The Black Range Naturalist

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Our Contents

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Partners for this symposium include: Western New Mexico University, United States Forest Service, Native Plant Society of New Mexico – Gila Chapter, Bureau of Land Management, the Audubon Society (Southwestern New Mexico Chapter), and the Western Institute of Lifelong Learning.

Everyone may attend the Natural History of the Gila Symposium FREE OF CHARGE.

Feathers

The Feather Atlas maintained by the U. S. Fish & Wildlife Service Forensics Laboratory is an excellent resource if you want to know what that feather on the ground is - and, the site comes with a handy-dandy legal notice. Please read the notice before thinking about making a feather collection. There are bad actors out there; yes, a black market for feathers.

Feathers are one of the wonders of evolution and natural selection. They are beautiful and they are functional, they are structurally complex, and they serve many purposes. For our discussion we will focus on function, structure, and color and we will limit our discussion to living species. Sorry, no warbler-colored dinosaurs are pictured in this article.

Feathers are part of an intricate design which allows most birds to fly. Like the bones of a bird, the shafts of feathers are hollow, all to reduce weight. The more a bird weighs the more energy it must expend to fly. Even so, the total weight of the feathers of some species, the Magnificent Frigatebird for instance, are the heaviest part of the animal. Feathers used for flight vary in shape and structure depending on the specific sub-function that they perform - everything from stabilization and control to enabling the lift which is required for flight.

Feathers also provide thermal control. They trap air in small pockets near the body that provides excellent insulation and keeps a bird warm - the same way a down sleeping bag can keep you warm. Birds have the ability to adjust how their feathers lie against their bodies, allowing them to control the amount of air which is trapped by the feathers and thus the amount of insulation the feathers provide. The more insulation, the more the bird is protected from a cold environment. During cold weather, birds are often seen "all fluffed up", or you might say they are maximizing the thermal benefit the feathers can provide. Note that feathers do not generate heat, they trap heat against the body, preventing it from escaping. Thus, with feathers fluffed the bird has to expend less energy to stay warm; it maximizes the use of the heat it generates.

At the other extreme, feathers provide some protection against excess heat. Feathers reflect a certain amount of heat (radiation), the amount of air they trap can be minimized (allowing body heat to radiate), and feathers can be used to collect water (which absorbs body heat and is then shaken off). Birds use a variety of other methods to cool themselves off, primarily panting (which both expels hot air from the body and

allows heat to radiate from the interior of the mouth) and exposing bare parts (like legs) to water. "A Warming Desert - Mammals and Birds" in the July 2021 issue of this magazine notes some of the issues associated with cooling. Interestingly, some studies have indicated that there is not a correlation between temperature and the likelihood that a bird will bathe in water, and others have attributed bathing to the inclination to play. The question of whether or not water bathing is used to control body temperature requires additional testing.

Some species of sand grouse will gather substantial amounts of water in their feathers to carry back to their nest to cool and hydrate their young.

Feathers provide a physical barrier which protects birds from "the elements". The degree to which this is effective will often depend on how oily the feathers are. In some species the structure of the feathers and the body oils of the bird are sufficient to allow a bird of that species to swim above and below the surface of water. Some species - penguins, for instance - can swim to great depths. Other species, like Anhingas, swim underwater but must perch periodically to dry their feathers.

In some species, feathers are arranged to funnel sound into the bird's ears. Owls have feathers which reduce the sound of flying, allowing an owl to hunt without alerting its prey by flight sound.

Feathers are also used in sexual and territorial displays and conversely as camouflage. And the list goes on and on and on.

These myriad functions dictate that the structure of individual feathers vary significantly. One feature of feathers, often likened to velcro, helps feathers retain a specific shape. On the following page, a series of photographs, each of the same flight feather, increasingly magnified, shows the elaborate structure of a feather. Note that the sides (vanes) of a flight feather are uneven in width. In this feather, about one quarter of its width is on the right side of the shaft. A tail feather, on the other hand, will have a shaft which runs down the middle of the feather.

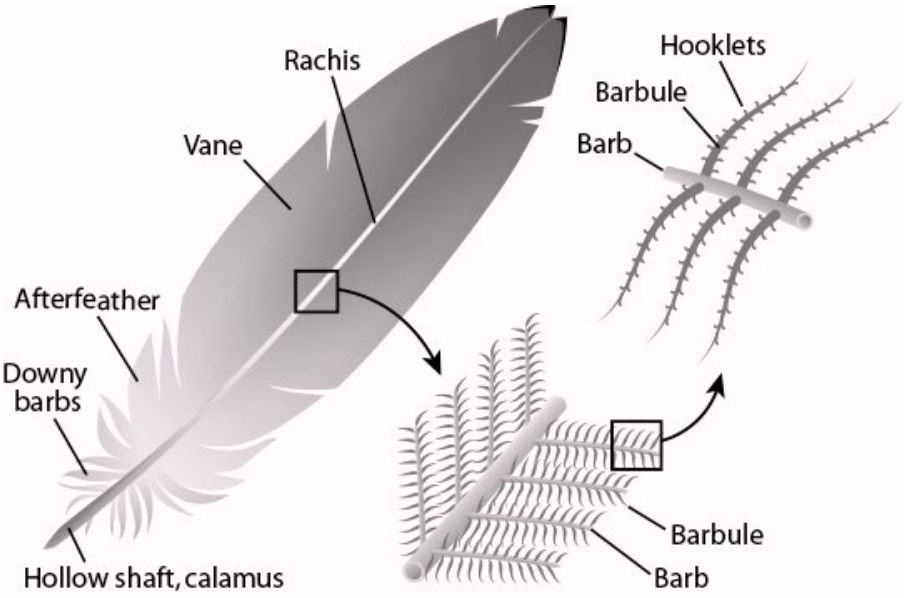
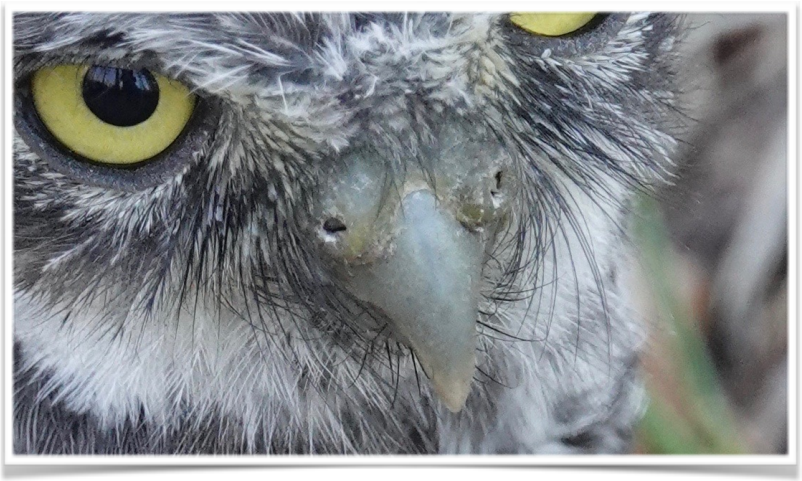


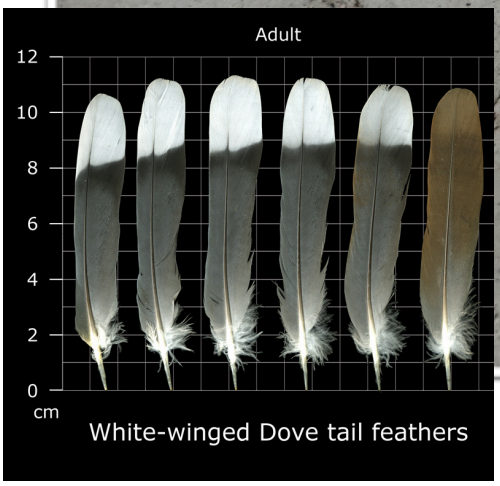
Image from: Feather Biology, CJ Kazilek, Arizona State University School of Life Sciences, Ask A Biologist Site, published: August 11, 2009, accessed: June 27, 2021

The rachis is the central spine which extends up from the shaft (quill or calamus), which is hollow. In the photo at the top right of the next page it is the rachis which is visible as a very dark line in the lower left of the image. From the rachis, barbs can be seen radiating on both sides. In the middle photograph, the barbs are the light and dark posts which march across the image (three of them can be seen in the bottom photo). From the barbs, barbules extend outward mingling with those from the next barb over. Each of the barbules has numerous structures (hooklets) which radiate out from each side. The hooklets and barbules intertwine. This structure maintains the shape and integrity of the vanes and thus the feather. It is the reason why it is possible to separate a vein and then smooth it back into shape, and not be able to tell where the point of separation was.

Birds will spend a fair amount of time preening. They do this to clean themselves, and others, of parasites, debris, and pests and to maintain the quality and integrity of their feathers. Keeping their feathers clean and well oiled is an important activity which affects flight, thermal control, and overall health.

There are some types of feathers which do not have all of the parts described above. Examples are shown on the following pages, and in the bristle feathers around the mouth of the Mountain Pygmy Owl shown below.





Flight feather (below) and tail feathers (above) from a White-winged Dove, showing the difference in vane shape between these two types of feathers - each optimized for the function that they perform. The Feather Atlas images of the tail feathers of White-winged Dove are shown to the left, an example of material available at that site.

The feathers shown above are semiplume feathers. This type of feather has the features described earlier but may be layered beneath other feathers around the body. This type of feather traps air very well, providing insulation and, in the case of swimming birds, floatation. At first glance these feathers might be confused with the downy feathers which are those found next to the skin of the bird. Downy feathers lack the central rachis (but do have a calamus, the quill); they do not need the added support provided by the rachis. In fact, the structure provided by the rachis might be dysfunctional. The more random shape of the feather enables it to trap as much air as possible.

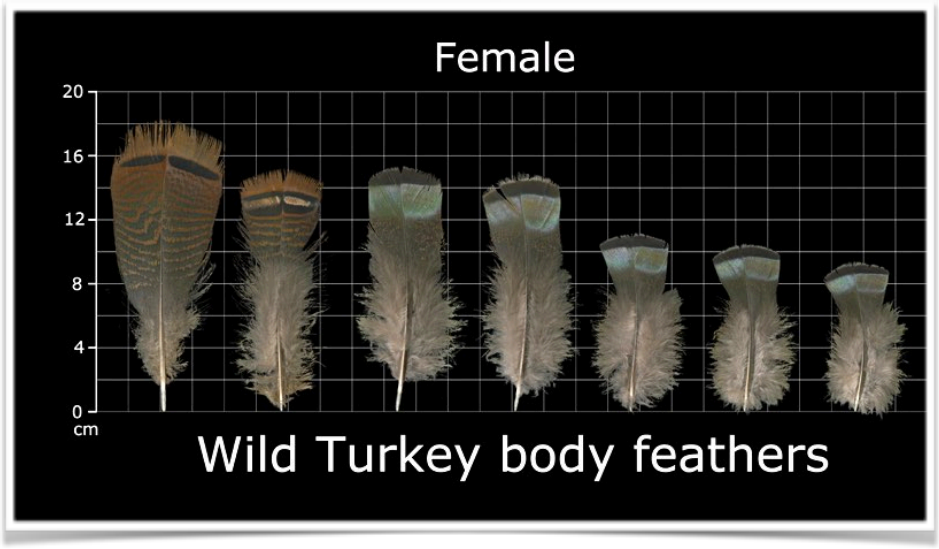
The feather shown on the next page is also a semiplume feather, most likely a body feather from a Wild Turkey. The structure of the feather is quite different from that shown above. As with many species, the color of Wild Turkey feathers will vary depending on the subspecies. The diagnostic image shown with this feather is from the Feather Atlas. This feather would have been layered with many others. The portion of the feather to the left would capture air effectively providing warmth for the body. The portion of the feather to the right is that part of the feather which would be visible from outside. This part of the feather would cover the lower portions of other like feathers, providing a barrier to debris and trapping heat beneath it.

The right end of this feather is that part which defines the plumage of the bird. The plumage of the Wild Turkey found in the Black Range (Merriam's subspecies) is shown on the second page following. Such elaborate plumage patterns are built up feather by feather, and each of those feathers is probably serving several functions. (See Harley Shaw's article which follows this one.)

Feathers come in a variety of pigmented colors, and each feather may have complex color patterns which build to

elaborate plumages. Feathers can also create a complex of colors. Color is created by the structure of the feather and its surroundings. Refracted light (for example, iridescence) occurs when a feather's structure disperses light into its component wavelengths.

We will address the ways which feathers add to the color/plumage of a bird, in turn. This discussion is simplified and generalized. The specifics of the color inherent in a feather and the color(s) it may create are complex, convoluted, and absolutely wonderful.



Merriam's Wild Turkey, *Meleagris gallopavo merriami*,
photographed in the Percha Box east of Hillsboro in the Black Range.

The basic physics of color are the same regardless of whether the color is a function of pigmentation or refracted light. In both cases, wave lengths of light are reflected from the surface of the feather.

Pigmentation is the color which is inherent to a feather. It requires light to show itself but it is not created by light, per se. In the case of pigmentation, the color will be relatively stable since the pigment granules and keratin cortex are stable.

Feathers are made from keratin, which is light in weight, strong, and relatively rigid. Keratin (containing carotenoids, melanins, or porphyrins) creates color which is not determined by feather structure. The keratins found in birds are "derived forms" and are harder than the forms of keratin found in other vertebrates.

Birds consume carotenoids from plants or from creatures which have consumed plants. Carotenoids produce the bright yellow color of goldfinches and the reds of cardinals. They can mix with other pigments to produce a variety of colors. At one time, the difference in coloration between bright red House Finches and those which were pale orange was considered a function of genetic vitality. Now it is just a function of their diets.

Melanin is found in both feathers and skin. In addition to producing blacks and hues of brown and yellow, melanin makes a feather more resistant to wear and structurally stronger. Feathers without pigmentation can be quite weak.

Mexican Spotted Owl, *Strix occidentalis lucida*, Black Range. Identification by Brenna Farrell & others at iNaturalist.

(Merriam's) Wild Turkey, *Meleagris gallopavo merriami*, Sawyer's Peak Trail, Black Range

Porphyrins are created when certain amino acids are changed. Thus, they create many different colors, but all will fluoresce when ultraviolet light is shined on them. This may prove to be an especially interesting feature as a bird's eyesight is generally much better than ours, both in terms of resolution and sensitivity to a broader range of wavelengths. They simply see things we cannot.

Since the structure of feathers may be changed by all sorts of things - wind, debris, water, etc. - the color created by refracted light is variable. The angle of light, and the amount of light, which contacts a feather will change the color of the feather we perceive.

Iridescence from a feather is created by the complex structure of a feather. A feather which has multiple layers of structure will refract light at a variety of angles. The angle at which an observer views the refracted light determines the color that the observer sees. The variation in the color of the gorget of the Rufous Hummingbird (right) photographed in Hillsboro is a function of the angle at which we are seeing the individual feathers.

When refraction is highly organized only one color may be perceived by an observer. This is how the blue color of a Steller's Jay is created (shown on next page, a photograph taken in Hillsboro, NM). To prove this point, try this interesting little experiment. First, find a legal feather of a Steller's Jay. Second, hold it up to the light and observe its blue color. Third, take the same feather and shine the light from a flashlight through the feather towards you. You will

not see blue because the light is not being refracted back at you; you will see brown.

Just how effective a feather can be in refracting or capturing light was described in a 2018 paper by Dakota E. McCoy.[1] In studying the feathers of five Bird-of-Paradise species, she found their black feathers reflect light at close to the effectiveness of the best "man-made ultra-absorbent materials". The kicker is that man-made materials rely on structure at the nanometer scale. Bird feathers perform just as effectively, absorbing up to 99.95% of all light which hits them, at the (much larger) micrometer scale. The structure of these feathers is intricate and "each time light scatters at a surface interface, a proportion of that light is transmitted into the material, where it can be absorbed. By increasing the number of times light scatters, structurally absorbing materials can increase total light absorption to produce a profoundly black appearance."[1]

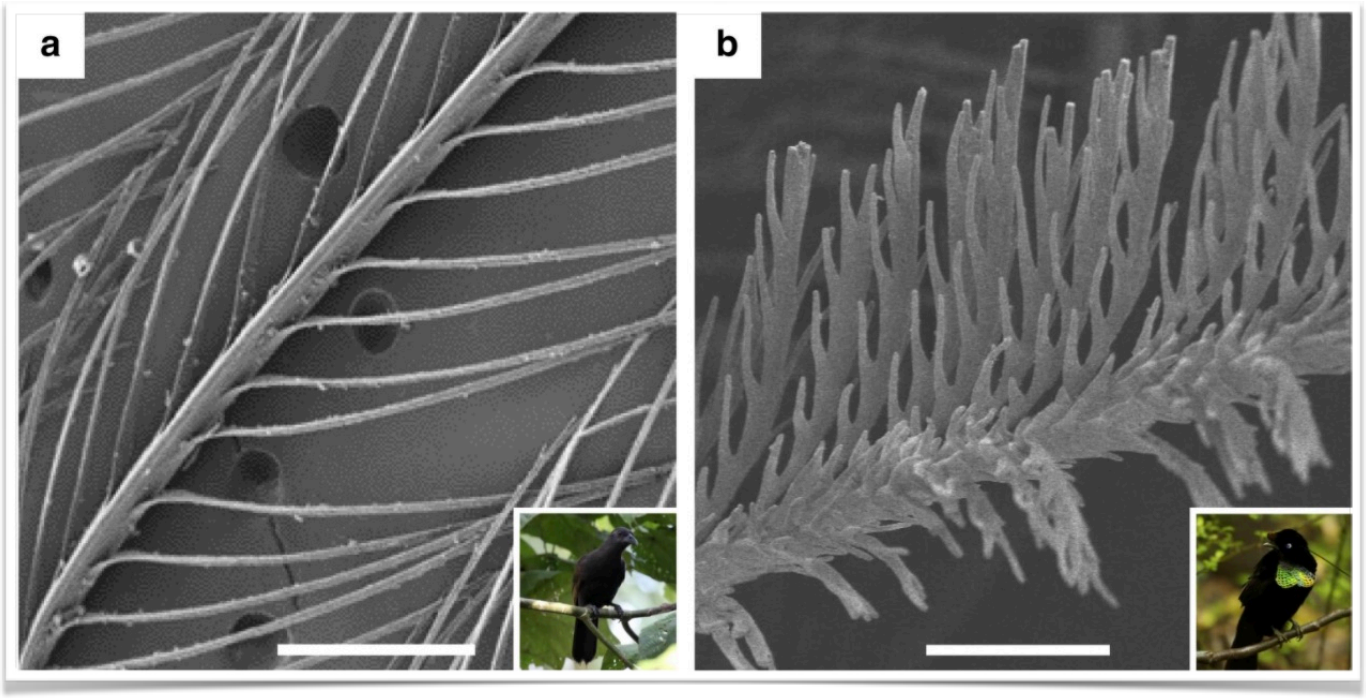
The Superb Bird-of Paradise image (above) is taken from her article. The authors posit that the plumage evolved "to enhance the perceived brilliance of adjacent color patches during courtship". (Maybe. Compare with the Steller's Jay

at the top of the page, especially the eyebrows of the Jay.) As to the black feathers of Bird-of-Paradise species, the authors comment, "unlike normal black feathers with typical barbules, we find that super black feathers have highly modified barbules arranged in vertically tilted arrays, which increase multiple scattering of light and thus structural absorption." The image at the top of the following page, from the cited paper, depicts a normal black feather on the left and a super black feather on the right. These feathers are not shown at the same scale; the normal black feather scale bar is 200 μm in length while the super black feather scale bar is 50 μm in length. (A μm is a micrometer. A human hair is from 20 to 200 μm in width. Nanometers are one-thousandth of a micrometer.)

Feather color can only be understood in terms of what other birds see. The optic capabilities of birds enable them to see the world, including other birds, differently than we do. Flowers look different, for instance, to a bird than to us, and this extends to markings on the flowers which are not apparent to us because they are created by wavelengths that we cannot see. And the same is true of other birds. Humans don't see well enough to appreciate the true beauty and functional utility of bird plumages.

The interplay between feather structure, temperature regulation, and color is intricate. In "Enhanced photothermal absorption in iridescent feathers"[2] researchers found that birds with iridescent feathers (in which color is a function of structure) tended to heat up more than those with feathers which were colored by pigmentation, as much as 8 degrees celsius more. The feathers and the skin beneath the feathers heated up corresponding amounts. The experimenters used artificial sunlight on bird specimens.

Although some reviewers posited that very iridescent males were demonstrating their vigor by being able to



endure higher temperatures, others noted that the study did not address what the effect on live birds would be since they often flit in and out of sunlight. Additionally, iridescence has evolved in many bird species, and it is unlikely to have a universally negative thermodynamic effect. Although not mentioned by reviewers, many of the most iridescent birds live in very shaded environments. In such environments a flash of color is even more dramatic than when it is seen against a fully lit background. It is quite possible that additional (albeit limited) feather heating in darker (and cooler) spaces might provide real benefit. All of this falls more in the "interesting factoid" arena than it does within a structured and holistic understanding of what is going on as a bird goes about living its life. It is from myriad factoids, however, that structure can evolve.

Overheating has been cited as one factor in the die-off of birds migrating through our area. To what extent birds with iridescent feathers are exposed to direct sunlight, either because they are migrating during the day or are resting and feeding during the day after migrating at night, is unknown. It is quite possible, however, that iridescent feathers might increase the heat loading of birds in transit more than pigmented feathers would. Given the short period of human-induced increases in global heating, bird species may not be able to cope, evolutionarily, with such quick and dramatic temperature changes.

In this article we have grouped feathers into major types. There are, in fact, scores of feather types, each specialized to perform a specific function. Even within a specialized feather type, the structure of a feather may vary significantly, as noted in the Bird-of Paradise discussion above.

1. McCoy, D. E., Feo, T., Harvey, T. A. et al. "Structural absorption by barbule microstructures of super black bird of paradise feathers". *Nature Communications* 9-1 (2018). https://doi.org/10.1038/s41467-017-02088-w

2. "Enhanced photothermal absorption in iridescent feathers", Svana Rogalla, Anvay Patil, Ali Dhinojwala, Matthew D. Shawkey, and Liliana D'Alba, *Journal of the Royal Society Interface*, 4 August 2021

History Can Mess Things Up

by Harley Shaw

From the days of John Ray and Linnaeus, scholars under the guise of naturalists, biologists, ecologists, taxonomists, cladists and systematic geneticists have struggled to define appropriate criteria for categorizing creatures. The sheer diversity and constant changing of life forms on our planet make this task impossible. In spite of a changing view of history of life on earth over the past 300 years, assignment of a binomial consisting of a genus and species remains the most accepted process for naming life forms. While different countries, cultures, and geographic regions may assign different popular names to particular creatures, the scientific binomial is considered the appropriate title to be used by experts studying species and publishing facts about them.

But many species have large ranges and live under disparate conditions. As a result, all creatures assigned a particular binomial may not fit perfectly its "type" descriptions. Because evolution is an ongoing process, and because creatures enough alike to be considered a species may nonetheless exhibit a range of differences, taxonomy has adapted to the need for a finer classification acknowledging such differences. The most frequently used category is named subspecies. For many species, any subspecific designations are of consequence to only a few specialists studying the fine details of behavior, coloration, or distribution, but a few have taken on political or economic significance. Many of these are relatively unnoteworthy creatures that happen to be, for various reasons, considered threatened. These are not the subject of this essay.

A few large and dramatic creatures have been broken into subspecies, which attract the attention of trophy hunters. Among these is the almost comically unlikely wild turkey. Within North America, five subspecies of wild turkey are recognized by turkey experts as extant; a sixth that once existed in Mexico was subsumed through domestication, probably within the past two centuries. Between 1965 and 1972, I was responsible for a wild turkey study on and around the South Rim of the Grand Canyon. The turkeys in that area were classified as *Meleagris gallopavo merriami* – the Merriam's turkey. Our research ultimately focused upon habitat selection by this subspecies. I had chosen the study area because I assumed that it was within the native range of the Merriam's subspecies. I worked mainly on the Moqui District of the Kaibab National Forest and that portion of Grand Canyon National Park on the south side of the big canyon. The entire area will hereafter be called the Moqui. The area of turkey habitat within the Grand Canyon National Park boundary was minuscule, compared with the adjacent National Forest lands, but we hoped to implement the National Park area as a "control" area, where turkeys and their habitat were protected, as opposed to the "treated" National Forest, which had a history of logging, and where turkeys were hunted in season. In truth, the park and national forest populations were the same, with birds ranging freely back and forth across the boundaries. Our experimental design was imaginary at best. Also, throughout the period we worked in that area, I assumed that we were studying a historic, natural population of turkeys. Only recently (2021), have I read the historic literature more carefully and realized that wild turkeys may not have populated the south rim of the canyon, nor the Moqui Ranger District until after the 1930s, perhaps as late as the 1950s. Most compelling is a National Park Service bulletin published in 1937 by no other than Florence Merriam Bailey – the guru of southwestern birdlife at that time, if anyone could claim the title. Mrs. Bailey and her husband, Vernon – famous in his own right as a mammologist – spent the period of May 8 to September 9, 1931 wandering the Moqui and documenting birdlife. Her notes are explicit as to the locations she visited and birds, as well as mammals, that she observed. She visited and wrote about birds at springs and earthen dammed tanks where, only 35 years later, I found wild turkeys in abundance and trapped and marked them as part of our study. In her book, she mentions no turkeys, even though 1931 was a dry year and turkeys, if present, would have been forced to congregate near water. In addition, Mrs. Bailey delved into the notes of her famous brother, C. Hart Merriam, who had visited the area some 31 years earlier. He didn't record turkeys on the Moqui, either.

So, if turkeys ranged into the area before this, they were sporadic in occurrence and scarce in numbers. Because early writers on turkeys were prone to speculate on their distribution, and because humans have since messed extensively with the distribution of various turkey subspecies, we may never know the full truth. What we do know is that the early naturalists, while working with the best tools at hand and philosophically attuned to the acceptable taxonomic processes of their day, perhaps jumped to conclusions that haven't always held up under the scrutiny of subsequent study and more modern methods. An important part of research involves reading and re-reading the early literature carefully and modifying our interpretation under the scrutiny of more refined (we hope) information.

Pondering how the above realization might have affected how I interpreted results of our turkey habitat research on Moqui caused me to scrutinize how those early naturalists determined range boundaries for various species and subspecies. On the whole, it depended upon an alliance between field naturalists, often medical men, traveling with early expeditions or stationed at remote military posts, who collected specimens wherever they traveled and sent them to be reviewed by institutional experts at some centralized location, usually the Smithsonian Institute in Washington D. C. Said experts then examined the specimens, compared them with past collections, and either assigned them to some established category or declared them a new entity and alerted the field folks to keep collecting. Recording where the specimens were collected was a must, and, over time, these provided dots on maps showing where the creature had been found. If the outermost dots were connected, rough depiction of the distribution of the species or subspecies in question appeared. Over time, the experts or, more often, the field naturalists supplementing the emerging maps with their own observations, began to draw conclusions about features of the habitat that delimited the species or subspecies range. Such conclusions allowed the experts, in field or lab, to extrapolate the hypothetical range to the boundaries of the supposed limiting environmental traits. Thus published distributions might come to exceed the objectively determined locations made via mapping collected specimens. This is probably the way that turkeys came to be shown to occupy the south rim of the Grand Canyon on early maps. The habitat was right; turkeys should be there.

So distribution maps evolved over time, and continuing field efforts informed later versions. According to Schorger[1], S. P. Boyer[2] (1930) attempted an early map of the historic range of the wild turkey. So far, I've been unable to acquire a copy of Boyer's map, but Schorger felt that Boyer extended historic turkey range too far north. Schorger felt that a 1940 typed report by Robert O. McClanahan[3] more accurately depicted the historic turkey range, as well as showing a much-diminished range of the species by 1940 (figure 1). McClanahan did not distinguish between wild turkey subspecies, but his map suggests that turkeys extended to the south rim of the Grand Canyon, and his map may have influenced writers, including J. Stokley Ligon, who estimated the range of the Merriam's turkey five years later (figure 2).[4]

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1. Schorger, A. W. 1966. *The Wild Turkey – its history and domestication*. Univ. Okla. Press, Norman.

2. Boyer, S. P. 1930. "A Nation-wide Survey of the Wild Turkey," *Am. Field*, 113:50-61; W. T. Hornaday. 1931. *Thirty Years War for Wildlife*. New York.

3. McClanahan, R. C. 1940. *Original and Present Breeding Range of Certain Game birds in the United States*, Biol. Surv. Wildl. Leafl. BS-158.

4. Ligon, J. Stokley 1946. *History and Management of Merriam's Wild Turkey*. The University of New Mexico Press. Albuquerque.

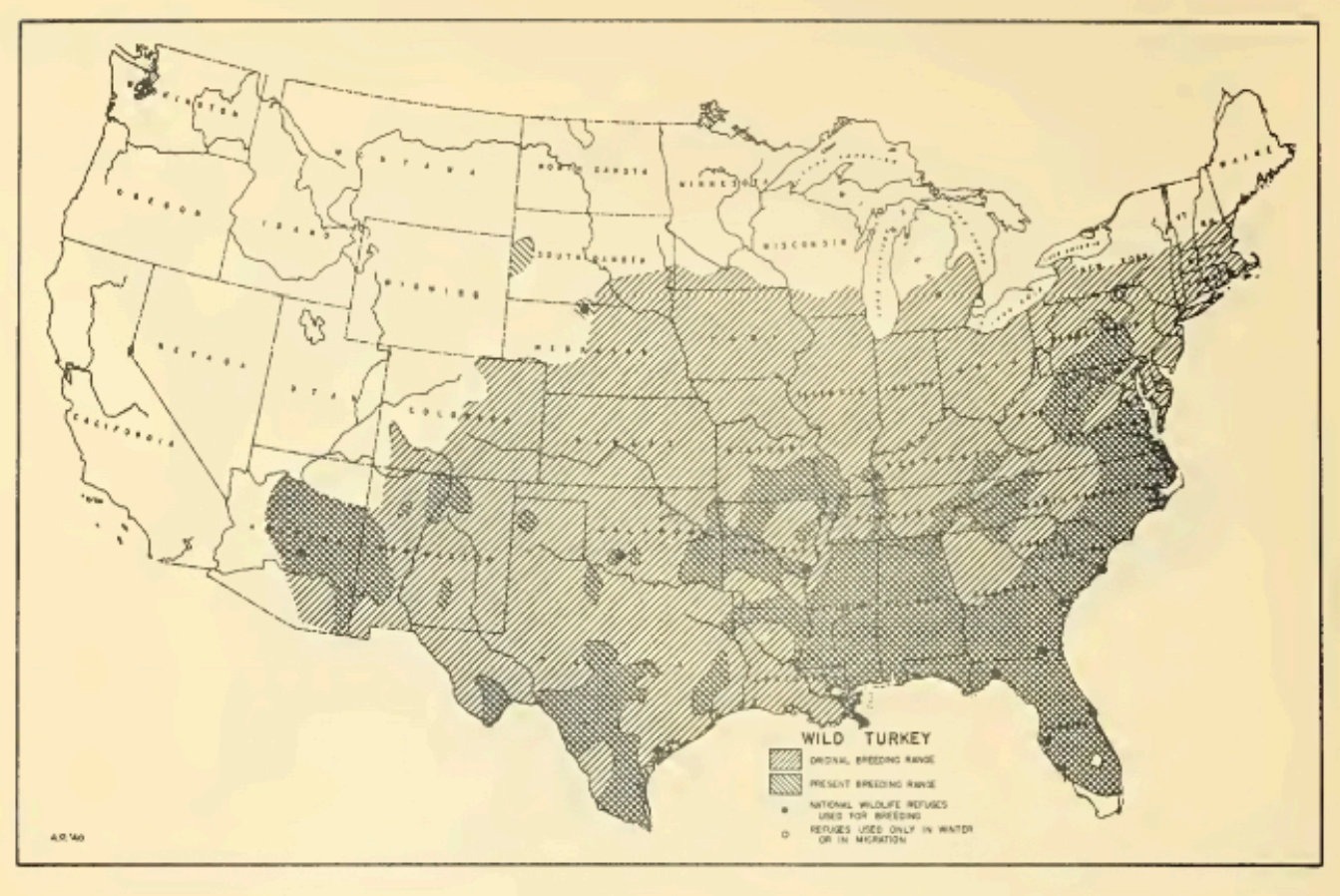

Figure 1. Estimated historic range and distribution of wild turkeys in the U. S. in 1940, as compiled by McClanahan.

McClanahan was aware of the difficulty of his subject. Early in his bulletin, he states, "It is generally recognized that ranges are not stable, but are continually changing." McClanahan probably plotted the extremes of known (or speculated?) distribution of turkeys in the U. S., without acknowledging natural gaps in suitable habitat. When biologists began to become alarmed about reductions in turkey numbers and shrinking distribution, such early failure to acknowledge discontinuities of habitat may have created an illusion of greater loss of turkeys than actually happened. This would be especially true if one compared McClanahan's broad-brush approach with Ligon's more detailed estimate of natural range for Merriam's turkey, published in 1946. Ligon noted:

> ***"The ancestral range of this turkey is the yellow pine-oak forest of the intermountain region at elevations of from 6000 to more than 10000 feet, from central Colorado southward almost to the United States-Mexico boundary."***

A good chance exists that Ligon took McClanahan's word for the existence of turkeys on the canyon rim.

If you examine the maps of both McClanahan and Ligon (map on following page) closely, you can see that both had already assigned the distribution of turkeys to the distribution of habitat they were expected to use. Both showed turkeys living in the ponderosa pine forests on the south rim of the Grand Canyon. Merriam's turkey was given subspecific status by E. W. Nelson[5], describing feather markings on a single type specimen taken SW of Winslow, Arizona:

> ***Meleagris gallopavo merriami, subsp. Nov. Merriam's Turkey. Type, No. 165898, male ad., U. S. Nat. Mus., Biological survey Collection. Collected 47 miles southwest of Winslow, Arizona, Jan. 9, 1900, by E. A. Goldman. Meleagris gallopavo merriami, subsp. Nov. Merriam's Turkey. Type, No. 165898, male ad., U. S. Nat. Mus., Biological survey Collection. Collected 47 miles southwest of Winslow, Arizona, Jan. 9, 1900, by E. A. Goldman. Distinguished from Meleagris gallopavo fera [now M. g. sylvestris] by the whitish tips to feathers of lower rump, tail coverts and tail; from Meleagris gallopavo Mexicana by its velvety black rump and the greater amount of rusty rufous succeeding the white tips on tail coverts and tail, and the distinct black and chestnut barring of middle tail feathers.***

Ligon, citing James Lee Peters[6], stated that the difference in the five recognized races of the wild turkey lie mainly in

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4. **Ligon, J. Stokley 1946. *History and Management of Merriam's Wild Turkey.* The University of New Mexico Press. Albuquerque.**
5. ***The Auk*, XVII (1900), 120.**
6. **Peters, James Lee 1934. Check-List of Birds of the World. Harvard University Press, Cambridge.**

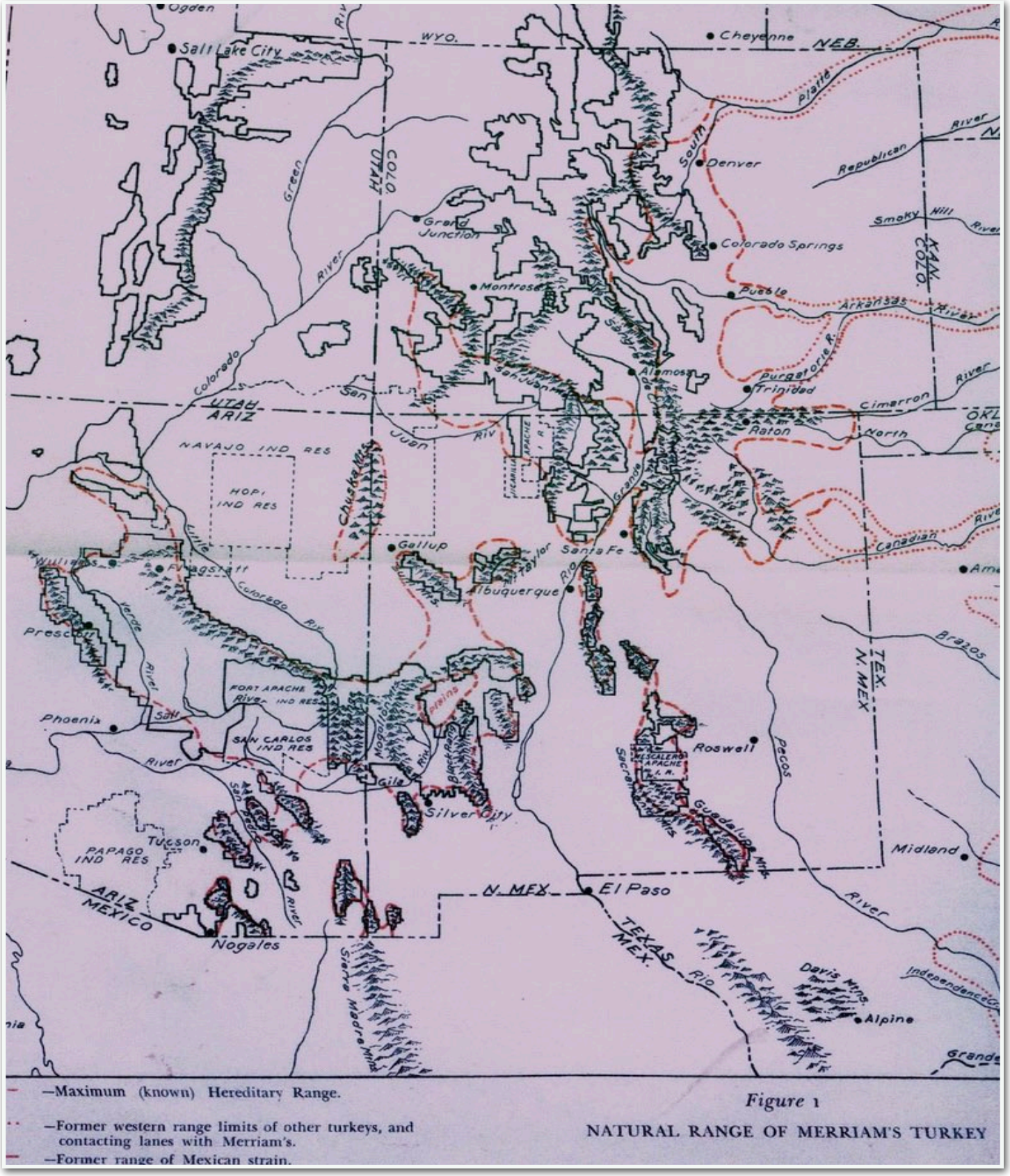

Figure 2. Ligon's 1946 map showing historic range of Merriam's wild turkey, and places where he felt it interfaced with other subspecies.

color and markings which were influenced by habitat, climate, and altitude. Nelson gave the distribution of the Merriam's as:

> *Mountains of Arizona, Western New Mexico, and south to the Mexican border and north probably into extreme southwestern Colorado.*

So. . . fast forward to 2021, 49 years since I worked on the Moqui. I now live in Hillsboro, New Mexico, some 340 airline miles southeast of the south rim study area. Miraculously, I'm still around. I have not, for decades, done wild turkey research, but I live at the edge of native wild turkey range, where the birds are also classified as Merriam's turkeys. I've lived here for 20 years and have observed turkeys multitudinous times during excursions into the nearby Black Range. This is Ligon's country, and I've had no reason to doubt the early turkey classifications and distributions he helped describe. I've assumed the birds I've seen have the patches of lighter colored feathers that distinguish them from darker eastern subspecies (*M. g. sylvestris*) or the more brownish Rio Grand subspecies (*M. g. intermedia*). A madrean subspecies (*M. g. Mexicana* – Gould's turkey) reaches the northern extent of its range in the sky islands of southern Arizona and New Mexico, not all that far from the Black Range. But a lot of desert grassland extends between our local turkeys and those Mexican birds, while potential connectivity exists from the Black Range all the way to known Merriam's range northwest of Arizona's San Francisco Peaks – ergo, almost to the Moqui. Over the past 20 years, I've wondered if any genetic gradient exists in the turkey population of the southern Black Range, mainly Ladder Ranch, where presumed "Merriam's" turkeys range from mixed conifer forests in areas exceeding 10,000 feet to riparian bosques along the Rio Grande River near 3500 feet. This gradient of turkey occupation is continuous and theoretically connects with an artificially established population of purported Rio Grande turkeys on the Bosque del Apache.

A tremendous volume of literature is now available on wild turkeys throughout the United States. On the one hand, this contains a wealth of knowledge about population dynamics and habitat needs of the various subspecies. On the other hand, the "sporting" nature of the bird has detracted from more basic research, with available funds supporting projects focused on increasing turkey range and producing more birds for hunters. Effects of introductions on native species, on introgression into native subspecies, and on sensitive habitats have been inadequately considered in the past. At the same time, the subspecies of turkeys have become significant to hunters due to the development of the "grand slam" concept, wherein hunters attempt to kill at least one of each of the known wild turkey subspecies. Thus turkey subspecies have taken on both political and economic importance, in addition to scientific prestige. One might certainly be cautious about meddling with turkey classification. Nor is that the purpose of my dabbling. Because of my past interests in the Merriam's turkey and its habitats, I simply find myself intrigued by the circumstance I see associated with the turkeys of the east face of the Black Range and its adjacent Rio Grande River riparian habitats. In his 1946 map, see previous page, Ligon[7] notes areas of supposed blending of wild turkey subspecies at the margins of Merriam's turkey range. He does not show turkeys along the Rio Grande River much below the latitude of Santa Fe. However, Florence Merriam Bailey noted that:

> *Along the Rio Grande, they descended . . . lower in winter and were common December, 1824, in the bottomlands near Socorro at about 4500 feet.*[8]

These were undoubtedly Merriam's that summered in the mountains surrounding Socorro.

Black Range, New Mexico turkeys are considered to be merriami. So far, I've found no early history of presence of native turkeys along the Rio Grande near the Black Range. Schorger shows the original range of the Rio Grande subspecies barely reaching into the southeastern corner of New Mexico, perhaps intergrading with Merriam's at the southern tip of the Guadalupe Mountains. However, turkeys now range from the Rio Grande River to the top of the Black Range along Animas Creek and probably other major drainages. Turkeys are scattered all along the river, so continuity of Black Range habitats with the Rio Grande to the north exists, including connectivity with the Bosque del Apache population. Turkeys at the Bosque are considered by New Mexico Game and Fish Department to be of the Rio Grande subspecies, established through transplants in 1983 and 1990 (figure 3).

Unlike many species, the existing turkey subspecies designations have held up well under genetic reassessment.[9, 10]

Perhaps any probe of local taxonomic status of turkey populations is worth not much more than an emphatic "so what?" A turkey is a turkey. Any questions I might ask could be considered the skeptical dabblings by an octogenarian with too much time on his hands. So be it. I'm beyond the point in life wherein I worry about my future professional reputation, and feel qualified by my sheer tenacity to judge as well as anyone where I might direct any fuzzy-headed curiosity I have left. Had I funds and ability, I'd mount a detailed genetic assessment of the turkey populations of the Bosque del Apache and the east face of the Black Range. Maybe some other populations as well. I don't have those resources, and I've wondered for 20 years what kind of muddling up of genes has happened in Black Range turkeys since, say, 1983, when Rio Grandes were dumped in the neighborhood.

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7. Ligon, op. cit.; Figure 3

8. Bailey, Florence Merriam 1928. *Birds of New Mexico*. New Mexico Game and Fish, New Mexico Game Protective Association, and the Bureau of Biological Survey.

9. Mock, K. E. T. C. Theimer, O. E. Rhodes Jr., D. L. Greenberg and P. Keim 2002. "Genetic variation across the historical range of the wild turkey (Meleagris gallopavo)". *Molecular Ecology* (2002) 11, 643–657.

10. Speller, C. F. et al. 2018. "Ancient mitochondrial DNA analysis reveals complexity of indigenous North American turkey domestication". *PNAS* February 16, 2010 107 (7) 2807-2812; https://doi.org/10.1073/pnas.0909724107.

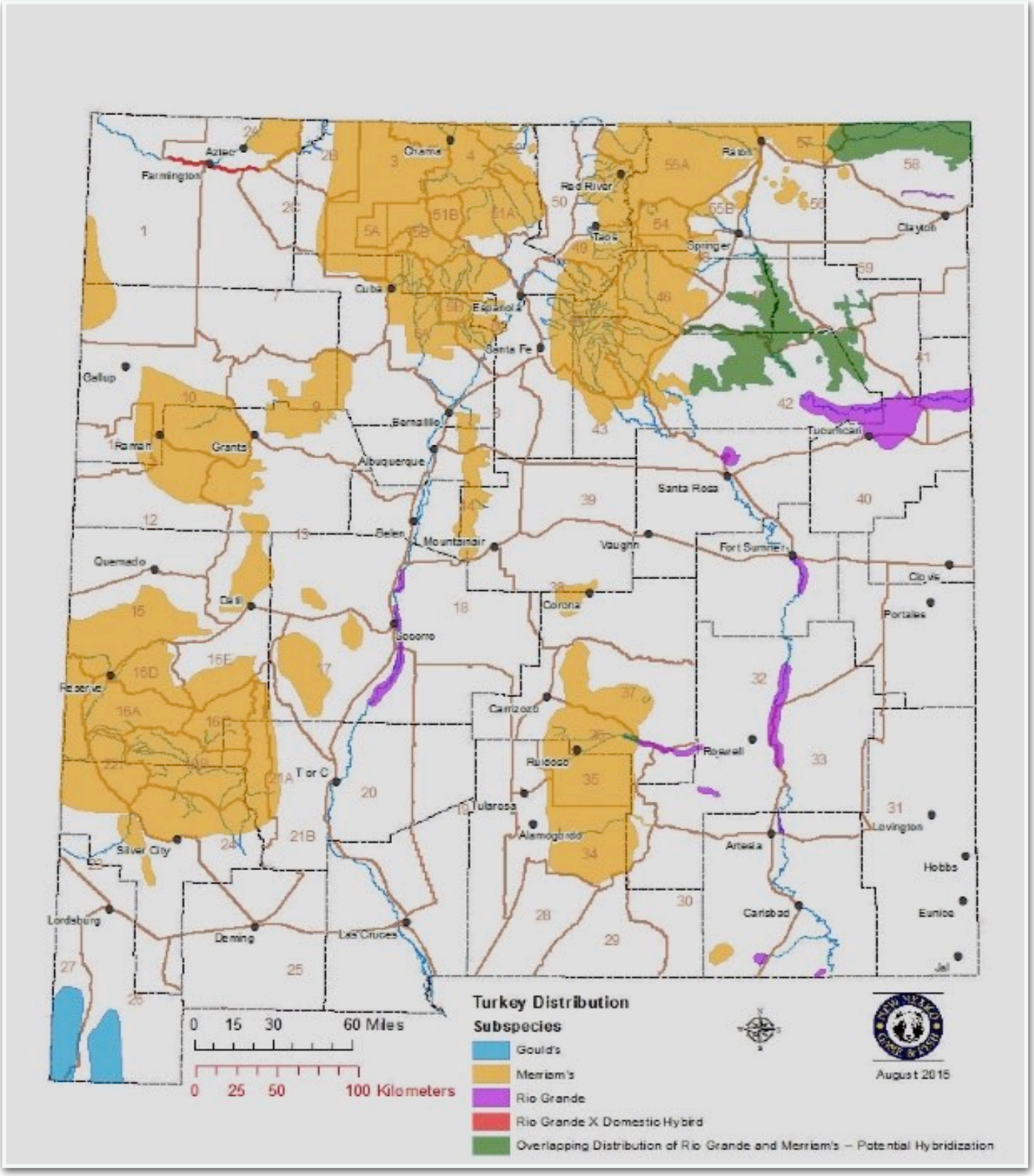
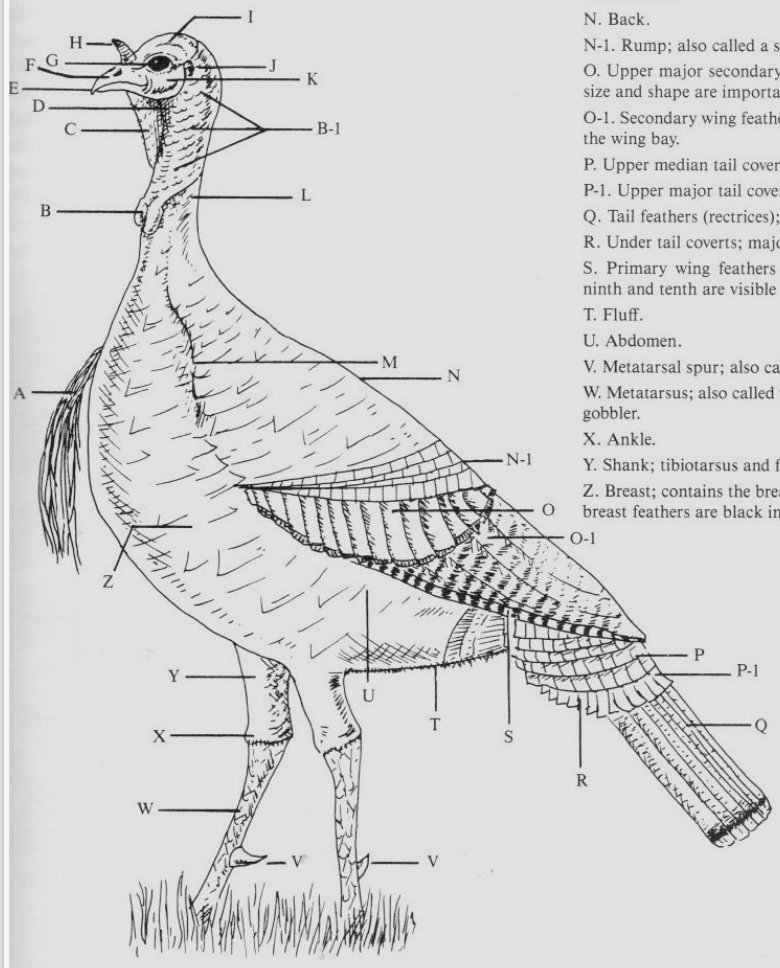


Figure 3. New Mexico Game and Fish Department (2015) depiction of wild turkey subspecies' ranges.

So when Dr. Travis Perry of Furman University offered access to some 13 years of trail camera photographs, near 6000 of which were of turkeys, I decided that this was an opportunity to assess feather coloration differences between the Bosque del Apache and the Ladder Ranch in the Black Range. Simply stated, could I evaluate how close turkeys on the two areas approached the basic color traits used to describe type specimens of the subspecies. How different were the two populations some 38 years after the Rio Grande subspecies had been introduced adjacent to Merriam's range?

I had little hope of doing a definitive study, but felt that results might be suggestive enough to stimulate

Figure 1. External Anatomy of the Male Wild Turkey



KEY

A. Beard.

B. Major caruncles; large and bulbous shaped in the male.

B–1. Minor caruncles.

C. Dewlap.

D. Throat.

E. Beak.

F. Nostril.

G. Eye.

H. Snood; also called a dewbill or leader; prominent in the male.

I. Crown of head; color is white or red in the male, especially during mating season; color is dull gray-blue in the female year-round.

J. Ear opening; covered with bristle feathers.

K. Face; color is important for sex identification.

L. Neck; longer in the male.

M. Shoulder.

N. Back.

N-1. Rump; also called a saddle.

O. Upper major secondary coverts; these form the wing bar, and their size and shape are important for age identification.

O-1. Secondary wing feathers (remiges); they number 18 or 19 and form the wing bay.

P. Upper median tail coverts.

P-1. Upper major tail coverts.

Q. Tail feathers (rectrices); usually number 18.

R. Under tail coverts; major, median, and minor.

S. Primary wing feathers (remiges); 10 in number; usually only the ninth and tenth are visible in the folded wing.

T. Fluff.

U. Abdomen.

V. Metatarsal spur; also called tarsometatarsal spur and tarsal spur.

W. Metatarsus; also called the tarsometatarsus and tarsus; longer in the gobbler.

X. Ankle.

Y. Shank; tibiotarsus and fibula.

Z. Breast; contains the breast sponge in mating season; color of tips of breast feathers are black in the male and tan to brown in the female.

Figure 4. Turkey feather classes. From: The Wild Turkey: Biology and Management, James G. Dickson et al., National Wild Turkey Federation and the U. S. Forest Service, Stackpole Books, 1992, p. 33. Illustration by Paul H. Pelham and James G. Dickson.

someone to assess the genetics of the two populations. The results so far are crude and tentative, but are different than I anticipated and have set me to wanting details about how the original subspecific determinations were originally accomplished, some 120 years ago, and what has changed within the Black Range population since that time.

Below is a selection of turkey rump photographs from Ladder Ranch and Bosque del Apache. I've looked at many more than these and have many more to look at, but I think this provides an idea of the range of variation of turkey rump colors and patterns, historically used to distinguish subspecies. I had hoped to find some simple classification system that would reflect subspecies introgression. Instead, it looks rather chaotic.

Factors that may affect feather coloration and pattern as seen in photos include:

- Individual genetic variation
- Gender
- Age
- Season (hence, molt status)
- Lighting (hence time of day)
- Angle and position of camera
- Population genetic history
- Camera traits
- Traits of viewing device
- What else?

As a pilot effort, using samples of photos from Ladder Ranch and the Bosque, I scrutinized feather groups N-1, O, and O-1 as shown in figure 4 (see previous page) using the L* measurement of Apple's digital color meter application as an indicator of relative brightness. Defined by the *Commission Internationale de l'Eclairage* (CIE), the L*a*b* color space was modeled after a color-opponent theory stating that two colors cannot be red and green at the same time or yellow and blue at the same time. As shown below, L* indicates lightness, a* is the red/green coordinate, and b* is the yellow/blue coordinate. Deltas for L* (ΔL*), a* (Δa*) and b* (Δb*) may be positive (+) or negative (-). The total difference, Delta E (ΔE*), however, is always positive (https://sensing.konicaminolta.us/us/blog/identifying-color-differences-using-l-a-b-or-l-c-h-coordinates/). L* is a relative measure of brightness, with an L* of 0 being completely black and L* of 100 being absolute white within the grayscale range of colors. Making L* measurements with the digital color meter is simple and straightforward. You simply place the square sensor on the color patch you intend to measure, and the meter provides an average of brightness of the area covered by the rectangle. A modest adjustment of the rectangle size is possible, and I used the largest expanse for taking measurements of the rump brightness of turkeys in the camera trap pictures. I made the measurements for only one turkey per usable turkey frame. Because of the large number of turkey photos available in each area, I carried out a systematic sample. For Ladder Ranch, I scrolled down five frames for each measurement. If a turkey in suitable position and light was not available in a given frame, I scrolled down single frames until a measurable image became available. For the Bosque del Apache, I scrolled down 15 frames for the sample. Resulting sample size was 110 images for each area. Criteria for acceptance of a turkey image included position of turkey, providing adequate view of the rump patch area to allow measurements; and light conditions. Acceptance of photos therefore involved a level of subjectivity, as well as added elements of variation that influenced L* measurements. Measurements of turkeys in low light were inevitably darker (lower L*) than turkeys in bright sunshine. Also, differences between brightest and darkest measurements on rump patches were smaller in low light. Further work is needed to objectify the L* measurement. Also, turkey rumps on both areas displayed considerable variation in pattern of colors. An ideal measurement would be an L* that averaged melanism across the complete rump patch, along with a system to classify patch pattern. Further refinement might involve inclusion of the a* and b* color components of the L*a*b* system, because L* acknowledges only relative brightness along a grayscale gradient. Some of the variation in rump coloration involves a number of birds with amber, hence, carotenoid pigmentation that has historically been considered indicating the Rio Grande subspecies. For the present, attention probably should be directed toward relative brightness across the grayscale gradient and pattern of color markings.

In order to cover as much of the "rump patch" as possible for each turkey, I reduced the size of photos until the patch approximated the size of the measurement rectangle, then placed the pointer as close as possible to the apparent center of the patch as visible in the photo. This, obviously, introduced a subjective element, but repeated measurements using this approach were consistent and provided what appeared to be credible results.

At this stage, such colorimetry on photographs, given the sources of variation listed earlier, is still open to question as a valid measurement technique. The above analyses are only examples of what might be possible, given valid methodology.

While the coloration distribution of turkeys on the Ladder Ranch may have changed over the 120 years since Nelson described merriami, conceivably due to contamination by Gould's imported to the Rio Grande valley some 47 years ago, I'm inclined to suspect that Nelson may well have chosen, with bias, one of the lightest specimens available in the collection to describe Merriam's and that subsequent observers classified birds in different parts of the range on the basis of habitat and connectivity with the home location of the type specimen. Given such an approach to subspecies classification, Merriam's turkeys are best defined as turkeys occurring within Merriam's turkey habitat, regardless of coloration. Classification of other subspecies may be based upon similar criteria. That said, it seems almost miraculous that the genetic classification of subspecies corresponds so well with the earlier, feather based determinations.

Figure 5 depicts the "type" colorations of Merriam's, Rio Grande, and Eastern subspecies. The fourth photo shows a Gould's turkey photographed near Patagonia, Arizona. I do not know exactly how closely this represents the type specimen for this subspecies.

The photographs on the following page show the extremes found among trail camera photographs from the Ladder Ranch (summarized in Figure 6). The L* measurement taken from the photograph is shown at the upper left of each image. The point of these photos is to demonstrate that a wide range of color patterns exists within a population that was historically classified as the Merriam's subspecies, presumably based

Variation of L value determination in Rio Grande and Merriam's Subspecies

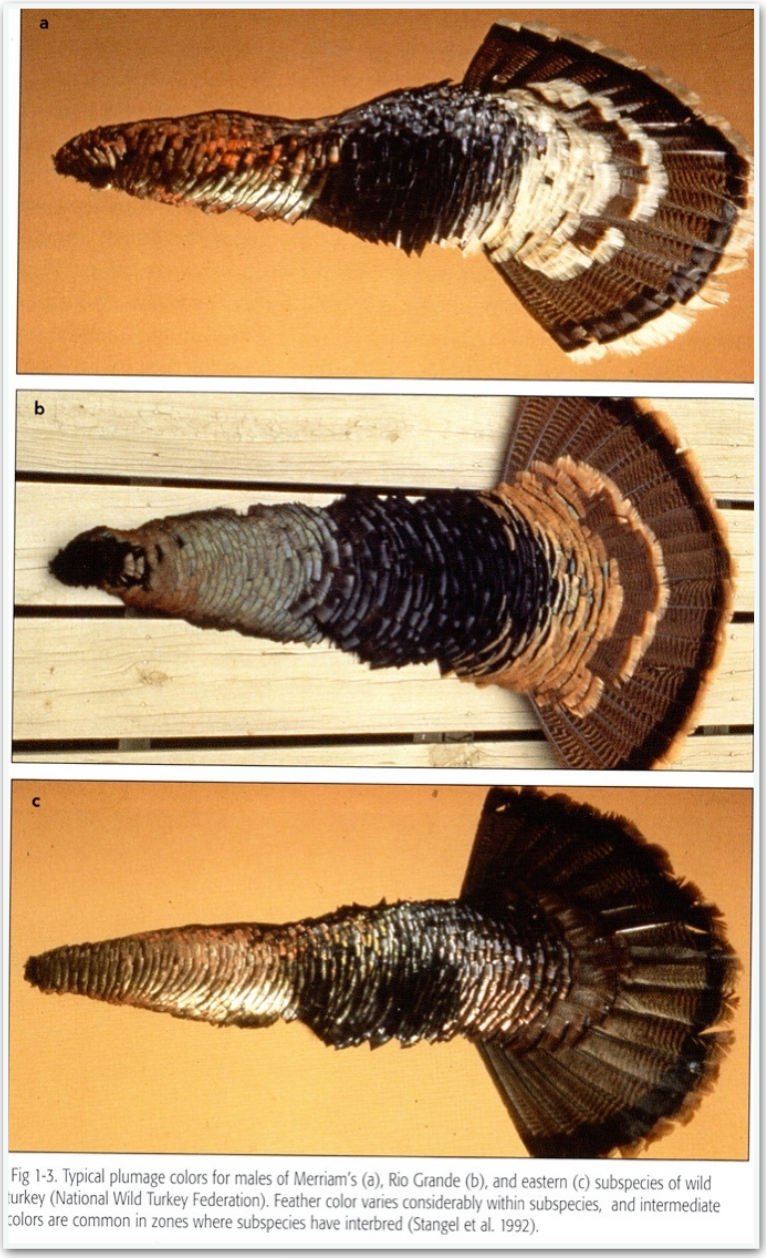


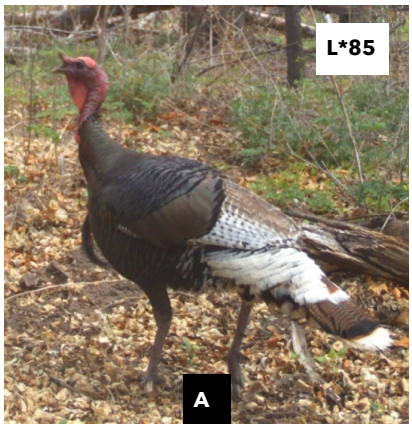
Figure 5. "Type" specimens for Merriam's, Rio Grande, and eastern wild turkeys, and a live example of a Gould's turkey.

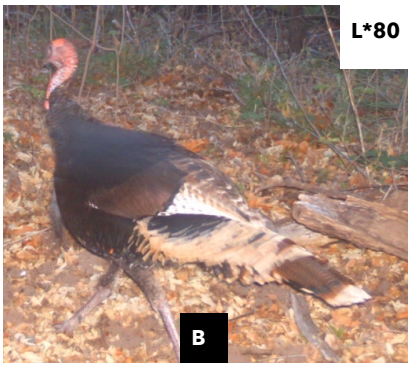
Gould's subspecies

upon the very light "type" coloration selected by Nelson in his original description. Yet it is obvious from figure 6 that turkeys exist within the Ladder Ranch population that deviate considerably from this original type. I have to wonder how a turkey taxonomist might classify the darkest of the birds in figure 6, if no location information were available for the bird.

Figure 7 shows the distribution of lightness measurements on a sample of 109 each of Ladder Ranch and Bosque del Apache birds. Mean lightness of birds from both areas fall within the range of Rio Grande turkeys. The modal measurement of Ladder Ranch birds (approximately 58) also lies within the brightness range of Rio Grande birds; mode for the Bosque birds is at the darker extreme of brightness range of Rio Grande birds. Based upon odds of color being selected, a random collection effort should yield a "type" specimen for both populations within the Rio Grande subspecies brightness range.

Although the "types" for wild turkey subspecies are typically indicative of those subspecies, the range of individual coloration, within the Merriam and Rio Grande subspecies, is extensive and overlapping. The fact that coloration may be indicative rather than conclusive when used to determine subspecies may be the result of "reintroduction" programs which may have also affected some of my earliest research. This topic is worthy of further research, by the next generation of naturalists.





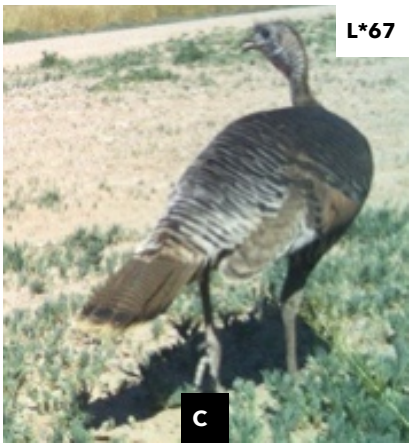
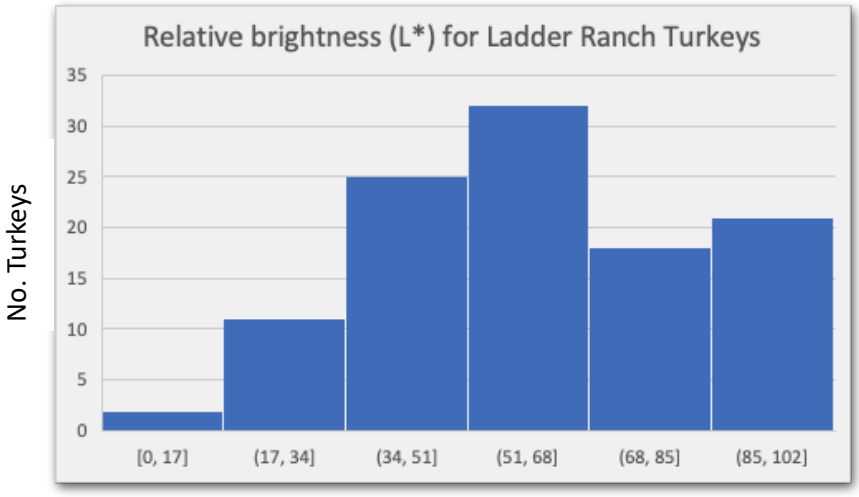
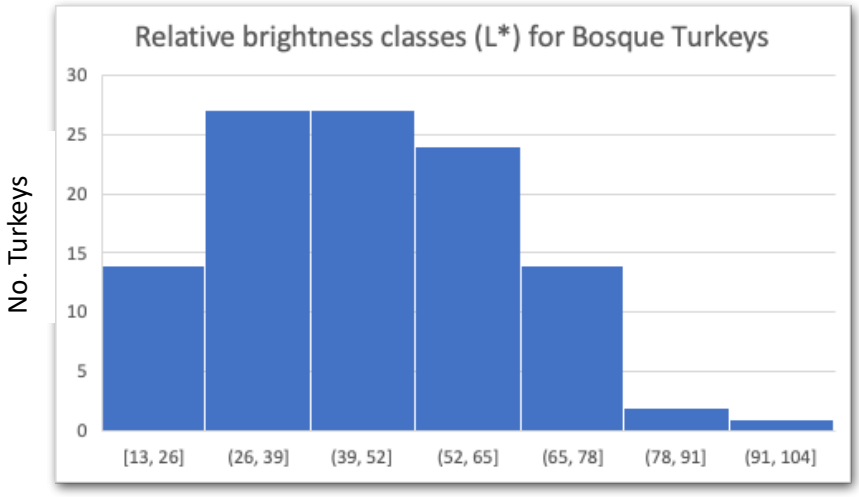


Figure 6. Ladder Ranch Turkeys:

- **A. "Merriam's" type;**
- **B. Light color but tending to buff (Rio Grande type);**
- **C. Gray banded (Gould's type);**
- **D. and Larger dark bands or fully dark (tending toward Eastern).**

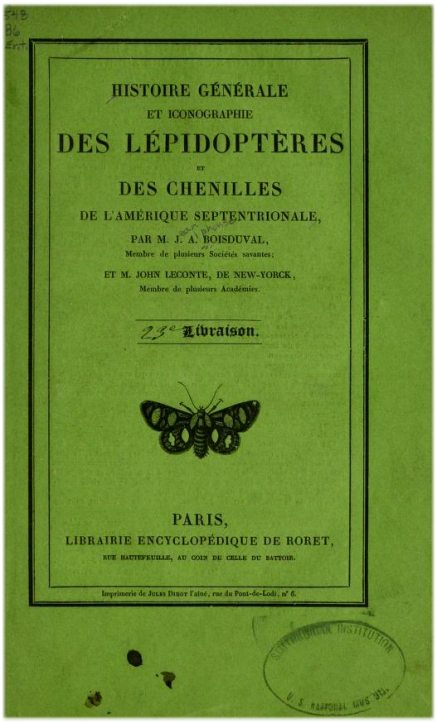




L* ranges

Birds with L* above about 75 mostly exhibit "Merriam's" coloration. Birds with L* below about 30 are dark, "eastern" turkey like. Intermediate colorations are extremely variable, with some similar to Rio Grande (uniform amber) and others ranging from black/white striping to mottled gray with fine striping.

iconographie des lépidoptères et des chenilles de l'Amerique septentrionale (see right). M. John LeConte funded the publication. John Abbot, who did the illustrations in the book (*P. ornythion is not illustrated*) is credited for specimen collections but not for any of his illustrations. Abbot is one of the first to show insects in all stages of development.



Papilio ornythion - Ornythion Swallowtail

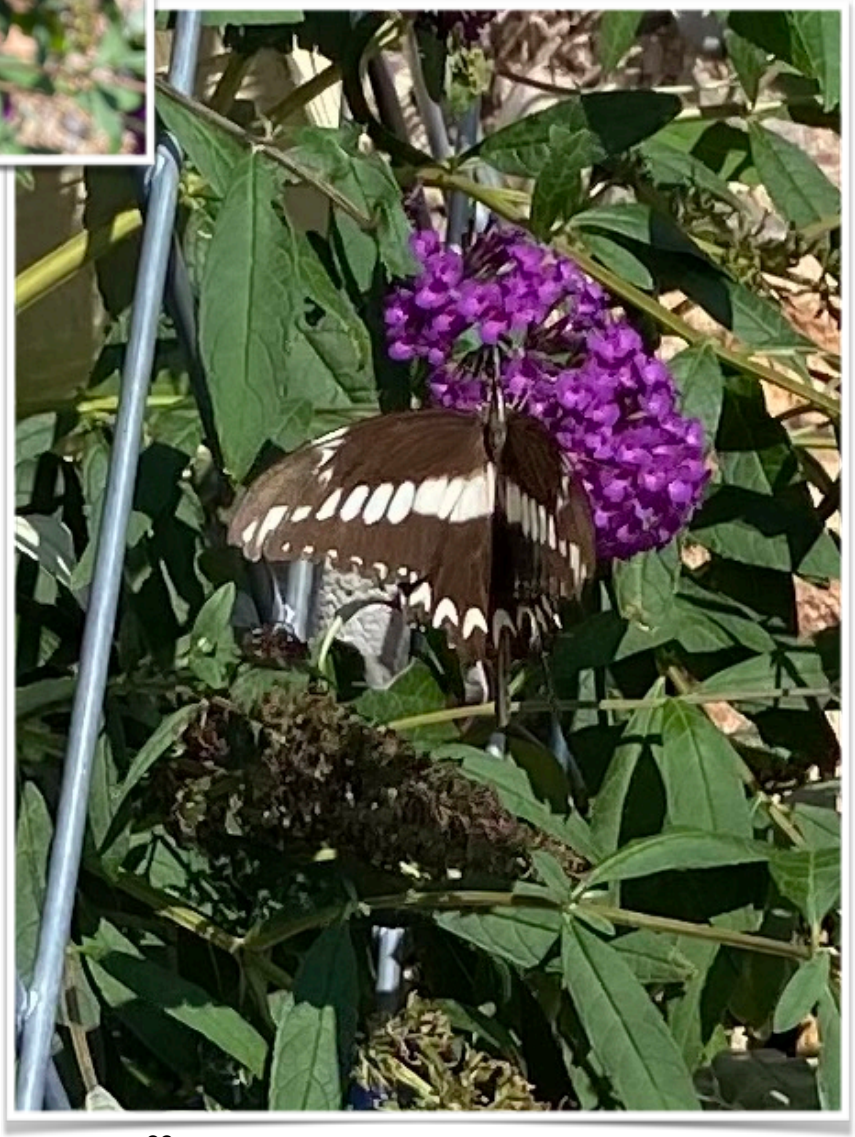
Photographs by Jan Richmond

The photographs of an Ornythion Swallowtail shown here were taken by Jan Richmond (Hillsboro) on August 5, 2021.

Previous to the 5th, this species had been documented in New Mexico only four times. More typically it is found in the Southern Rio Grande Valley, Mexico, and Guatemala.

This species *probably* has two generations a year. Adults feed on flower nectar (Verbena, Lantana, Buddleia, and *Asclepias*) and larvae feed on citrus leaves.

Synonyms for this species include *Calaides o.* and *Heraclides o.* Jean Baptiste Boisduval first described this species in 1836. He was French, and it is unlikely that he ever saw a live specimen of this species. The original description was published in *Histoire générale et*



Penstemon lanceolatus

by Rebecca Hallgarth and Bob Barnes

In mid-August 2021, Hallgarth found a species of *Penstemon* that was unknown to us. Hallgarth revisited the site, east of Hillsboro, N. M., on August 26 (with Barnes) and September 3 (with Patricia Woodruff).

In vetting the photographs shown in this article, we learned of the taxonomic changes that this article discusses. (Except as noted, photographs are by Hallgarth/Barnes).

The *Penstemon* has been identified as *Penstemon lanceolatus*, formerly called *Penstemon ramosus*. They were subsumed into *P. lanceolatus* following a study by Anderson, Williams, and Williams. See "Penstemon lanceolatus Benth. or P. ramosus Crosswhite in Arizona and New Mexico, a Peripheral or Endemic Species?" (Anderson, Williams, & Williams, 2007) for an extended discussion of why the two former species were lumped together, or perhaps more accurately, why the former *P. ramosus* was redetermined as a peripheral population of *P. lanceolatus*.

The map at the lower right shows locations where *P. lanceolatus* (circles in Mexico) and *P. ramosus* (diamonds [old records] and squares [new records]) have been found. The map is from the referenced study (link above). From this map, the cited article, a search of SEINet (see following page), and the NM Rare Plant Listing, the population described here appears to be newly found.

Prior to the determination that it was a peripheral population of *P. lanceolatus*, *P. ramosus* (Branching Beardtongue) was listed as a rare plant in New Mexico. Because of the peripheral population determination, the populations of this plant are no longer considered a full species and have been dropped from the rare plant listing.

When Crosswhite first described the Arizona and New Mexico populations in 1966, working with the limited number of specimens to which he had access, he relied heavily on three characteristics to distinguish between *P. ramosus* and

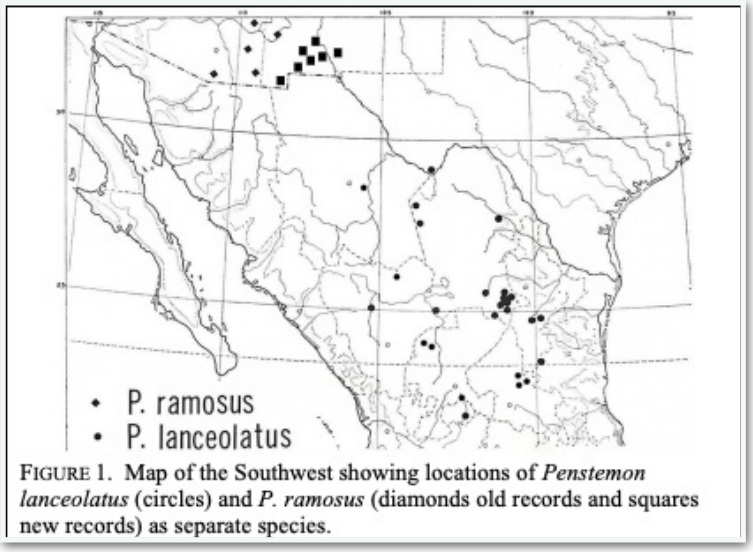
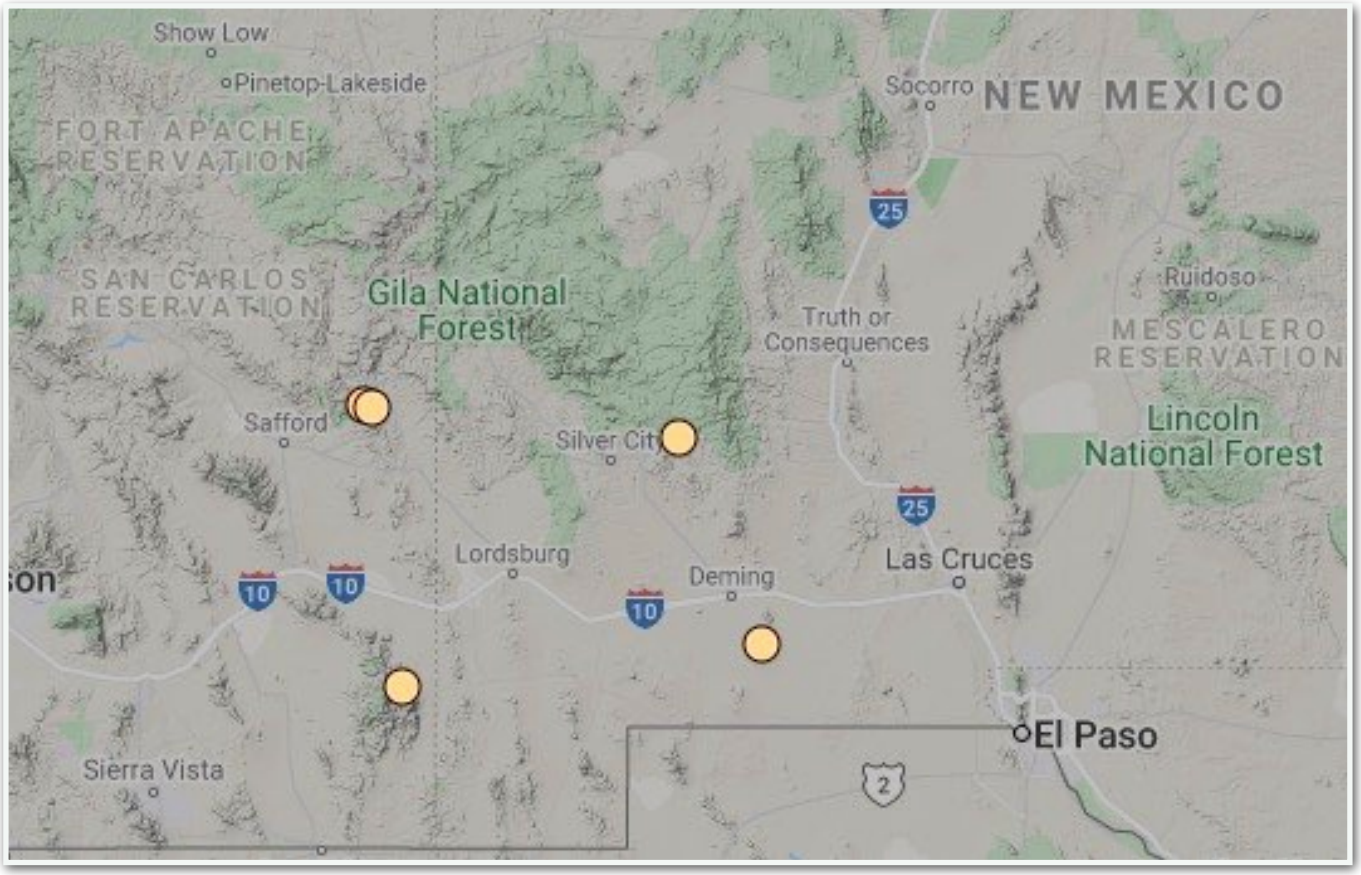
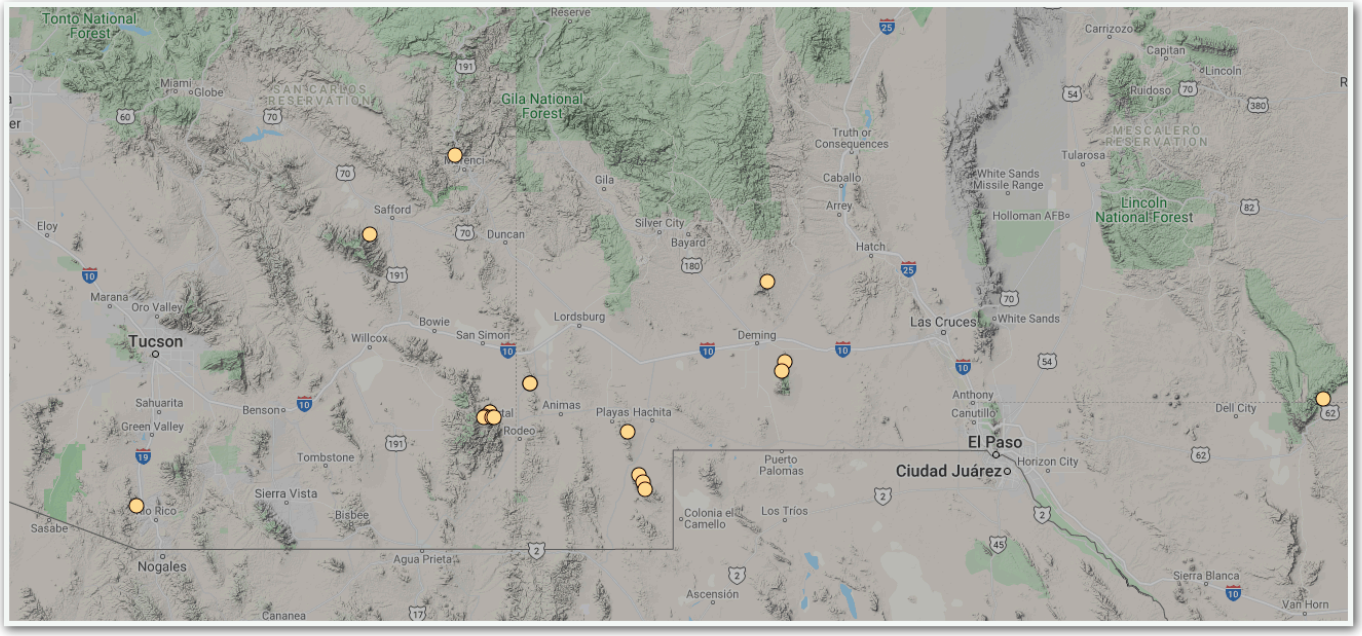


FIGURE 1. Map of the Southwest showing locations of *Penstemon lanceolatus* (circles) and *P. ramosus* (diamonds old records and squares new records) as separate species.



***Penstemon lanceolatus* specimens listed in the SEINet database.**



***Penstemon ramosus* specimens listed in the SEINet database.**

***P. lanceolatus*. He determined that *P. ramosus* had branching stems below the inflorescence while *P. lanceolatus* was unbranched. There was no evidence of branching stems found in the population east of Hillsboro. Crosswhite also noted that the leaves were linear and from 1-6 mm wide in *P. ramosus* while *P. lanceolatus* had lanceolate leaves which were 4-8 mm wide. The leaves of the population east of Hillsboro appeared more linear than lanceolate and were within the width defined for both species. Crosswhite also noted that the leaves of *P. ramosus* were revolute (folding inward on the bottom side of the leaf) while those of *P. lanceolatus* were not. The leaves of the subject population folded inward along the top of the leaf (conduplicate).**

Roughly a foot tall. Unbranched. Leaves linear, estimated to be .5 cm wide, 7 cm long. Flowering late August/early September as noted in several sources, not May and June as in some sources. These plants were seen flowering after monsoon rains began. The site had not been visited during May and June. In photograph below, buds show yellow at the base.

Habitat: North slope, dry, rocky. Elevation: 5,600′

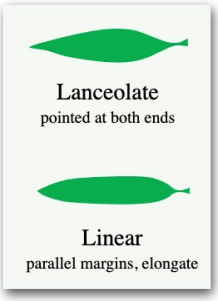


Diagram above from Wikimedia Commons.

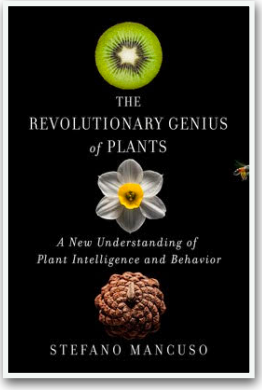
Photograph by Patricia Woodruff.

During the vetting of this population and the photographs shown here, Dr. John Hubbard noted the following: "this series of color photographs of a red-flowered penstemon taken east of Hillsboro, New Mexico in August 2021, does indeed represent a highly-localized species of this genus that typically grows in lower-elevational mountain ranges (and sometimes in the foothills of higher ones) in southwestern New Mexico and certain adjacent states. The taxon has generally been known as *Penstemon lanceolatus* Bentham 1869 and with its type locality in northern Mexico – plus with two recognized synonyms as follows: *P. pauciflorus* Greene 1881 (TL: Bluffs of the Gila [River,] NM); and *P. ramosus* Crosswhite 1966 (nom. nov.). Back in my years-ago days as a field collector of wild plants in New Mexico, I twice took vegetative specimens of this species in the Riley Spring area of the Cooke Range in Luna Co. on 25 April and 3 June 1980 (both now at UNM's MSB). In addition and also some time ago, I also logged additional museum specimens of the taxon from this state from Sierra de las Uvas (1), Florida Mts. (3), Pyramid Mts. (2), Big Hatchet Mts. (2), Alamo Hueco Mts. (1), and Dog Spring/Mts. (2), along with a quite-northerly record from around the mouth of Whitewater Creek (1) in Catron County, N.M.

This widespread yet strictly "insular-montane" type of current distribution of Penstemon lanceolatus suggests to me that at one or more times in the past, climatic conditions in this lowland region of North America were probably such that these plants were able to achieve an essentially continuous distribution across the lowest elevations there -- perhaps along with other such forms including live-oaks (Quercus spp.), pinyons (Pinus spp.), junipers (Juniperus spp.), and even in some places stands of the Arizona cypress (Cupressus arizonica), et cetera! However, as hotter and drier conditions returned to those lowlands over subsequent time, many if not most of such more-mesomorphic plants quite likely largely died out there – thus at most leaving behind series of scattered, disjunct, and otherwise more-protected populations of them. The latter may now serve more rightly as reminders of the more-bountiful ecological pasts of those plants, but in some cases they could also eventually become places from which the depleted ranks of certain taxa could rightly be expected to expand from in the future!

The seeming "iffyness" of these latter conclusions of mine are by no means meant to downplay the biological and related significance of such a rare, disjunct, and thus truly unique population of New Mexico plants as the stand of Arizona cypress that grows at the northernmost end of the Cooke Range – which population has so far managed to survive the cumulative onslaughts of Homo sapiens in this state, and where no other seemingly-native aggregation of these conifers appears to have yet been confirmed to occur according to my information. In fact, I find it miraculous that these plants were not all turned into fence posts, mining timbers, other construction materials, firewood, and other human commodities centuries ago. Indeed, given that my first views of them there in that range occurred some 35-40 years ago – I now wonder if the ultimately ill-fated woolly mammoths (*Mammuthus primigenius*) that survived on several of the small islands in today's Bering Sea between Alaska and Siberia, had indeed all perished from there as far back as five to six thousand years ago!"

Mancuso's *The Revolutionary Genius of Plants*



Any book that early on heralds the positive contributions of Lamarck to science is bound to get this reader's attention. Most of us remember Jean-Baptiste Pierre Antoine de Monet, chevalier de Lamarck as the guy who got it all wrong in genetics. Stefano Mancuso, the world's leading authority in the field of plant neurobiology, reminds us that Lamarck coined the term biology and focused much of his attention on the rapid movements of sensitive plants, and discovered that at least one, *Mimosa pudica*, had a memory. Mancuso has spent his career studying the less-understood sensitivities, memories, and socializations of plants from all over the world.

In *The Revolutionary Genius of Plants – a new understanding of plant intelligence and behavior*, Mancuso takes us on a remarkable and very readable tour of the state of our knowledge of traits few of us attribute to plants. For years, I've complained that plant books generally stop at identification of species and delineation of their ranges, telling us little or nothing of their roles on the landscape. For the first time, I found myself reading a book about what plants do. And Mancuso tells us that they do a lot. Mancuso ranges from early Greek scholars, such as Aristotle, to current uses and needs for plants in the space programs.

He challenges the tendency to model technology after the animal model – a centralized brain controlling a limited network and surviving by way of motion. He nudges us toward thinking that plants might be just a little bit smarter, because they've had to solve the problem of surviving without the ability to run away.

In a sense this short book is two books in one. Its early chapters deal with plant evolution, behavior, socialization, memory, you name it, often discussing these traits in particular species. You might say it started out as the book I've always wanted to read, but then it morphs into revelation of modern efforts to incorporate the "plant model" into modern technology – something that Mancuso and his coworkers seem to be doing very well.

Of late, I've wondered if I've read too much in my lifetime. More and more often, I start a book, recognize a familiar path, go to the last chapter to see if it adds anything new, then put it away. *The Revolutionary Genius of Plants* held me all the way through. In fact, I'm probably going to go back and read it again to see what I might have missed.

And by the way, the illustrations throughout the book are exquisite.

-Harley Shaw
Hillsboro

Owls of the Black Range

At least eleven owl species are reported from the Black Range. They are presented here in no particular order.

Mexican Spotted Owl

Perhaps the most iconic species found in the Black Range is the Mexican Spotted Owl, *Strix occidentalis lucida*. The presence of this species causes angst for those who want to do whatever they want in the Black Range, and many of those people will swear that the species is not present here. The photographs on this page, reports from eBird (following page), and various field surveys all indicate that the population of this species in the Black Range is well established, although (assumedly) small.

This species can be difficult during the day because it is silent at that time and tends to be very stationary. It will fly in and watch you silently while you lean up against a Ponderosa and wonder about the state of your feet after a long hike, that is how I saw my first.

The Northern Spotted Owl is a North American species; there are three recognized subspecies. The Northern Spotted Owl and the California Spotted Owl subspecies are found along the west coast. The Mexican Spotted Owl is found in the interior west and into the central valley of Mexico (see range map on the following page).

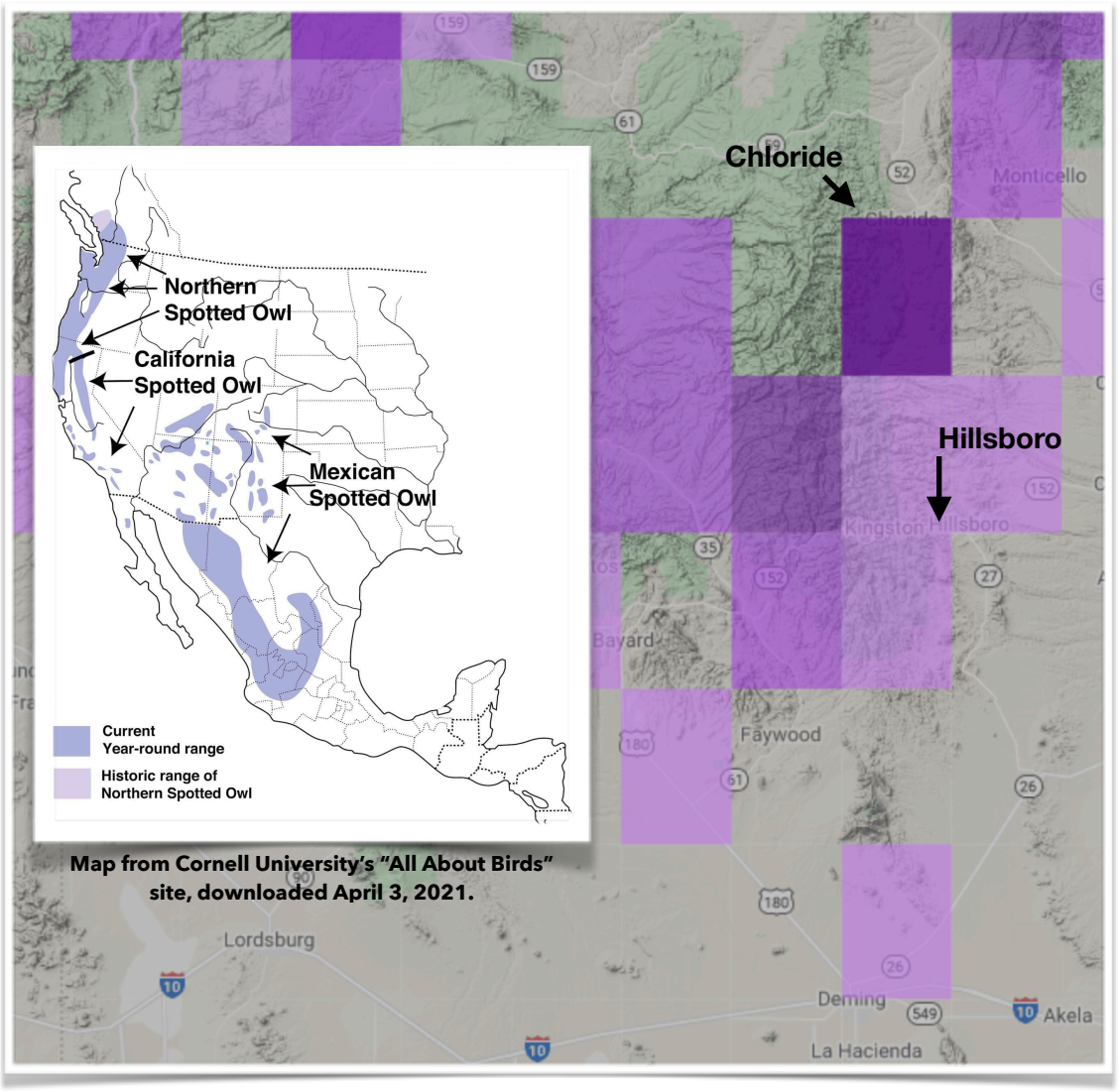
The Northern Spotted Owl, including the Mexican Spotted Owl subspecies found here, is under significant pressure from human activities and from range expansion by the Barred Owl.

The Barred Owl utilizes the same biological niche as the Northern Spotted Owl.

The protections from human activity which have been granted the Northern Spotted Owl are generally insufficient to maintain the species, given that many humans, especially those who want to ranch, mine, or log the lands on which the owls live, actively seek to circumvent those protections. One tactic which

Mexican Spotted Owl, *Strix occidentalis lucida,* feather Black Range, June 14, 2021

Mexican Spotted Owl, *Strix occidentalis lucida* (below and to the right) photographed in the Black Range on March 15, 2019. Photographer name and specific location withheld.



Map from Cornell University's "All About Birds" site, downloaded April 3, 2021.

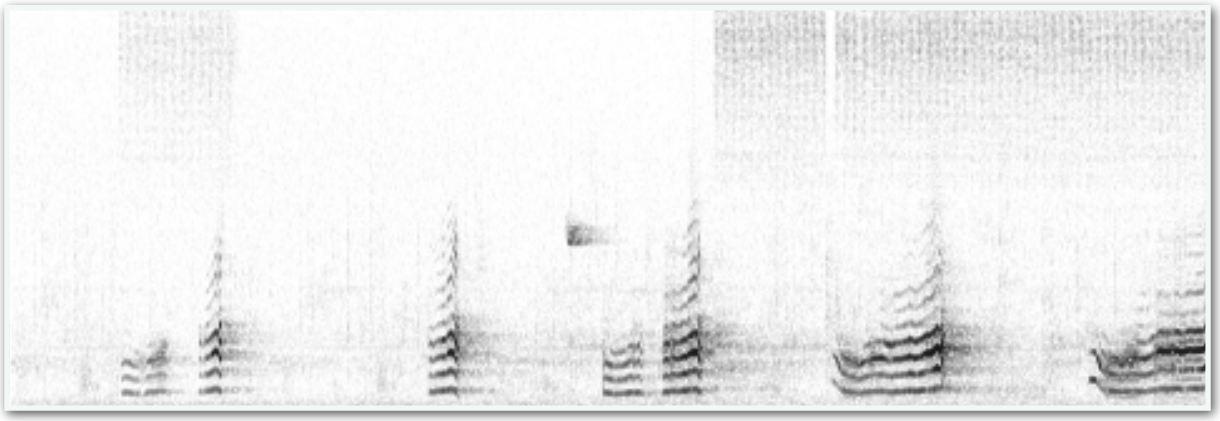
This grid, from eBird, indicates the prevalence of the Mexican Spotted Owl in this area based on observations. Each grid is 25 square kilometers; specific sighting sites are withheld. The color of the darkest grid indicates that a trained observer in the right area may sight/hear a Mexican Spotted Owl from 10-25% of the time. These birds are rare; that is what they are labeled "Threatened". The lighter the color of the grid is, the less likely it is that a bird of this species will be observed - but observations have occurred in all colored grids. The Black Range and Gila are some of the best places in the United States to see the Mexican Spotted Owl. Downloaded April 3, 2021.

they use is denial; as in climate denial, they simply deny that the owls are present and therefore protections are not warranted in the area.

The Northern Spotted Owl is one of our larger owls and its eyes are black, not yellow as in most owls.

Although it does not reflect the most recent research, the 1995 Recovery Plan for the Mexican Spotted Owl, Strix occidentalis lucida, has a significant amount of information about the natural history of this species. Like most things to do with this species, this plan and especially the one that followed are very controversial.

In the Black Range, the Mexican Spotted Owl is found in mature mixed confer forests, often in rocky canyons. We have plenty of both, even with the fires of the last two decades. The species seems to generally be found in areas with a closed canopy. That type of habitat has become more problematic in the Black Range since the Silver Fire of 2013.



To help protect this species most voice recordings of this species are restricted. This is what the sonogram looks like (courtesy xeno-canto).

Elf Owl, by Dave Cleary, Black Range, Sierra County May 4, 2020

Range of the Elf Owl. Susanna G. Henry, Frederick R. Gehlbach, Donna Molfetto, and Phillip Howard, Birds of the World. The Cornell Lab of Ornithology, https://birdsoftheworld.org (via Wikemedia CC license)

Elf Owl

Elf Owls, *Micrathene whitneyi*, like the one shown in the photograph by Dave Cleary on the preceding page, are found in the Black Range during their breeding season. Listen to one of its calls.

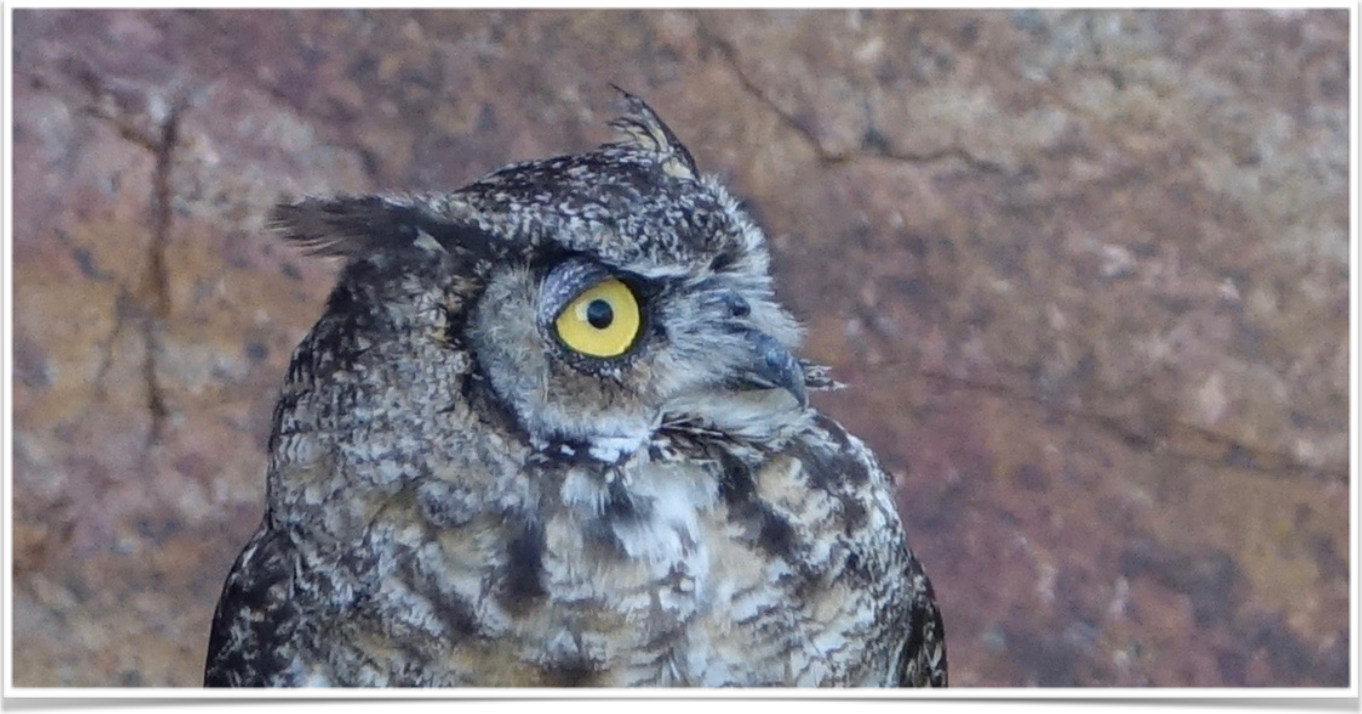
Elliott Coues established the genus (*Micrathene*) in 1861, recognizing the singular attributes of this very small owl. There are four recognized subspecies at the moment, although one of those may be extinct. The nominate form is found here. The most closely related species is probably the Long-whiskered Owlet of northern Peru.

The Elf Owl is often described as the world's smallest owl. Although just about anything can be unique if enough parameters are prescribed, this title is probably appropriate; the Elf Owl typically weighs about 1.4 ounces, is less than 6" high (4.9" to 5.7"), and has a wingspan of about 10.5".

American Barn Owl

If the Elf Owl is emblematic of the American Southwest and Mexico, then the Barn Owl (also, Common Barn Owl) is emblematic of the world. Up to thirty subspecies are recognized of *Tyto alba*, with the taxonomy in dispute. Some authorities would like to split the Barn Owl into several species. The International Ornithologists' Union recognizes several "split" species, including the American Barn Owl, *Tyto furcata*, which is the "Barn Owl" found, mostly, in the Americas south of the U.S. - Canadian border. Listen to one of its calls.

The individual shown below was photographed in Hillsboro, NM. View video, view other photographs.



Great Horned Owl

The range of *Bubo virginianus*, the Great Horned Owl, is restricted to the Americas, the North American range is shown above.

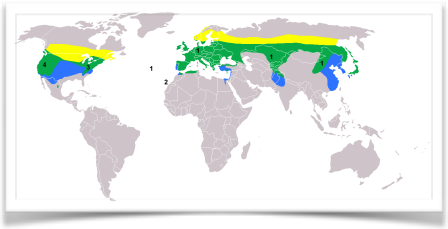
This is a large owl. The Great Horned Owl is the heaviest owl in Central and South America, and only the Snowy Owl is heavier in North America - thus, it is the heaviest owl in the Black Range. The Great Horned Owl is found throughout the Black Range (see other photos), from the desert foothills to the highest trails. An early nester, it is often found incubating in late winter. In the Black Range it has been found nesting in trees and on cliff ledges. (See photo above from near Hillsboro.)

There are more than 20 subspecies of Great Horned Owl. The subspecies shown above, photographed in Hillsboro, is either the Desert Great Horned Owl (*B. v. pallescens*), the Rocky Mountains Great Horned owl (*B. v. pinorum*), or an intergrade. The two subspecies tend to differentiate by elevation. The subspecies range map shown above is from the *Peterson Reference Guide to Owls of North America and the Caribbean* by Scott Weidensaul. If you are interested in the owls of this region, you should buy this book.

Great Horned Owls prey on rabbits and hares (among many other creatures), and the Black-tailed Jackrabbit and Desert Cottontail are frequent sources of food for this species in the Black Range. Listen to one of the calls of an immature bird. See video from New Mexico.

Long-eared Owl

The Long-eared Owl, *Asio otus*, is found in most of the Northern Hemisphere. There are four subspecies. *A. o. tuftsi*, is the subspecies which is found here. Some consider this subspecies to be a clinal variant of *A. o. wilsonianus*, which is found in eastern and central North



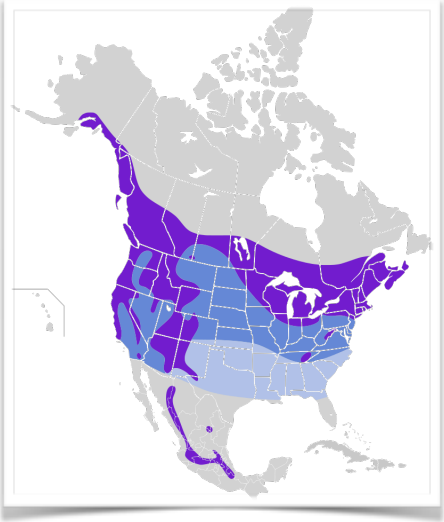
In the map above, yellow indicates the summer breeding range, green indicates the breeding resident range, and blue indicates the non-breeding winter visitor range.

America. The individual shown above was photographed at Black Mountain s.w. of the Black Range (n. of Deming).

Several individuals of this species are sometimes found roosting in hackberry trees in the washes east of Hillsboro, during the winter. See video and additional photos. Listen to begging call of juvenile.

Northern Saw-whet Owl

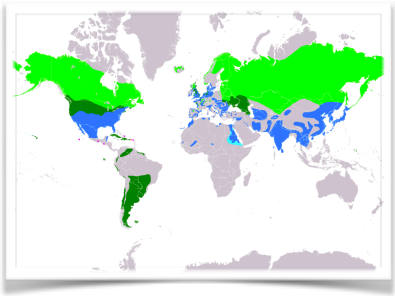
The Northern Saw-whet Owl, *Aegolius acadicus acadicus*, is found in our area year around, but count yourself very lucky if you see one (see range map, below). This small owl, which is only about the size of an American Robin (see photo to the right), will sit quietly for long periods. Listen to one of its calls.



By Cephas - Rasmussen, J. L., S. G. Sealy, and R. J. Cannings (2008). Northern Saw-whet Owl (*Aegolius acadicus*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi-org.acces.bibl.ulaval.ca/10.2173/bna.42, CC BY-SA 4.0

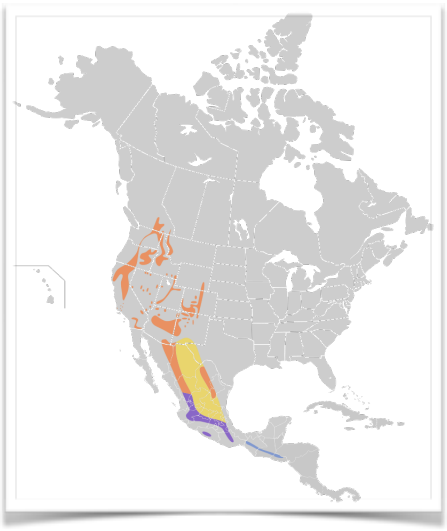
Short-eared Owl

The Short-eared Owl, *Asio flammeus*, is found in the Americas, Eurasia, and parts of Africa (see range map below). There are eleven subspecies; the nominate form is found in our area. Listen to one of its calls.



Flammulated Owl

The Flammulated Owl, *Psiloscops flammeolus*, is monotypic and in the United States is typically a bird of the mountain west. (See the range map below.) Listen to one of its calls.



Like many owls, it is primarily nocturnal. It is a small species, generally less than six inches long. Flammulated Owls nest only in tree cavities and are most easily found by locating the cavity hole.

Western Screech Owl

The Western Screech Owl, *Megascops kennicottii*, is found in North America (see range map below).

There are currently nine recognized subspecies. Screech Owls have undergone a significant amount of taxonomic revision in the last two decades or so; it appears to have settled down at the moment, but before naming a Screech Owl to species or subspecies do a bit of research into current taxonomic questions. For instance, the range map, below left, is from 2017. The Wikipedia entry for this species (accessed on August 13, 2021) indicates that this species is found in Central America. Listen to one of its calls.

The Western and Eastern Screech Owl were most recently separated into distinct species in the 1980s. They are most readily distinguished by vocalization. Some experienced birders have said that they have heard Eastern Screech Owl calls in the area of Hillsboro.

Megascops kennicottii aikeni is the subspecies which is currently recognized from our area. English common names for this subspecies include Arizona Screech-Owl and Aiken's Screech Owl. The individual pictured above was photographed in the Percha Box, east of Hillsboro.

Burrowing Owl

The Burrowing Owl, *Athene cunicularia*, is found throughout the Americas. Note the range map at the top right. This map depicts some interesting natural history. The blue color is the northern hemisphere winter (non-breeding range of the species). What the map's authors claim is yellow depicts the northern

hemisphere summer breeding range of the species. The green depicts the resident breeding range of the species (different populations in North and South America).

There are currently 18 recognized subspecies of Burrowing Owl. The subspecies found in the Black Range is *A. c. hypugaea*, the Western Burrowing Owl. The individual shown at the top of the next page is not of this subspecies and it was not photographed in North America. It was photographed in southern Brazil, where it is a breeding resident, of the South American population.

Burrowing Owls have been declining in population for some time. Part of the decline is attributed to the fact that the primary (traditional) food source of the species was the prairie-dog and

associated ground dwellers. Burrowing Owls are often seen near the burrows of such ground dwellers, commonly standing by the entrance. Listen to its alarm call.

Northern Pygmy-Owl
Mountain Pygmy-Owl

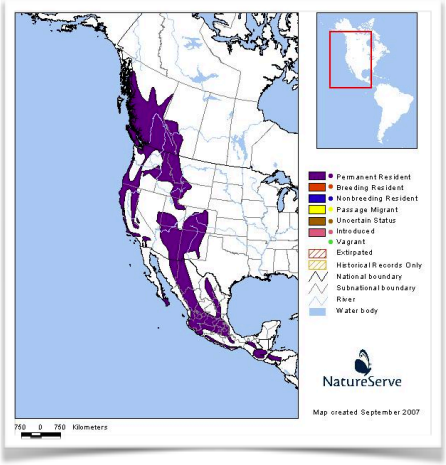
The Northern Pygmy Owl, *Glaucidium californicum* vs. Mountain Pygmy Owl, *Glaucidium gnoma*, is another group of birds trapped in taxonomic limbo. The International Ornithologist's Union (IOU) recognizes the Mountain Pygmy Owl as a separate species (see range map in middle column). The American Ornithological Society (AOS) considers the birds we have here to be a subspecies (one of four) of Northern Pygmy-Owl. The range map in the right column (NatureServe 2007) shows the range of the Northern Pygmy-Owl if the species is not split. Listen to one of the calls of the Mountain Pygmy Owl.

These birds (whatever the name) seem to prefer mature mixed forests near streams. The bird shown on the next page was photographed in Railroad

Canyon on the west slope of the Black Range in June of last year.

Summary

Owls are often found at night, by following their calls. That is the reason that we provide many links to calls from



the xeno-canto website in this article. This website is a repository for bird call recordings from around the world and often has dozens, sometimes hundreds, of recordings for each species. Owls, like all bird species, have a variety of calls. Different calls are used depending on the circumstances of the moment. This website is a fantastic resource, surpassing all other sites offering vocalization recordings.

Mountain Pygmy Owl
Glaucidium gnoma
Railroad Canyon
Black Range, NM
June 14, 2021

Follow-ups

As a follow-up to articles in our last issue, Harley Shaw noted that the Spotted Skunk is a species he has studied closely in the past.

Photo Submittals

Some natural history observation occurs when we are driving down the road. Tom Lander (Kingston) provided these images of a Western Diamondback Rattlesnake, *Crotalus atrox*, on July 22, 2021. Although this is our most common rattlesnake species, we saw few over the last summer.

Aldo Leopold – His Legacy, Part 7
by Steve Morgan

Life after the war and the Spanish Flu held a sense of renewal for the thriving little city of Albuquerque, New Mexico. On August 1, 1919, Leopold left his short but productive stint at the Albuquerque Chamber of Commerce and rejoined the US Forest Service. He came back to a promoted position, far above where many felt he had the experience to be, but he was the new Assistant Forester in Charge of Operations. This made him second in command of Forest Region 3 with its eleven national forests to operate and manage.

After only a few months in the new position, the District Forester of Region 3, Paul Redington, left the region and was replaced by a man who thought Leopold was not the right man for the job and told him so. Frank C. W. Pooler even had another position lined up in another region for Leopold to take. Aldo dug his heels in and said no thanks. His family and so many of his ongoing projects were in Albuquerque and New Mexico.

Typical of Leopold, he went after his new position with great passion to do his best, and on Christmas Eve, 1920, District Forester Frank Pooler wrote to Leopold this note:

> *In the closing days of my first year as District Forester, I want to express my appreciation for the loyal assistance you have given me and for the perfectly splendid way in which you have run your office. It was not an easy thing to take up Operation work when you did, with a change of District Foresters in the air, but you have overcome these difficulties in a way that has unqualifiedly won my fullest confidence….. It is with a great deal of personal satisfaction that I can write to you in this way at this time.*

The next few years gave Leopold a deep understanding of the conditions that existed on Forest lands. He became very concerned about the soil erosion he saw increasing on most forests, the Prescott and Carson National Forests being two of the worst. In December of 1923, he completed a Watershed Handbook, a guide to teach field personnel how to diagnose and respond to watershed problems. It was a culmination of his observations from his inspection trips throughout Region 3. The range control policy before had been short-sighted. It held that the range could be stocked with as much livestock as possible, as long as there was forage enough to feed them, and that heavy grazing helped reduce the fire hazard.

Aldo Leopold (Steve Morgan) reads from his journal and encourages us all to document what we see around us. Image: Jen Gruger, Otero Chapter.

The author presenting to the 2021 State Conference of the Native Plant Society of New Mexico as shown in the Oct-Dec 2021 issue of their newsletter.

In his Handbook, Leopold changed that approach. He proposed that the number of allowed livestock be controlled by the overall condition of the watershed itself and not seasonal observations. It was a change of policy thinking from managing cattle to managing the forest and range as a whole. He stated that *"The stockman must realize that grazing his livestock on public lands is a privilege and with that privilege comes the responsibility to treat the land with love and respect."*

His observations from his inspection tours of the eleven Region 3 forests had given him a much larger view of the overall ecological conditions existing in the Southwest. Leopold was now in a position to challenge some of the policies he saw as creating these conditions and needing to change. He said, *"The destruction of soil is the most fundamental kind of economic loss which the human race can suffer."*

Leopold was now very aware of how fast the wild lands were disappearing. He had seen the devastating effects that over-logging and overgrazing had caused on Arizona's Blue River. Even by the time he had first visited the Blue in 1909, the lush grasses for ranching and the deep soils for thriving farms were gone, washed away in a short decade of unregulated land use. The automobile was being seen, deeper and deeper into the wild country. He stated, *"To those devoid of imagination, a blank spot on the map is a useless waste, to others, the most valuable part. I am glad I shall never be young without wild country to be young in. For of what avail are forty freedoms, without a blank spot on the map to pursue them?"*

He had been considering the need for wild land recognition as early as 1913, but it was on a conference trip to Denver in 1919 that he started discussing the idea of preserving wild lands with his colleagues. He met with Arthur Carhart, a twenty-seven year old Landscape Architect, the Forest Service's first "Beauty Engineer". They shared kindred concerns and Leopold encouraged Carhart to write out his thinking. In a memo to Leopold, Carhart wrote, *"There is a limit to the number of lands of shoreline on the lakes; there is a limit to the number of lakes in existence; there is a limit to the mountainous areas of the world, and in each one of these situations there are portions of natural scenic beauty which are God-made, and the beauties of which of a right should be the property of all people. These areas, in order to return the greatest value to the people, not only of the Nation but of the world, ought to be protected from the marring features of man-made constructions."*

The meeting with Carhart seemed to galvanize Leopold into acting on this need. He began looking at the lands within the 11 National Forests in Region 3 for a suitable area. He considered wilderness to be, *"A continuous stretch of country, preserved in its natural state, open to lawful hunting and fishing, big enough to absorb a two-weeks pack trip,*

and kept devoid of roads, artificial trails, cottages or other works of man." **He also realized that "*It will be much easier to keep wilderness areas than to create them. In fact, the latter alternative may be dismissed as impossible.*"**

On his 1922 inspection tour of the Gila National Forest, Leopold had a meeting planned with his good friend Fred Winn, Supervisor of the Gila National Forest. They had planned to look at a portion of the forest Leopold thought met his criteria for wilderness. On May 22, 1922, Leopold met Winn at the Kingston Ranger Station. Their plans, though, were changed by nature. The Gila National Forest was tinder dry, as the seasonal rains had not arrived yet, and was being overwhelmed by wildfires. In a ten-day period, forty-one fires had broken out. Both men were kept fully occupied with managing the fire crews. The stories of how quickly they moved men and materials around the Black Range and Gila Forest interior mountains are testament to the condition of the trail system in those days and the condition of the horses and riders. The Black Range Crest trail, which linked the fire lookouts at Hillsboro Peak and McKnight Mountain along with telephone wire to each, was just being completed and most of the rest of the current system was already established.

Eventually, on June 20, Leopold met with Winn and his staff in Silver City where they drew out the boundaries for the proposed Gila Wilderness Area. It was an area of deep canyons and very rugged, wild lands encompassing over 750,000 acres.

While in Silver City, Leopold observed first-hand another example of human impact on the land. Between overgrazing of the grasslands above the town and heavy timber harvesting to supply the mines, the situation was set for a catastrophe. The first hit in 1895 and the last in 1903, as heavy rains created flooding which replaced Main Street with a fifty-five foot deep chasm now known as "The Big Ditch." Backdoors on businesses became front doors as the town recovered.

After Leopold returned to Albuquerque from this trip, he put together the proposal for the Wilderness Area. The plan met with enough opposition from within the Forest Service, though, that he dropped the idea for the time being. Meanwhile, he made an inspection trip to the Prescott National Forest in Arizona where he refined his ideas on another critical area of concern.

Fire fuels had been studied in-depth, but with Leopold looking at all of the Region 3 forests and the fire behaviors he had seen, he was specifically charged with looking at the overgrowth of shrubs: manzanita, mountain mahogany, shrub oaks and others. What he came up with was a remarkable new view which would change policy direction for fire control, forest management, and range management. There was an eleven-year drought cycle pattern which had never been considered in range management policy but had a severe impact on the land. He was starting to realize that fire had an important role in forest ecology but was not ready to say that natural fires were a good thing. This overall view had revealed the connection of fire to grazing to vegetation change to erosion.

Over the next year, Leopold continued to refine his thinking in the areas of wildlife management, fire control, erosion and the need for wilderness areas. In March of 1924, he along with Morton Cheney completed the Recreational Working Plan which, when approved, would establish a 755,000-acre wilderness area within the Gila National Forest.

Leopold's western sojourn was about to come to an end. Forester Greeley in Washington D.C. requested that Leopold take on the Assistant Director position at the Forest Products Laboratory in Madison, Wisconsin. Reluctantly, the Leopold family, Aldo, Estella, Starker, Luna, Nina and little Carl, all made the move from the southwest they knew so well. It was only four days after the family left Albuquerque that Regional Forester Pooler signed the paperwork officially creating the Gila Wilderness Area.

Aldo Leopold went on to teach at the University of Wisconsin, becoming the first professor of Game Management in the country. In 1935, the family bought the now renowned "Shack" property near Baraboo, Wisconsin, which the Leopold family over the next thirteen years restored back to a healthy land. He went on to put together many of his writings into a book he had titled "Great Possessions".

On April 21, 1948, a grass fire broke out on his neighbor's property. The Leopold family turned out to fight it, and it was while fighting this fire that Aldo Leopold, at age 61, died of a heart attack. Just one week before, he had received word that his book was going to be published. It was and came out in 1949 under the now familiar name of "The Sand County Almanac."

This Leopold Legacy series was a focus on Aldo Leopold's incredible life and work while living in Arizona and New Mexico from 1909 to 1924. His experiences in the southwest shaped much of his latter thinking which appeared in his now well-known book. His concern for the land was clarified with his essay "A Land Ethic", which has become the guiding principle for conservationists who followed Leopold's philosophy. We who live in this land of the Southwest are fortunate to have had such a brilliant thinker call the mountains and grasslands of Arizona and New Mexico home.

If you find yourself wishing to know more about this remarkable man, there are many books written about him, but the most comprehensive work is Curt Meine's biography called *Aldo Leopold – His Life and Work*. I used many different sources for these articles, but the bulk of my knowledge came from referring to Meine's book over and over.

If you are interested in learning more about Aldo Leopold, please contact me at aldoleopold1909@gmail.com.

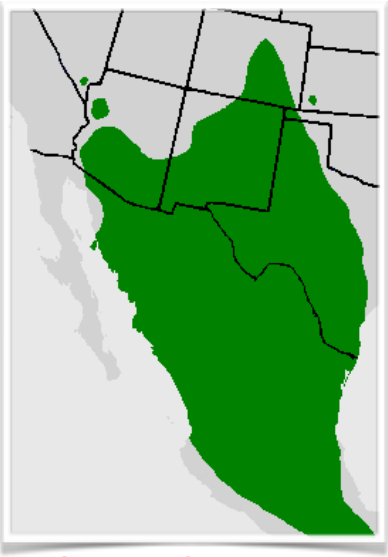
Thank you,

Steve Morgan
Aldo Leopold Living History

Our Covers

The Mountain Pygmy Owl shown on our back cover is described in "The Owls of the Black Range", see earlier in this issue.

The Curve-billed Thrasher, *Toxostoma curvirostre*, depicted on our front cover was photographed at City of Rocks State Park at the southeastern edge of the Black Range. This is the most common thrasher of the Black Range. In some areas, the Crissal Thrasher is found, and at times a Sage Thrasher is to be seen. (All three species were seen during the last Hillsboro Christmas Bird Count.) Its range is shown below.



Map by Aznaturalist - CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=27687852

This species can be extremely easy to see, perching in full view and singing lustily - or not. Sometimes they hide within a thick bush, sing lustily, and dare you to find them.

Tom Lander (Kingston) and Gary Sapp (Hillsboro) provided a series of photographs, taken in Hillsboro, of a young Curve-billed Thrasher. The photographs on this page and in the left hand column of the next page were taken by Lander in early to mid July 2021. This series ends with the end of nesting process, when all that is left is an egg which never hatched, a photograph by Gary Sapp. On July 14 they reported that the thrashers were gone.

Published in Hillsboro, New Mexico