rumors in the same category as those regarding crocodiles in the New York City sewers.

All rumors aside, however, our state is blessed with a multitude of grandiose old "alligators", as they're called by many. They occur on the warmer slopes of our ponderosa pine forests and the cooler portions of the pinyon-juniper woodlands. Obviously since grandiose hardly apples to a large, ugly amphibian from the Everglades, the subject at hand is a tree - the alligator-barked juniper.

The alligator is only one of several juniper species that grow throughout the western United States. Arizona doesn't have a monopoly on alligators; it does, however, have the largest forest of this species of any of the states. Alligators also grow across New Mexico and into western Texas, where they are known as Texas cedar.

Alligator-barked junipers get their name from the rough, square-checked bark which resembles alligator hide. Old-timers in Arizona usually refer to it as simply juniper or alligator juniper, to differentiate it from the various other juniper species. The other species are generally called cedar. The rough bark of alligators is



Alligator Juniper Bark from a tree along Forest Trail 796, Kingston to Emory Pass, Black Range, New Mexico.

only one of many characteristics which make it an interesting tree.

A large old alligator can be from four to six feet in diameter at the base and grow to over 60 feet in height. This does not place it among the giants of tree-dom, but the scraggly growth form and sheer hulk of mature alligators make them seem larger and older than they really are. I rather suspect that the alligator is the kind of tree our long-tailed, tree-climbing ancestors might have called home.

This feeling of home, in fact, might be what attracted me to the old trees in the first place. Even before I was old enough to single out various species and identify plants by their names, the alligator juniper impressed me. I was desert reared, and the cacti and mesquites, which are unique to non-Arizonans, were simply backyard weeds in my young eyes. When I began to accompany my parents on deer hunts in the higher country around Mayer, the tree that stood out in the forest was the alligator juniper. As I began to hunt on my own, I invariably selected an old juniper for a deer stand or simply for a midday break. The best camps I can remember were those built under a spreading old check-barked tree. With my bedroll under such a tree, I always felt protected. I guess that long-tailed ancestor is nearer to the surface in some of us than we might like to admit.

In later years, I've learned that my instinctive choice of old alligators for deer stands was not bad strategy. Probably no tree species receives more use by deer and elk in our state for fall and winter bedding sites.

After the big snow of 1967-68, near Flagstaff, scraggly old alligators could be spotted from the air by the wheel-spoke pattern of animal tracks leading to and from them. Deer, elk, antelope, and cattle all used the old trees for protection and emergency rations during this period of stress. The main losses of antelope occurred only in areas where they were driven to lower elevations and away from the protective juniper cover. During years when snow is deep or when crops, such as acorns or pinyon nuts, fail, juniper berries are used extensively by wild turkeys. The larger alligators are used as roost trees when severe weather forces turkeys below their normal winter range.

Even after the snow melts, the alligator offers a fringe benefit. Some of the first green grasses of spring will usually appear under the larger, more isolated old junipers. This feed, though limited in amount, is a welcome treat for foraging animals coming out of a hard winter.

Of course, the values of juniper from the human standpoint are not all positive. Like any tree species, when juniper grows in dense, closed stands, it prevents the smaller grasses, forbs, and shrubs from growing. These, too, are important food for livestock and wildlife. Considerable time and money have been spent by land management interests in Arizona to thin or clear dense juniper stands, alligator juniper included. Even in control programs, however, the alligator offers unique problems. It is the only juniper species in Arizona which will sprout from a cut or burned stump. Young alligators cut to ground level return to their original size and density in 10-12 years. Measures must be take to ensure against this where complete clearing of juniper stands is desired.

By and large, though, the benefits of alligator-barked juniper, except in exceedingly dense stands, outweigh its negative values. Dead, standing juniper offers some of the finest firewood to be cut. It splits easily and burns with a lively flame. It has just enough snap, however, to require a good screen in front of the fireplace. Limited use of its red, cedar-like wood has been made in small speciality items such as jewelry boxes. Its essential oils have been extracted under the name of Texas Cedar Oil for use in perfumes, patent medicines, etc. "Cedar" fence posts, including those made of alligator juniper, have been known to last as long as 80 years. Juniper is the only native wood which withstands the ravages of Arizona's dehydration and termites underground without special treatment.

All in all, then, the alligator is an asset to our wildlands. It, along with other juniper species, may overpopulate at times. Proper management of the species involves use of man-made substitutes for nature's clearing agent, fire. With such management, large well-spaced old alligators provide both food and shelter for a variety of wild and domestic animal species.

They also frequently serve to satisfy the atavistic urges of at least one lazy wildlife biologist in search of a suitable "nest" for a midday nap on a warm spring day.

The Junipers of the Black Range and Nearby Areas

Here we use the Plants of the Gila Wilderness website as our primary reference source but also rely heavily on *Junipers of the World: The Genus Juniperus, 4th Edition*, Robert P. Adams. This is a go-to source for those who are interested in this topic.

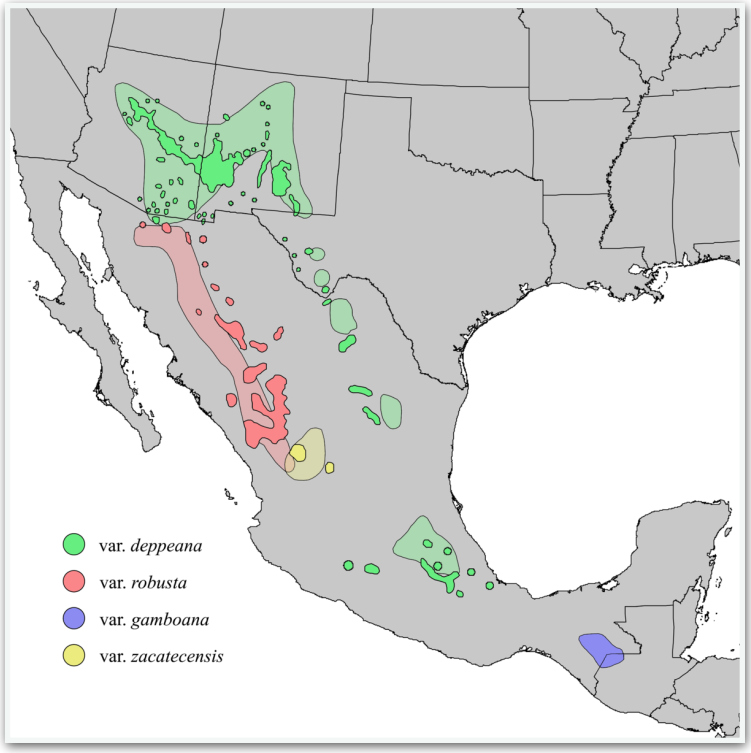
The Juniper species listed at Vascular Plants are:

- ***Juniperus arizonica*, Roseberry Juniper. It is probably not found in the Black Range, but is found west and south of Silver City (Bill Evans Lake, Burro Mountains, etc.). It is distinguished from *Juniperus monosperma* (One-seeded Juniper) by having pink vs. purple berries. It also has more resin on its leaves than does One-seeded Juniper (Adams, pp. 80 - 81);**
- ***Juniperus communis var . depressa*, Spreading (or Dwarf) Juniper. This species is found in Rocky Canyon on the west side of the Black Range. See Adams pp. 116-140 for an extended summary of this species and pp. 129-130 for a description of this variety. Adams characterizes the Rocky Canyon population as "outlying". Major population is well to the north;**
- ***Juniperus deppeana*, Alligator Juniper. This is one of the two dominant juniper species found in the Black Range. The nominate variety is found here. See Adams pp. 154-168 for an extended discussion of this species and pp. 157-158 for a discussion of the nominate form. See also other articles in this issue;**
- ***Juniperus monosperma*, One Seeded Juniper. This is the other dominant juniper species found in the Black Range. See Adams pp. 222-224 and a later article in this issue for a more detailed description of this species;**
- ***Juniperus osteosperma*, Utah Juniper. This species is not found in the Black Range but is found in the northwestern part of the Gila. See Adams pp. 237-238 for a description; and**
- ***Juniperus scopulorum*, Rocky Mountain Juniper. This species is found in the central part of the Gila National Forest, including at Lake Roberts and in the Pinos Altos Range. There are unconfirmed reports that this species may be found in the Black Range. See Adams pp. 280-282 for a detailed description.**

The Natural History and Range of the Alligator Juniper

***Juniperus deppeana and its varieties form a discontinuous ring in the mountains above 2000 m (occasionally down to 1500 m) around the Chihuahuan desert in the southwestern US and Mexico, thence at 1600 - 2200 m in the mountains in the very southern-most part of Mexico and northern Guatemala. Wells (1966 - see below), using data from rat middens from the Big Bend Texas region, concluded that during the Wisconsin (70,000 - 13,000 ybp) life zones descended about 800 m enabling the formation of pinyon-juniper in the present Chihuahuan desert between the Big Bend Region of Trans-Pecos, Texas and the city of Del Rio. Even if the effects of glaciation were mediated southward into Mexico so that life zones descended only a few hundred meters in Hidalgo, it appears that all of the now disjunct populations (varieties) of J. deppeana were connected in a continuous ring of distribution around the Chihuahuan desert (perhaps with islands of J. deppeana within the ring). The recently described J. d. f. elongata (Adams & Nguyen, 2005) grows as scattered trees in the Davis Mountains of Trans-Pecos, Texas.* (Adams & Schwarzbach, pp. 230-231)**

Wells found that "*Eight Pleistocene wood rat middens at elevations of 1200, 880, and 600 meters in the Chihuahuan Desert contain abundant macrofossils of pinyon pine, juniper, shrubby live oak, and Opuntia, together with smaller quantities of Agave lechuguilla and other xerophytes of existing desert vegetation, which indicate a xerophilous woodland vegetation in* the lowlands, as much as 800 meters below existing woodland, during the



From "Infraspecific Adjustments in Juniperus deppeana", Robert Adams and Andrea Schwarzbach, *Phytologia*, December 2006, pp. 227-232

Wisconsin pluvial." (Wells, Philip V., "Late Pleistocene Vegetation and Degree of Pluvial Climate Change in the Chihuahuan Desert", *Science*, Vol. 153, Issue 3739, August 26, 1966, pp. 970-97.)

The middens in question were dated from 40,000+ to 11,650 years before present.

Evidence of *Juniperus deppeana* was found only at the highest midden site, which is assumed to have been both cooler and wetter than the other sites. The juniper species most studied by Wells was *Juniperus pinchotii* (which is not found in our area). However, the general finding of species growing at elevations up to 800 meters (2400') lower than they do now is significant. This, in itself, may explain the relict stands of many species which now exist in the mountains of our area and the extended range of *Juniperus deppeana* depicted on the map on the preceding page. See, for example, our discussion of the relict Arizona Cypress stands north of Cookes Peak (July 2022 issue of this journal).





Alligator Junipers in the Black Range.
Above: Along the trail from the Kingston Cemetery to Emory Pass.
Left: Trail 135 on the east slope.

Wells posits that the shift of vegetation to lower (and drier) elevations may have resulted in evolutionary changes. He cites the change in Pinyon Pine from three to two needle species.

"The pluvial expansion of the woodland zone revealed by the wood rat midden record documents a former continuity across the intervening lowlands for existing disjunct stands of pinyon-juniper-oak woodland on the numerous isolated high mountains of the Chihuahuan Desert region; but the indicated downward displacement of 800 m leaves little or no room for the existing, treeless, desert shrub community and implies the absence of desert climate throughout the extensive Chihuahuan Desert

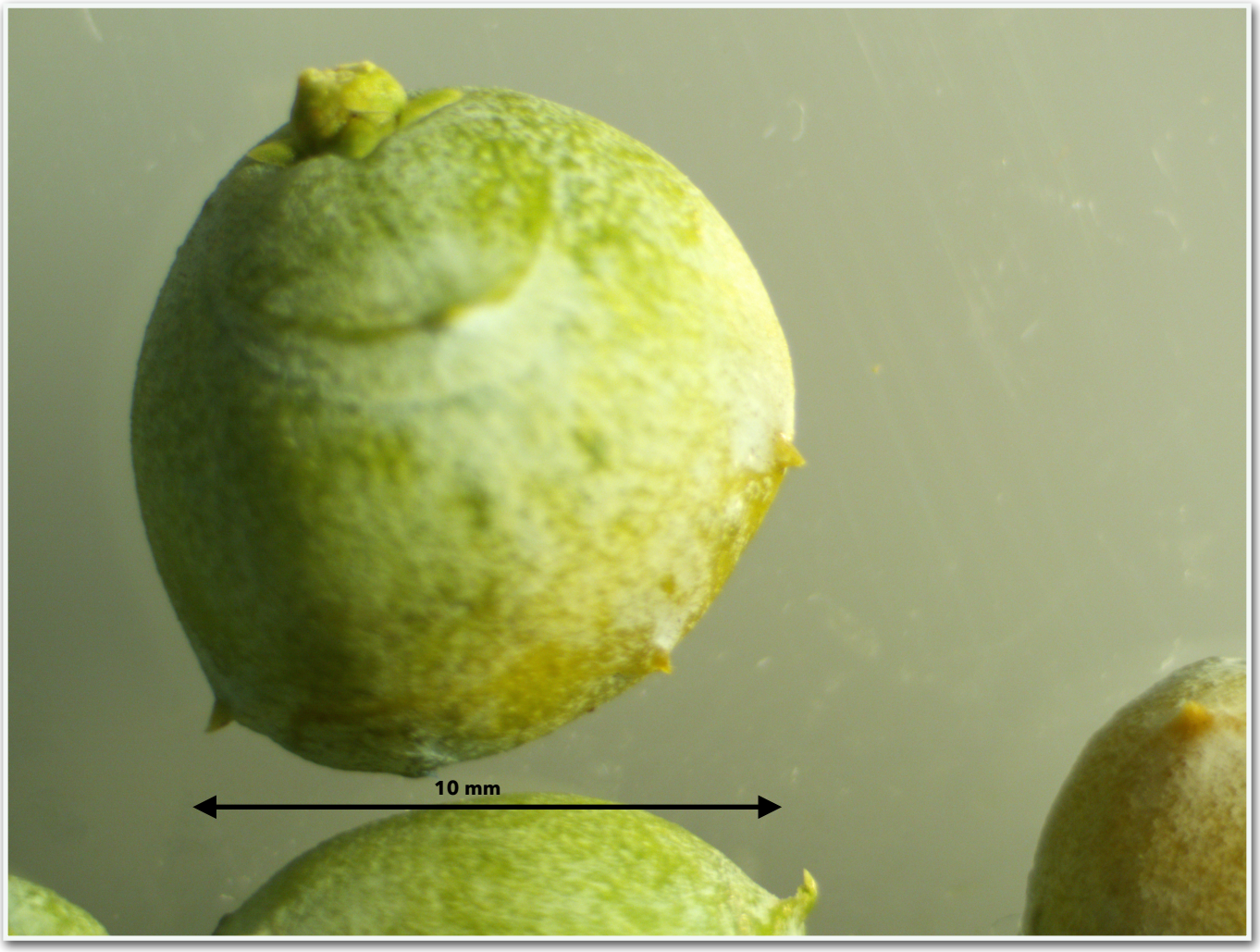


The leaves of *J. d. deppeana* are scalelike and exude resin (which may be clear, yellow, or white) from ruptured glands. The photographs here were taken along FR 157 (North Percha Road) on the east side of the Black Range.

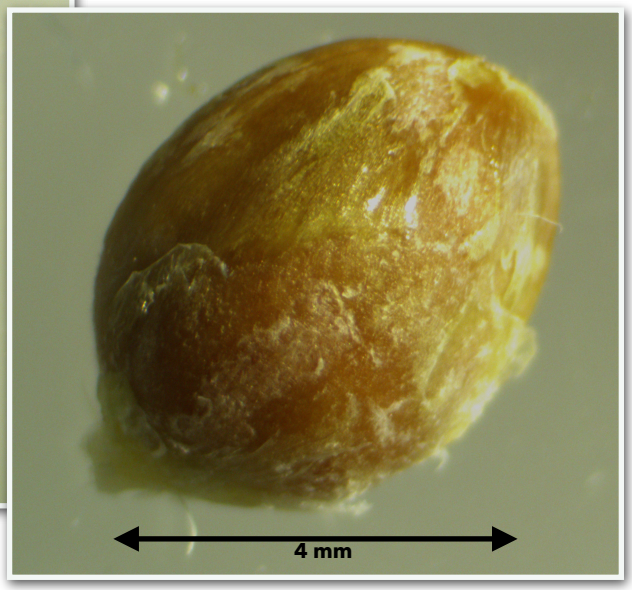
province during the pluvial correlated with the Wisconsin glaciation." (Wells, p. 971)

The Alligator Juniper is a mesophyte (they need a good supply of water but do not do well in either very dry or very wet conditions). Alligator Juniper is prone to temperature stress as well. This species may be in for a rough time as the global temperature increases and the prolonged drought in the Southwest continues. Note that the Arizona Cypress is also a mesophyte.

"Since the pluvial climate during the glacial maximum of Wisconsin time evidently permitted only the xerophilous woodland zone to attain continuity across the extensive lowlands of the Chihuahuan Desert province, there is a suggestion that the presently disjunct, relatively mesophytic, montane vegetation zones on isolated peaks have been







Alligator Juniper berry (cone), broken to show arrangement of seeds, and individual seed.

discontinuous since Tertiary time. Indeed, it is quite likely that many mesophytic species have never had a continuous distribution across the intervening lowlands." (Wells, p. 974)

"Since long distance transport of propagules must account for many anomalous features of geographic distribution on oceanic islands throughout the world, it seems appropriate to consider that this mechanism has been operative in the stocking of islands of mesic environment on isolated high mountain peaks of the Chihuahuan Desert province, with mesophytic plants unable to grow in the surrounding lowlands, even during pluvial climatic phases of the Pleistocene." (Wells, 974) If you have a particular interest in this point and wish to read a discussion on the role of Band-tailed Pigeons in this process (and in particular the fact that their crops do not secrete gastric juice, which would diminish the germination rate of some seed types), see footnote 18, Wells, p. 975.



The range of the Alligator Juniper was more geographically extensive in the past and within that range it grew at lower elevations than in its present range. However, it may never have had a continuous range but existed, rather, within a discrete elevational range on the sky islands of the American Southwest and the mountains of Mexico.



Alligator Juniper berries and leaves along North Percha Road (FR 157) on the east slope of the Black Range.

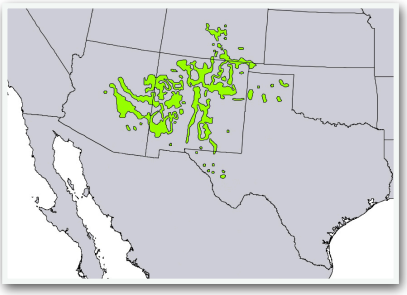
The taxonomy of this species is in dispute and extends to determinations of varieties and forms. In whatever scheme you select, however, it is the nominate *J. d. var. deppeana* which is found in the Black Range. Not all of the varieties exhibit the checkerboard bark pattern of the nominate variety.

This species sometimes grows in a multiple trunk form. The berries of this species have from two to six seeds (see photographs on this and the preceding page). Each leaf of this species has a transparent or yellowish bit of resin on it.

The Natural History and Range of the One-seeded Juniper

The One-seeded Juniper is the other common juniper of the Black Range. It can be readily separated from the Alligator Juniper by bark, berry color, number of seeds per berry, and foliage color. (Additional photos.)

Juniperus monosperma, One-seeded Juniper, is a species of New Mexico, although we share it with Arizona, Colorado, Oklahoma, and Texas. The map below is from "Atlas of United States Trees" by Elbert L. Little, Jr.



Over the years, the One-seeded Juniper has been known by several synonyms, including; *J. occidentalis var. monosperma, J. californica var. monosperma, J. occidentalis var. gymnocarpa, J. mexicana var. monosperma, J. gymnocarpa,* and *Sabina monosperma*. Even from this short list it is easy to parse the importance of the fact that each berry has only one seed, in the identification of this species.



Both of the juniper species commonly found in the Black Range can be found in the Piñon-Juniper (with a touch of Ponderosa Pine) woodlands which girdle the range.

The seed of this species is fairly big and there is not a large amount of flesh surrounding it in the berry. As noted earlier, the berries would be pinker if this were Arizona Roseberry Juniper, *Juniperus arizonica*, and the leaves would have more resin on them.

The One-seeded Juniper is more likely to branch closer to the ground than is the Alligator Juniper. Many times the tree will be multi-stemmed, giving the plant a more "shrub-like" rather than "tree-like" form. One-seeded Junipers can grow to thirty-six feet, however, and their trunks can be quite massive (see bottom photo on the following page).

In the past some members of this genus were considered a separate species, *J. gymnocarpa*. These plants had berries (cones) with the seed apex exposed. Subsequently, it was recognized that this characteristic was caused by insect damage to the developing cones. Seeds which have been damaged in this manner are sterile. Seeds are often dispersed by birds. The berries (properly cones) are produced by females while the males form pollen cones (photo right). Pollen is typically wind-dispersed.





Above: Berries (cones) and leaves of One-seeded Juniper, North Percha Road (FR 157) east slope of the Black Range.
Below: Bark and trunk of One-seeded Juniper, Forest Trail 135, Black Range, New Mexico.







One-seeded Juniper berries, showing one seed extruded, and seed. Note ridges on seed below.



Additional Resource

The Ecology, History, Ecohydrology, and Management of Pinyon and Juniper Woodlands in the Great Basin and Northern Colorado Plateau of the Western United States, Miller et al., General Technical Report RMRS-GTR-403, December 2019

Phoradendron juniperinum, Juniper Mistletoe

The Juniper Mistletoe parasitizes many juniper species, including the One-seeded Juniper. It is hemiparasitic; it has chlorophyll and can perform photosynthesis and produce some energy for itself. For more information about mistletoes see Mistletoes Pathology Systematics Ecology and Management. Photographs on this page are from the east slope of the Black Range.







Damselflies of the Black Range

James Von Loh documents the natural history of three species of spreadwing - the Great Spreadwing, the California Spreadwing, and the Plateau Spreadwing - in the following article. The Great Spreadwing and the Plateau Spreadwing have been documented at the City of Rocks State Park and the Great Spreadwing is documented from Hillsboro. The California Spreadwing has been found no closer than Radium Springs. In fact, there are only 2 sightings (one which is described in the following article) for New Mexico in the iNaturalist/Odonata Central databases.

Representative Damselflies of Doña Ana County, New Mexico - Part I - The Spreadwing Family; Lestidae

by James Von Loh

The discussions of damselflies, members of the taxonomic order Odonata, are prepared herein under their respective taxonomic families. Images to support each species' identification, observed behaviors, and representative habitat were collected from Doña Ana County (by the author unless otherwise credited) from 2019-2022. Habitats particularly attractive to damselflies include the Rio Grande (primarily west of Las Cruces and Mesilla) and its associated irrigation/wastewater return canals, natural springs and seeps along the west-facing slopes and canyons of the Organ Mountains, and monsoon rain season (July-September) temporarily-filled ponds, waterfalls, and intermittently-flowing drainages.

Represented are winged immature (if encountered) and adults, behavior types as defined in *Dragonflies and Damselflies of the West* (Dennis Paulson, 2009), and when possible, instances of predation by these predatory insects and instances of their becoming prey for other predatory wildlife species. Because species of damselflies have an aquatic larval stage I rarely observe or can photo-document, each discussion, by design, is incomplete. Damselfly morphology, anatomy, and/or behaviors that may be illustrated within these family/species discussions were presented and defined in Paulson (2009), as follows: Perching; Sleeping; Flight; Vision; Feeding; Predators and Predator Defense; Sexual Patrol; Courtship and Mating; Egg Laying and Hatching; Larval Life History; and Metamorphosis and Emergence.

Spreadwings include the largest damselfly species within NM, and their morphology presents a challenge to photograph, e.g., bring into focus and photograph in crisp detail due to length, width, depth, color, and behavior elements. Additionally, long wings are often held open at ~75 degrees while the even longer abdomen is typically inclined downward, at an angle.

Great Spreadwing *Archilestes grandis* Rambur, 1842

In Dona Ana County, my encounters with Great Spreadwings (GSw) to date occurred in mid fall of 2021 and mid to late fall of 2022, while I investigated riparian and wetland habitat supported by perennial flow within the Rio Grande.

GSw use riparian, wetland, and upland habitats from Arizona, New Mexico, and adjacent Texas; north to northeast into the central U.S., to New England; and south to Georgia (three isolated populations occur in two coastal areas and the Central Valley of California) (Paulson 2009). They also range south through Mexico and Central America to Venezuela. My observations include a few GSw (<5; 30 September 2022) in Pueblo, CO in addition to local sightings discussed in detail herein.

GSw are considered to be the largest North American damselfly. (I believe their size is equalled by locally-observed California Spreadwings [*Archilestes californicus* McLachlan, 1895]). They typically use streams with wooded riparian/bank vegetation types/communities, their flight season ranges from May to October (Paulson 2009), and I have observed a few (<15) along the Rio Grande during late October and early November.

In Dona Ana County during the fall seasons in 2021 (05 November) and 2022 (21 October to 08 November), I observed GSw using Rio Grande habitats where there is perennial flow via the City of Las Cruces, Jacob H. Hands Wastewater Treatment Facility (JHH) lined canal. This reliable surface-water source supports linear stands of coyote (sandbar, narrow-leaf) willow (*Salix exigua* Nutt.) tall shrubs, tamarisk (saltcedar) (*Tamarix ramosissima* Ledeb.) small trees, and reaches characterized by linear,



Treated wastewater discharge outlet from the JHH to the Rio Grande channel (22 November 2022). The watercourse is a gathering place for several species of resident and migratory waterfowl, other insectivorous birds, and species of aquatic arthropods, fish, amphibians, and turtles along its length. Undoubtedly, a portion of their winter diet includes damselfly larvae.

dense, water speedwell (*Veronica anagallis-aquatica* L.) herbaceous wetland plant communities.

Projected release volume of treated, disinfected wastewater from JHH in 2025 (estimated for a population of ~151,000) is ~13.0 million gallons per day or ~4.75 billion gallons per year (Utilities Department; City of Las Cruces, New Mexico: Final Water and Wastewater System Master Plan Update). Discharge into the Rio Grande channel occurs ~150m north of I-10 and surface flow extends south to the Calle del Norte bridge (NM-359).

Documented herein, GSw hunted, sunned, and displayed to attract mates from perches on branches extending over the flowing stream and on twigs protruding from the embankment adjacent to the stream. It is important for GSw to use branches overarching the water because females deposit eggs into branch tissue by piercing the bark, and upon hatching, the larvae drop directly into the water (Paulson 2009). GSw mate when females are grabbed/seized by males, joined in tandem linkage, copulate in a mating wheel configuration, then spend up to 18 hours in tandem linkage while ovipositing in leaf petioles or stems/branches of plants/ shrubs (sometimes well above water) (Paulson 2009).

I also observed/photo-documented (06 November 2022) an interspecies pairing of river spreadwings. A female GSw had been grabbed/seized and joined in tandem linkage with a male California Spreadwing (*Archilestes californicus* McLachlan, 1895). Representative images and discussion of this interaction are presented herein.



Common sunflowers, to 3m tall, provided GSw perching, sunning, and/or hunting sites at the Pueblo, CO linear wetland.



My earliest GSw observed along the Rio Grande arrived on 22 October 2022. This individual male perched on a small twig protruding from the riverbank where it patrolled a small habitat area, defended it from other damsel- and dragonflies, sunned, hunted, and displayed to attract a potential mate (see displaying behavior later in this article).



A representative GSw male perched on and hunting from a common sunflower (*Helianthus annuus* L.) petiole near a small, wetland drainage in Pueblo, CO (~510 miles north of Las Cruces) (30 September 2022). This wetland habitat was characterized by dense softstem bulrush *Schoenoplectus tabernaemontani* ((C.C. Gmel.) Palla) and common reed, *Phragmites australis* ((Cav.) Trin. ex Steud.) plant communities established along a narrow drainage.

Right: Representative GSw female perching on a small branch on the Rio Grande bank (06 November 2022) on a sunny, open site to sleep, warm, attract a mate, and/or to hunt for small flying insects. It is common for GSw to hang from the underside of branches while perching, hunting, and/or sleeping.



Below: GSw male head, thorax, legs, wing bases, and first abdominal segment (S1) detail: Note the blue coloration of its eyes, light blue facial postclypeus (jutting portion), brown median stripe (top of thorax), metallic green humeral stripe (upper edge of thorax), and white lateral stripe (lower edge of thorax) that is bordered by blue stripes, and light blue on the ventral side of the abdomen. The remaining areas are predominantly a dark, metallic green-black, which reflects a sheen in sunshine.





GSw female head, thorax, legs, wing bases, and first abdominal segment (S1) detail: Note the grayish-blue over brown eye coloration, light blue facial postclypeus (jutting portion), brown median stripe (top of thorax), blackish humeral stripe (upper edge of thorax), and yellowish-white lateral stripe (lower edge of thorax) that is bordered by blue stripes, and light blue on the ventral side of the abdomen. The remaining areas are predominantly a dark, metallic green-black, which reflects a sheen in sunshine.

Although I have observed only a few GSw in the field, on at least two occasions they have been males that used courtship displays to attract females (as presented on the following page). The courting males arch their abdomen upward and vibrate their extended wings (creating a soft sound like leaves rustling in a breeze). During image examination, they also appeared to display the black-colored stigma cells near the wingtips upward. Their abdomen angle is then rapidly reversed, flexing the tip dramatically downward (this vertical motion flashes the S9 and S10 terminal segments which are white-to-bluish in color [pruinose]). I have also observed damselflies of different species use rapid, downward flexing of the abdomen to discourage the approach of damselflies of other species.



Top Left: On 04 November 2022 this male GSw began a courtship display to attract a female to mate. Its outspread wings vibrated slightly, displayed the black-colored stigma cells upward, and the abdomen was extended in an upward, nearly vertical, arc (note the bluish-colored S9 and S10 abdomen segments).

Left Center: Then the abdomen is rapidly flexed downward as the light-colored tip flashes in the sunlight.

Top Right: Abdomen approaches the horizontal position.

Right Center: Abdomen tip flexes sharply downward from horizontal. This courtship/mate attraction activity may be repeated a few times from the same perch.

Following Page

Following mate capture/selection and mating, pairs of great spreadwings oviposit (deposit eggs) into branch-bark or into leaf/petiole tissue (by making a slit in which to insert an egg) over a 15-minute to 3-hour time period (Paulson 2009). Up to 230 eggs may be deposited by a single female GSw. The pair often remains connected in tandem linkage during oviposition, but the female may oviposit on her own (as documented on the following page). Plant material selected for ovipositing must arc/ extend over open water so that larvae emerging from the eggs can drop into the water to grow and develop.

Top Left: A female GSw (01 November 2022) is preparing to pierce the bark of a seepwillow (a.k.a. mule's fat), *Baccharis salicifolia* (Ruiz & Pav. [Pers.]) tall shrub stem and implant an egg (egg is visible as a white dot at the tip of her abdomen). Note that she seems to provide leverage for the abdomen by positioning her head under a protruding twig.

Left Center (2 photos): This day (01 November 2022) was very windy and a gust causes her to miss the seepwillow stem on her first attempt at ovipositing. Note the white-colored egg and tucked head position. On her next egg implanting attempt (left bottom photo), she uses her back pair of legs for cradle/ support while guiding her abdomen for successful oviposition.









Eggs may be implanted a few inches above the water to the highest recorded deposition height for a damselfly of 44 feet (Paulson 2009). The larvae hatch and fall to the stream, tending to forage from and mature in pools (resembling small fish as they swim).

Below: An adult male GSw occupied the same seepwillow branch with a dragonfly, an adult male Roseate Skimmer (*Orthemis ferruginea* Fabricius 1775). Notable are the differences in size, eye structure, coloration, body morphology/shape, and perching position/style.



Potential Interspecies Mating Event Among Spreadwings

Paulson (2009) states that "courtship behavior in North American damselflies may be exhibited by a few species, but in most species the male just grabs a female (but she still chooses whether or not to mate with him). Further, males of one species will often attempt to mate with females of other species (most females are apparently able to detect, by touch, whether the male that grabs them is their own species)."

On 06 November 2022, I heard wing vibrating/rattling and observed a pair of large, spreadwing damselflies perched on the base of a southern cattail (*Typha domingensis* Pers.) plant in tandem linkage (the male's two cerci were applied to the back of the female's prothorax with the two paraprocts holding it firmly). I acquired several images of the linked pair, a California Spreadwing (CSw) male and a GSw female and included a representative adult male CSw and adult female GSw on the following page.

Left: Representative male CSw and typical color pattern for the Rio Grande population (note the brown-colored stigma cells near the wingtips). In general, CSw individuals were present in higher numbers along the Rio Grande when compared to GSw.

Below: Representative female GSw hanging from a coyote willow twig and typical color pattern for the Rio Grande population (note the black-colored stigma cells near the wingtips).





Following Page (Left Column)

Top: Spreadwing pair, with a CSw adult male (upper left) that has grabbed and tandem-linked with a GSw adult female (lower right). Both are perched at the base of a southern cattail plant on the bank of the Rio Grande (06 November 2022).

Bottom: Image enlarged by cropping to enhance thorax and head color pattern examination between these spreadwing species.

This mixed pair of tandem-linked spreadwings flew out of sight together and I cannot confirm if the attempted mating was abandoned. For mating to be completed would require the pair to join into a copulation/mating wheel to transfer sperm and fertilize eggs.





Latest Observation of GSw Along the Rio Grande on 08 November 2022

Low numbers of individual GSw were observed along the Rio Grande in the first week of November in 2021 and October 21 to November 08 in 2022.

The latest observations of GSw along the Rio Grande (including the adult male presented below) were recorded on 08 November 2022. They were perching in sunny, open sites to attract mates and to hunt for small flying insects.





This representative Rio Grande habitat of tamarisk, seepwillow, and adjacent coyote willow shrubs, with branches overarching the water, attracted both Great and California Spreadwing species. Seepwillow branches were used by females of both species to deposit their eggs; I believe the bark roughness and relatively soft texture (GSw puncture the bark to insert each egg within the tissue) were the characteristics attractive for ovipositing.

California Spreadwing *Archilestes californicus* McLachlan, 1895

In Doña Ana County, my encounters with California Spreadwings (CSw) to date occurred in mid-fall of 2021 and mid to late fall of 2022, while I investigated riparian and wetland habitat supported by perennial flow within the Rio Grande.

CSw use slow streams and sometimes ponds or lakes associated with those streams. Their range extends from coastal southern California, north across all of northern California, all of Oregon, and eastern Washington. A population also occurs in south-eastern Arizona, slightly across the southwestern New Mexico border. Prior to this report, CSw were not observed in the south-central New Mexico/Rio Grande corridor (Paulson 2009). CSw also ranges south to the tip of Mexico's Baja Peninsula and Sonora (Paulson 2009).

CSw are large, and along the Rio Grande, easily equal the size of Great Spreadwings (*Archilestes grandis* Rambur, 1842), which are considered to be the largest North American damselfly. Locally CSw use a perennial low-flow reach of the Rio Grande that supports dense, wooded riparian/bank vegetation types/ communities. Their flight season ranges from July to November in southeastern Arizona (Paulson 2009), and I have observed them from October to December along the Rio Grande.

The relative size of CSw when compared to small-to-average-sized damselfly species is shown in the photographs at the bottom of this page and the top of the following. The photograph at the bottom of the following page starts a short series which shows the relative size of CSw compared to small-to-average-sized dragonfly species.

In Doña Ana County during the fall seasons in 2021 (21 October to 09 December) and 2022 (20 October to 29 November), I photo-documented CSw using Rio Grande habitats where there is perennial flow downriver from the outfall of the City of Las Cruces, Jacob H. Hands Wastewater Treatment Facility (JHH) lined canal. (See the entry on Great Spreadwing for details about this location.) This reliable surface water source supports linear stands of Coyote (Sandbar, Narrowleaf) Willow (*Salix exigua* Nutt.) tall shrubs, Tamarisk (Saltcedar) (*Tamarix ramosissima* Ledeb.) small trees, and reaches characterized by linear, dense, Water Speedwell (*Veronica anagallis-aquatica* L.) herbaceous wetland plant communities.

Documented herein, CSw hunted, sunned, defended territory, displayed to attract mates, paired through tandem linkage and in mating wheels, and oviposited (laid eggs) under



Protruding Tamarisk branch provides a perch and hunting site for an adult male CSw (L) and a much smaller adult male Desert Firetail (*Telebasis salva* Hagen, 1861) (R).



Above: Mule's fat, *Baccharis salicifolia* (Ruiz & Pav. [Pers.]) branch provides a perch and hunting site for an adult male CSw (left) and a much larger adult male Flame Skimmer, *Libellula saturata* (Uhler, 1857) (right).
Below Left: Size comparison of the Variegated Meadowhawk (upper and lower), Roseate Skimmer (upper middle), and CSw (lower middle) as they perch and hunt from a Mule's Fat stem.
Below Right: A Tamarisk perch and hunting site for an adult female CSw (left) and an average-sized adult male, Blue-ringed Dancer, *Argia sedula* Hagen, 1861) (below).





woody branches extending over the flowing stream. Common perches were twigs, branches, and graminoids protruding from the embankment adjacent to the water. It is important for CSw to use branches overarching the water because females deposit eggs into branch tissue by piercing the bark, and upon hatching, the larvae drop directly into the water (Paulson 2009).

CSw mate when females are grabbed/ seized by males, joined in tandem linkage, copulate several minutes in a mating wheel configuration, and then spend several hours in tandem linkage while ovipositing. Each oviposition site contains 6 eggs neatly laid. After laying a set of eggs the pair moves down and repeats the process until 70-180 eggs are deposited. Eggs are laid in woody tissue of shrub stems/branches, sometimes up to 10' above water (Paulson 2009).





Above: Tamarisk twig provides a perch and hunting site for an adult male CSw (left side of image), a much larger adult male Roseate Skimmer, *Orthemis ferruginea* (Fabricius, 1775) (right side of image), and an investigating adult male Familiar Bluet, *Enallagma civile (*Hagen, 1861) at the top.

Left: Coyote Willow twig provides a perch and hunting site for an adult male CSw (lower part of image) and an adult male Variegated Meadowhawk, *Sympetrum corruptum* (Hagen, 1861) (upper part of image). The CSw is longer than the Variegated Meadowhawk but far more slender.

Characteristics of Adult Male and Female CSw

Left: CSw adult male perches by hanging from a Mule's Fat branch. Note the pruinose (white waxy) coloration of the S9 and S10 abdominal segments and the light brown-colored stigma cells near the wing-tips.

Below: CSw young adult male perches from a Coyote Willow twig.

Below Left: CSw adult male head, thorax, legs, wing bases, and first abdominal segment (S1) detail. Note the blue coloration of its eyes, facial frons and postclypeus (jutting portion); narrow, tan median stripe (top of thorax); blue-green dorsal thorax; tan upper edge of thorax; lateral blue-green patch (oblong); and light blue ventral thorax. The remaining dorsal areas of the abdomen are predominantly a dark, shiny, metallic bluish-brown.











Above: Brighter and darker coloration of a young adult male CSw.

Left: CSw adult female perches by hanging from a grass blade. Note the abdomen width and expanded tip of the distal abdomen (S9, S10), with little pruinosity and the light brown-colored stigma cells near the wing tips.

Top of Following Page: CSw adult female perches by hanging from a False Indigobush (*Amorpha fruticosa* L.) leaf petiole.

Bottom Left of Following Page: CSw female head, thorax, legs, wing bases, and first abdominal segment (S1) detail. Note the light blue coloration on top of her predominantly pinkish/grayish colored eyes, blue facial postclypeus (jutting portion); narrow, tan median stripe (top of thorax); blue-green dorsal thorax; tan upper edge of thorax; lateral blue-green patch (oblong); and tan ventral thorax. The remaining dorsal areas are predominantly a shiny, medium-brownish hue.







Bottom Right: CSw female head, thorax, legs, wing bases, and first abdominal segment (S1) detail. As above with a more dorsal/rear thorax perspective.





Displaying Male Attempting to Attract a Female Mate

Male CSw grasp a branch where they are highly visible, move their wings somewhat (flicks/vibration) and orient them to show the light brown stigmatic cell, then arc their abdomen very high, return it to the starting position (or deflect it downward) and repeat in a series, as shown here:

Top Left: Male CSw perches on exposed Mule's Fat stem to attract a mate by displaying. Note that he keeps his wings at about 30-degrees to his body and fully exposes the colored wing cell (stigma) to reflect the sun's rays.

Center Left: He then arcs his abdomen to swing his pruinose (white-waxy colored) S9 and S10 segments upward to attract attention.

Top Right: This is his maximum upward extension.

Center Right: With wings still presenting the distinctive stigmatic cells, he returns his abdomen to its resting position.

Bottom Right: Then repeats this behavior a few times in succession. Following a successful female approach, the pair forms a tandem linkage.







CSw Tandem Linkage and Mating/Copulation Wheels (Following Three Pages)

Most pre-mating tandem linkages result when CSw males grab or capture a female then attach to her upper thorax with hooks (cerci, paraprocts) on their S10 abdominal segment. On one occasion, I observed a male CSw flying over the water when a female flew up behind him (from cover on the shoreline) and attached to him in flight.





Top: Once a female is grabbed/captured, the CSw adult male (top) connects its abdomen tip (S-10, equipped with paraprocts, cerci) to a site on the female's prothorax (bottom) which is the top, front of the thorax.

Left: A tandem linkage is thus formed which allows the mating process to begin. Here the male transfers sperm from his genital opening under the ninth segment (S9) to be stored in the seminal vesicle in his second segment (S2).

Following Page Top Left: CSw adult female completes copulation/mating wheel by attaching her vagina of the S9 abdominal segment to the male's S2 segment where transfer of sperm occurs via his penis during a prolonged mating process.

Following Page Bottom Left: CSw adult male (UR) and female (LL) "in copula" as sperm are being transferred from his S2 (through penis) to her S9 (into vagina) where the eggs are fertilized. The pair may remain in the mating wheel formation for up to an hour. Note the difference in size of the male and female abdomens.











Top Right Previous Page: This mating CSw pair selected a perch on dried Johnsongrass, *Sorghum halepense* ([L.] Pers.) leaves behind a large Tamarisk shrub; the site provided both shelter from gusty wind and direct sunshine.

Bottom Right Previous Page: Copulating CSw pairs are often tended/visited by unpaired males (top of image) that perhaps sense an opportunity to mate.

Above: Two CSw pairs attached in mating/copulation wheels selected the same small Tamarisk twig to perch, and were blowing in tandem with a light breeze.

Ovipositing CSw Pairs and Individual Adult Females

Following mating/copulation, CSw adult females typically remained in tandem linkage with adult males and flew as a pair to Mule's Fat tall shrub branches overhanging flowing water (I rarely observed them using other shrub species). The male would select a landing site and firmly grasp a stem while the female selected an egg deposition site lower on the same stem or on lower stems. As she produced eggs, she would curl her S10 abdomen segment to the stem surface, pierce the wood, and deposit eggs. When a site had been used to place six eggs (Paulson 2009), she would move slightly lower and repeat the process. Often, a single adult male would visit the pair and remain with them for some time, perhaps to attempt to replace the mating male.



Above: Egg-laying CSw pairs are often tended/visited by unpaired males (upper right) that perhaps sense an opportunity to mate.

Below: CSw mated pair selects an oviposition (egg-laying) site on the underside of a Mule's Fat branch. Note the shape of the female's S10 segment (LR) and the sharp points used to pierce the wood.





Above: The female CSw raises her S10 segment to the branch when her eggs emerge and are available to deposit.







Top Left: She will deposit six eggs, neatly arranged, in the wood of the branch (Paulson 2009).

Bottom Left: The pair then moves to another site and repeats the ovipositing process until 70-180 eggs are laid (Paulson 2009).

Top Right: Two pairs of mated CSw arrive at the same branches to select egg laying sites in this Mule's Fat tall shrub.



Top: CSw ovipositing pair (adult male (left) and adult female (right)) using a dead Coyote Willow branch, overhanging the flowing stream, as their egg deposition site.

Rarely, I observed CSw adult females that were not paired with males, ovipositing alone. The series of images on the following page illustrate this process. Note that the female anchors her head against the stem to provide leverage for her abdomen (S10) to pierce the stem surface; when in tandem linkage with a male, he would provide that anchoring effect by clasping the stem and being connected to her thorax with his S10 abdominal segment.



Right: Adult female CSw selects a Mule's Fat stem, extended over flowing water, on which to lay eggs (note she anchors her head against the stem).







Top Left: She swings her S10 abdominal segment into place against the woody tissue to pierce the bark.
Center Left: She pierces the wood and deposits up to 6 eggs (Paulson 2009).
Bottom Left: Following egg deposition she swings her abdomen outward.
Top Right: Her next egg appears to be slightly protruding from her distal (S10) segment.



Preferred Spreadwing Habitat Along the Rio Grande

Most of the CSw population photo-documented during October through December 2021-22 centered around open-crowned Mule's Fat and Coyote Willow tall shrubs and larger Tamarisk trees. Many egg-depositing females oviposited in the woody tissue of branches of the Mule's Fat shrub following mating.

Important CSw habitat on the Rio Grande bank, where branches overhang the flowing water. Below: 2021 and 2022.





Prey Captured by Hunting CSw

In two seasons I have photo-documented only the following CSw prey capture/consumption images along the Rio Grande.

Left: CSw adult male ingesting unknown food/prey while perched on a Mule's Fat branch.

Right: An adult male CSw captured a black-colored fly (Diptera) at streamside and returned to consume it at the perch.





Plateau Spreadwing *Lestes (Archilestes) lacer* Hagen, 1861

In Doña Ana County, NM, I observed Plateau Spreadwings (PSw) beginning in the final week of August 2022 at two sites: 1) an individual at the Southwest Environmental Center-managed La Mancha Wetland along the Rio Grande; and 2) a population using the retention pond at Dripping Springs Visitor Center (DSVC) in the Organ Mountains. The known PSw habitat and range include permanent or temporary ponds, springs, and seeps with emergent vegetation from Arizona, New Mexico, Texas, and Oklahoma; south (in uplands) to Costa Rica (Paulson 2009).

PSw population arrival timing was sudden and apparently in response to monsoon rainfall. Using Las Cruces rainfall data (which I believe to be proportional to the pattern/amounts at DSVC, some seven miles to the east) monthly monsoon rain totals were: June (1.69"); July (1.27"); August (6.97"); September (1.26"); and October (1.80") (http://www.lascruces-weather.com/wxanalraindata.php). Monsoon rainfall, in these amounts, maintained surface water and supported emergent vegetation in the DSVC retention pond bottom throughout summer and autumn seasons.

Paulson (2009) states that PSw males and linked pairs use shallow-water/marsh vegetation as breeding habitat and oviposit in the stems and leaves of emergent herbaceous vegetation (in the DSVC retention pond, the emergent shoreline graminoid providing this habitat was Green Sprangletop, *Disakisperma dubium* ([Kunth] P.M. Peterson & N. Snow). Also, mature PSw adults may roost in woody vegetation up to 0.5 miles from the pond and immatures often use adjacent open, wooded habitat. Per Paulson (2009) the PSw flight season ranges from January to October in New Mexico. My 2022 observations at the DSVC site suggest this range be extended to November.

During late August and continued into October, damselfly larvae emerged from the DSVC retention pond. These larvae are also called nymphs or naiads, and those of PSw have three prominent, black, caudal gills that extract oxygen from the water and also are used by larvae to swim by waving them back-and-forth similar to a fish tail. All damselfly larvae are predatory and can be cannibalistic (Paulson 2009).

Further, Paulson (2009) stated that damselfly larvae undergo many molts as they feed and grow, perhaps up to a dozen molts prior to emerging. In the last few molts, adult wings begin forming in wing pads that extend above and back from the larval thorax. At this stage, larvae stop feeding and switch to aerial respiration, then climb onto emergent plant stems/leaves close to the waterline, attaching to the plants with their legs. The larva then expands its thorax until a split appears through which it exits from the now-empty larval skin (exuvia). There, it rests and allows its cuticle to partially harden and muscles to become stronger, then it reaches upward to pull away from the larval skin.

The newly exposed wings are folded like accordions and begin to fill, from the base (with fluid transferred from



Mature adult male PSw (dorsal view) observed perching on a rush (*Juncus* sp.) stem at the Southwest Environmental Center, La Mancha Wetland, pond habitat during the last week of August 2022. Unless otherwise noted, all photographs in this article are the work of the author.

the larva's body), until they reach full length/width (Paulson 2009). The wing fluid is then pumped back into the abdomen which also expands and fully extends beyond the wings. Finally, the wings harden, open, and the teneral (pale and soft-bodied) immature PSw flies to protective cover. DSVC damselflies usually emerged during daytime, at the warmer temperatures near midday to late afternoon; the process from larvae exiting the water to tenerals/ immatures flying into cover may require one to two hours to complete.

Per Paulson (2009) the male thorax has a wide median black stripe, tan or blue (with maturity) antehumeral stripe with straight edges, and a narrow black humeral stripe. Sides are usually pale brown in males. In the image below, the sides have become pruinose (bluish and obscuring the humeral stripe) indicative of an older individual. The last two abdominal segments (S9 and S10) are pruinose on males and with age, the S8 segment is also pruinose, as below.

Per Paulson (2009) the female thorax is similar to the male. As in males, the oldest females develop blue eyes and a blue antehumeral stripe with straight edges. Their wide black humeral stripe is more prominent because no pruinosity develops on the female. It was difficult to locate individual mature females to photograph, as most were immediately captured by a male, engaged in tandem linkage, then paired in mating wheels (illustrated at the top of the following page).



Representative mature adult male PSw of the DSVC retention pond population, perched on emergent Green Sprangletop stem, during early September 2022.

Center Left: Mature adult male PSw perched on dried stem and displaying (flexing abdomen rapidly up-and-down) to attract a potential mate.

Bottom Left: … the downward abdomen flexing motion.

Top Right: Representative mature adult female PSw of the DSVC retention pond population, here in tandem linkage with a male (note the large abdomen size and brown color of the female vs. the male). This pair had already mated and were in the process of moving among oviposition (egg deposition) sites.

Center Right: Tandem-linked PSw pair with mature adult male (R) and mature adult female (L) pre-mating perch on Green Sprangletop stem.

Bottom Right: This mature adult male (upper) and immature female (lower) form a mating wheel to transfer the male sperm into the female vagina where eggs may be fertilized prior to ovipositing. Note the brown eye color and tan antehumeral stripe of the immature female PSw. The mating pair is perched on a Green Sprangletop stem.













Left: Adult PSw began to mate in late August 2022. This mature adult male (upper) and mature female (lower) form a mating wheel to transfer the male sperm into the female vagina where eggs may be fertilized prior to ovipositing. The pair is perched on a dried Switchgrass (*Panicum virgatum* L.) stem.

Center: Tandem-linked PSw mature adult male (U) and ovipositing adult female. Eggs are being inserted into a Green Sprangletop leaf. The male guides the female from site to site to oviposit, the pair spending ~1-to-5 minutes at each site.





Left: Immature female PSw, post-mating, inserting fertilized eggs into the stem tissue of Green Sprangletop. Eggs will develop into larvae which drop into the water to forage and grow, molting perhaps a dozen times before emerging. Typically, female PSw remain in tandem linkage with the male mate during oviposition.



Above: The same PSw pair from center image on the the previous page being joined by a tandem-linked mature adult pair moving between sites to oviposit in Green Sprangletop leaf and stem tissue.



Left: Mature PSw larvae (nymph, naiad) climbs from the pond onto a Green Sprangletop panicle to begin emergence. The three caudal gills are still underwater but are not taking in oxygen at this late larval stage.

Following Page

Top Left: The PSw larva climbs higher above the waterline on the grass panicle and clasps it firmly with its legs. Its wing pads are easily observed protruding backward from the thorax.

Bottom: The head and thorax have pulled free from the larval skin and the wings are being pulled from the wing pads. The abdomen begins to be exposed as the teneral (soft-bodied) PSw emerges from the larval skin.

Right: A dorsal view of the PSw teneral/immature form as it emerged, completing the process by climbing upward from the larval skin. Ventral view at the top of the following page.









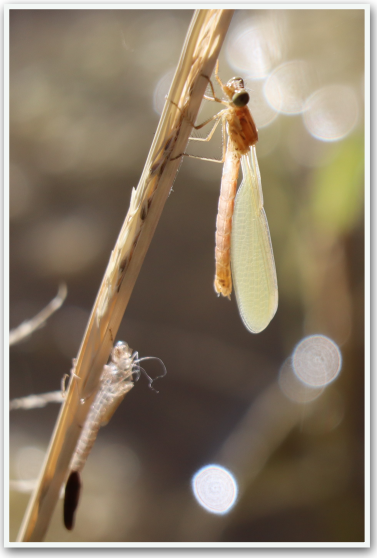


Left: PSw wings, free and folded like accordions, emerging from the teneral/immature damselfly thorax. They have yet to be filled with fluid (to be pumped from the abdomen).

Below: Teneral/immature PSw rests on larval skin to gain strength and begin drying. Note its expanding wings are being filled with fluid pumped from the abdomen.









Above: Teneral/immature PSw rests on larval skin to gain strength to climb upward. Note its wings have filled completely with fluid from the abdomen.

Far Left: Teneral/immature PSw has climbed up the stem away from the exuvia, its wings have filled with fluid, expanded, and are hardening, while the fluid has been pumped back into its abdomen, which is expanding and lengthening.

Center: PSw emergence nearly complete following fluid transfer to/ from wings, abdomen expansion/ extension, and wing/cuticle hardening for this immature female PSw.

Emerging PSw teneral/immature forms are particularly susceptible to predation at this vulnerable life cycle stage. A variety of insects including adult dragonflies, amphibians and reptiles, and birds all represent potential predators. The most effective immature PSw predators I was able to photo-document were species of orb weaver spiders.

Right: Long-jawed Orb Weavers (*Tetragnatha* sp.) were predators of PSw during the emergent life cycle phase at the DSVC retention pond, building webs among the Green Sprangletop stems, leaves, and panicles.

Below: Long-jawed Orb Weaver ingesting a captured immature PSw, beginning at the eyes/head.







Immature PSw represented the population during October and November 2022. Paulson (2009) describes the color of both sexes as a wide, black stripe on the front of the thorax contrasting with entirely pale sides.

Left: Immature PSw with fully expanded/ extended abdomen and hardened wings, has just flown to Switchgrass panicles to perch/hide, warm, and allow further hardening of its wings and cuticle.

Center Right: Immature male PSw perched on Switchgrass leaf on October 26, 2022.

Bottom Left: Immature male PSw perched among dried Switchgrass panicles in November 2022, prior to migration.

Bottom Right: Immature female PSw perched on honey mesquite (Prosopis glandulosa Torr.) fruit, overhanging the DSVC retention pond-edge, September 27, 2022.









Immature male PSw with wings reflecting the October 22, 2022 low-angle light.







Habitat - Plateau Spreadwing

This retention pond is is about 30'x80' and 12"-16" in depth (pool below outlet culvert elevation) and forms over an impervious liner (otherwise it would rapidly drain into the underlying gravel). Green Sprangletop (emergent) and Switchgrass (embankment top). Switchgrass (above) is hiding cover for PSw immatures.





Gordon Berman provided this brooding and beautiful monsoon-season landscape through a dense and humid atmosphere highlighting the DSVC retention pond (used by the PSw population depicted in this article) and its bordering tall grass and surrounding Chihuahuan Desert tall shrub plant communities, the nearby, light-colored, La Cueva Formation rocks, and the majestic (~9,000-ft high) Organ Mountains backdrop overtopped by cumulus clouds.

Other Clearwing Critters - Antlions and Lacewings

There are many clear-winged insects, and several can look a lot like damselflies. The photograph on the following page was taken by Matilde Holzwarth in 2012, south of Hillsboro. It is most likely an antlion in the family *Myrmeleontidae*. There are more than 100 species (in 22 genera) in this family, in the United States and Canada.

The Holzwarth image on the following page is included as much for its artistic merit as for the natural history of the subject.

The photographs which follow the Holzwarth photo are all in natural tones and were taken by James Von Loh.

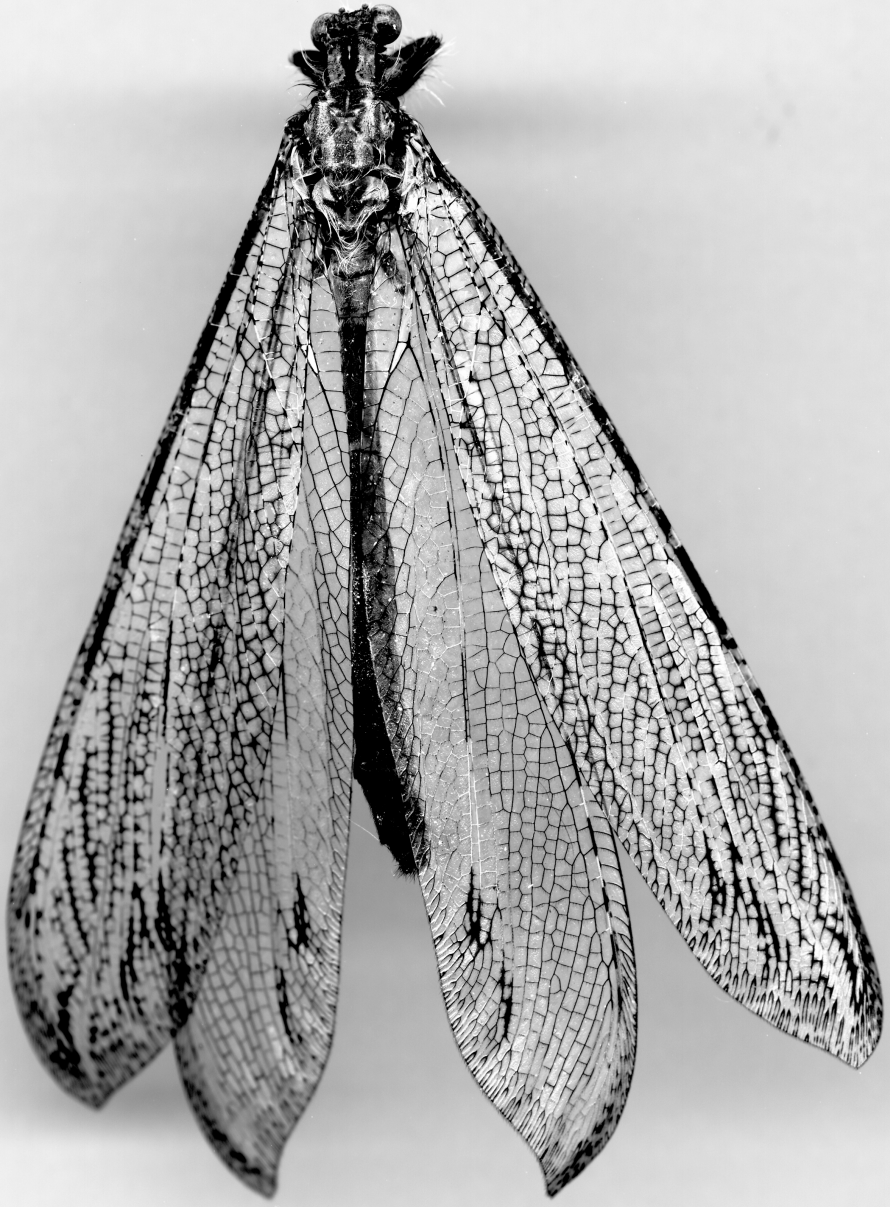
The clear-winged insects present an opportunity to play with light. The images to the right (from one of Von Loh's originals) have simply been converted to a black-and-white image and the contrast adjusted.

The editor's personal preference is for the images in natural tones, but when presented with Jim's beautiful images he was over-whelmed with the desire to play "what if". Preferences remain unchanged but additional perspective has been gained.









by Matilde Holzwarth
2012

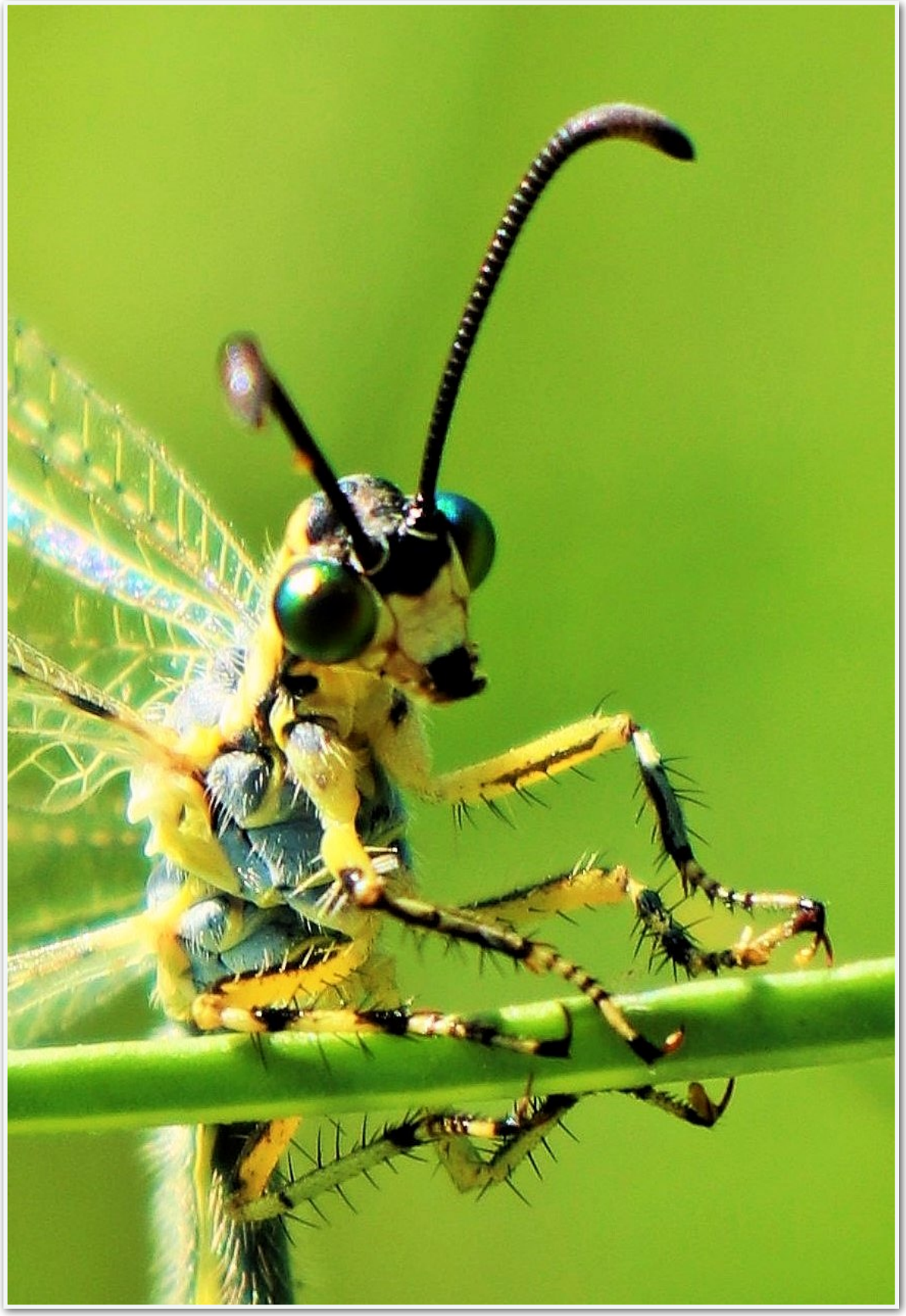
Photographs of an antlion and a lacewing (upper right) by James Von Loh. The wings of lacewings tend to be more tented: they fold in such a way as to form a ridge well above the abdomen.











The antlion shown above and on the preceding page was photographed in the wild by James Von Loh along the Rio Grande. It has been identified as *Scotoleon nigrilabis*. There are 20 species of *Scotoleon* in Canada and the United States, 23 species in all.

Rain, Virga, and Sublimation

It is sometimes said that there is more virga than rain in the Black Range. Puzzled looks aside, it is an important phenomenon in our region.

When precipitation falls from a cloud but evaporates or sublimates before it reaches the ground, it is call virga. When it reaches the ground it is called rain, or more frequently "a trace."

Virga occurs when the precipitation passes through a layer of warm and/ or dry air. When it starts its fall the precipitation may be water or ice. Virga simply means that it doesn't reach the ground.

As the (liquid) rain transitions into water vapor, a significant amount of heat can be removed from the air, causing the resulting colder air to sink rapidly to the ground. This transfer of energy and the rapidly sinking air creates microbursts which can be dangerous to flying machines.

Although virga can be quite rare in many places, in the southwest it is quite common. We will have to look elsewhere to find something which makes us unique.

Evaporation is a term we all know; some are not familiar with the term "sublimation", however. Sublimation occurs when a substance transforms from a solid to a gas without passing through an intervening liquid state. In the case of virga, sublimation may occur when the initial precipitation is composed of ice crystals. Sublimation is the process we see when dry ice vaporizes, forming clouds of fog.

Sublimation is an important concept here in the southwest. We are grateful for the snow pack which sometimes occurs in the Black Range. We do not, however, get to reap the full benefit of that snow melting and the water entering our soils. Sublimation is an important process here: Much of our snow pack simply sublimates into water vapor, reentering the atmosphere from which it just came. Sublimation occurs when the temperature of the snow pack is below freezing but intense sunlight is hitting the snow.



Photograph by Véronique De Jaegher, looking east from the Black Range.



Virga over the Black Range. August 9, 2013.

Sexstone et al. found that in the central Rockies "sublimation losses to the atmosphere were equivalent to 28% of winter precipitation and were relatively greater during low snow years". (Graham Sexstone et al., "Snow Sublimation in Mountain Environments and its Sensitivity to Forest Disturbance and Climate Warming", *Water Resources Research*, Vol. 54, Issue 2, February 2018, pp. 1191-1211.)

Other Resource: Svoma, "Canopy effects on snow sublimation from a central Arizona basin", *Journal of Geophysical Research: Atmospheres*, 2017.

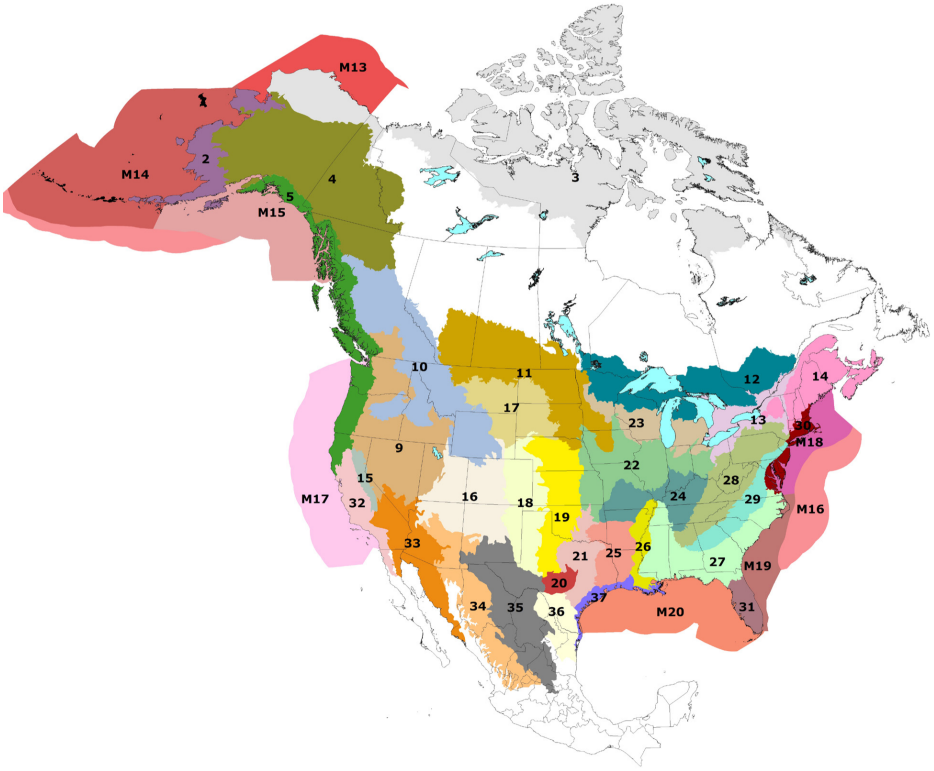
National Water Dashboard

This site provides access to over "13,000 USGS real-time stream, lake, reservoir, precipitation, water quality, & groundwater stations in context with current weather & hazard conditions. Data are refreshed every minute."

The site has a significant amount of information, provided in various arrays and formats, like the detailed stream flow data of the Mimbres River at the Mimbres Gage (below)



Migratory Bird Program, Birds of Concern, Chihuahuan Desert



The overall goal of the USFWS report referenced here was to identify those bird taxa (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities of the USFWS.

Here we focus on those species identified for the Chihuahuan Desert Bird Conservation Region (BCR), number 35 on the map at the right (p. 15 of this report).

The assessment considered breeding (B) and non-breeding (NB) status separately.

The species identified in the report for the Chihuahuan Desert BCR are:

- **Common (Henry's) Nighthawk (B)**
- **Mexican Whip-poor-will (B)**
- **Lucifer Hummingbird (B)**
- **Broad-tailed Hummingbird (B)**
- **Mountain Plover (NB)**
- **Snowy Plover (B)**
- **Long-billed Curlew (NB)**
- **Ferruginous Hawk (B)**
- **Flammulated Owl (B)**
- **(Western) Burrowing Owl (B)**
- **Black-capped Vireo (B)**
- **Pinyon Jay (B)**
- **Woodhouse's Scrub-Jay (B)**
- **(Speckled) Cactus Wren (B)**
- **Bendire's Thrasher (B)**
- **Sprague's Pipit (NB)**
- **Evening Grosbeak (B)**
- **Chestnut-collared Longspur (NB)**
- **Thick-billed Longspur (NB)**
- **Cassin's Sparrow (B)**
- **Black-chinned Sparrow (B)**
- **Baird's Sparrow (NB)**
- **Chihuahuan Meadowlark (B)**
- **Scott's Oriole (B)**
- **Colima Warbler (B)**
- **Virginia's Warbler (B)**
- **Grace's Warbler (B)**
- **Pyrrhuloxia (B)**
- **Varied Bunting (B)**

This list of birds of concern augments the listing of endangered (E) or threatened (T) species which includes the following in our area:

- **(Western) Yellow-billed Cuckoo (T)**
- **(Mexican) Spotted Owl (T)**
- **(Northern) Aplomado Falcon (E)**
- **(SW) Willow Flycatcher (E)**

All of these species are due consideration in any project or management plan which affects the Black Range. This is true even in those cases where the species is locally common.

Riparian Research and Management: Past, Present, Future Volumes 1 & 2

This report (*General Technical Report RMRS-GTR-411*, link to Volume 2, [Volume 1 link below], June 2020) from the Rocky Mountain Research Station, USFS, addresses two developments of concern to the people of the Black Range: 1) the introduction of Tamarisk Leaf Beetles (*Diorhabda* spp.) to eradicate Salt Cedar and; 2) the destruction of significant numbers of mesquite bosques.

In Chapter 2 (Vol. 2), "A Naturalized Riparian Ecosystem: Consequences of Tamarisk Leaf Beetle (*Diorhabda* spp.) Biocontrol", Carothers, Johnson, and Kingsley describe the history of *Tamarix* introduction and the subsequent attempts to eradicate it. This is a complicated question given the usage of *Tamarix* stands by the Southwestern Willow Flycatcher and the general failure of native flora to reestablish itself in areas where successful eradication has occurred, complicated further by the fact that the riparian zones before and after *Tamarix* introduction/removal are sometimes inherently different than the *Tamarix* riparian zone. This difference can have a significant effect on the fauna, and other flora, of that zone. Table 3 (pp. 22-27) of this Chapter has an especially interesting comparison of breeding birds found in these different riparian habitats.

The authors conclude that "It appears so far that in the absence of active restoration efforts, recolonization of the post-biocontrol Tamarix-dominated habitat is almost exclusively limited to a mixture of native and nonnative grasses and often weedy, herbaceous cover with the conspicuous absence of woody species. Thus, at least in the short term, the biocontrol effort has resulted in the loss of important wildlife-producing habitat without replacement. In most areas where

Tamarix has proliferated, both human-caused alteration of natural flow regimes and Tamarix-caused alteration of soils are complicating or prohibiting the establishment of native riparian woody plants." (p. 39)

Volume 1 of this report includes *Tamarix* focused chapters (Chapter 4 "Invasion and Restoration of Western Rivers Dominated by *Tamarix* spp." and Chapter 5 "Unintended Consequences: Tamarisk Control and Increasing Threats to the Southwestern Willow Flycatcher").

In Chapter 3 (Vol. 2), "Vanishing Riparian Mesquite Bosques: Their Uniqueness and Recovery Potential", Johnson, Carothers, and Carothers, note that "The 'mesquite bosque' (Spanish for 'forest' or 'woodland'), one of the most unique and productive southwestern riparian habitat types, was once far more abundant than it is today." (p. 47) They go on to describe the attributes of mesquite bosques and then examples of the loss at specific sites and the implications that has had for a variety of flora and fauna species and for the rivers in question. Chapter 11 of Volume 1, "Terrestrial Vertebrates of Mesquite Bosques in Southwestern North America", outlines the basic flora-fauna web of this native ecosystem.

The report goes on to cover a variety of watershed and riparian restoration issues.

Bird Nests

Here in the Black Range we are lucky to have a number of nesting bird species. The nests of these species vary significantly in terms of material used, shape, and years of use.

Golden Eagles (video from Nevada), for instance, may build a nest in a large tree or on a cliff ledge. Their nests are made of sticks with a lining of softer material (grasses, leaves, etc.) and the nest is used for several years. Each year the nest is added to, so they get big. As with the Common Raven, which builds in similar locations, the nest is built and added to by both sexes. A Golden Eagle nest averages 6' in diameter and the inner nest may be 3' wide and 2' deep. (The largest on record was 20' tall and 8.5' wide.). The nest of a Common Raven may be 5' in diameter and 2' tall. Neither of these species make nests which are as large as that of the Bald Eagle (video from Bosque del Apache NWR) which can make a nest which weighs more than two tons and can be 10' wide.

At the other end of the spectrum we enjoy nesting Black-chinned Hummingbirds (video). Intermediate between these extremes we have nests of several dove species (video of nesting Eurasian Collared-Doves).

The nests of the species referenced above are all open cup type nests. Some species build intricate nests, others' look more like a bit of debris.

Turkey Vultures may simply lay eggs on a ledge or under a log. Their nests may be little more than a scrape, similar to that of a Killdeer. We do not have any species which simply lay an egg on a wide area on a branch like the Potoo of tropical America.

Some species like to be enclosed. Woodpeckers and owls for instance are often cavity nesters (the larger owls are generally not). Cliff Swallows will build nests of mud which have narrow openings, and Burrowing Owls nest underground. Some of our orioles build dangling nests with entrances at the top. Verdins and Cactus Wrens will build ball-like nests with entrances on the side.

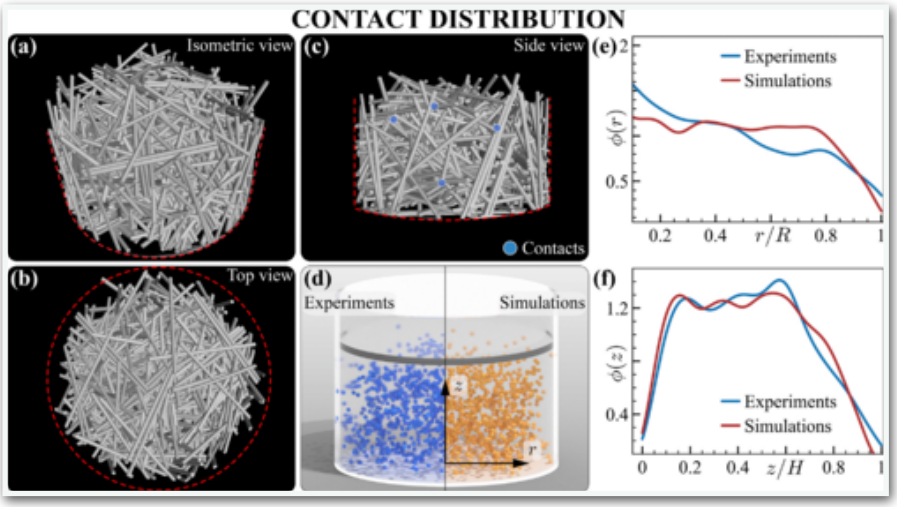
There are many types of nests and variations on each type. Sometimes the nests appear haphazard, sometimes they are intricate. Some are on the ground, some are high in trees. There is no "norm". All suit the needs of their builders.

Bhosale et al. studied the structure of bird nests and reported their findings in "Micromechanical Origin of Plasticity and Hysteresis in Nestlike Packings", *Physical Review Letters*, 128, 198003 – Published 13 May 2022 and in *Science*. The graphic below is from their published material. The interweaving of bendable materials which are in frictional contact (got to love the terminology, accurate as it is) may be the key to the flexibility and sturdiness that we see in many nest types. Even a dove's nest can be remarkably resilient.

It is not always possible to discern the species which built a nest from the appearance of the nest itself. Seeing a species build and/or use a nest is the best "nest identification" technique there is. A number of the nests which are depicted in this article have met that test.

Please be mindful of the effect that your presence may have on the success of nesting birds. Your observations should be kept to a minimum.

The following nests are arranged in order of the English common name of the species which built it.



Eurasian Collared Dove
Streptopelia decaocto

The Eurasian Collared Dove is often found near human habitation in the Black Range. It is an exotic, being introduced from Eurasia to the Bahamas in 1974. It is now found in most of the United States.

In the July 2019 issue of this magazine we reported on the nesting of a pair of Eurasian Collared Doves (from March 3 to April 8); that article includes numerous photographs and provides links to video. The photographs below are from that project, the middle photograph from March 4 and the bottom (of a nestling) from March 31.



Eurasian Collared Dove with nesting material, February 28, 2011.







White-winged Dove nest, Hillsboro, February 22, 2014

White-winged Dove
Zenaida asiatica

The nests of White-winged Doves are as flimsy as those of the other common dove species in our area. Nests are usually built between 4' and 30' above the ground. Although the ones shown here are isolated, White-winged Doves will nest very close together when nest building sites are limited and nearby food sources are plentiful.

There are generally two eggs which are oval to elliptical in shape. The eggs will vary from light cream to white in color and have no gloss.

A nest, even with eggs, is very difficult to distinguish from that of a Mourning Dove. Mourning Dove nests are so basic that it is often easy to see through them when looking up from below.



Right: Nesting can draw attention to a bird's location. Predation in Hillsboro, Feb. 14, 2015.



Above: White-winged Dove nestlings, March 7, 2014, Hillsboro.
Center and Right: Hillsboro, April 27, 2011.
Below: Pony Hills, SW of Cooke's Peak, April 16, 2015.







Cooper's Hawk
Accipiter cooperii

The nest of a Cooper's Hawk is quite large, generally over two feet in diameter (average 27") and from a half foot to a foot and a half deep. The size of the nest may vary because of the willingness of Cooper's Hawks to build nests in many types of vegetation. Given this species' willingness to build a nest in a variety of settings (riparian zones, like that shown here, to desert scrub) there is a wide range in the height of the building location. When vegetation types allow, the nests are usually 20-50' above the ground.

Nests are often built where large branches fork or next to the trunk, this because of the bulk of the nest. The two views of a nest at the A-Spear Ranch on the east side of the Black Range show the typical placement of a nest.

Males, which are the nest builders in this species, will sometimes build on top of, or refurbish, an old nest. The old nest may be any supporting structure ranging from the nest of a wood rat or squirrel to that of another large bird species. Nests are always lined with smaller pieces of wood, chips, or twigs.
The incubation period is quite long, averaging just over a month at 36 days.

The Sharp-shinned Hawk looks like a downsized version of the Cooper's Hawk, and its nest looks like a downsized version of the Cooper's as well. Sharp-shinned Hawks apparently prefer to build their nests in conifers. The other species in the *Accipiter* trilogy, the Northern Goshawk, nests in more remote areas, near the top of large canopied trees. It builds a nest which is proportionally larger (averaging about 3' in diameter) but otherwise similar to those built by its smaller cohorts.





Black-chinned Hummingbird
Archilochus alexandri

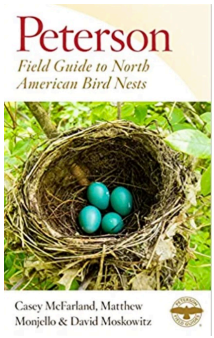
Nests of Black-chinned Hummingbirds are generally not far above the ground (typically 6'-12', but sometimes up to 30') and are most easily located by watching the movement of female Black-chins during nesting season. In our area there may be several clutches, so basically any time in the summer.

There are generally two eggs per brood, and where there is ample food it is common for both young birds to fledge. Some broods have as many as three eggs and some only one. Eggs are white, not glossy, and oval in shape. They are vey small, typically a bit over 12 mm x 8 mm (about a third of an inch by half an inch).

Video of the nesting season of a Black-chinned Hummingbird is included in the set of videos supporting this journal.

The female uses plant down, dry leaves, moss, spider silk, etc. to build the nest. Spider silk is often used extensively to add support and flexibility to the nest and to bind it to small stems, or as shown on the following page, wire. The rim of the nest may curve inward near the top (see photograph at top right on the following page). The nest is roughly 1.5" in diameter and the cup is generally about .8" deep.

For years, the standard guide to bird nests in the western United States has been *A field guide to western birds' nests,* editions of 1979 and 2001 by Hal Harrison, Houghton Mifflin, Boston, MA.



In 2021, a new book (shown above) on this topic was published.



Female incubating, San Lorenzo, Black Range, New Mexico.



Above: Adult male, Hillsboro, Black Range, New Mexico.
Below: Female incubating (7/31/2018), Hillsboro, Black Range, New Mexico





● Photographed in Hillsboro, by Rebecca Porter, during August 2022.

● Photographed in Hillsboro on July 14, 2013.











Western Kingbird
Tyrannus verticalis

The nest of the Western Kingbird is a cup made of sticks with some interior lining. Nests are usually placed at the fork of major branches. They are usually about six inches wide and about four inches deep; the cup is about three inches wide by two inches deep. The clutch size varies between two and seven eggs. Incubation takes from two to almost three weeks.

On May 12, 2023, I was driving through the Nutt Grasslands on the southeastern border of the Black Range when I saw a Chihuahuan Raven at a nest, a nest which was smaller than its own should be, so I stopped to investigate.

The nest turned out to be that of a Western Kingbird. The shape and size of the nest was obscured by tumbleweeds on the western side, my initial view.

As I watched, a Western Kingbird returned to the nest and was immediately chased off by the Raven. After waiting a while, and knowing how the story ends, I took a photo of the predation and was on my way.

In Hillsboro, we often see Common Ravens raiding the nests of anything they can find, and they are very good at finding nests. Many a dove clutch and House Sparrow brood has turned to lunch before our eyes. It is not unusual to see a raven flying over with a nestling in its beak, without a doubt lunch for its own brood. (RAB)









Top: Western Kingbird nest, Nutt Grasslands, view from the east.
Center: View from the west. Note that the tumbleweeds (Russian Thistle) which have accumulated at the base of the shrub obscure/blend with the nest.
Bottom Photos: View inside the nest with detail of the predation.











Top and Center Right: Nest placement and Raven perched nearby.
Center Left: Chihuahuan Raven
Bottom Photos: Western Kingbird

Horned Lark
Eremophila alpestris

Based on the aspect and location where the nest shown below was collected, and on its construction, it is most probably the nest of a Horned Lark. This nest was collected by Rebecca Porter during August 2022, from the mesa south of Hillsboro, New Mexico.

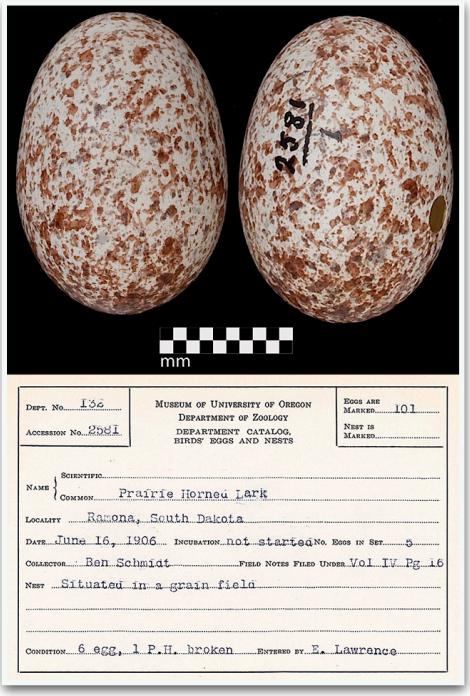
The bird was never seen on the nest, and the photographs are not from the natural location. Horned Larks build their nests in unprotected areas which are open to the sky. Open grasslands like the mesa where this nest was collected are favorite building locations. The nest is typically 3"- 4" in diameter and roughly 2" high. The bowl is 2" to 2.5" in diameter and roughly 1.5" deep.

There are generally 4 eggs per clutch, sometimes 3 or 5. The eggs have a non-gloss base color generally in grayish tones, sometimes with a greenish tinge. The eggs are covered with brown spots. There may be 2 or 3 broods during a breeding season.









The collecting of wild bird eggs is illegal in the United States (and in many other countries).

The Horned Lark eggs shown here were collected in South Dakota by Ben Schmidt in 1906. They are part of the collection of the University of Oregon Museum of Natural and Cultural History.

Bullock's Oriole
Icterus bullockii

The nest of the Bullock's Oriole is often described as "gourd shaped", that is, it is longer than it is wide (pendulous or pensile cup nest). This general shape of nest is indicative of the nests of orioles. Bullock's Orioles weave their nests from long stands of grass and sometimes fiber.

These photographs were all taken in Hillsboro, New Mexico. The nest was located near a feeding station in a yard where there was a fair amount of activity. Male below, female top right, female at nest center right, nest at bottom.

In an afternoon of camera observation it was noted that on average, only three seconds elapsed from the time the female entered the camera frame to her being settled in the nest. Departure took even less time – drawing as little attention to the nest as possible.









Barn Owl
Tyto alba

A Barn Owl does not make a nest. It will choose to lay its eggs in a variety of places which have a bit of flat space, in old structures or hollow trees for instance. In our area, mine shafts are often a nesting site of choice.

There are many Barn Owl subspecies. The one found in the Black Range is *T. a. pratincola,* which was once considered a full species.

A Barn Owl's brood of eggs usually contains from 5 to 9 eggs (range of 3-11). There may be two broods per year, but this is variable. In some years, when food is limited, Barn Owls may not nest at all. With this number of eggs asynchronous hatching occurs, and the first owlet which hatches may be two weeks old by the time the last egg hatches. Eggs are 43 mm x 33 mm (1.7" x 1.3") in size, thus elliptical and different in shape from many other owl species'.



The egg shown above is from the egg collection of the Museum Wiesbaden in Germany.









Photos above: A mine shaft east of Hillsboro, Black Range. Top image shows the "wash" left by a Barn Owl (photo June 1, 2015). The photograph immediately above shows a (poorly focused) fledgling at the same location on August 8, 2015.

Two photos to left: Hillsboro, NM, June 2019.



Great Horned Owl
Bubo virginianus

The nests of Great Horned Owls? To quote from Hal Harrison's, *A Field Guide to Western Birds' Nests*, referenced earlier: "Nest: Generally in old nests of large birds: hawks, eagles, herons, ravens, crows; squirrels' nests. Also in tree cavities, stumps, on rocky ledges, in caves; rarely on ground in logs, among rocks. Little if any material added except feathers and down from breast." (p. 90). That about sums it up, a Great Horned Owl's nest looks like wherever it chooses to lay its eggs.

There are 1-4 (rarely 5) eggs per brood. The image shown below is of a replica of a Great Horned Owl egg which you can buy on the internet for about $30. This image demonstrates how odd the eggs of this species are - it is almost completely spherical.



Left and Below: Great Horned Owl, *Bubo virginianus*, and nest site east of Hillsboro, New Mexico, August 7, 2016.



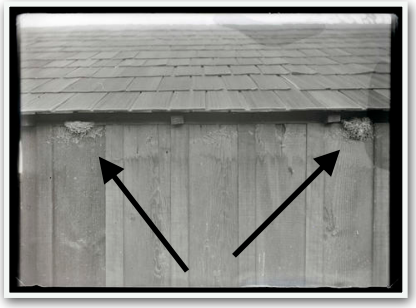
Black Phoebe
Sayornis nigricans

The nest of the Black Phoebe is always found near water, since this species uses mud extensively in its nest building. The nest is reminiscent of that of a Barn Swallow, a half cup attached to a wall. Something (like a ceiling or rock overhang) is always just above the nest, making for a restricted zone of access. The nest is adhered to the wall with mud and the bottom section of the nest is made of mud. Unlike the Barn Swallow's, the top part of the nest is woven of fibrous material and lined with softer material like down or hair.

The nest shown here was photographed in Hillsboro in May 2023. The mud foundation is partially obscured in these images but the softer upper layers of the nest are clear.

The range of the Black Phoebe extends southward into western South America, as far south as northern Argentina.

William L. Finley took this photograph of Black Phoebe nests in 1906, showing the preferred nest placement of the species.









Black-throated Sparrow
Amphispiza bilineata

Black-throated Sparrows nest on or near the ground. The nest shown here was located in a cholla. Black-throated Sparrow nests are roughly 4.5" in diameter and 3.5" high. The bowl is generally 2.5" in diameter and about 2" deep.

The nest is constructed of various grasses and plant material. As in many other species, the cup of the nest is lined with softer materials like hair and wool.

There may be two broods per nesting season, and each brood typically has three eggs (+/- 1). Eggs are generally 17 x 13 mm (.6" x .5") in size and are white, although they may have a slight tinge of blue.

The willingness of an incubating bird to stay on the nest when disturbed varies by species. In the case of the Horned Lark, the incubating bird will leave the nest very early. In the case of Black-throated Sparrows, the female incubates the eggs and will remain on the nest even when approached very closely.

The female builds the nest in this species, often placing it on the north side of the low bush. This placement maximizes morning sun and afternoon shade.

Often food preferences are driven by seasonal needs and the types of food available during those seasons. For instance, Black-throated Sparrows are primarily insectivores during the breeding season when that type of food is available and their nutritional needs are greatest. During the winter, when insect populations are lower, they are primarily seed eaters.





Above: Black-throated Sparrow on nest south of Hillsboro, by Matilde Holzwarth 2012.
Left: Eggs in the nest shown above, same date/location.
Below: Black-throated Sparrow, July 6, 2016, Warm Springs Wash, northeast of Hillsboro.



Barn Swallow
Hirundo rustica

The nest of the Barn Swallow, *Hirundo rustica*, is constructed of mud mixed with grass stems. The swallows gather mud and form it into small pellets mixed with grass (see two photos lower right). A classic southwestern adobe home. The inside is lined with grass (next to the mud form) and feathers. Both sexes build the nest. As seen at the upper right, the nest form shown here is roughly half a circle, this because it was built on a flat vertical surface below the eave of a building (see following page). If the nest had been built on a horizontal surface the nest shape would have been circular.







Nest photographs on this page by Tom Lander, 2021, who found the nest on the ground in Hillsboro, below where it had been actively inhabited all year.





Barn Swallow nests are generally about two inches deep and about three inches wide. With only minor maintenance, replacing the feathers and repairing the mud structure, swallows may use nests of previous years. In our area there may be two broods of from three to seven eggs each. Both sexes incubate the eggs.

Eggs are typically 18.8 mm x 13.5 mm in size (.74" x .53"). Eggs have a non-gloss white base color and are covered with brown splotches. They, apparently, can not be distinguished from the eggs of Cliff Swallows.

The Barn Swallow species may have the most extensive distribution of any passerine species (more than 96.5 million square miles or 250,000,000 square kilometers). This distribution does not include the range of the Welcome Swallow of Australia, which has been determined to be a separate species.

There are six subspecies of Barn Swallow which are currently recognized. The subspecies which we have in North America is *H. r. erythrogaster*. It is found from Canada to Argentina.

The Barn Swallow eggs shown to the right are from the historical collection of Jacques Perrin de Brichambaut. The photograph is by Didier Descouens who authorized the image use under a Creative Commons License.









Barn Swallow nest and its builder, Hillsboro, August 1, 2015

Cliff Swallow
Petrochelidon pyrrhonota

The Cliff Swallow is a species of the Americas, having a range which extends from Alaska/Canada to Argentina.

Cliff Swallows gather bits of mud, as shown in the photograph at center right, to make their gourd-shaped nests. The Cliff Swallow nest photographs on this page were taken in the Percha Box (east of Hillsboro) on March 11, 2015.

Since the eggs of the Cliff Swallow can not be reliably distinguished from those of the Barn Swallow we do not show them here.

Cliff Swallows are colonial nesters: when you find one nest you will find many others. They return to nesting areas year after year, so nests in various stages of repair will be found at a nest site. Note, however, that at some locations Cliff Swallows will allow a nesting site to remain dormant for several years. It is generally assumed that this occurs when a site becomes infested with parasites. The size of a nesting site can be used as a clue in aging this species. Younger birds tend to nest in colonies which are larger than those of older birds.









Curve-billed Thrasher
Toxostoma curvirostre



The Curve-billed Thrasher has a range which extends from the Southwestern United States southward through much of Mexico.

This species shows a strong (but not exclusive) preference for cholla cactus when it comes to nest placement. Nest sites all are generally quite low to the ground.

There may be two broods a year, and each brood will generally have three eggs (but +/- 1). The eggs of the Curve-billed are fairly large, generally just over an inch in length.







The photograph to the left was taken by Gary Sapp; those in the right column and on the following page were taken by Tom Lander. They monitored the nest of a Curve-billed Thrasher in Hillsboro during 2021. By July 14, 2021 the nest was empty.

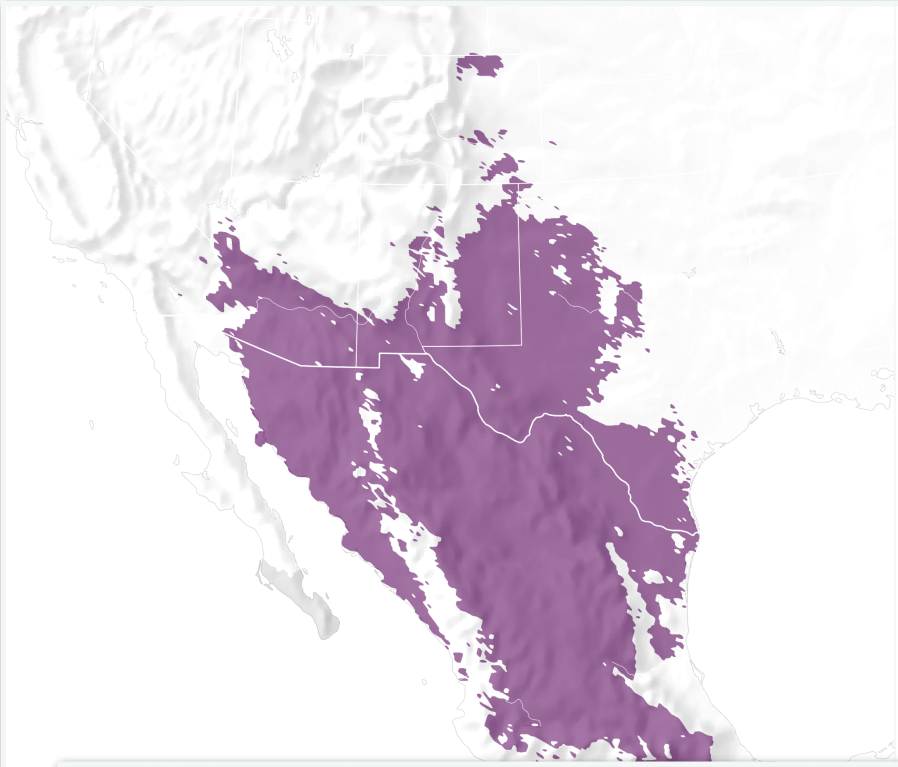
eBird has a wealth of information gleaned from observers from around the world. Follow the link to peruse information like that shown on the following page. Range maps are useful tools and are found in most field guides. Add a map of species abundance and the picture becomes much richer. The last graphic shows both the habitats the Curve-billed prefers and those which it avoids - by month - in New Mexico. The bottom line for the Curve-billed Thrasher; although common, there are many areas within its range where it is more abundant, and its habitat preferences during the year do not change much.

Nest failure occurs in various forms and degrees. In this instance, it appears that one of the eggs laid in this brood was infertile.

There is enough variation in the appearance of the Curve-billed Thrasher subspecies (six or seven are currently recognized) that there is the occasional call for elevating one or more of the subspecies to full species. We are in an area where the clinal variation of several subspecies overlaps. Just be aware that if you see a Curve-billed Thrasher in eastern Arizona and then see one from the Brownsville, Texas, area they will look different. At the extremes of the species' range it is fairly easy to separate the birds into subspecies. In areas of clinal overlap, naming a bird to subspecies may be problematic.







Curve-billed Thrasher

Toxostoma curvirostre

Range

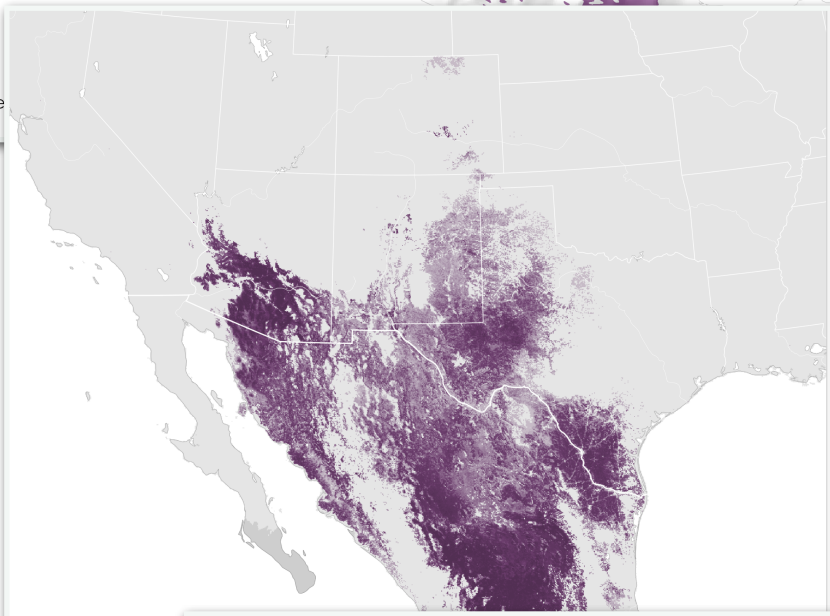
The range map depicts the boundary of the species's range, defined as the areas where the species is estimated to occur within at least one week within each season.

OCCURRENCE

Year-round

Modeled area (0 abundance)

No prediction



Curve-billed Thrasher

Toxostoma curvirostre

Abundance

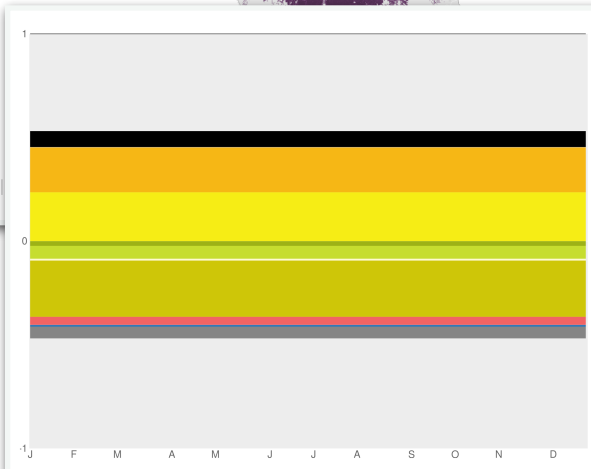
Relative abundance is depicted for each season along a color gradient from a light color indicating lower relative abundance to a dark color indicating a higher relative abundance. Relative abundance is the estimated average count of individuals detected by an eBirder during a 1 hour, 1 kilometer traveling checklist at the optimal time of day for each species.

RELATIVE ABUNDANCE

Year-round

0.28 0.53 1.6

TheCornellLab



TheCornellLab | Data provided by eBird

Curve-billed Thrasher *Toxostoma curvirostre*

Habitat regional charts

This stacked area chart depicts the habitat associations (positive) and avoidances (negative) for a species among 27 habitat types. Habitats with the greatest areas on the chart represent more important association or avoidance.

New Mexico

Scaled abundance (0-1)

HABITAT TYPES

- Open forests
- Sparse forests
- Barren
- Sparse herbaceous
- Dense herbaceous
- Sparse shrublands
- Dense shrublands
- Shrubland/grassland mosaics
- Herbaceous croplands
- River
- Lakes
- Roads
- Nighttime lights

eBird data from 2006-2020. Estimated for 2020.

Fink, D., T. Auer, A. Johnston, M. Strimas-Mackey, O. Robinson, S. Ligocki, W. Hochachka, L. Jaromczyk, C. Wood, I. Davies, M. Iliff, L. Seitz. 2021. eBird Status and Trends, Data Version: 2020; Released: 2021. Cornell Lab of Ornithology, Ithaca, New York. https://doi.org/10.2173/ebirdst.2020

Canyon Towhee
Melozone fusca

In some sources this species is still referred to as *Pipilo fuscus* (Brown Towhee). There are still debates over whether Canyon Towhee is a separate species from California Towhee.

The nest of the Canyon Towhee is made from a variety of materials and has a relatively deep cup (up to 2.5"). The outside diameter of the nest may be as much as 7.2" and the nest may be 4.5 inches tall. Two photos (top and center) by Matilde Holzwarth 2012.

A brood of eggs is usually 3, rarely 2 or 4. Each egg is roughly 23 mm x 17 mm (.9" x .7") in size. Harrison (see page 68) describes the eggs of *Pipilo fuscus mesoleucus* (the Canyon Towhee subspecies at the time he wrote his book) as "off-white with reddish-brown spots, blotches, scrawls, and scribblings".

The Canyon Towhee eggs in a nest (below) were photographed south of Hillsboro, May 3, 2014.









Plumbeous Vireo
Vireo plumbeus

At the time that Hal Harrison wrote his book (see page 68) the Plumbeous Vireo was considered a subspecies of the Solitary Vireo. The Solitary Vireo was split into three species in 1997: the Plumbeous Vireo, the Cassin's Vireo, and the Blue-headed Vireo. There are four subspecies of Plumbeous Vireo.

Range map to the right is from Wikipedia (orange is breeding range).

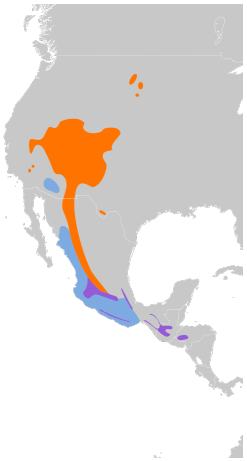
Each brood consists of from 3 to 5 (usually 4) eggs, white with a few brown spots.

The nest is built by the female and is generally between 3.5" and 4.66" in diameter (outside) and about 3.5" high. The cup of the nest is about 2.5" in diameter and depth.

Both sexes incubate the eggs. Some authorities indicate that the male will often sing while incubating (others say that once the eggs are laid the male sings less - with no reference to incubating). Incubation lasts from 12 to 14 days.

Many authorities note that the outside of the nest often includes tissue paper, and true to form, high in the foothills of the Black Range, there was tissue paper readily apparent on the outside of the nest shown at the bottom.

Want to try out your Spanish? Audubon has a species page for the Plumbeous Vireo which should open in Spanish, at this link.







This National Park Service photograph of a Plumbeous Vireo nest shows a Brown-headed Cowbird egg with four vireo eggs. The vireo eggs are 20 mm x 15 mm in size (.78" x .59").



Plumbeous Vireo, *Vireo plumbeus*, Carbonate Creek, east slope of Black Range. June 9, 2011

Lucy's Warbler
Leiothlypis luciae

In the October 2021 issue of this journal we published a series of articles which revolved around William L. Finley. On one of his expeditions to Arizona he photographed the nest shown to the right. There is something inherently sharp and clear about glass plate images. The image is a bit of a mystery, however. Lucy's Warblers are usually described as cavity nesters or at the very least as nesting under loose bark. This placement is clearly not that, and it may be that the nest was removed from its original location before the photograph was taken.

Lucy's Warblers will lay from 3-7 (usually 4-5) eggs in each brood. The eggs are fairly small at 14.6 mm x 11.4 mm (.57" x .45") in size.

The Prothonotary Warbler is the only other cavity-nesting warbler. Nest size is assumed to be determined by the size of the cavity. Lucy's Warbler is the smallest warbler species in North America.

Scientific synonyms for this species include *Vermivora luciae, Helminthophaga luciae,* and *Oreothlypis luciae*. Its current Latin binomial has been valid since the Sixtieth Supplement to the American Ornithological Society's Check-list of North American Birds.

Except for a zone along the Rio Grande in western Texas, we are at the extreme eastern edge of the nesting range of Lucy's Warbler here in the Black Range. They typically nest during May and June. However, some birds may begin nesting in the last part of April while others may not start until the first part of July.

Right: The Tucson Audubon Society sells Lucy's Warbler nest boxes as part of their efforts to study and support the species. Lucy's Warblers have been seen in Hillsboro during their breeding season. One of Tucson Audubon's boxes was placed in a hackberry in Hillsboro in 2021 (pictured right). To date it has not been utilized. Note that the box covers the nest area and provides two access points.



Lucy's Warbler nest, 1910, Arizona, William L. Finley - From the collection of the Oregon Historical Society





This range map for Lucy's Warbler is from The American Bird Conservancy (ABC) website. ABC is one of the premier conservation programs and its activities directly benefit us.

"Orange" represents breeding range.

Acorn Woodpecker
Melanerpes formicivorus

The Acorn Woodpecker is more common on the western slopes of the Black Range than on the eastern slopes. In season it is quite common along the Black Range Crest trail north of Emory Pass. As their name suggests, they are generally found in and around oak trees.

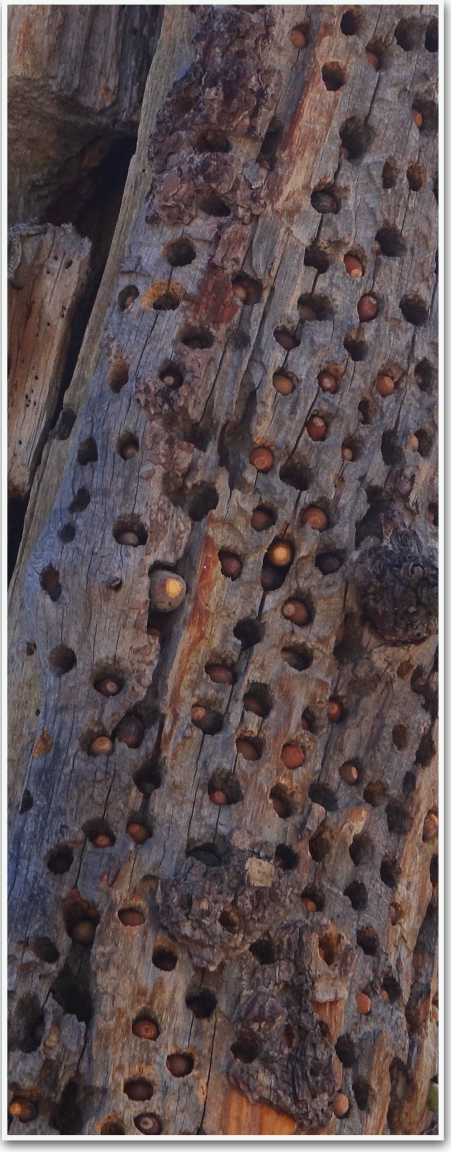
There are seven subspecies which are currently recognized. The one found in our area is the nominate form.

The Acorn Woodpecker is a colonial cavity-nester. The entrance to the nest, usually in an oak (but not always, see below right) anywhere from 6 - 25 feet above the ground, is round. The nest cavity is anywhere from 8" to 2' deep. No additional material is added to the nest.

A colony is usually separated from other groups and includes birds of breeding and non-breeding age, totaling as many as 15. All members of the colony may help in excavating the nest and feeding the young, perhaps also in incubating. The term generally used for Acorn Woodpeckers is "cooperative breeders"; all males of breeding age in the colony will breed with all females of breeding age. The males are related to each other (sibling or parent/child), as are the females. All breeding females will share the same nest, but it is thought that a laying female will remove all other eggs before laying her own. Cooperative breeding is fairly rare, thought to be a practice in about 9% of bird species.

It has been asserted that food supply is a driving force in the dynamics of cooperative breeding. The colony gathers and stores acorns in dead trees (or limbs) and utility poles. These trees are called granaries (see photo below left). A small hole is pecked out of the storage material and an acorn is inserted, to be moved to smaller holes as they dry, and eventually eaten. Acorn Woodpeckers in the far south of their range do not construct granaries but rather insert the acorns in folds of tree bark. As important as acorns are in the diet of Acorn Woodpeckers, their primary food sources are insects, sap, and some fruits.

Eggs are non-gloss white measuring roughly 26 mm by 20 mm (1" x 3/4"). There are 4-5, sometimes 6, eggs in a clutch.





Ladder-backed Woodpecker
Dryobates scalaris



All woodpeckers are cavity nesters, so what we routinely see of their nest is a hole in the tree, like that of the Acorn Woodpecker shown on the previous page or that of the Ladder-backed Woodpecker (photographed in Hillsboro by Janice Richmond, April 2023) shown to the right. Or for that matter, of the Hairy Woodpecker shown below, but probably only if you are in the forested areas of the Black Range.

When you find a round hole in the tree, what can you assume? First, it may not be the nest site of a woodpecker. There are several cavity nesting species in our area including various owls, nuthatches, bluebirds, and others.

The hole in the tree can give you some hints about the species involved, however, even if you fail to see the bird using it at the time of your observation. Firstly, observe the size of the nest hole. Obviously, smaller birds may use holes which are larger than they need, but the reverse is not true. Larger birds can not use smaller holes than they can enter. A first crude filter, but it can be used to sort out many species.

Secondly, the type of tree (post, cactus, etc.) that the hole is made in can provide a clue to the species which made it. For instance, Acorn Woodpeckers, in New Mexico, generally nest in live Gambel Oaks while Northern Flickers are more likely to nest in Ponderosa Pine.

Such preferences extend to secondary users of nest holes. Flammulated Owls show a preference for old Northern Flicker nest holes. Western Bluebirds seem to prefer old Acorn Woodpecker nest holes. These preferences may stem from the size differences of the species involved.

See "Differentiating Nest Sites of Primary and Secondary Cavity-Nesting Birds in New Mexico" by David P. Arsenault for more information about the four species referenced above.

Old Ladder-backed Woodpecker nesting holes are also used by other species, including Ash-throated Flycatchers.

To get an idea of the amount of work which goes into the excavation of a woodpecker nesting hole watch this video of a Pileated Woodpecker excavating a new nest in Oregon.



Ladder-backed Woodpecker (left) and Hairy Woodpecker (right), Hillsboro, July 2016.

Cactus Wren
Campylorhynchus brunneicapillus

The Cactus Wren is endemic to the southwestern United States and the northern and central states of Mexico. See range map below.





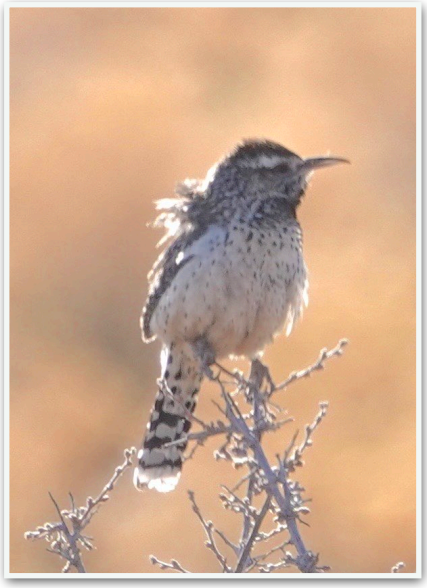
Above: Cactus Wren with nesting material, East of Hillsboro, August 30, 2015
Below: Nest east of Hillsboro, May 21, 2016.

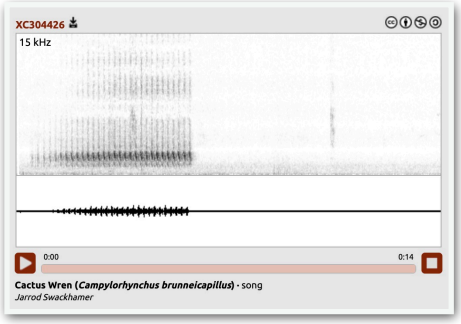


The eggs of the Cactus Wren are "salmon pink to buff with reddish brown spots". They may be as long as an inch (.8" - 1") and more than a half inch in width (.6"-.7"). Clutch size ranges from two to seven and incubation usually takes 16 to 17 days. There may be as many as three broods a year.

Nests are generally placed from 4'-9' above the ground in cactus or thorny trees. The entrance to the nest is on the side, and the entrance passage leads to the nest chamber which is about 6" in diameter. The outside diameter of the nest is generally a foot or so. Following the fledging of young, the adults may continue to use the nest as a roosting site. Males will build additional nests which the breeding pair may use following fledging.







One of the easiest ways to find a Cactus Wren is to listen to its loud and distinctive call. Listen to a call by clicking on the link arrow above. It will take you to xeno-canto, which is an incredible resource of bird sounds. The photograph to the left was taken on April 7, 2021, east of Hillsboro.



Above: Rock Wren nest, south of Hillsboro, Black Range, October 23, 2011
Right: September 3, 2015



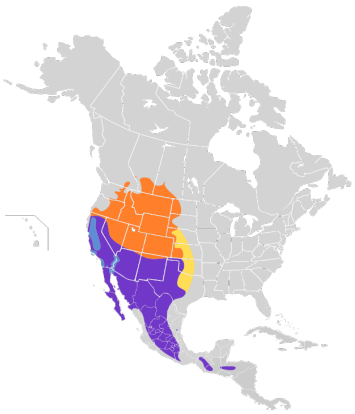
Rock Wren
Salpinctes obsoletus

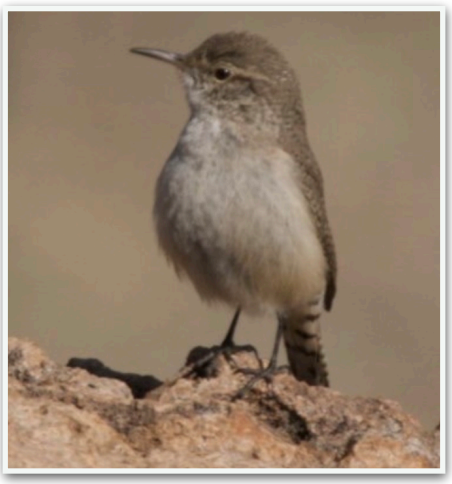
The Rock Wren is found in North America and in the northern part of Central America. See range map below (Cephas - Lowther, P. E., D. E. Kroodsma, and G. H. Farley, 2000).

With the exceptions of Winter/Pacific and House Wrens (which are in the genus *Troglodyte*) all of our wrens are in different genera.

The eggs of the Rock Wren are white with slight speckling (brown, reddish, purple). They typically are in the range of 19 mm x 15 mm in size.

Rock Wren nests are a bit unusual. They are typically made within a small alcove in rock. The wren will often place stones and other material at the entrance to the alcove.





A Few Final Notes on Nests

When birds are nesting they are very vulnerable. If a nesting bird perceives your presence as a threat it may abandon the nest, perhaps only temporarily, perhaps permanently. In either case, the nest may fail.

Collecting bird eggs was something that naturalists did on a large scale prior to the twentieth century. Now it is illegal in the United States, and in most other countries.

Everyone of us should tread lightly, observe but not interfere.

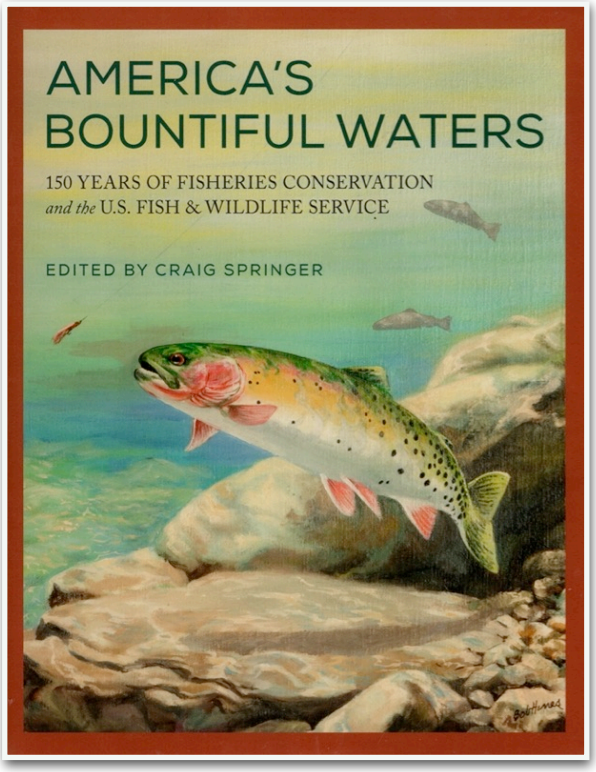
The Fish Side of the U. S. Fish and Wildlife Service

Book Review by Harley Shaw of *America's Bountiful Waters*, edited by Craig Springer.

As an employee of a state game and fish department, I viewed our federal wildlife organization as the agency that managed national refuges, protected migratory birds, and enforced the Endangered Species Act. I never gave much thought to the "fish" side of the equation. In reading *America's Bountiful Waters –150 years of fisheries conservation and the U.S. Fish and Wildlife Service*, I discovered that the fisheries role of this agency evolved decades before its successor assumed terrestrial wildlife management chores. Federal fisheries have been in business since 1871, when Freshman Congressman Robert Barnwell Roosevelt wrote a bill creating the U. S. Fish Commis-sion. RBR, as the family called him was a mentor to his more famous nephew, Theodore. After various renditions, the commission he created became part of today's United States Fish and Wildlife Service.

One stage of the wildlife side during the first half of the 20th Century was the Bureau of Biological Survey. The activities in the Black Range of that agency's biologists – Vernon Bailey, E. A. Goldman, J. Stokley Ligon, and others – are well known. Accomplishments of federal fisheries biologists on our almost stream-free mountain are less well documented. However, the book's editor, Craig Springer, brings the larger story to bear even upon our small and remote creeks. On pages 5 and 6 of the book, writing of early stocking of hatchery-raised trout, Springer notes:

> On land, the most efficient transport was the rails. The first transcontinental railroad was completed in 1869, just two years before the creation of the U. S. Fish Commission. In 1873, the first "aquarium car" attempted the cross-continental transport of fish . . . . Improvements ensued and between 1881 and 1928, ten fish cars were specifically designed to transport fish across the nation. . . . This supremely efficient fish distribution method succeeded in stocking fish in practically every available waterway near a railhead. However "near" is a relative term belied by determination. . . . in 1919, the U. S. Bureau of Fisheries delivered cutthroat trout to the railhead at Lake Valley, New Mexico, then by truck and then by panniers hanging over a mule, to the remote and troutless Holden Prong, a tiny stream on the east flank of the Black Range in the Gila National Forest.



Even though such fish planting strategies verged upon miraculous, their results were not positive. As early as 1921, small streams that drain from the west side of the Black Range to the Gila River were among the last bastions of the Gila trout, a native species threatened by overgrazing of the watersheds, drought, and eventually, hybridization with non-native rainbows brought in earlier by rail, road, and trail. Tenuous retention of Gila trout has been accomplished by way of stocking hatchery-raised pure Gila stock into small headwaters, including those on the northwest end of the Black Range. Even today, a drive into that remote portion of the Gila River watershed is not done without preparation. In 1919, keeping sensitive trout alive during such an expedition was a bold undertaking by a handful of bloody optimists!

Now, over 100 years later, fish scientists in the service function with greater sensitivity and so quietly and efficiently that, except for endangered species involvements, they attract little attention in today's controversial world of conservation. They just keep doing and refining the job they've done for over 150 years.

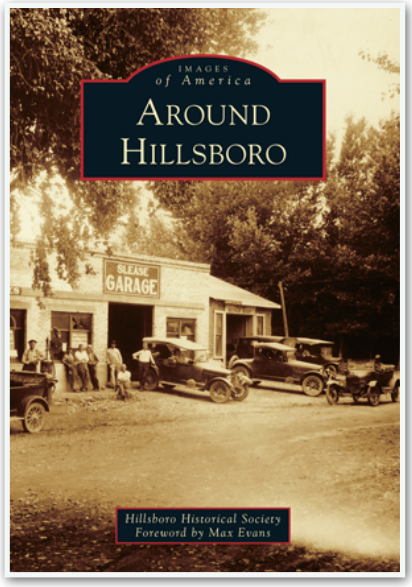
In this beautifully and copiously illustrated book, Craig, plus some 47 other past and current employees of that agency, provide internal views of how management, and sometimes mismanagement, of our country's lakes and streams developed. The book also provides biographical sketches of significant historical personalities in fish management, including, Spencer Fullerton Baird, David Starr Jordan, artist Bob Hines, and Rachel Carson. Carson is best known for Silent Spring, considered by many to be the

founding document of our modern environmental movement. Most of Carson's books became known after she retired from the Fish and Wildlife Service, but her early years with the agency provided her with the insights as well as writing experience that served her well after she stepped into the conservation limelight. Also, as the book discloses, Rachel Carson was only one of several women scientists who contributed significantly to natural resource management long before women were commonly employed in field positions by other agencies.

***America's Bountiful Waters* is not a simple, single-subject book. Editor Craig Springer has somehow blended history, biographies, and species accounts of 46 aquatic organisms into an interesting and highly readable book – a task for which he is highly qualified. He was already attending NMSU in 1989, when his parents bought the historic Miller house in Hillsboro, New Mexico. Having home-schooled Craig through high school, his mother solicited his help in digging up facts to place their house plus several other Hillsboro buildings on the State Historic Register. She became the force in listing and restoring the town's high school, turning it into a community center the likes of which are seldom found in towns with a scant 100 souls. Craig developed an expertise in the history our area that continues to the present. In 2011, he coauthored *Around Hillsboro* with Matti Nunn, Patti Nunn, and me. We are well-justified in considering him "local."**

Craig's title in his day job is Fish Biologist – within the agency covered by the book. He has a B. S. in fisheries from NMSU and an M. S. in fisheries from the University of Arizona. His research subjects include smallmouth bass and the indigenous White Sands pupfish. Craig's passion for writing science and local history led him to acquire an M. A. in Rhetoric at the University of New Mexico with a thesis on rhetoric of conservation and nature. Craig edited the U.S. Fish and Wildlife Service's *Eddies* magazine through seven volumes and his byline has appeared on nearly 450 stories in 170 publications, including *Farmer's Almanac, SkyWest, Field & Stream, ESPN, Wild West, Country Living, Sporting Classics, Fishing Tackle Retailer,* and the *New York Times*. His popular sport fish guides cover nearly the entire U.S. He was awarded the New Mexico State University, 2022 Outstanding Alum of the Year - College of Agriculture, Consumer, and Environmental Sciences. Amidst all of this, Craig and his wife, Felicia, have raised three children who are well on their way to simulating their father's accomplishments.

***Bountiful Waters* might be a temporary pinnacle of Craig's writing career – I expect to hear of awards it has won. But the man doesn't rest on his laurels. I'm sure there is more to come.**

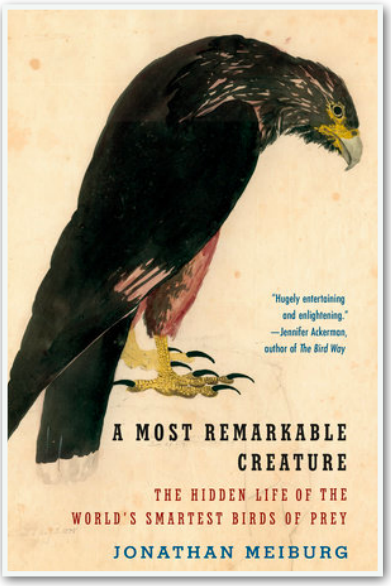


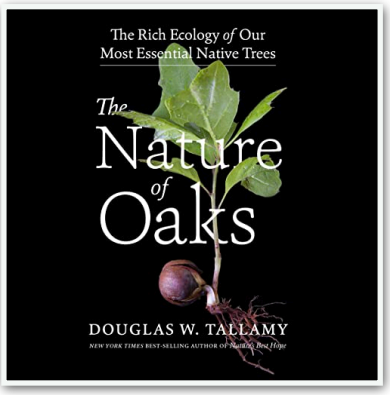


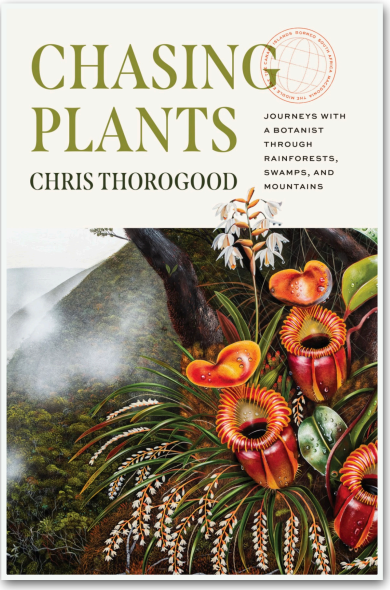
Craig Springer

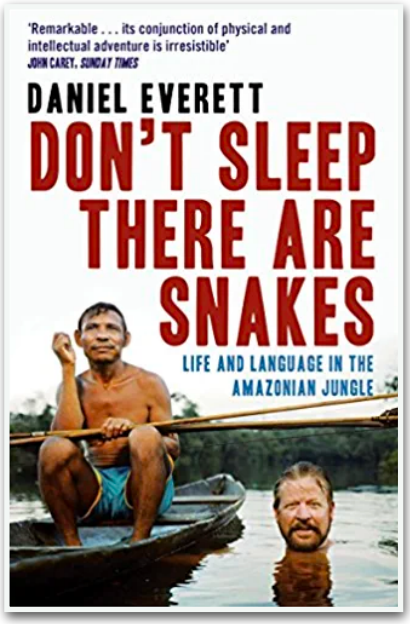
What is Being Read and Listened To in the Black Range

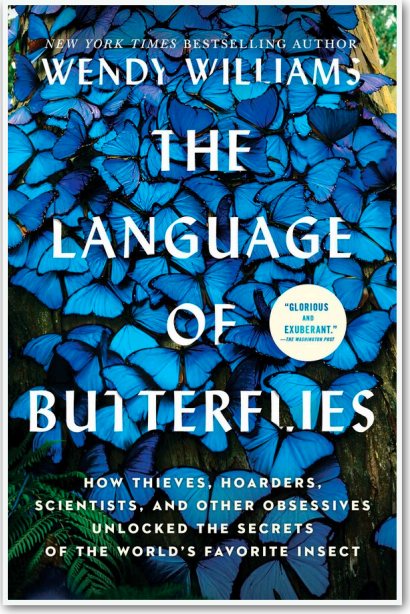
When it comes to natural history the people of the Black Range have a varied reading diet. Here are some of the current books being read here.

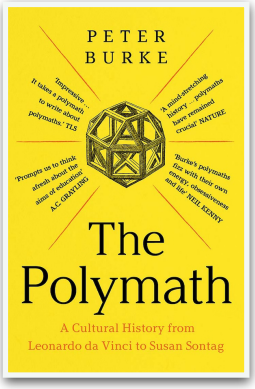


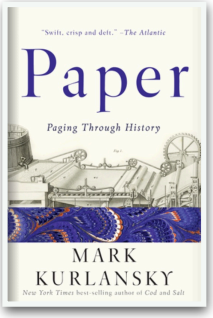


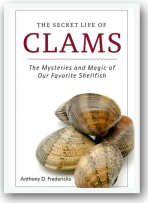


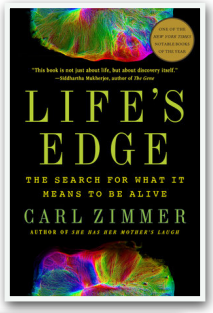






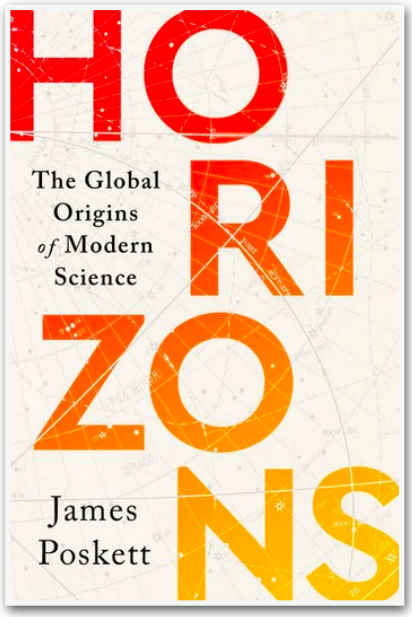


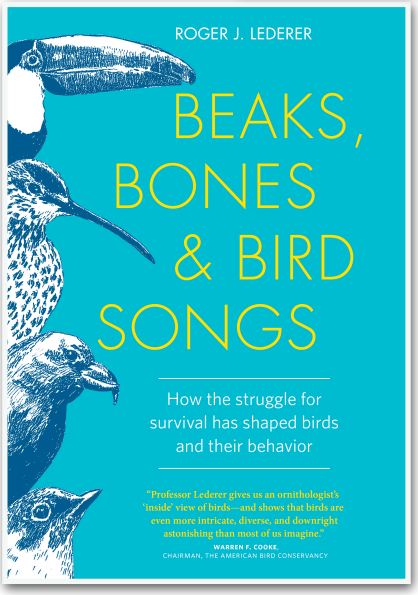


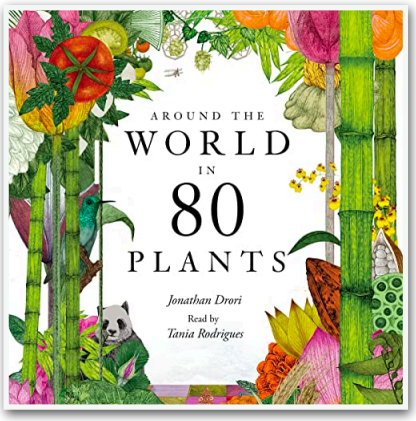


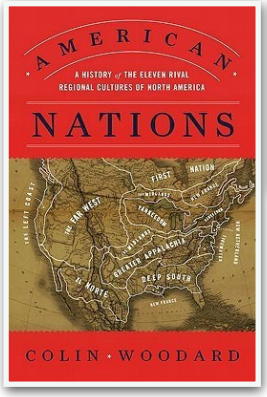
Don't Sleep There Are Snakes

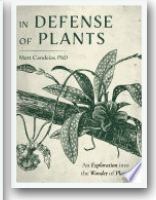
A linguistic and social study of the Pirahã of Brazil's Amazon. It includes a substantive discourse about challenging the established scientific (in this case, linguistic) norm, as in Thomas Kuhn's *The Structure of Scientific Revolutions*. Little did I know when I read Kuhn's work in grad school that it would be one of the most formative works I would ever encounter. - Bob Barnes, Hillsboro

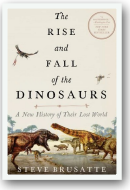


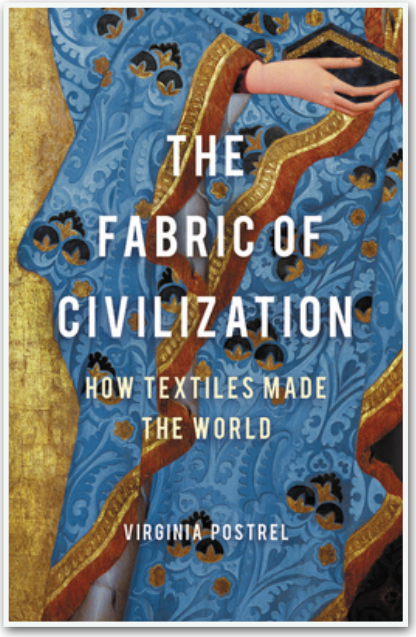


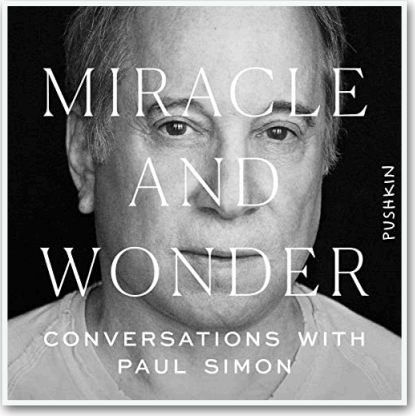












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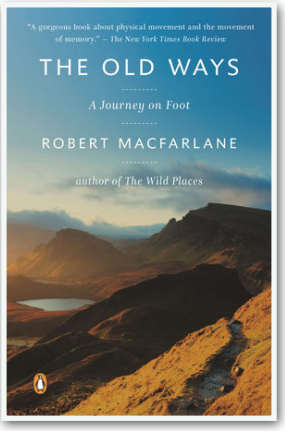
A book which must be listened to, not read, a study in genius.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A Journey on Foot
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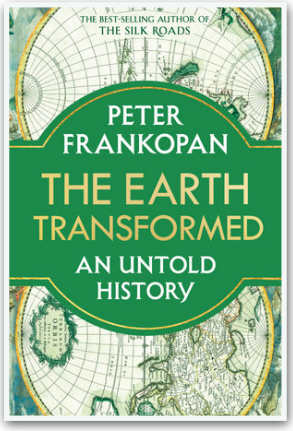
author of The Wild Places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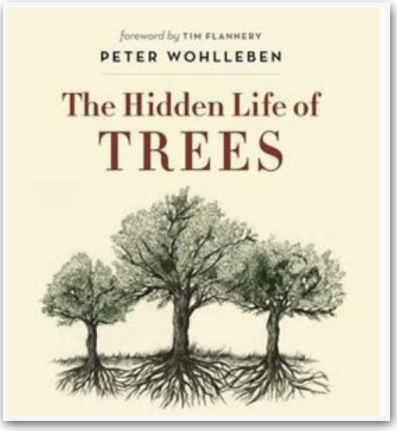
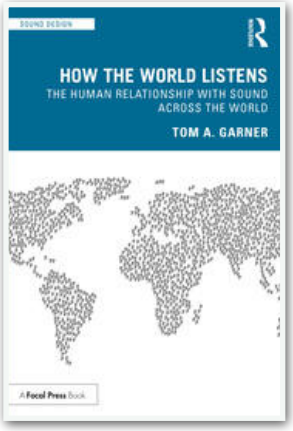

foreword by TIM FLANNERY
PETER WOHLLEBEN
The Hidden Life of TREES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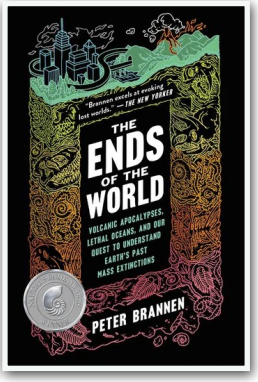
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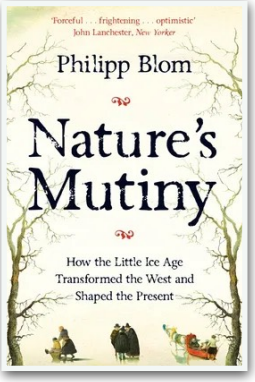
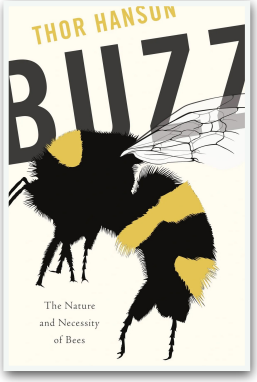
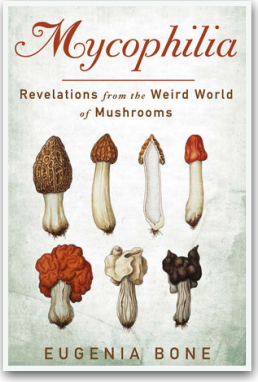
PETER BRANNEN


'Forceful . . . frightening . . . optimistic' John Lanchester, New Yorker
Philipp Blom
Nature's Mutiny
How the Little Ice Age Transformed the West and Shaped the Present


THOR HANSON
BUZZ
The Nature and Necessity of Bees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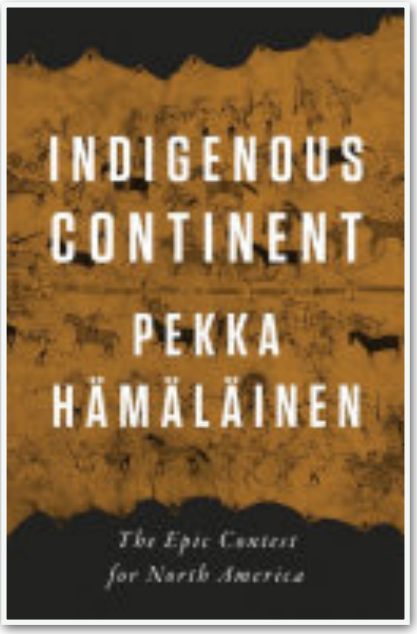
Revelations from the Weird World of Mushrooms
EUGENIA BONE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PEKKA HÄMÄLÄINEN
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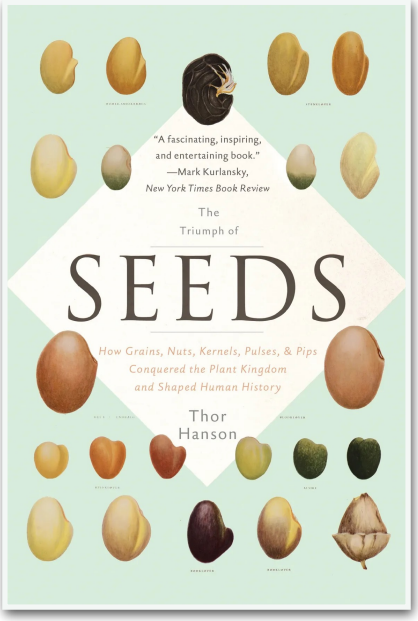
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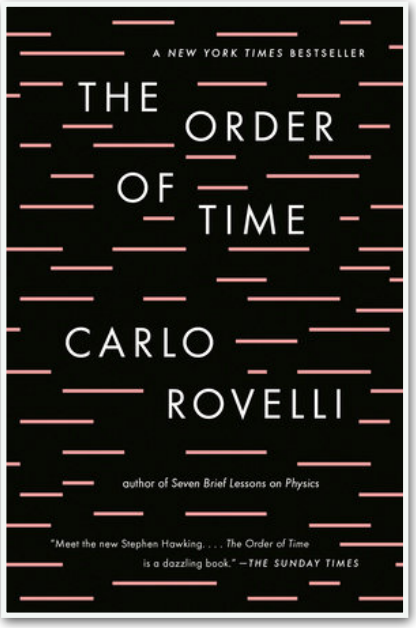
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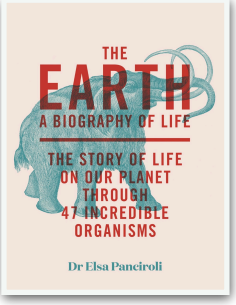
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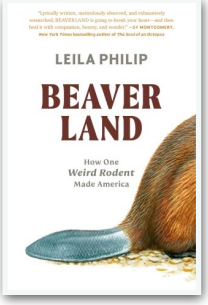
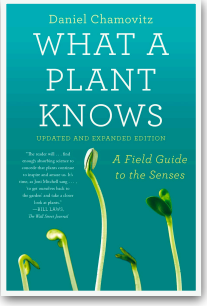
A BIOGRAPHY OF LIFE
THE STORY OF LIFE ON OUR PLANET THROUGH 47 INCREDIBLE ORGANISMS
Dr Elsa Panciroli


LEILA PHILIP
BEAVER LAND
How One Weird Rodent Made America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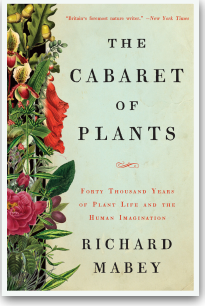
WHAT A PLANT KNOWS
UPDATED AND EXPANDED EDITION
A Field Guide to the Senses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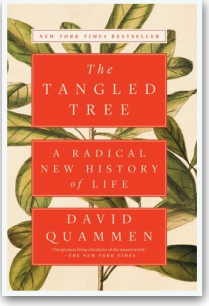
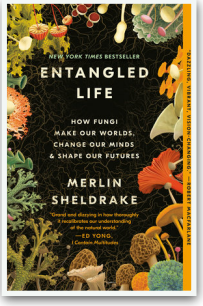
Forty Thousand Years of Plant Life and the Human Imagination
RICHARD MABEY


The TANGLED TREE
A RADICAL NEW HISTORY of LIFE
DAVID QUAMMEN


NEW YORK TIMES BESTSELLER
ENTANGLED LIFE
HOW FUNGI MAKE OUR WORLDS, CHANGE OUR MINDS & SHAPE OUR FUTURES
MERLIN SHELDRAKE

Follow-Ups & Tidbits

Sediment and Debris Flows Follow-up on "From the Crest to the Dam", BRN, 6-2

On 15 Feb 2023, Aaron et al. published their development of new measurement systems for the real-time assessment of debris flows. They report on their research and note, "*Work by others has identified that debris flows tend to develop a distinct segregation between large particles concentrated at the front of the flow and small particles at the tail; however, the formation process and implications of this for debris-flow motion have remained vague. In this work, we present measurements from laser scanners, originally developed for autonomous vehicles, that provide insight into this process. The scanners provide 10 scans per second, which can be used to measure the velocity of objects (rocks and woody debris) on the surface of the flow. We show that different objects in the flow move at different speeds, which results in many destructive features of debris flows. These measurements, and the resulting process understanding, are important for predicting debris-flow hazard and reducing the associated risk.*" (Aaron, J., Spielmann, R., McArdell, B., & Graf, C., "High-Frequency 3D LiDAR Measurements of a Debris Flow: A Novel Method to Investigate the Dynamics of Full-Scale Events In the Field", *Geophysical Research Letters 50*). One of their findings helps in explaining the debris surge dynamic which leads to dramatic, swift, and previously unpredictable changes in the flow of the debris. They note: *". . . front velocities are consistently slower than surface velocities of the trailing material, which moves ~1.5 to 2× faster than the front in the present event. Boulders slow down as they reach the front and are not recirculated, but instead move through a combination of rolling and sliding.*"

This video shows the difference in velocity rates in different parts of the flow. The video shows that friction at the head of the debris flow is a major contributing factor to this phenomenon.



**Yellow-throated Warbler, Hillsboro, March 24, 2023.
(Bird species 172 on a yard list.)**

Bird Species - Black Range Follow-up on "Seasonal Bird Species Distribution" BRN, 2-1

A Yellow-throated Warbler was added to the tally described in the initial article on March 24, 2023 (see above). One or two individuals of this species are seen in New Mexico every year.

White Angled-Sulphur

Nichole Trushell was reminded of a 2010 photo of this species when she saw the photo of the species in the last issue.



NM-152 Closure

From March 20 to May 26, 2023, NM-152 was closed across the Black Range, from Kingston to San Lorenzo.

While many lamented the disruption this caused in their lives, others relished the opportunity to walk along the road without fear of traffic.

Wild Turkey (see below) are frequently seen along the NM-152 roadside, and with no traffic, they were out and about. Taking time to slow down allowed views of Ash-throated Flycatcher (directly below) and the Black-throated Gray Warbler, Bewick's Wren, and Chipping Sparrow shown on the flowing page.















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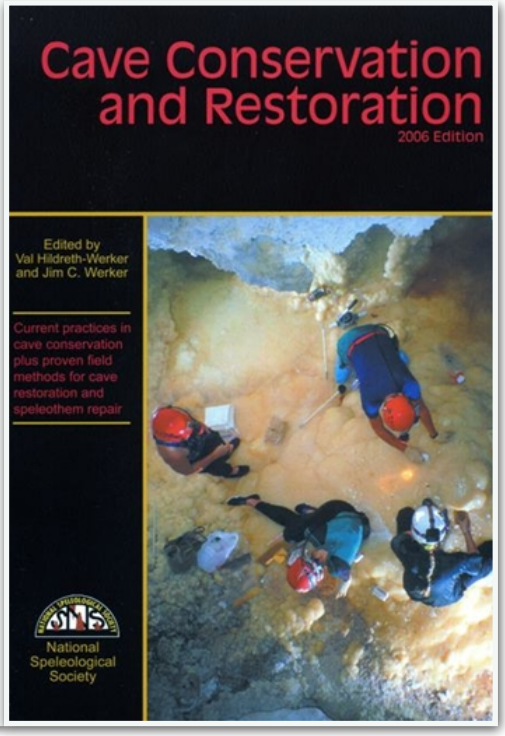

We are sorry to note the death of Jim Werker, of Hillsboro, in April of this year. The internationally acclaimed cave exploration and cave conservation team of Jim Werker and Val Hildreth-Werker edited, and wrote much of, the National Speleological Society's book on *Cave Conservation and Restoration* in 2006. It remains the standard on the topic. Photo Left: Jim Werker and Val Hildreth-Werker, 2008, receiving the Australasian Cave and Karst Management Association award for Outstanding Contribution to Cave and Karst Management. Portrait by Penny Boston; photo composite by Dave Bunnell.

Several years ago, Jim lost an arm in an auto accident. That did not stop him from carrying on in his explorations of the underground. Indeed he continued to accomplish what few of us would even dream of trying to do. Val and Jim have always inspired us and Jim will be missed greatly.



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