



# Sego Lily

*Newsletter of the Utah Native Plant Society*

Summer 2021 Volume 44 Number 3



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# Looking for Rare Plants

by Diane Ackerman and Mary O'Brien

It was a warm July Castle Valley morning when I started out with Joel Tuhy, Mary O'Brien of Project Eleven Hundred and Emma Fletcher-Frazer, a pollinator intern from Whitman College in WA state. This plant outing had been planned to convey to Mary some of Joel's field data on *Mentzelia shultziorum* and *Cycladenia humilis* var. *jonesii*. Some of his data had been collected as early as 1993 in-and-around Castle Valley, UT. Mary is interested in tracking down the pollinator(s) of the rare Shultz' Blazingstar and curious as to the habitat of the perhaps not-so rare, but long-lived and federally-listed Jones Cycladenia.

We started out following the eroded rivulets of the Moenkopi at the north end of the valley. Our destination was up—to a steep "bare and banded" Moenkopi layer that both species call home. Lucky for

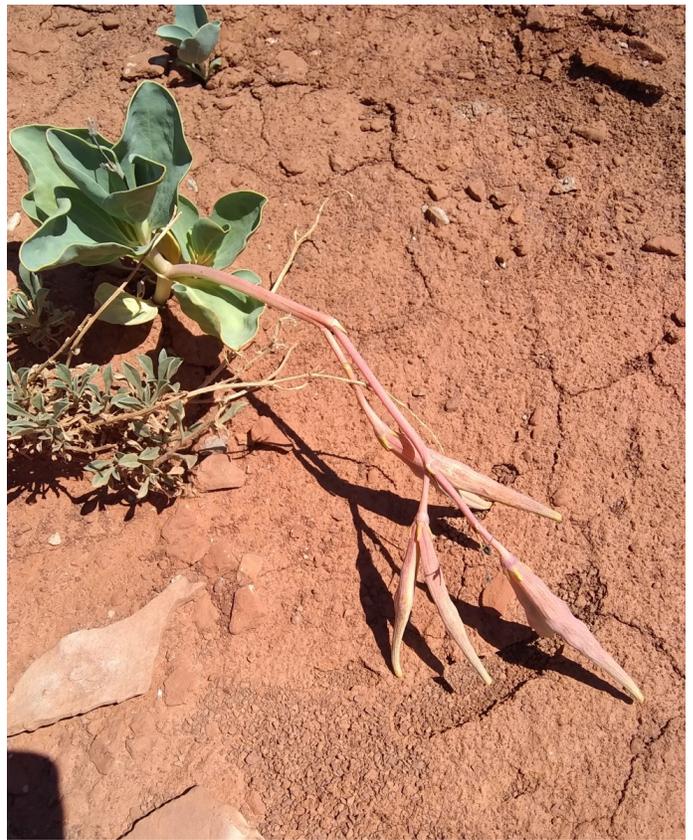
us, the more common *Mentzelia multiflora* was growing along the road where we parked and we took note of its thin, sticky and lobed leaves. We knew we would be looking for a much different leaf on Shultz' Blazingstar, more like a holly leaf with points.

While we were aware of the parched landscape in the plants around us, the few Shultz' Blazingstar plants we encountered were no exception. We learned this was not solely due to lack of moisture. Professional photographers never find a grand display of flowers in *M. shultziorum*. Instead, buds, flowers and seeds are all on display at the same time. We welcomed a single flower, several buds showing yellow and spent flowers on our plants before we descended into disconnected, deep arroyos on our way down the Moenkopi back to our vehicle.

Our next adventure was across the valley. The sun was



*Mentzelia shultziorum*. Photo Leila Shultz.



Jones Cycladenia, *Cycladenia humilis* var. *jonesii*.  
Photo by Diane Ackerman

Cover photo: A favored habitat of *Mentzelia shultziorum* is an upper Moenkopi layer, as here on a steep slope in Porcupine Canyon between Castle Valley to the south and the Colorado River to the North. Photo by Mary O'Brien.



*Mentzelia shultziiorum* favored habitat on Moenkopi slopes between Castle Valley and the Colorado River. Photo by Mary O'Brien.

And it's still there.

Plants and Rocks! What a great summer day. Thanks Joel and Mary!



Closeup of *Mentzelia shultziiorum* in Salt Creek. Photo by Emma Fletcher-Frazer.

already bearing down at 10 AM in the morning and we were determined to find our next subject. Marvel of the desert in severe drought, we were amazed to find a fair amount of Jones Cycladenia heavily endowed with seed pods.

A most unexpected piece of geology was 10 miles northeast of Castle Valley after we had driven up Onion Creek and into Fisher Canyon where the road opened up to Fisher Valley. Wow to the 25 creek crossings to get there! Wow to the Stinking Springs that we could smell just passing by! Wow to the exposure of the 350 million year-old Pennsylvanian Paradox Formation where the light-colored salty rock presents a sharp color contrast to the red rock of the younger Cutler formation!

It was on this final jaunt we found sparse *M. shultziiorum* hanging onto the steep slope. We began to envision the day back in 1974 when *M. shultziiorum* was first discovered by Leila and her husband John. Surely, there could have been a less steep slope to climb than the one we were standing on, but she had been out that day specifically to look for anything that was unusual. And there before her was this *Mentzelia* that just didn't seem to fit with the others she knew.



Diane Ackerman, Emma Fletcher-Frazer and Joel Tuhy visit *Mentzelia shultziiorum* at the upper Onion Creek site where Leila and John Shultz first noticed this species. Photo by Mary O'Brien.

**Editor's Note. This is an example of an original species description:**

**This description of *Mentzelia shultziorum*, written by Barry A. Prigge, was published in the *Great Basin Naturalist* in 1986.**

No longer in publication, the *Great Basin Naturalist* was a journal published by Brigham Young University. According to the <https://scholarsarchive.byu.edu/gbn/> website:

*Great Basin Naturalist* was published from 1939 to 1999 and was succeeded by the *Western North American Naturalist*. With a few exceptions, the journal published experimental and descriptive research pertaining to the biological natural history of western North America, focusing primarily on the Intermountain States.

## NEW SPECIES OF MENTZELIA (LOASACEAE) FROM GRAND COUNTY, UTAH

Barry A. Prigge<sup>1</sup>

**Abstract.** A new species, *Mentzelia* (Section *Bartonia*) *shultziorum*, of the *Loasaceae* (*Mentzelioideae*) is described. A close relationship with *M. multicaulis* (Osterh.) Darl. and *M. argillosa* Darl. is suggested based on the morphology of the flowers, leaves, and seeds.

Recent field work in Grand County of southeastern Utah has turned up two populations of an undescribed species of *Mentzelia* (sect. *Bartonia*). This section of *Mentzelia* demonstrates considerable morphological diversity and adaptability and has radiated into many of the diverse and often isolated habitats resulting from the wide range of substrate, elevation, and precipitation of the Colorado Plateau Province of eastern Utah, western Colorado, northern Arizona, and western New Mexico. Many species of this section occur on unusual substrates that are commonly unsuitable for most species because of textural properties or high concentrations of evaporites or minerals. *Mentzelia* is apparently able to exploit these habitats by escaping intense competition from species that occur on more suitable substrates. Edaphic factors and isolation are very important in their speciation and probably account for the many edaphically restricted, and often locally endemic populations of *Mentzelia* in the Colorado Plateau Province. It is from such a small, isolated, unusual substrate that this new species was discovered.

Within *Mentzelia* species recognition is based on subtle and technically difficult characters, and in the section *Bartonia* speciation has created many permutations of the available character states. This has resulted in many taxonomic headaches that standard collecting and herbarium techniques have generally been ineffective in solving. Scanning electron microscopy has greatly

facilitated the delimitation of taxa by revealing the microstructure of the seed coat (Hill 1976), thus providing two new characters and several character states (radial walls straight or wavy and number and shape of papillae on tangential walls) that help elucidate the taxonomic problems. It is on the basis of micromorphological characteristics of the seed and the standard macromorphological characteristics that we recognize this new species.

*Mentzelia shultziorum* Prigge, sp. nov. Fig. 1

*Mentzelia multicaulis* (Osterh.) Darl. affine, sed ab eo alis seminibus 0.20-0.35 mm latis, foliis caulinis ovatis vel obovatis, dentibus non profundis, diversum. Rounded, much branched, herbaceous perennial 20-30 cm tall; branches generally arching upward; pubescent with glochidiate and pointed hairs. Cauline leaves obovate, ovate or elliptic in outline, 10-30 (33) mm long, 4-20 mm wide, shallowly toothed at margin with 3-4 teeth on each side, cuneate or broadly attenuate at base, rounded obtuse or acute at apex, densely pubescent on both surfaces with both glochidiate and pointed hairs, some of which have pustulate bases. Bracts linear, lanceolate or oblanceolate; 3.5-11.5 mm long; 1.2-2 mm wide; entire or with 1 or 2 short teeth along margin. Flowers with pedicels to 2.5 mm long; calyx lobes 5, 5.4-8.5 mm long, deltoid, acuminate, 2.2-3.0 mm wide at base, calyx tube 1-1.5 mm long; petals 5, yellow, 9.2-15.5 mm long, 2.7-5.2 mm wide, acute at apex, clawed, glabrous; the next whorl within the petals of 5 petaloid stamens, broadly obovate to oblanceolate, 6.5-9.0 mm long, 1.1-3.8 mm wide, with functional anthers; stamens numerous; grading from 9 mm long for the outermost

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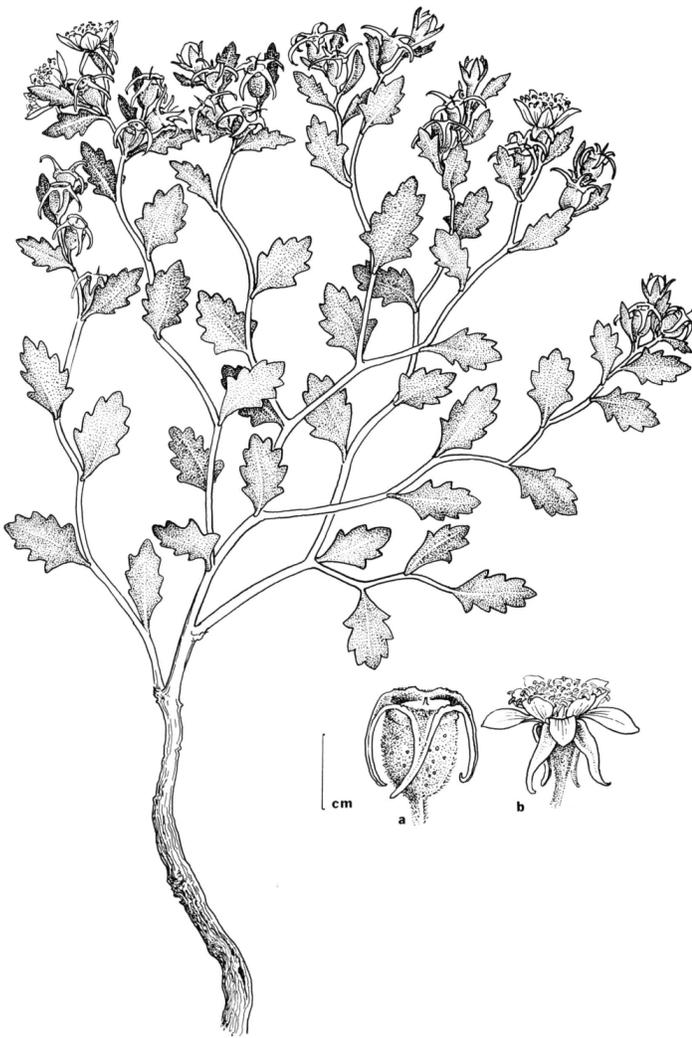


Fig. 1. *Mentzelia shultziorum* flowering branch a, Fruit. b, Flower. Illustration by Kaye Thorne.

whorl to 3.8 mm long for the innermost whorl; filaments narrow except sometimes for about 3 in the outermost whorl which are up to 1.5 mm wide; anthers 0.7-1.0 mm long; pistil mm long, 1.4-3.1 mm wide, with a narrow wing 0.2-0.35 mm wide, often ridged on one or both faces, seed coat cells with straight radial walls and with 2-5 papillae on tangential walls. Flowers from July to Sept. Type: Utah. Grand Co. : 7.3 mi S of intersection of Hwy 128 and Onion Creek Rd in Fisher Valley, 11 air mi NE of Moab; Elev 5,200 ft; T24S, R24E, Sec 19. , Shultz & Shultz 2070. Holotype: UTC. Isotypes: RSA.

Specimens examined: Utah. Grand Co.: above Onion Creek, 5,200 ft., 7.1 mi E of State Hwy 128 on Fisher Ranch Rd (38° 42' N; 109° 15' W), Prigge , Shultz & Shultz 6644 (LA); Onion Creek drainage of Fisher Valley (11 air mi NE of Moab) 7.3 mi ESE of Hwy 128: Sec 22, T24S, R24E, 38° 42'N, 109° 15' W, elev 5,200 ft, Shultz, Shultz & Prigge 9030 (UTC, LA); 9 mi NE of Moab, NW

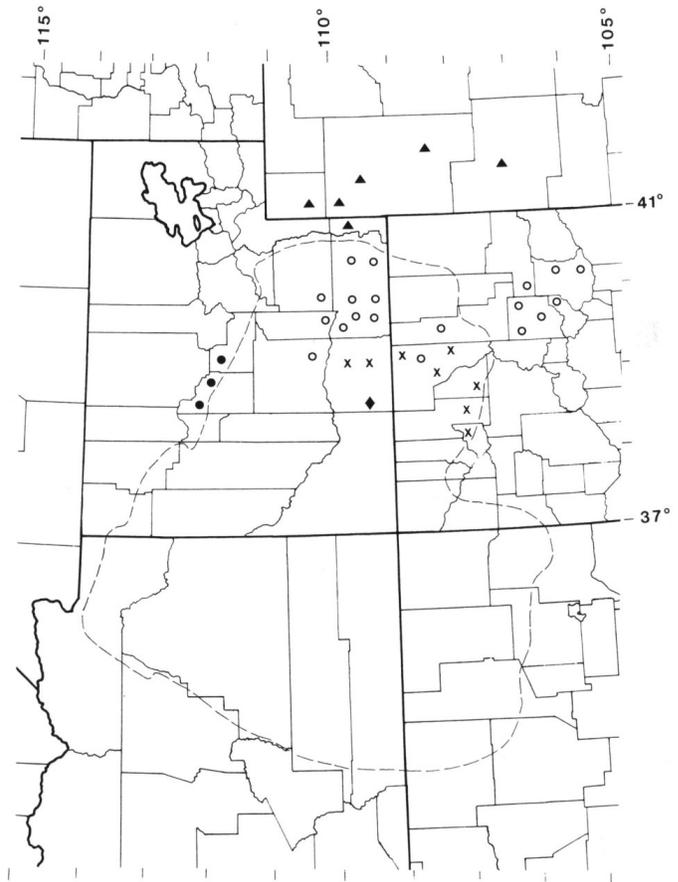


Fig. 2. Map of Utah and adjacent states showing the distribution of *Mentzelia shultziorum* (♦), and some other species that also occur: *M. multicaulis* (○), *M. argillosa* (●), *M. marginate* (×), and *M. pumila* (▲). Dashed line represents boundary of the Colorado Plateau Province.

above pass between Castle Valley and Porcupine Canyon, T25S, R23E, Sec 6 NW 1/4, 4,600 ft, Franklin 2201 (BRY).

The specific epithet is in honor of John and Leila Shultz, students of the botany of the Great Basin and Colorado Plateau, who found this new population of *Mentzelia* .

*Mentzelia shultziorum* is known from only two localities in Grand Co., Utah (Fig. 2). At the first locality it occurs near an old uranium and vanadium mine site on gray clay substrates of the Moss Back Member of the Chinle shale, which outcrops locally. It is restricted to steep, sparsely vegetated southfacing exposures on these substrates where alluvial and colluvial erosion rates are high. Associated species are: *Oryzopsis hymenoides* , *Fallugia paradoxa* , *Atriplex canescens* , and *Chrysothamnus nauseosus* . At the second locality it is on dark red clay of the Moenkopi Formation(?) with *Atriplex* , *Eriogonum* , and *Ephedra* .

*Mentzelia shultziorum* possesses no characteristics that

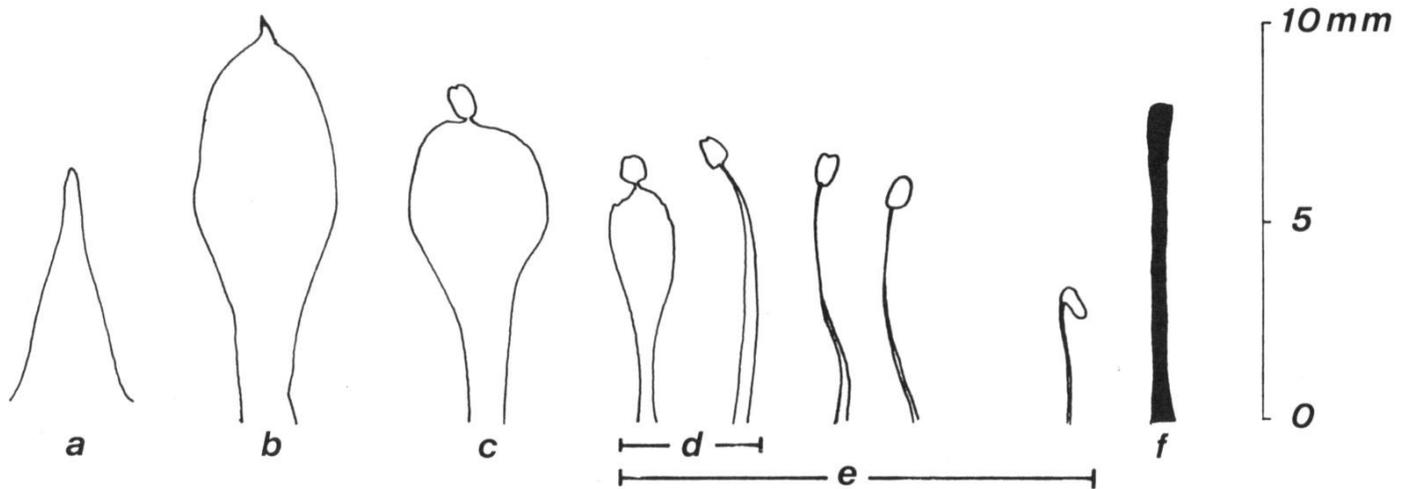


Fig. 3. Floral diagram of *Mentzelia shultziorum* representing elements Petaloid stamens. d, Outermost whorl of stamens. e, Stamens from outermost to innermost whorl. f, Style.

are not found in other species of *Mentzelia* (Sect. *Bartonia*) in Utah. However, the combination of characteristics is unique, and its relationships within the section *Bartonia* are not entirely clear. Seed shape, which is lenticular with a narrow wing 0.2-0.35 mm

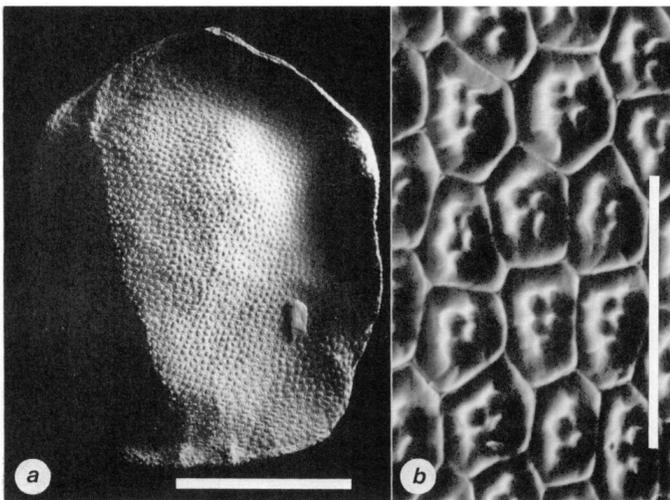


Fig. 4. Scanning electron micrograph: a, Whole seed (white bar = 1mm). b, Seed coat cells showing straight radial walls and 2-5 papillae on tangential walls (white bar = 0.1mm).

wide (Fig. 4), is similar to that of *M. pumila*; the seed coat cells, which have straight radial walls and 2-5 papillae on tangential walls (Fig. 4), are like those of *M. pumila* (Nutt.) T. & G. as well as *M. multicaulis* (Osterh.) Darl. and *M. argillosa* Darl.; the floral parts, which are of 5 obovate, glabrous petals and 5 obovate, petaloid stamens (Fig. 3), are like those of *M. multicaulis* and *M. argillosa* (to a lesser extent); and the leaves, which are obovate to ovate and shallowly toothed, are similar to *M. marginata* (Osterh.) Thompson & Prigge or

*M. pterosperma* Eastw. Based on floral (petal shape, vestiture, and size; petaloid stamens presence/absence), seed (size, winged, seed coat cell radial walls straight or wavy and tangential wall papillae), and cauline leaf (shape and size) characteristics, *Mentzelia shultziorum* is phenetically close to *M. multicaulis* and *M. argillosa* (perhaps closer to the latter) and is probably closely related to these two species. Chromosome counts and hybridization studies will have to be done to confirm its relationship to these two species.

## Acknowledgments

I thank John and Leila Shultz for their help in collecting *M. shultziorum*, John Shultz for the Latin diagnosis, Henry J. Thompson for his helpful suggestions and discussions and for the use of his file of SEM micrographs of *Mentzelia* seeds, and Kaye Thorne for the illustration of *M. shultziorum*. Literature Cited Hill, R. J. 1976.

Taxonomic and phylogenetic significance of seed coat microsculpturing in *Mentzelia* (*Loasaceae*) in Wyoming and adjacent western states. *Brittonia*28: 86-112.

## Literature Cited

Hill, R. J. 1976. Taxonomic and phylogenetic significance of seed coat microsculpturing in *Mentzelia* (*Loasaceae*) in Wyoming and adjacent western states. *Brittonia*28: 86-112.

Prigge, B.A. New species of *Mentzelia* (*Loasaceae*) from Grand County, Utah. *Great Basin Naturalist* 46:361-365. Reprinted with permission. Copyright 1986, Brigham Young University, Provo, UT 84602. Except for personal uses allowed by Sections 107 and 108 of the U.S. Copyright Law, all other uses require the permission of the copyright owner.

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# Naturally occurring rare oak hybrids along the Central Wasatch Front provoke thought and respect

by Tony Frates (originally published on-line in November of 2008)

In 1954, Rudy Drobnick, a University of Utah graduate student of the famous botanist and conservationist Dr. Walter P. Cottam (1894-1988; he first taught at BYU for 12 years and then 31 years at the U.), initially noticed an oak hybrid on the west side of the Oquirrh Mountains (which run north and south along the west side of the Salt Lake valley). Later in the course of Drobnick's research for his master's thesis, more isolated occurrences were found including locations, amazingly and somewhat ironically, very near to what would become Cottam's Oak Grove (and which then led to all of Cottam's famous work that continued unabated for the remainder of his life) at Red Butte Garden, on the University of Utah campus in Salt Lake City.

These naturally occurring oak hybrids involve a cross of between *Quercus gambelii* (Gambel's oak, also called Gambel oak, scrub oak, Rocky Mountain white oak or Utah white oak) and *Quercus turbinella* (Turbinella live-oak, Turban oak or Sonoran scrub oak). Taxonomically they are known as *Quercus x pauciloba* Rydberg (Few-lobed oak) but can be designated in other ways.

## About Gambel's oak

Gambel's oak was named by Thomas Nuttall in 1848 for ornithologist/naturalist William Gambel who in 1841 collected it in northern New Mexico. (Gambel was only about 20 years old at the time; sadly he died of typhoid only a short number of years later in 1849). It is widespread along Utah's Wasatch Front and is typically thought of as a shrub to small tree since most frequently it is found in less favorable dry/rocky habitats growing in groves or thick stands; so, it is an important soil stabilizer, particularly in light of its extensive woody, thick root system (lignotubers) and its clonal nature. But given the right location such as in canyon bottoms, it can form dense stands and grows straight and can easily reach heights of well over 35 feet (Dr. Ty Harrison, ecologist and long-time hybrid oak enthusiast and retired Westminster College biology educator, and I measured one in 2010 that I had noticed that was over 50 feet tall). Gambel's oak grows slowly (I have a plant grown from an acorn that is now just over 10 years old



Typical Gambel's oak community in northern Utah (9/18/08 Olympus Hills Park)

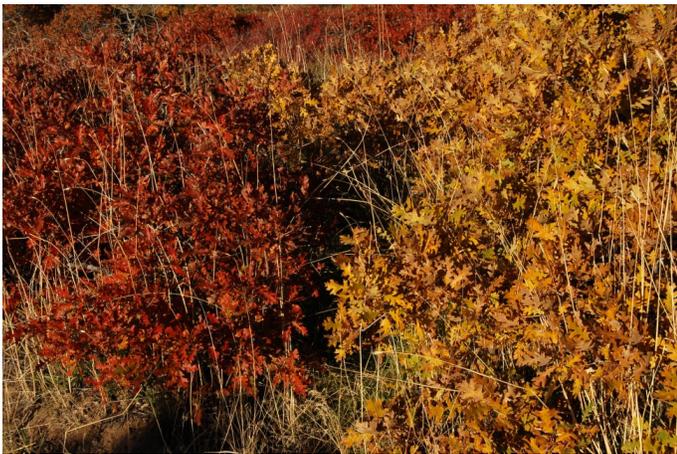
and is not much more than seven feet tall, and which gets more water than it probably normally would on a north-facing aspect); but it readily resprouts in response to fire, within just a year or two. It is not a plant that you would want to ever remove normally. Gambel's oak is deciduous; Turbinella live-oak is evergreen and normally never grows as tall as Gambel's can, is usually in the four to eight foot range, and has smaller, holly-like leaves that



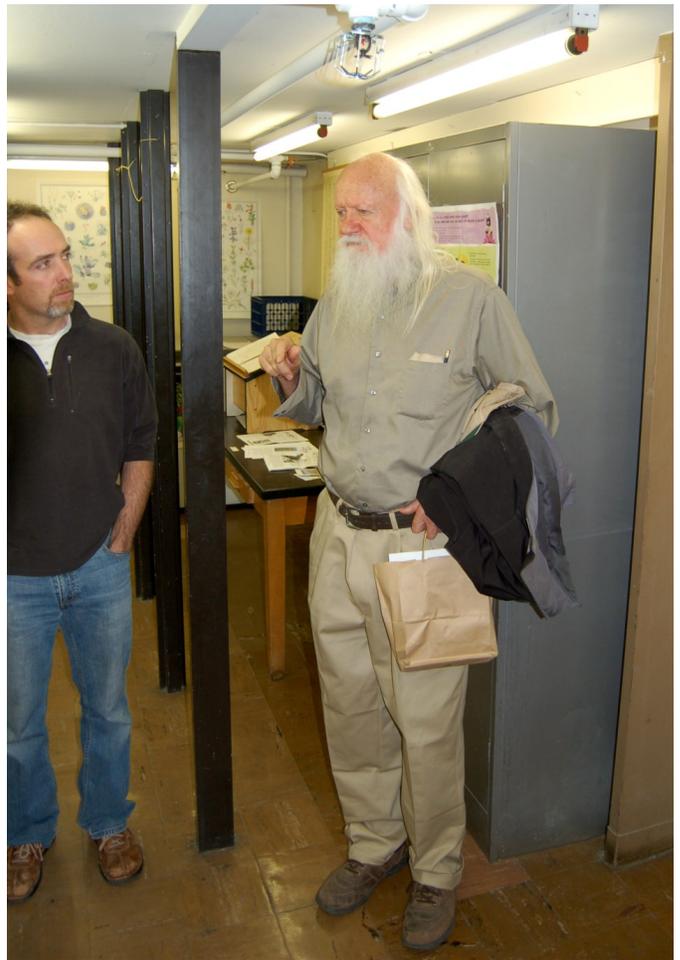
Gambel's oak acorns (9/6/08 U of U Research Park area). Acorns are a prized and important food for a variety of wildlife including birds, squirrels, deer, bear and probably the buffalo that once roamed the Salt Lake valley until the late 1830's. They were also widely used by Native Americans. The trees generally are very important for wildlife.



Gambel's oak fall leaves (10/21/08 Olympus Hills Park) .



Gambel's oak leaves turn red or, more often, yellow-brown in the fall (10/21/08 Olympus Hills Park) .



Rudy Drobnick with Dr. Mitchell Power (at left) on December 3, 2010, at the old Garrett Herbarium location on the lower campus at the University of Utah, Salt Lake City, Utah.

come to sharp and almost spiny points. It is now restricted to extreme southern Utah in Kane, San Juan and Washington counties. Gambel's oak occurs primarily at 4500 to 7000 feet in the Central Wasatch Front (but can be found at higher elevations). Turbinella live-oak grows generally at lower elevations.

While Gambel's oak has been reported from almost all counties in Utah (except Daggett and Rich) and comes into contact with *Q. turbinella* (primarily in Washington County) and is generally widespread, its actual distribution in Utah can be thought of as along the I-15 corridor and all along our north-south mountain ranges, and to the east (mainly southeast). It is largely absent from Utah's west desert and from the Great Basin. So its presence in Box Elder, Tooele, Juab, Millard, Beaver and Iron counties is limited to their extreme eastern edges

Utah is in fact at the growth center of Gambel's oak distribution in the U.S. as it tends to be the most prolific here. Restricted primarily to the western United States, it is not reported from Idaho nor Oregon and it is limited in

Wyoming to the southeastern part of the state. While occurring in Nevada, it is mainly known there from the southwestern portion of that state. It also occurs in Colorado, New Mexico, Arizona and in scattered locations in Texas and northern Mexico.

Gambel's oak is itself thought to be of hybrid origin and is known to form other hybrids. A rare variety of Gambel's oak is *Quercus gambelii* var. *bonina* (Goodhope oak), a taxon that has not yet gained general acceptance as a legitimate variety, known from only one population in San Juan County, Utah, and which is aborescent rather than clonal, and appears to be a fast growing, riparian small tree. A species named in 2003, *Quercus welshii* (Shinnery or Tucker's oak), and which can often be found buried in sand with only its tips exposed, is known to form hybrids or intermediates with *Q. gambelii* and *Q. turbinella*. In Utah *Q. welshii* is also only found in the southern part of the state but does occur over a wider area and more to the north than *Q. turbinella*.

### Back to the northern Utah hybrids: when?

So when did these two species hybridize in northern Utah? Cottam (1959) suggested that neither *Q. turbinella* nor probably *Q. gambelii* survived the Wisconsin glaciation (which ended about 10,000 years ago). Sometime during the Middle Holocene (5,000 to 8,000 years ago) a drier period occurred which allowed plants and animals better adapted to arid conditions to move northward (a period during which species richness is thought to have decreased). Cottam believed that *Q. turbinella* then spread up primarily along the western edge of the Wasatch Front (essentially along the Lake Bonneville shoreline). Thereafter, cooler conditions prevailed forcing *Q. turbinella* to be pushed back to the south leaving *Q. gambelii* and the stranded hybrids which were only able to survive vegetatively.

Based on northern Utah and southern Utah/northern Arizona (locations where the parent species occurred) temperature data collected from 1956 to 1957, Cottam posited that a distant past climate event created less warmth from late fall to early spring. This he thought might be the critical factor that would account for the current distribution of the parents as well as explain the presence of the stranded hybrids.

The research of University of Utah biogeography professors Ron Neilson and Leroy Wullstein (published in scientific articles in 1983 and 1986) suggested that where Gambel's oak is less common, it reproduces sexually, and where it is more abundant at its northern limits, its primary reproductive method is asexual, and that Gambel's oak seedlings require summer rains and adequate moisture to survive. They concluded that Gambel's oak became established in a mid-Holocene environment when summer moisture was more reliable.

In a 1996 article, University of Utah plant ecologists Jim Ehleringer and Sue Phillips noted that there were no firm age estimates for the hybrid oaks. Their research suggested that the lack of summer rains may have been the critical factor that caused *Turbinella* to recede, and that the climate event that decreased or lessened summer monsoons in northern Utah took place well less than several thousand years ago. In fact, based on the loss of corn in the diet of Indians along the Wasatch starting about 700 years ago and the analysis of certain hybrids of *Pinus edulis* (Pinyon pine) that are less than 400 years old, the loss of summer moisture may have begun relatively recently. Hybrids left behind were able to continue to survive because they were not dependent on summer rains. This they explained is also related to the fact that Gambel's oak has a deeper and more developed root system than *Turbinella*. These findings were highly consistent with the observations and conclusions of

Neilson and Wullstein.

The Ehleringer-Phillips explanation as to why *Q. turbinella* is now no longer able to persist north of its current distribution is compelling in several respects and leads to one to the conclusion that these hybrids could be less than 750 years old. This would coincide with the exodus of the Anasazi during the droughts of the late 12th and especially the late 13th century. It would also make more sense in light of the history of Lake Bonneville. About 15,000 years ago, Lake Bonneville was at its highest level (and as high as about 5,100 feet). By 10,000 years ago, the lakes in Utah west desert were mostly dried up and the Great Salt Lake had reached an elevation of about 4,200 feet where it has since remained (until recently when it has dropped down about 10 feet). The climate change event relating to the ultimate disposition of these oaks and the stranded hybrids seemingly was something perhaps somewhat more subtle (although still of great consequence) and something that might have occurred much more recently than originally suggested by Cottam.

Another reason that supports the notion that these hybrid oaks are of more recent origin relates to reported ages of the two "parent" species. Several sources suggest that Gambel's oak reaches old age at approximately 80 years. *Turbinella* is reported to grow much more slowly. Even if *Turbinella* itself can live for thousands of years (a fact for which evidence does not appear to be readily available), a hybrid with an oak that typically lives for much less than 150 years seems logically more likely to produce a shorter life expectancy than indicated by Cottam (and especially when the northern Utah hybrids are typically intermediate between the two parent species). Even if so, this does not negate the basic concept and premise that Cottam used to explain the presence of the hybrids. And it shows how relatively minor, recent climate changes may have had significant impacts.

On the other hand, because of their clonal nature, (similar in that sense to the aspen clone dubbed Pando in southern Utah), surviving clones could be very old since migration northward could have occurred in more than one event. Neilson has suggested that these hybrids represent living fossils that could be 5,000 to 6,000 years old (Warchol, 2007) which if true would be older than the oldest known Great Basin bristlecone pine.

Well-known Brigham Young University native plant taxonomist Dr. Stanley Welsh has suggested that the hybrids have occurred as a result of long-distance pollen dispersal. This notion however has been specifically discounted by both Cottam as well as Tucker (1990); other knowledgeable biologists also do not accept this explanation.



Few-lobed hybrid oak leaves (Dry Creek plant, 11/15/08)



Bill Gray inspects an oak hybrid at George's Hollow (11/20/08)



Closer view of the Dry Creek plant (11/15/08).



Hybrid oak leaves (F1) at George's Hollow (11/20/08)



Few-lobed hybrid oak growing in Gambel's oak stand (11/15/08 at Dry Creek north of U of U Hospital), surrounded by mostly non-native grasses, most noticeable here is the invasive *Secale cereale* (cereal rye, a revegetation/forage plant gone bad that is, along with others, threatening our remaining foothill natives in Salt Lake County).

### The Dry Creek hybrid

On Saturday November 15, 2008, UNPS co-president Dr. William "Bill" Gray (U of U emeritus biology professor) and I were fortunate to visit one of these naturally occurring hybrids thanks to University of Utah biology professors Drs. Lynn Bohs and John Sperry. This is one of the earliest hybrids discovered by Rudy and is referred to as the "Dry Canyon" location by Cottam (1959).

Late October/November is the time to look for these distinctive hybrids. After roughly December 1, they too will have typically lost their leaves. The Gambel oaks will generally then be bare, growing around the fading but darker green-leafed hybrids.

The Dry Creek plant clump above (maybe 20 feet by 10 feet in overall area) was growing right within and at the edge of an existing colony on a fairly steep slope. It may be infertile. Speculation is that the plant could easily be well over 1,000 years old.



Bill and Chuck look at the George's Hollow back-cross (11/20/08).



Gambel's oak frames downtown Salt Lake City and the northern Salt Lake valley as we return to our vehicles (11/20/08)



Salt Lake valley from the perspective of the George's Hollow's hybrid (11/20/08)



Leaving the George's Hollow hybrid oak habitat (11/20/08). Hybrid habitat is at center to upper left (ridge line).

### A Chat with Rudy

On November 17, 2008, I was privileged to have had a phone conversation with Rudy Drobnick (who had then been with the Division of Wildlife Resources, State of Utah, for 51 years). He indicated that on this same Saturday past, he and "Chuck" (U of U emeritus geography/biology professor Dr. Leroy H. Wullstein) had been on the west side of the Oquirrhos looking at the most significant hybrid oak find yet: a group of some 12 or so hybrid oak plants. Usually a single plant/clump is found.

In all he thinks there may be about 55 occurrence (43 of those representing plants he has previously found north of where *Q. turbinella* now grows in southern Utah) with the northernmost occurrence located east of Ogden, Utah.

He indicated that a perfect grad student project, and the highest priority task, would be to go out and GPS each and every occurrence.

When asked about their fertility, he said that most hybrids are fertile but that birds and squirrels usually take away the acorns before they ever have a chance to hit the ground; September is a good time to re-visit plants and check for acorns.

He also mentioned that Chuck saved plants from being destroyed at This is the Place Heritage Park, and that they are trying to save one on Traverse Mountains on the new Alpine road west of Highland that is on private property in northern Utah County, which is immediately south of Salt Lake County. Occasional/rare hybrids have been found elsewhere in Utah County such as in Springville.

### Hybrids in George's Hollow

On November 20, 2008, Bill Gray invited me to tag along

with him and the enthusiastic Dr. Wullstein ("Chuck") to see the the hybrids at George's Hollow (south of Red Butte Garden). Somehow we survived the military training exercises and blustery conditions. This is another one of the original locations found by Rudy in the late 1950's and Chuck believes that the colony is about the same size then as now. Growing almost to the ridge line at about 5,650 feet on a steep slope, these plants are facing to the south/southwest, and in general very much unlike the Dry Creek occurrence. The plants were overall "less green" than the Dry Creek plant but still had many greenish leaves. These low growing plants seem to be more prickly and in fact one of the clones is thought to be a back-cross to the now long gone *Q. turbinella*.



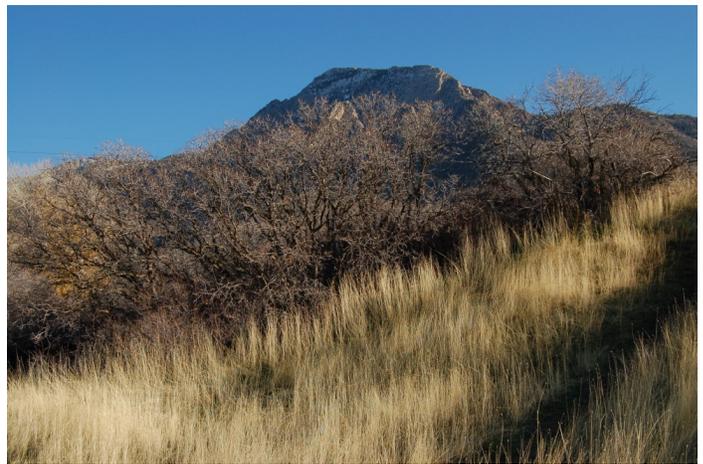
Chuck at This is the Place Heritage Park near hybrid oak grove (11/20/08)

**Hybrids saved at This is the Place Heritage Park**

After visiting the George's Hollow plants, we stopped at the This is the Place Heritage Park (just south of the University of Utah) occurrence relatively recently



Signage at This is the Place Heritage Park (11/20/08)



Gambel's oak with Mt. Olympus in background (11/20/08 Olympus Hills Park)

discovered by Chuck. Commercial development proposals could have destroyed these plants, but thanks to Chuck's advocacy and intervention by Larry Miller, the plants were saved. Now there is a well-maintained, low impact trail though the hybrid oaks which have become an important part of the park's interpretive activities (and perhaps have helped to change or least expand the focus of the park somewhat; whether that is still the case in 2021, I do not know).



Gambel's oak grove showing arborescent growth form

The plants growing here at about 4,960 feet are in marked contrast to those at Dry Creek and George's Hollow. Here the terrain is flat and the plants are growing intertwined with Gambel's. They had already lost all of their leaves and one plant could not be distinguished from another. Based on fallen leaves, Chuck showed us how the lobes of these leaves were pointed (rather than having the characteristic rounded

lobes of Gambel's). But their leaves are much more "Gambel-ish" and it is apparent that these plants are closer to Gambel's than to Turbinella (and so are probably closer to F2, rather than F1\*, hybrids). Their



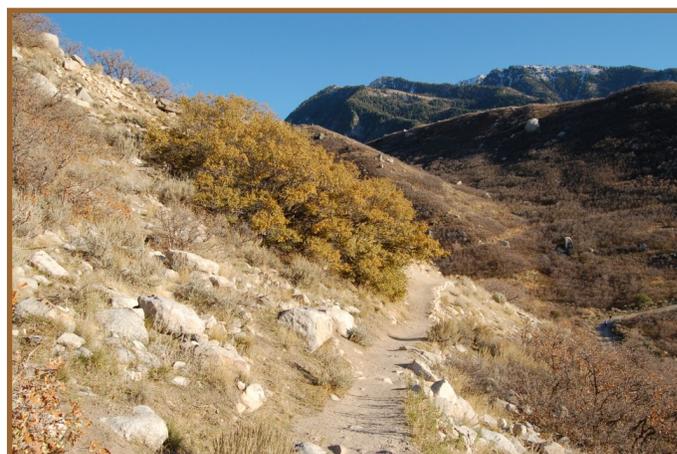
Mature Gambel's oak acorns (11/22/08 Dimple Dell Regional Park)

identities as hybrids were confirmed by oak expert Dr. John Tucker prior to his death on July 5, 2008. John was a professor emeritus of botany at the University of California. The herbarium's name there was changed to the J.M. Tucker Herbarium upon John's retirement in 1986.

(\*An F1 hybrid plant or animal species is one that results from the first generation offspring of two different species and that therefore expresses morphology that represents both parents. Hogle Zoo's famous Liger, Shasta, would be an example. She had parents consisting of an African lion and a Siberian tigress, and Shasta had characteristics of both. Mules are F1 hybrids between horses and donkeys. Such offspring may or may not be fertile. F2 hybrids are second generation plants produced as offspring of F1 parents, either - in the case of plants - by cross-pollination or by self-pollination. They tend to have less consistent traits than F1s. As a result then of further potential crosses and back crosses over time, it often becomes difficult to determine the status of any given oak hybrid. As the result of extensive experiments hybridizing *Turbinella* with other native and non-native oak species as conducted by Cottam and Drobnick, *Turbinella* would tend to dominate or be strongly represented in the offspring regardless of the species it was crossed with. So plants that more closely resemble *Turbinella* tend to be closer to F1 hybrids such as the George's Hollow clone, and where *Turbinella* was the mother plant; plants with leaves closer to Gambel's are more likely to be closer to F2 hybrids, and probably had Gambel's as the mother plant.)

### **The future of these hybrids in northern Utah**

There is a concern that ongoing University of Utah developments and expansion could inadvertently lead to the destruction of one of these ancient, living fossil



Bell Canyon hybrid. An intermediate F1 as referred to by Ty although it is not as close to an F1 as the George's Hollow large clone. (see next pics of its leaves). Noted first by Ty Harrison (in 2008 or 2009 I believe). Picture was taken on Nov 6, 2009 which is about the time that oak hybrid "hunting" season starts: notice how the Gambel's oak around it have essentially lost its leaves.

Ty's comments from Nov. 10, 2009 about this plant: this intermediate F1 hybrid is growing on the upper area of the south lateral moraine of the Little Cottonwood Canyon glacier which is crosscut by the eastern limb of the Wasatch Fault. The clone was evidently established from an acorn deposited on the bare slip face of the Wasatch Fault. If these hybrids are as old as we think they are (early Holocene) based on Walter Cottam's and others earlier work, the clone could possibly date from when the Wasatch Fault cut across this moraine complex. The local geologist's "Megatrench" site which is located less than a mile away to the north at the mouth of Little Cottonwood Canyon on the same fault line has been studied to date the frequency of earthquakes here. C14 dates have been published for this site and could be used to date the oak hybridization event since the clone is clearly growing on the fault line which cuts the moraine. The clone is growing on a steep southwest exposure and is apparently very old based on its diameter and height. It has not been recently burned due to the lack of herbaceous ground cover. Unfortunately, the popular hiking trail to Bell Canyon runs immediately adjacent to the clone, and should probably be relocated.

gems. A hybrid oak formerly known from north of the base of Big Cottonwood Canyon in the vicinity of the massive sand and gravel pit is already now gone. Hybrid oak habitat on the Traverse Mountains has been significantly altered. These trees cannot be simply moved or transplanted, and other than through cloning (via its underground stems), they may have no way to propagate themselves and may now be in decline. Their



Bell Canyon trail hybrid clone leaves. Note the smaller leaf size and pointed lobes. Picture taken Nov. 6, 2009.



Bell Canyon hybrid leaves, Nov. 6, 2009. I did not find any acorns; might be infertile.



Another perspective of the Bell Canyon hybrid. Nov. 6, 2009.

occurrences need to be treated as rare and unique elements of our natural world that need to be preserved not only for their beauty but also as a critical scientific resource: they may help us to answer questions about the past, and ultimately our future.

### Postscript

Partly in following up on Rudy's prior recommendation and in view of some spectacular finds by Blake Wellard (a Weber State botany major) who caught the hybrid oak bug in a big way, a meeting was held at the old Garrett Herbarium location on the University of Utah campus in December of 2010 that included Blake, Ty, Rudy and myself along with Dr. Mitchell Powell, the herbarium's curator, about a potential hybrid oak study by Blake as part of a potential master's degree. The late Ann Kelsey, assistant curator, was working at her desk nearby. Rudy was as sharp as ever and it was fascinating to hear him talk about Walter Cottam as if Doc Cottam was also in the room. While that potential hybrid oak study did not happen, ongoing searching continued. When Rudy later called me a number of years later (circa 2014) as he was in the process of updating the total count of known oak hybrids (i.e. known from north of Iron County in Utah) for a presentation he was going to make, that number had increased to well over 60, including finds he was previously unaware made by Ty (Bell and Tolcats Canyons) and a number of finds made by Blake. Blake in particular learned how to potentially locate likely hybrids using Google Earth, and then performed often highly perilous ground truthing work. I joined in that search effort, but only one of the many I suspected actually turned out to be what we were looking for.

Rudy's eyesight gradually worsened and by 2016 he was nearly blind. Ty developed pancreatic cancer towards the end of 2016. We ended up losing them both in 2017. Rudy was 86; Ty was 75. Both had ties to two of Utah's greatest botanists in Walter Cottam and Seville Flowers (in Ty's case).

It is suspected that many of our oaks in northern Utah here have experienced some amount of past hybridization, evident in part due to the extreme variability we see in overall leaf shape, and that it is simply an engrained part of their genetic mix.

Along with other of native plant species that have moved north and then retreated multiple times just within the last 12,000 years or so, this further provides yet more evidence of significant past climate changes.

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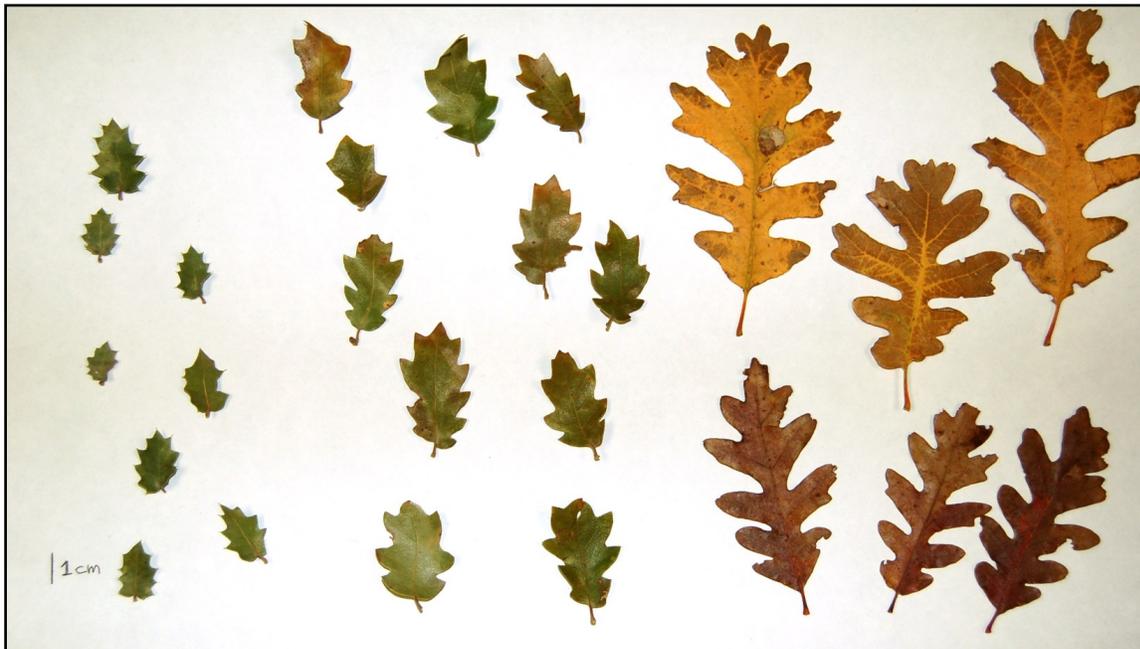
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Comparison of *Quercus turbinella* (left), the hybrid *Q. x pauciloba* (middle), and *Q. gambelii* (right)

About these leaves: the *Q. turbinella* leaves had previously been properly obtained from the somewhat nearby Cottam's Oak Grove by a biology professor for a recent biology class and had been discarded. The leaf tips were spinescent, and the leaves tough and stiff. (*Q. turbinella* is not known to naturally occur in this area). The hybrid leaves were taken from a branch that was already separated from the hybrid tree clump/clone on 11/15/08. In addition to shape/size, they have a relatively rough texture compared to Gambel's oak due to pubescence. The lobe tips are not spinescent. The Gambel's oak leaves were taken from the Olympus Hills Park area on 9/27/08 and not from the Dry Creek area. The upper/right leaves were from a representative tree/shrub where the leaves were turning yellow/brown as is commonly the case, but from an immediately adjoining tree/shrub with the same aspect/elevation/exposure/slope/size, the leaves on that adjacent oak (lower/right) were turning red and were smaller and had a somewhat less smooth/shiny surface texture. Gambel oak leaves are incredibly variable and can be much larger than these, and deeply lobed/shaped in numerous other ways. Note also that these are leaves from upper branches yet oaks in general (and not unlike many other plant species) typically have differently shaped lower leaves that can also be much larger.

# The Mystery On My Strip

by Catherine King



A volunteer shrub has been growing on the strip of my garden for about five years and to be perfectly honest I was just assuming it was another *Mahonia fremontii* because of the sharply pointed, rather silvery leaves that would poke me while working around it. It wasn't until the acorns appeared (what?, acorns?!) that I realized I should have been looking at it a little more closely. I had suspected something was different about it but where did this oak, that appears to be a shrub live oak, come from?

I sent photos to Dick Hildreth who is an oak specialist and knows oaks very well having been the former director at Red Butte Garden and the arboretum at the University of Utah and also to Tony Frates who wrote the article in this issue of the *Sego Lily* about "Naturally Occurring Rare Oak Hybrids." Both concurred the oak in my garden is a shrub live oak, *Quercus turbinella*. Northern Utah is far out of its natural range of Washington County, southern Utah and the desert southwestern states.

Huh. I didn't plant it but it is a very welcome volunteer. How did it get there? A squirrel, a bird? Did it travel in with some other plant? (Not likely). *Quercus turbinella*, according to Dick Hildreth, does grow on the U of U campus arboretum. I have checked out the other native gardens in my neighborhood but have not spotted another shrub live oak.

It is a bit of a mystery.

Even my ever-curious, exceptionally observant, eight-year-old neighbor friend across the street discovered the acorns and pointed them out to me. Maybe he is a budding botanist.

Such things make gardening fun.

# Nature Journaling: How It's Changed My Life

by Amanda Sharette-Kay

The experience of nature journaling has had a significant positive impact on my life. What began as curiosity and a thirst for knowledge grew into something more – a chance to connect, to see the bigger picture, and to find peace and purpose in the storm of our tumultuous world.

If you have never heard the term nature journaling it means what the words say: to journal about nature. It is the process of observing the natural world, recording what you see, and reflecting on those observations (for what is journaling without reflection?). Nature journaling is a practice in patience and mindfulness that can be done from anywhere, by anyone. The benefits are numerous, and the steps are simple. Before cameras were small enough to fit in pockets or smartphone apps could identify plants and animals in minutes, naturalists and scientists depended on some form of nature journaling for their research. Nowadays, journaling about nature is less of a scientific necessity, and more of a mental one. At least that has been my experience.

I have always had a love for animals, birds in particular. As a child even my favorite dinosaur, *Archeopteryx*, was a bird. I could never resist the urge to point out any and every bird I saw to family and friends, and that impulse remains today. It is not uncommon for me to stop mid-sentence to stare into the distance because some feathered creature has captured my attention.

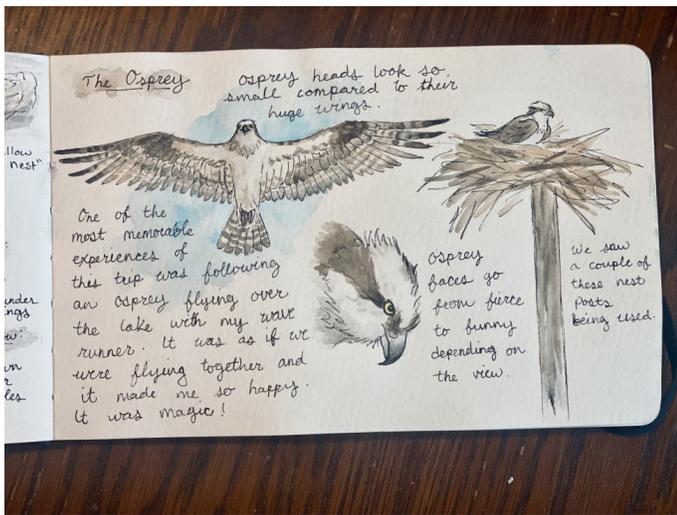
Aside from my interest in wildlife, I have always been artistically inclined. When I began getting serious about my art roughly ten years ago, I felt driven to paint landscapes and animals on any surface that would take to paint – stone, eggshell, seashell, wood – you name it.



There was something particularly rewarding about capturing the beauty of natural subjects on a natural canvas, such as slate.

Roughly four years ago I decided to teach art from a studio in my home. Half of my house was overrun with paints and canvases. I went on to take my work outside of the home by conducting painting events at bars and birthday parties. Although I loved teaching and connecting with people, I did not love every aspect of the business. I hated the social media game and maintaining budgeting sheets. Most importantly, I began to dread the amount of waste each class would create and was dismayed to see canvas after canvas piling up around me, just to be tossed. I realized I needed to find a different way to connect with others and create art without a significant negative impact on the world. It took me another year to take that first step.

Although I had been painting for a decade and a nature-lover forever, I did not try my hand at nature journaling until last year. Like most people, the pandemic left me searching for ways to get outside, connect with others, and find purpose in a time of uncertainty. Being forced



to cancel my scheduled art classes gave me the space and motivation I needed to set my business aside and ponder what I wanted to expend my time and energy on. The silver lining of a life-threatening global pandemic is the opportunity to realize what truly matters. Family matters. Mental health matters. The environment matters. It took me months to shape my intentions into a specific path, but I eventually determined my purpose: to use my artistic skill to promote understanding and awareness about our environment and the animals that inhabit it. To do this, I knew I needed to hone my skill in painting the flora and fauna around me. I took my first Nature Journaling course from the Cornell Lab of Ornithology Academy in June of 2020.

While the purpose of the class was to learn the how's of nature journaling, I learned something much more profound. I discovered the mental and physical value of getting outside, feeling the grass below my feet, and hearing the birds sing. Taking a few minutes to sit quietly in nature requires patience. I noticed my thoughts and breathing slowed as I focused my attention on the subject of my journaling. While concentrating on what I saw, heard, and smelt, I found myself forgetting about my to-do lists or nagging house projects. I studied animals interacting with each other and recognized how we are all connected. I realized the impact we can have on each other, for better or for worse.

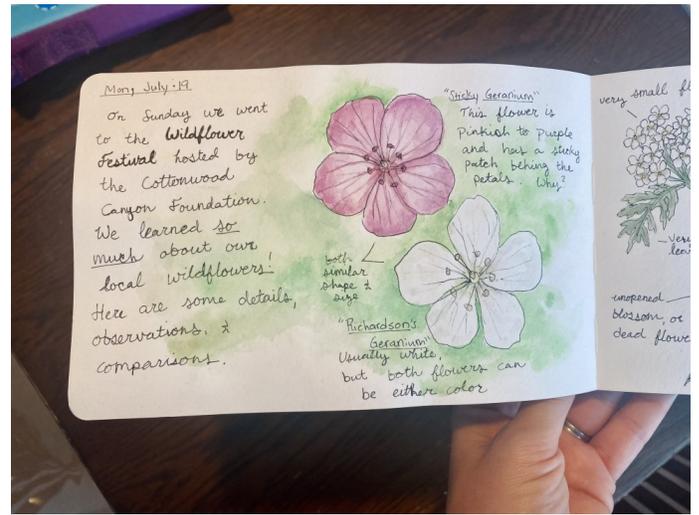
Not only is observing nature relaxing and rejuvenating, but it is exceptionally fascinating. It did not take long before I started noticing things I had not noticed before. My questions became the head of Hydra. When one was answered, two more materialized. As with any subject, the more I learned the more I realized I did not know.

Aside from the mental benefit I felt while observing nature, there was a social one. The year of 2020 was a

lonely one for extroverts such as myself. Being restricted to my home, I rarely saw a soul outside of my immediate family. Being cooped up together day in and day out became challenging for us all. The volunteer opportunities that gave me purpose and reprieve were put on hold. Mental health issues of my past began creeping in around the edges of my brain. Fortunately, getting out into nature remained an option. Hiking my favorite trails allowed me to see people from a safe distance. Fellow nature-lovers would smile with their eyes in greeting. I knew they felt the same appreciation and need for the outdoors. We were strangers, but kindred spirits! We could communicate without speaking and connect without touching.

The benefits of nature journaling extend beyond one's personal needs. It also benefits the subject of these journals. Plants and animals are adaptable and resilient, but they have their limits. Humans are constantly changing the shape of the landscape and the habitats of creatures around us. The more we understand the balance of nature the more we will understand our impact. Curiosity fosters knowledge and knowledge fosters compassion. The more I learned about spiders and insects, the more I looked at them with curiosity and less with repulsion. When I paint them in my nature journal, I notice their beautiful patterns and colors. I cannot help but admire the subjects of my journals, and I want to protect them. I want to share their beauty with others.

Nature journaling may have a more direct benefit to wildlife as well, as one takes on the role of a community scientist. Several programs allow users to share observational data with nationwide or global databases. A couple of examples are iNaturalist and eBird. Both programs allow participants to use a free app to log nature or bird sightings. Cataloged sightings are collected to better understand how animals and even



plants are traveling and changing in numbers. Better understanding how these factors are shifting prompts research to discover how and why. I often take my observations past my journaling and add them to these databases to assist in data collection.

With how much can be gained through this simple activity, it is easy to see why it is becoming such a popular hobby. Throughout this last year, I have taught nature journaling to children and adults, and I have shared my personal journals with anyone willing to look. My goal of using art to encourage wildlife awareness remains, but more than that I want to share the importance of the process. I want to encourage people to step outside and pay attention. I believe that this practice will have more of an impact on people's lives than staring at a beautiful landscape painting inside a gallery. Apart from my own personal observations, I continue to learn everything I can about the local ecosystems and animals through volunteer work with Great Salt Lake Audubon. Nature journaling has had a truly meaningful impact on my life. I hope others who experiment with this process will feel its benefits as much as I do.

*Do you have an interest in nature journaling? Here are some simple tips to get you started.*

The "journaling" component can be done with any medium and in any style. Some prefer to write out their observations or take a more creative approach and record their *feelings* about nature, sometimes in verse. Others prefer to document what they see in the form of drawings or paintings. And of course, many nature journalers combine these two approaches. There is no wrong way to journal!

The "nature" component is what makes this process different from other forms of journaling. To gain the full experience of this practice, one must approach the

activity with the intention of immersing oneself in nature. If necessary, this can be done inside, sitting near a window or a favorite houseplant. However, stepping outside allows for a richer experience. Observing nature is more than simply looking at a tree. It is using all senses, taking in a scene as a whole and noting interactions between plants, animals, or even people. It is also blocking out the broader landscape and focusing your attention on individual specimens or microenvironments. It is feeling the wind, hearing the buzz of a bee, and feeling the tacky pedals of a sticky geranium.

### *The supplies*

Journals and sketchbooks can be purchased almost anywhere and range in price and style from dollar store notepads to high-end mixed media notebooks that can endure paint or ink. Any pen or pencil will do, depending on what technique you will use. While pencils can erase, they can also smudge. Alternatively, pens, once dry, do not smear. However, not all pens are waterproof. Be sure to purchase a permanent or waterproof pen if you will be painting your drawings.

For painting, watercolors are my favorite medium for nature journaling. Watercolors afford a flexibility that many other mediums do not and are therefore ideal for transporting and outdoor use. They dry fast, limiting the risk of mess and smearing. Unlike acrylic paints, watercolors can be rewetted and used repeatedly. They are compact by nature and can cover surfaces more quickly than colored pencils. Travel watercolor paints come in small cases and come with water-brushes. These brushes hold water in the handle to eliminate the need for separate water containers. Other mediums nature journalers use include chalks, colored pencils, and watercolor pencils to name a few.



## The process

To begin nature journaling, gather your supplies and head outside! As you walk around your neighborhood or a favorite trail, ask yourself questions. What do you find interesting, pretty, or strange? What interactions do you see between different plants and animals? What do you feel, smell, or hear? Find a comfortable place to sit and begin recording your observations. It is helpful to begin your entry with the date and other relevant details: the temperature and weather conditions, your location, the time of day, etc.

Try sketching or painting the landscape as a whole.

Next, pick one plant in that landscape to observe more closely. Move closer still and select one part of that plant to focus your attention on. Pick a leaf, find a bug, note similarities and differences, count petals – record everything you can about a subject small enough to fit inside your palm. This practice will improve your awareness about the nature around you and allow you to start making those connections. When first starting, you may not have a preferred design or approach. Style, technique, and personal preferences will come with time and practice. The more you practice the more naturally it will come to you. The important thing is to step outside and start paying attention.



Smoothstem Blazingstar (*Mentzelia laevicaulis* var. *laevicaulis*), Loasa family (Loasaceae). Mouth of American Fork Canyon, Utah County, Utah. Photos by Andrey Zharkikh. <https://www.flickr.com/photos/zharkikh/>

## Federal Status of *Eriogonum tiehmii*.

See previous article “*The Plight of Eriogonum Tiehmii*” by Bill King, *Sego Lily* Winter 44(1), pp. 7-9. <https://www.unps.org/segolily/Sego2021Winter.pdf>

Utah Rare Plant Meeting 2021

*Stunning destruction: Unraveling whether humans or rodents attacked Tiehm’s buckwheat*

Jacqueline Grant, PhD Southern Utah University

<https://www.youtube.com/watch?v=hdovhjc7sWg&list=PLLv26qEbGIKGjdvyhzLXh6FCpSqWraO9f&index=4>

Tony Santoro, creator of *Crime Pays but Botany Doesn’t*, visited the habitat of *Eriogonum tiehmii* in this video:

[https://www.youtube.com/watch?v=yt9QgV22A\\_Q&t=1150s](https://www.youtube.com/watch?v=yt9QgV22A_Q&t=1150s) (explicit).

### DEPARTMENT OF THE INTERIOR Fish and Wildlife Service

#### 50 CFR Part 17

[Docket No. FWS-R8-ES-2020-0017;  
FF08E00000 FXES1111080000 212]

RIN 1018-BF94

#### Endangered and Threatened Wildlife and Plants; Finding on a Petition To List the Tiehm’s Buckwheat as Threatened or Endangered

**AGENCY:** Fish and Wildlife Service, Interior.

**ACTION:** Notification of 12-month petition finding.

**SUMMARY:** We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list Tiehm’s buckwheat (*Eriogonum tiehmii*) as an endangered or threatened species under the Endangered Species Act of 1973, as amended (Act). The Service has determined, after a review of the best available scientific and commercial information, that the petitioned action to list Tiehm’s buckwheat, a plant species native to Nevada in the United States, is warranted. The Service, therefore, will promptly publish a proposed rule to list Tiehm’s buckwheat under the Act.

**DATES:** The finding in this document was made on June 4, 2021.

**FOR FURTHER INFORMATION CONTACT:** Marc Jackson, Reno Ecological Services Field Office, 1340 Financial Boulevard, Suite 234, Reno, NV 89502; telephone 775-861-6337. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.

*Availability of supporting materials:* Our Species Status Assessment for Tiehm’s buckwheat is available at <https://www.fws.gov/reno/species>, and at <https://www.regulations.gov/> under Docket No. FWS-R8-ES-2020-0017.

#### SUPPLEMENTARY INFORMATION:

### Background

Section 4(b)(3)(B) of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq.*), requires that, within 12 months of receipt of a petition to add a species to, or remove a species from, the Lists of Endangered and Threatened Wildlife and Plants, a finding be made as to whether the requested action is: (a) Not warranted, (b) warranted, or (c) warranted, but precluded by other listing activity. If the action is found to be warranted, section 4(b)(3)(B)(ii) requires a prompt publication in the **Federal Register** of a general notice and the complete text of a proposed regulation to implement such action.

On October 7, 2019, we received a petition from the Center for Biological Diversity (CBD; CBD 2019, entire) requesting that Tiehm’s buckwheat be listed as threatened or endangered, that critical habitat be concurrently designated for this species under the Act, and that the petition be considered on an emergency basis. The Act does not provide for a process to petition for emergency listing; therefore, we evaluated the petition to determine if it presented substantial scientific or commercial information indicating that the petitioned action may be warranted. The Service published a 90-day finding on July 22, 2020 (85 FR 44265), stating that the petition presented substantial scientific or commercial information indicating that listing Tiehm’s buckwheat may be warranted.

On September 29, 2020, CBD filed a complaint in the U.S. District Court for the District of Nevada against the Service alleging violations under the Administrative Procedure Act (5 U.S.C. 551 *et seq.*); CBD amended the complaint on October 8, 2020, to include a claim under the Endangered Species Act that the Service had missed the 1-year deadline of October 7, 2020, for issuing a 12-month finding for Tiehm’s buckwheat. On April 21, 2021, the court issued a decision, and, in response to a stipulated request for a revised remedy order, on May 17, 2021, the court amended the decision and ordered the Service to deliver a 12-month finding on Tiehm’s buckwheat to the **Federal Register** by May 31, 2021. The Service now announces a 12-month finding on the October 7, 2019, petition to list Tiehm’s buckwheat.

## Species Description and Habitat

Tiehm's buckwheat was first discovered in 1983 and described in 1985. All available taxonomic and genetic research information indicates that Tiehm's buckwheat is a valid and recognizable taxon and represents a distinct species. Tiehm's buckwheat is a low-growing perennial herb, with blueish gray leaves and pale, yellow flowers that bloom from May to June and turn red with age. Seeds ripen in late-June through mid-July. Tiehm's buckwheat is a narrow-ranging endemic known only from one population, comprising eight subpopulations, in the Rhyolite Ridge area of Silver Peak Range in Esmeralda County, Nevada. The single population of Tiehm's buckwheat is restricted to approximately 10 acres (4 hectares) across a 3-square-mile area, located entirely on public lands administered by the Bureau of Land Management (BLM). The subpopulations are separated by a rural county unpaved road where subpopulations 1, 2, and 8 occur north of the road, and subpopulations 3, 4, 5, 6, and 7 occur south of the road. A 2019 survey estimated that the total Tiehm's buckwheat population is 43,921 individual plants. Surveys have not detected additional populations of Tiehm's buckwheat.

Tiehm's buckwheat is a soil specialist specifically adapted to grow on its preferred soil type. The species is restricted to dry, open, relatively barren slopes with light-colored rocky clay soils derived from an uncommon formation of interbedded claystones, shales, tuffaceous sandstones, and limestones. Vegetation varies from pure stands of Tiehm's buckwheat to sparse associations with a few other low growing herbs and grass species. The abundance and diversity of arthropods (insects, mites, and spiders) observed in Tiehm's buckwheat subpopulations is especially high (1,898 specimens from 12 orders, 70 families, and 129 species were found in 2020) for a plant community dominated by a single plant species. Primary pollinator visitors to Tiehm's buckwheat include wasps, beetles, and flies. Tiehm's buckwheat benefits from pollinator services and needs pollination to increase seed production.

## Threats

The naturally occurring Tiehm's buckwheat population (represented by one population with eight subpopulations) and a seedling transplant experiment suffered detrimental herbivory in 2020. All of the naturally occurring subpopulations experienced greater than 50 percent damage or loss of individual plants, while almost all transplants were lost to rodent herbivores in a 2-week period. An environmental DNA analysis (*i.e.*, trace DNA found in soil, water, food items, or other substrates with which an organism has interacted) conducted on damaged Tiehm's buckwheat roots, nearby soils, and rodent scat strongly linked small mammal herbivory to the widespread damage and loss of the naturally occurring Tiehm's buckwheat population. This was the first time herbivory

was documented on the species, although, prior to 2019, surveys of the population were infrequent. The significance of herbivory in the naturally occurring population depends not only on its frequency and intensity, but whether damaged plants can recover and survive, as we are uncertain if the species will be able to recover from this damage and loss. Rodent herbivore pressure precluded seedling survival in experimental plots. Further studies and monitoring need to be conducted to determine if management to reduce rodent herbivory is necessary to maintain Tiehm's buckwheat individuals and subpopulations, or if it was just a random catastrophic event that is not likely to occur on a regular basis.

The specialized soils on which Tiehm's buckwheat occurs are high in lithium and boron, making this location of high interest for mineral development. In May 2020, Ioneer USA Corporation (Ioneer) submitted a plan of operations to BLM for the proposed Rhyolite Ridge Lithium-Boron project. The proposed project is awaiting BLM permitting and approval for mineral development in the areas where the Tiehm's buckwheat population occurs. Ioneer's proposed Rhyolite Ridge Lithium-Boron project, if permitted by BLM, would result in the loss of habitat and subpopulations 4, 5, 6, and 7, even with the voluntary protection measures included in Ioneer's s project proposal. The potential impact from the proposed project, combined with the loss resulting from the recent herbivory event, would reduce the total Tiehm's buckwheat population by 70 to 88 percent, or from 43,921 individuals to roughly 5,289–8,696 individuals. The number of individuals estimated to survive is a range because we do not know yet if the plants damaged from herbivory will be able to recover and survive. The low end of this range is based on permanent loss of damaged plants, while the high end represents conditions if all the herbivore-damaged plants recover. Dust deposition, generated from increased vehicle traffic associated with mine operations, may also negatively affect the overall health and physiological processes of the subpopulations remaining (1, 2, 3, and 8) after full implementation of the project.

Ioneer is proposing to salvage all remaining plants in subpopulations 4, 5, 6, and 7 by transplanting them to another location. However, we are uncertain whether the salvage operation will succeed because current research indicates that Tiehm's buckwheat is a soil specialist, that adjacent unoccupied sites are not suitable for all early life history stages, and there has been no testing and multiyear monitoring on the feasibility of successfully transplanting the species. The impact to Tiehm's buckwheat from mining, salvage operations, or both would be permanent and irreversible under the proposed project because the plants and the land on which they are currently growing, including any existing seed bank in the soil, would be completely removed, and in place of that site there would be a terminal quarry lake. The terminal quarry lake would develop when the mining operation ceased pumping out the anticipated groundwater that would infiltrate the quarry. Elimination of

these subpopulations may remove corridors for pollinator movement, seed dispersal, and population expansion. There is strong evidence that subpopulation 6 is the most resilient of the eight Tiehm's buckwheat subpopulations. This subpopulation contains multiple life stages of individual plants, including the majority of older and larger plants across all populations. In addition, subpopulation 6 has the most variety in size classes of individual plants, indicating it is likely experiencing the most recruitment. Loss of subpopulation 6, in particular, may have an immense impact on the overall resiliency and continued viability of the entire Tiehm's buckwheat population. In addition to the direct impacts from the physical removal of subpopulations as a result of the project, road development and vehicle traffic associated with the proposed mine, as well as livestock grazing which currently occurs within the Tiehm's buckwheat population as part of the BLM's Silver Peak allotment, may create conditions that further favor the establishment of nonnative invasive species within Tiehm's buckwheat habitat. Mineral exploration has already impacted Tiehm's buckwheat habitat by contributing to the spread of saltlover (*Halogeton glomeratus*), a nonnative invasive plant species, within all subpopulations of the species. Mineral exploration activities can result in disturbance to natural soil conditions that support Tiehm's buckwheat and encourage spread of saltlover, which alters the substrate by making the soil more saline and less suitable as habitat for Tiehm's buckwheat. Mineral exploration vehicles also can carry the seeds of nonnative invasive plant species into the area. Road improvements also allow easier and greater access for recreational vehicles and off-highway vehicles (OHVs), with OHV impacts documented in subpopulation 1. Both livestock grazing and OHV use cafragmentation and soil compaction. In addition, Tiehm's buckwheat is adapted to dry upland sites, subject only to occasional saturation by rain and snow. Under climate change predictions, we anticipate alteration of precipitation and temperature patterns, as models forecast warmer temperatures and slight increases in precipitation. The timing and type of precipitation received (snow vs. rain) may impact plant transpiration and the soil water recharge needed by Tiehm's buckwheat. Additionally, variability in interannual precipitation combined with increasing temperatures, as recently seen from 2015 through 2020, may make conditions less suitable for Tiehm's buckwheat by bolstering local rodent populations. High rodent abundance combined with high temperatures and drought may have contributed to the large herbivore impacts in 2020 in both the transplant experiment and native population. Thus, climate change may exacerbate impacts from other threats currently affecting this species and its habitat.

Tiehm's buckwheat does not currently receive regulatory protection from the State of Nevada. BLM has designated Tiehm's buckwheat as a sensitive species. However, BLM's regulations require operators to avoid adverse effects only to species listed as threatened or endangered under the Act

and their habitat (43 CFR 3809.420(b)(7)), not sensitive species. Also, under BLM's regulations operators may explore, place mining claim monuments, and cause a surface disturbance of up to 5 acres after an operator gives notice to BLM and waits 15 days (43 CFR 3809.21(a)). BLM lacks discretion to require conservation measures for sensitive species as a condition for exploring for or developing minerals subject to disposal under the Mining Law of 1872, as amended (30 U.S.C. 22-54). In some circumstances, operators may include voluntary commitments to undertake protection or conservation measures as part of their proposed mining operations, as Loneer has done in its proposed mine plan.

### **Finding**

Based upon the preceding fragmentation and soil compaction. In addition, Tiehm's buckwheat is adapted to dry upland sites, subject only to occasional saturation by rain and snow. Under climate change predictions, we anticipate alteration of precipitation and temperature patterns, as models forecast warmer temperatures and slight increases in precipitation. The timing and type of precipitation received (snow vs. rain) may impact plant transpiration and the soil water recharge needed by Tiehm's buckwheat. Additionally, variability in interannual precipitation combined with increasing temperatures, as recently seen from 2015 through 2020, may make conditions less suitable for Tiehm's buckwheat by bolstering local rodent populations. High rodent abundance combined with high temperatures and drought may have contributed to the large herbivore impacts in 2020 in both the transplant experiment and native population. Thus, climate change may exacerbate impacts from other threats currently affecting this species and its habitat.

### **Author**

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### **Authority**

The authority for this action is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

### **Martha Williams,**

*Principal Deputy Director, Exercising the Delegated Authority of the Director, U.S. Fish and Wildlife Service.*

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Your membership is vital to the Utah Native Plant Society. It is important that your information is correct and up to date for notifications and the delivery of The Sego Lily newsletter.

Any questions about your membership, Contact Tony Stireman, [tstireman@gmail.com](mailto:tstireman@gmail.com).

**Fall is coming soon...** It is time to consider another issue of the Utah Native Plant Society *Sego Lily* which relies mostly upon articles from the society's membership. Please submit articles of your native plant stories and photos from hikes and field trips, conservation activities... whatever might be informative and interesting to fellow members.

The *Sego Lily* editors can use most any text format for articles (**PDF is troublesome**). Photos are always best submitted in original resolution and as individual files separate from text. You can indicate desired positioning within a document. We are looking forward to hearing from you. For submissions and/or questions: [newsletter@unps.org](mailto:newsletter@unps.org) or [cathy.king@gmail.com](mailto:cathy.king@gmail.com).



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