Sego Lily

Newsletter of the Utah Native Plant Society

Fall 2020 Volume 43 Number 4

Coming to Public Lands Near You

by V.J. Tepedino

Are honey bees (*Apis mellifera*) benign or even beneficial users of public lands OR are they 1) detrimental usurpers of the floral resources needed by native bees, 2) unreliable pollinators of native plants, and 3) potential spreaders of pathogens to native bees? Some commercial honey beekeepers claim that their honey bees are beyond benign: "They're making more flowers. They're making healthier trees. It could wind up the honeybees are a benefit for public lands. The bees here are creating life. They're not damaging the flowers. By pollinating the flowers in the Forest Service [lands], it ensures a lot of flowers . . ." (https://www.sltrib.com/news/environment/2020/08/23/environmental-groups-want/). (And in their spare time they can substitute for buzzers on TV game shows). Beekeepers seem to have won over federal bureaucrats and land managers to their views because they have succeeded in gaining, practically gratis, the pasturing of commercial honey bee apiaries on public lands. This is occurring in the face of innumerable calls to combat alien species introductions to native ecosystems and much scientific evidence that the answer to the three possibilities posed above is a resounding YES.

How is this happening? Beekeeper applications are being enabled by federal policy (or lack thereof) for apiaries on public lands. Honey bees are being pastured on National Forests and Bureau of Land Management land in Utah and other states without any compliance with the National Environmental Policy Act (1970) which requires that federal agencies assess the environmental effects of their decisions (https://www.epa.gov/nepa). There has never been an Environmental Impact Statement, Environmental Assessment nor an invitation for public input on the effect of apiaries on public lands, all actions required by the Act. Apiaries are being allowed on public lands because honey bees have been treated as a Categorical Exclusion (CE) since at least 1981 though the number of permits requested has been comparatively small until recently. A CE allows bureaucrats and land managers to ignore potential environmental effects. Incredibly, the Forest Service has no record of having even considered the potential effects of apiaries on native ecosystems before granting the CE. The CE designation for apiaries is currently being challenged in a petition filed by four NGOs (non-governmental organizations) including UNPS. A counter petition has also been filed by representatives of the honey bee industry.

There are other reasons beekeepers are being allowed to pasture their bees on public wildlands. Paramount are public policies offered by well-meaning but partially -informed bureaucrats to address honey bee declines. A 2015 White House "Strategy" both publicized the problem of pollinator declines and proposed policies to address it (WHS; https://obamawhitehouse.archives.gov/the-press-office/2014/06/20/presidential-memorandum-creating-federal-strategy-promote-health-honey-b). The WHS, while also acknowledging the decline of native bee species (see, for example, Koh et al. 2016), focused instead on the difficulties confronting populations of monarch butterflies and especially the introduced honey bee. Honey bees have taken precedence over native bees in the WHS because they are viewed as a critical national resource: colonies of these hard-working social wonders that live mostly in commercial hives, are responsible for all of the honey production and most large-scale crop pollination in the U. S. – think almonds, apples, cherries, and a host of other crops. Honey bees also contribute billions of dollars per year to our economy (Durrant 2019) and are backed by an influential lobbying effort. In contrast, native bees have received less attention because they are *merely*

Cover photo by William Gray. Two female leafcutter bees share a thistle flower (*Cirsium clavatum*). Note the bright yellow pollen accumulated in the ventral pollen basket. The females have raised their abdomens to discourage advances by roaming males with romance on their minds.

A large apiary photographed along the Twin Creek road in Logan Canyon on the Cache National Forest on 6/20/2020. Photo by David Wallace

responsible for the pollination of our native flora, an ecosystem service that is hard to quantify. Aside from a few NGOs and many scientists there is little support for native bees.

Populations of honey bees are indeed under pressure from numerous factors including the loss of traditional forage lands in the upper Midwest (Otto et al. 2016; Durrant 2019; Durrant & Otto 2019), pesticides, and some as yet to be disentangled mix loosely termed Colony Collapse Disorder (CCD) that includes Varroa plus other mite species, viruses, fungi, bacteria, other arthropods, stress, nutrition and slovenly beekeepers (Steinhauer et al. 2018). However, there are reasons to regard the concern over honey bees as somewhat overstated. Though honey beekeepers have experienced increased rates of loss over the recent decade, the claim that their business is about to go the way of pimples pursued by an airbrush in an image of a fashion model's face is belied by USDA statistics which show that lost colonies have been readily replaced inexpensively by colony splitting and purchasing packaged bees. While this adds additional expenses to beekeeping operations, those expenses have been recouped with higher pollination charges. A recent economic analysis concluded: "We find . . . remarkably little to suggest dramatic and widespread economic effects from CCD" (Rucker et al. 2019a,b). In fact, there has been no appreciable decline in honeybee colony numbers over the past 20+ years (Hellerstein et al. 2017; Rucker et al. 2019a). For the most recent full year reported, Jan. 2019 to Jan. 2020, there was an 8% increase in colony numbers. (Don't take my word for it, just check with the USDA web site: https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Bee_and_Honey/). It is also well to keep in mind that colony loss rates are determined from beekeeper's unverified responses to questionnaires (Steinhauer et al. 2018) and not to any systematic field surveys. The importance of honey bees to our food supply is also somewhat exaggerated. No doubt you've heard that catchy meme that you should thank a bee for one bite of three. Not quite: It's actually

A female *Diadasia diminuta* forages on a *Sphaeralcea* flower. Note the pollen that she has collected in the pollen baskets on her hind legs. This species has a strong preference for globe mallow flowers and will visit other flower genera only under duress.

about one bite in five (Klein et al. 2007), not insignificant but less than the well- publicized estimate. Other's estimates are even lower – a 3 - 8 % reduction in total world agricultural production in the absence of animal pollination (Aizen et al. 2014; Potts et al. 2016). There is also growing evidence that native pollinators contribute to crop pollination under certain circumstances (Garibaldi, et al. 2013) and that roughly 20% of the value of crop pollination is due to bees other than the honey bee (Hellerstein et al. 2017). And finally, another claim, usually credited by media sensationalists to Albert Einstein (as if he hadn't enough trouble trying to reconcile relativity with quantum theory), is that if honeybees went extinct, emaciated humans would soon be crossing the River Styx to Hades. In fact, if humans went extinct my money is on causes other than a lack of honey or almonds. Nevertheless, you should tip your cap to honey bees for the abundance and variety of your diet (Potts et al. 2016). And then there's that multi-billion dollar contribution they make to the U. S. economy. Nuff said: thank you beekeepers, thank you honeybees. As my Yiddish Brooklyn friend might say: *zei gezunt un shtark* (be healthy and strong).

Some of the remedies recommended by the WHS to keep commercial honey bees healthy and strong evoke a potential cascade of unintended consequences for our native flora and the bees that service them. Specifically, the call to pasture commercial hives on public lands administered by the Forest Service and the Bureau of Land Management is extremely worrisome because these wildlands presently serve as the last relatively pristine repository of a large part of the rich native bee fauna of the U. S.: roughly three-quarters of our 4,000+ native bee species occur west of the Mississippi and much of this is on public lands. To use our home state of Utah to illustrate further, there are roughly 1100 documented species of native bees in Utah (one of the four most diverse states for native bee species). A recent study reported >660 bee species in pre-Zinke Grand Staircase-Escalante National Monument (GSENM) alone (Carril et al. 2018); an earlier study (Griswold et al. 1997) recorded 333 species from Utah's San Rafael Desert (SRD), an area roughly one-fifth the size of GSENM. The GSENM and SRD are embedded in other public lands of Utah, and their bee diversity is indicative of that on those lands. So far as we know, many of these species are uncommon or rare globally and locally. This native bee diversity, which is instrumental in pollinating our native flora, is of great value and is at risk. That risk is ecological and is intertwined with ecosystem integrity but unlike honey bee value it is difficult to estimate economically and therefore receives less attention.

Except for bumblebees and a few other species, Utah's bees are not the bees most recognize: some in lofty federal positions confuse them with barflies while many Utahns take them for flies or wasps and call them "meat bees" (for the record, all North American bees are vegetarians). For the most part our species are solitary rather than social. While there may be large nesting aggregations of independent females rearing their offspring alone and without helpmates, there are no hives with thousands of workers (Stephen et al. 1969; Danforth et al. 2019). Species are specialized in their nesting habits: females search for a likely nesting site, some in the ground, others in existing holes in wood or plant stems or, in a few cases, in empty snail shells; sometimes, they build nests using mud or drill out the soft pith of plant stems. Females excavate a burrow, and prepare it with various materials (mud, pulped leaves, small pebbles, resins, etc.). Females collect pollen and

nectar, primarily from native plants, and form it into an individual loaf to support the development of each of their offspring. Many species are extremely specialized in the flower species they will visit for pollen (Minckley & Roulston 2006) but not nectar. In most cases, offspring are individually sequestered from mom and from their sibs by partitions, usually made of mud or masticated leaves. Their short adult life span (females typically live 3-4 weeks, males less; they spend most of the year as immatures in the nest) and great investment in parental care of their progeny means that, for insects, they produce few offspring (Neff 2008). Species typically have but one adult generation per year and there is large turnover in species identity over the flowering season (e.g., Griswold et al. 1997).

Predictably, encouraged by WHS and federal land management policy makers, beekeepers are increasingly turning to public lands managed by the Forest Service and the Bureau of Land Management for pasturage. Into these relatively undisturbed high elevation ecosystems beekeepers would introduce staggering numbers of the semi-domesticated, but introduced, honey bee. Of great concern in Utah, for example, is the current request to pasture c. 9000 honey bee hives on four national forests (Manti-La Sal, Fishlake, Dixie, Uintah-Wasatch-Cache) some of which are in close proximity to the species-rich GSENM and SRD. Each of these hives, flush from crop pollination activities mostly on the West Coast, will contain upwards of 30,000 bees, a total of over a quarter of a billion honey bees. Beekeepers have also advised us of their future plans: "We are proposing to put as many apiary sites as possible across different Utah national forests at our researched sites," the manager of the nation's largest commercial beekeeping operation volunteered (https://e360.yale.edu/features/will-putting-honey-bees-on-public-lands-threaten-native-bees). And, importantly, what is being proposed is a yearly 3-4 month incursion of these enormous numbers of honey bees: there are no plans for a respite! Such requests completely ignore the effect on hundreds of species of native bees which will be active during the period when honey bees are usurping floral resources on these forests. And one wonders if Utah is the vanguard for future proposals in other states.

Well, why should honey bees not receive a CE? Isn't their use of the environment non-consumptive, even beneficial? Unfortunately, both honey bees and native bees subsist on the same pollen and nectar from flowers. It has been carefully estimated that a moderately-sized honey bee hive will remove from the environment pollen equivalent to that needed to rear 33,000 average-sized native bees/month (Cane & Tepedino 2017); a single apiary, typically 96 hives strong, would thus remove enough pollen in one month to rear over 3 million native bees. For a three-to-four month period (the length of most permit requests from beekeepers) one apiary would remove enough pollen to rear 9-to-12 million natives. Beekeepers are initially requesting permission to pasture about 90 apiaries or the equivalent in pollen of between 800 million and over a billion native bees on four Utah National Forests! Thus, when WHS policy makers encourage beekeepers to petition public land managers for permission to pasture their bees in summer for honey production they put honey bees and native bees on a collision course and also threaten the seed production of some native plants.

Beekeepers protest such estimates. Indeed, a beekeeper is quoted in a local newspaper article that he believed "the Uinta-Wasatch-Cache National Forest's Logan district can support five times the eight apiaries he is now allowed. Each of his sites has 64 to 96 hives." (https://www.sltrib.com/news/environment/2020/08/23/environmental-groups-want/). Apparently, he was not asked to substantiate such an egregious claim and it's a good thing for him because he would have had more luck proving that honey bees flew back and forth to the North Pole at Christmas to help Santa's reindeer deliver small presents.

To repeat, there are three major reasons why apiaries present a significant threat to native ecosystems, why they should never have been classified as a CE and why such a classification should be dispensed with as soon as possible: 1) competition with native pollinator species; 2) long-term changes in the flora because of honey bee pollination activity; 3) pathogen transmission from honey bees to native bees *and vice-versa*.

A small section of a large nesting site of *Diadasia nitidifrons*, a species with a great fondness for flowers of Iliamna species. Note the chimneys surrounding the nest entrances; no one really understands the purpose of the chimneys (the bees do not light fires in their nests, they have not yet discovered fire).

Competition. Our critical concern is competition for pollen because pollen is the primary source of protein and essential nutrients that all bees provide for their progeny and, unlike nectar, it is not renewed by flowers: once an anther dehisces its pollen that's it. A honey bee hive is a much more efficient harvester of pollen and nectar because of its highly developed and coordinated resource detection and foraging system (Winston 1987; Seeley 2009). Scout bees, ever on the lookout for productive flower patches, return to the hive and, through an elaborate communication system, direct numerous prospective forager bees to those pollen- and nectar-rich patches. Female native bees, since they act independently, have no similar capability and have never been challenged by such sophisticated pollen harvesting because no North American bee species has evolved such behavior.

Only if pollen were not limiting, if it were in superabundant supply, could competition not occur when such enormous numbers of honey bees are suddenly introduced to a landscape. What we critically need to know is how much, if any, excess pollen is available in flowers under "normal" circumstances but few such studies have been conducted. Two that have, show little pollen remaining in flowers at day's end when only natives are present, i.e., pollen was a limiting resource to natives before any introduction of honey bees (see Cane and Tepedino 2017 for references). Another carefully planned European study of pollen remaining in large populations of rosemary and thyme flowers in an area (32km^2) with 475 hives, found about 34% of rosemary pollen and 46% of thyme pollen remaining in flowers yet concluded that the wild bee community, particularly larger species, was negatively affected by honey bee removal of pollen (Torné-Noguera et al. 2014). Another study provided evidence that honey bee hives in dense clusters compete successfully not only against native bees but also against each other thereby lowering their own resource gathering efficiency (Henry and Rodet 2018).

How might native bees respond to the sudden scarcity of pollen resulting from honey bee foraging? Only two reactions are possible. Native bees may 1) leave the area; or 2) remain and compete. Bees that flee must find areas that have either few or no honey bees. Estimates of the distances natives must fly to escape honey bee hell vary depending on the time of year, total forage available and a host of other factors but given that honey bees from single hives with small numbers of workers can forage over median distances of 6 km (Seeley 2009), that distance could be formidable, particularly for smaller bees with reduced flight ranges (Greenleaf et al. 2007). In other studies, Smart et al. (2016), estimated that apiaries of 48 small hives (10,000 bees/hive) would require a foraging area of 15.5 km^2 over the flowering season. Such an estimate should at least be tripled for apiaries on public lands which will have twice as many hives each with three times as many workers. Under these circumstances an escape distance with a radius of 6 km is conservative. And this further assumes that there is no other apiary within 8-16 km, a very unlikely scenario given the numbers of apiaries placement is being sought for. Many native bees would likely die without issue in their attempt to migrate.

What of those native bees that remained? Because of intense honey bee foraging, natives that remained would be forced to visit more flowers to gather a full pollen load and to spend more time out of the nest and expend more energy to do so. Increased time out of the nest would increase exposure to enemies both for

foraging females and for their unprotected progeny back in the nest (Goodell 2003). Thus, we would expect increased mortality of philopatric natives, both adult and immature. In addition, other more subtle changes are likely. In general, female bees control both the gender and size of their progeny (Stephen et al. 1969; Danforth et al. 2019). In most species, females are larger than males and require more pollen and nectar to rear. However, when nectar and pollen are in short supply, adult females tend to produce more males and fewer females or smaller offspring than they would under usual circumstances (Bosch 2008). Smaller offspring are less likely to survive over winter (Tepedino and Torchio 1982; Bosch and Kemp 2004) and an excess of male bees simply translates into fewer progeny and smaller populations in subsequent years. Smaller populations, in turn, are under greater risk of local extinction. In addition, many native species only collect pollen from a few plant taxa and will have no alternative forage if they are excluded by honey bees from their preferred plants. Thus, the future of populations of those native bees that remained would be dim: populations, which would be confronted by yearly incursions of large numbers of honey bees, would surely dwindle and die over time thereby creating large areas devoid of many native bee species.

It seriously strains credulity to propose that the sudden introduction of such enormous numbers of pollen-gobbling honey bees could not be detrimental to bees that are native to these mountain ecosystems. Several published articles have reviewed the many past studies of competition between natives and honey bees (e.g., Stout and Morales 2009; Russo 2016; Geslin et al. 2017; Mallinger et al. 2017; Wojcik et al. 2018); generally all report that roughly half of past field studies find evidence of competition. One reason that results are not more conclusive is that competition studies between natives and honey bees are very difficult to conduct with replication under controlled conditions because honey bees have such large foraging ranges and because flower production and thus pollen production fluctuate greatly from year to year as does native bee diversity (Stout and Morales 2009). Finally, generally unmentioned, but of critical importance, is that almost all past studies have been conducted with few hives and with small numbers of bees/hive. As a result, they bear little relevance to current beekeeper requests to pasture many thousands of hives on public lands over an extended number of years. We really have no idea how detrimental the effect will be of acceding to such requests without proper long-term studies.

Effect on native flora. The introduction of massive numbers of honey bees will also have unpredictable long term effects on the flora of these mountain ecosystems. Presently, native bees pollinate about 75% of North American flowering plant species (Ollerton et al. 2011) and are, thus, instrumental in maintaining the health of natural wildland habitats and watersheds. The fruits, seeds and leaves of native plants that are consumed by mammals, birds and other wildlife ultimately owe their existence to pollination by native insects, primarily bees. Generally, native bee species are more effective pollinators of the diverse native flora with which they have evolved than are honeybees (Goulson 2003; Dohzono and Yokoyama 2010; Schweiger et al. 2010; Aizen et al. 2014; Aslan et al. 2016; Russo 2016; Magrach et al. 2017; Stanley et al. 2020). Honey bees will pollinate some, but not all, plants as effectively as do native bees and we have no idea which plants will be reproductively disadvantaged and which will not. Nor do we know how such changes in pollination dynamics will change the seed rain, the seed bank and the mix of animals dependent upon fruits and seeds for at least part of their livelihood. In other words, we have no idea how, over time, such alterations will cascade through the ecosystem.

Long-term changes in the flora also will be facilitated by the preference of honey bees for the flowers of some abundant invasive plant species. Numerous studies have shown that weed flowers are favorites of honey bees (Hanley and Goulson 2003; Requier et al. 2015; McMinn -Sauder et al. 2020; Melin et al. 2020) which, in turn, pollinate them and support their spread. As invasive plants spread, they replace native plants and displace the bee species that have entered into tight co-evolutionary relationships with those plants (Stout and Morales 2009). Specialized bees are generally incapable of collecting the pollen of alternative host plants and are at especial risk.

Pathogen spillover. There is a long history of pathogen spillover in vertebrate animals and much of it is due to destruction of natural habitat by humans and their thrusting together domestic and wild animals (Cunningham 1996; Daszak et al 2000; Cortezar et al. 2007): we ignore these examples to the peril of both our native bee and honey bee populations. Although research on pathogen spillover between bees is in its infancy, already several studies have shown that pathogens can be passed from honey bees to native bees at flowers and that some of these diseases are debilitating to natives (Tehel et al. 2016). It has been established that honey bees in almond orchards carry a host of pathogens before they are moved into honey production areas (Cavigli et al. 2016; Gisder and Generesch 2017); it is such hives that are intended for movement onto public lands. Other studies have documented the transfer of viruses from honey bees to bumblebees (Singh et al. 2010) and have demonstrated pathogenicity (Fűrst et al. 2014; McMahon et al. 2015). There is also evidence that other viruses have been transferred from honey bees to several genera of native bees (*Ceratina, Andrena, Anthophora, Osmia, Xylopcopa*; Radzeviĉiüte et al. 2017; Santamaria et al. 2018) and that these viruses replicate in those bee taxa.

Conversely, native bees carry a variety of pathogens to which honey bees, currently under pressure from various disease agents may be susceptible (Singh et al. 2010). New reports of potential native bee pathogens are appearing frequently (e.g., Murray et al. 2019; Graystock et al. 2020). We can ill afford to introduce such novel pathogens into honey bee populations when we are ignorant of their potential effect. It is hard to comprehend why honey beekeepers are willing to further risk the health of their industry by exposing their living capital to potential diseases carried by natives. This is especially perplexing because in the 1980s honey bee keepers, at the time experiencing significant losses due to the fungal disease chalkbrood, were quick to blame the solitary species *Megachile rotundata*, the alfalfa leafcutter bee, as the carrier of the disease; purportedly, it was spreading chalkbrood to honey bees in alfalfa fields. It wasn't but one does wonder how beekeepers could so quickly forget.

Resolution. Agreement on the honey bee-native bee issue can best be addressed if we agree that: 1) honey beekeepers require summer forage for their bees. Summer is the time when beekeepers switch from pollination services to honey production, both for additional income (roughly 55-60% of their revenue comes from honey; Hellerstein et al. 2017) and to allow bees to accumulate honey for the winter. And 2) public land managers have as one their primary objectives the preservation of biodiversity and the maintenance of ecosystem integrity. The question then becomes where honey bee hives are to be pastured in the summer and whose responsibility it is to provide that pasture. The resultant problem was summed up concisely by Durrant (2019): "Beekeepers are subject to exclusionary forces in part because they do not own the land they need for production in the United States. Thus, they are constantly vulnerable to land management decisions made by land owners and land managers on public lands." For the most part, beekeepers have never used their own lands for summer forage for their bees: they have always depended upon the flowers of strangers (with apologies to Blanche DuBois and Tennessee Williams); they have pastured their bees on or adjacent to the lands of cooperative landowners and repaid that privilege nominally (Nordhaus 2011; Hellerstein et al. 2017; Rucker et al. 2019). Tradition and inertia die hard. Beekeepers are now in a pickle because private forage land has become scarce for economic reasons (see below). "Society" must now decide, through our representatives in congress and in federal agencies, whether we want to subsidize beekeepers by allowing them on public lands in summer, thereby impacting native species, or if alternative measures can be devised.

The need for pastureland on which to produce honey was recognized by the WHS which enlisted action by several federal agencies and made numerous proposals to reverse bee decline, including: "restore or enhance 7 million acres of land for pollinators (including the monarch butterfly) over the succeeding five years through federal actions and public/private partnerships." Important programs for the addition of those 7 million acres include, but are not limited to, the Conservation Reserve Program (CRP) and Environmental Quality Incentives Program (EQIP) of

USDA. EQIP provides support to farmers and ranchers to implement practices to provide wildlife habitat and food sources for honeybees. Participation in the EQIP program to improve fish and wildlife and pollinator habitat declined from 14.9 million acres in 2009 to 9.9 million acres in 2016. The largest program, CRP, which actually began in 1985, compensates farmers, mostly in the Midwest, to convert fragile or environmentally sensitive cropland to wildlife and pollinator habitat for 10-15 years. Unfortunately, participation by farmers and landowners in CRP has declined by 13 million acres to 23.5 million acres because they can realize a greater profit by putting their land into biofuel crops such as corn, which is of no value to beekeepers, and soybean, some varieties of which may provide nectar and are attractive to bees but are heavily sprayed with pesticides (Otto et al. 2018; Durrant and Otto 2019). Such declines are particularly onerous in the Midwest where over 50% of honeybee colonies have traditionally spent their summers producing honey in the Northern Great Plains (the Dakotas, Minnesota, eastern Montana, and other states). In addition, much of the CRP land envisioned for pollinators, the CP42 program, was undersubscribed (only 1.4% of total CRP land went into CP42 because the cost was 3-4 times greater than the grassland option; Hellerstein et al. 2017).

If we have decided that subsidizing the honey beekeeping industry is in the best interests of society, then changes in federal programs will be necessary to increase the caps on eligible lands and to increase landowner participation. The recent Farm Bill increase in the statutory cap on the land area available for CRP participation to 27 million acres by 2022 is a positive step but is not nearly as large as that recommended to fully address the issue (Otto et al. 2018). Another positive step would be to subsidize those landowners willing to enroll in CP42 for the difference in the additional cost they must incur to prepare their land for pollinators rather than grassland. Other steps to encourage full subscription by farmers and ranchers to extant programs need to be developed. WHS also directed other federal agencies to take steps to provide pollinator habitat. For example, floral enrichments on military base margins, utility corridors, Army Corps of Engineer Projects and even airports could also expand acreage for summering apiaries of U.S. migratory beekeepers. Follow ups on these programs are needed to evaluate their efficacy. Other recommendations for habitat enhancements for pollinators on farmland can be found in Burkle et al. (2013) and Kovács-Hostyánszki et al. 2017).

Finally, there is also room for beekeepers to become more creative in providing for their little money-makers. Perhaps it is time to for them to explore mid-summer cooperative agreements with farmers wherein farmers plant and profit from nectar-rich oilseed crops such as those being investigated in Minnesota (Thom et al. 2016) and beekeepers pollinate those crops gratis while profiting from the honey. To quote Thom et al. (2016): "by integrating specialty oilseeds into Northern Corn Belt cropping systems on highly productive lands we can increase exponentially the availability of rich floral resources . . . Such a change would be a boon for both pollinators and producers." Sounds like it's worth a try to me. Beekeepers, what do you think?

We began this inquiry with a straightforward question: Are honey bees likely to be benign, beneficial or detrimental users of public lands? The scientific evidence, such as it is, suggests that honey bees are a detriment to native bees and some of the plants they pollinate. Although it is hard to quibble with the potential for pathogen spillover and its attendant dangers, some might object that the evidence for competitive displacement of native bees is mixed: it is. It is mixed for several reasons: 1) it is difficult to conduct meaningful, controlled and replicated studies of competition between honey bees and the native bee community on wildlands because of the ambit of honey bee foraging and the diversity of the native bee community; some studies are better than others at addressing this problem; 2) most studies are conducted using hive and bee numbers that are miniscule compared to current beekeeper requests and yet they find evidence of competition; 3) no study of which I am aware looks at the prolonged effect of yearly introductions of apiaries yet this is what is being requested by beekeepers. To what logical conclusion are we driven if some small scale, temporally-limited studies uncover evidence of competition and beekeeper requests are for sustained yearly introductions of honey

bee numbers that are orders of magnitude larger than any study thus far conducted?

To continue to treat honey bee usage of public lands as a CE without even considering these valid objections is to invite long-term ecological transformation of these high mountain landscapes. The CE designation for honey bees should be rescinded immediately pending the result of an EIS: honey bees should be kept off public lands in these enormous numbers until we have a better understanding of the risk their presence raises. To help resolve this issue we should commission well-designed studies of pollen limitation in ecosystems without honey bees present. Is it possible that the enormous amounts of excess pollen needed to feed honey bees is available? Unlikely, but then we don't know. And finally, we need to estimate the risk to bees by supporting studies of pathogen spillover.

And what of the legitimate plight of the honey bee? That plight can only be addressed by a combination of expansion and modification of government programs such as CRP, EQIP, etc., and the creation of new private partnerships between beekeepers and farmer/ landowners. Perhaps the government has a role in bringing such prospective collaborators together. But to address honey bee plight by allowing beekeepers to flood public lands with apiaries is to try to cure one problem while creating another. And when the potential for pathogen spillover is stirred into the pot the law of unintended consequences can cook up a noisome soup not on the menu at Chez Panisse. •

Acknowledgments: Thanks be to Mary O'Brien of the Grand Canyon Trust and Tara Cornelisse of the Center for Biological Diversity for sticking with this issue for the past three years. Their support has been invaluable.

Bio: The author began studying bees professionally 46 years ago after migrating (but not due to displacement by honey bees) from Brooklyn to Wyoming and then to Utah. He retired from a pollen-rich position in 2004 but continues to forage on bee conservation and ecology issues. He may be reached for civil comments/questions at: Tepadasia@aggiemail.usu.edu

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Utah Native Plant Society Virtual Annual Meeting

Thursday, November 12, 7:00 pm

Join us for our first ever virtual (e-meeting) Annual Meeting. Because of the ongoing Covid-19 pandemic, this year we will have to forgo the New World Potluck (feel free to prepare something tasty for yourself at home). There will be a brief business meeting followed by the election to the board of directors to UNPS. Then Bill Gray will give a presentation on *Utah's Giant Duniper Forest* (see below).

Details on how to attend the Zoom meeting will arrive in an email from UNPS. It will include a simple internet link to click at 7:00 pm on November 12th which will automatically connect you to the Zoom meeting.

If you need to update your email contact information, get in touch with Tony Stireman, the UNPS membership chair, at tstireman@gmail.com.

Utah's Giant Duniper Forest

by William Gray

Hidden in plain sight in our West Desert is an extraordinary forest of large old Utah Junipers (*Juniperus osteosperma*). Over the past months I have made several trips to get a better understanding of what makes them so special. Despite living in what may be among the driest areas in Utah (annual rainfall 5-6 inches) they live long healthy lives and reach relatively enormous sizes. This one, by no means the largest, first caught our attention with its spread of nearly 40 feet and a trunk thickness of 5 feet. It's growing in a sandy habitat right next to US Highway 6/50, near the border with Nevada. Really barren country.

Loose sand may be a key part of the story. Individual trees show up well in Google Earth and their crown diameters can be measured directly. Using this approach we located other areas with similar sandy habitats and even bigger trees than the original site. We refer these unique specimens to the new genus *Duniperus*! A few candidates approach 100 feet across the crown, though we have not yet verified this on the ground. Where there are active dunes it appears that a race for survival may develop – trees have to grow rapidly to avoid total burial. Of course "rapid growth" is a relative term in this context. We suspect the loose sand facilitates this by allowing water to percolate down to where evaporation is slower, and also keeps it out of reach of surface-growing plants.

Slow growth is often an important factor in enabling trees to achieve great age. Some we have verified to be more than 1000 years old, with one clocking in at probably more than 1500 years.

In my presentation I will introduce some iconic trees and talk about how we hope to use them to build a better understanding of our desert climate over the past couple of thousand years.

Salt Lake Chapter Report *by Cathy King*

Hello to members of the Salt Lake Chapter. It has been awhile since we have been able to meet as a chapter because of the persistent Covid-19 pandemic. We are hoping to organize meetings via Zoom if we can find speakers that are comfortable with using that format.

We also hope to organize field trips this coming summer in smaller groups that can be managed safely.

Since our last meeting, long time member Paul Zuckerman passed away at the age of 92. Many of you will remember him as an outstanding photographer and a native plant enthusiast.

Do plan to join the **Annual Meeting Zoom meeting on Thursday, November 12th at 7:00 p.m.** Keep an eye out for the email that will give you the connecting link. See you then!

For the love of cacti, Utah scientists get dirty to save threatened Siler pincushion

by Joan Meiners, reprinted here with permission of the St. George Spectrum & Daily News

Blake Wellard holds a middle-aged cactus in his hand, its long tendrilous roots dangling a foot and a half below the clod of desert dirt in which they are, purposefully, still enmeshed. The freelance botanist, as Wellard calls himself, knows that having these delicate and desiccated roots intact will be the key to this threatened Siler pincushion cactus's survival in its new home, just a few miles down the road at the White Dome Nature Preserve south of St. George.

Fewer than ten thousand individuals remain worldwide of the Siler pincushion cactus, according to a 2006 survey that Wellard fears is now an overestimate. The species was listed by the U.S. Fish and Wildlife Service as endangered in 1979 and improved to threatened status as of 1993. But recent spates of drought and development in southern Utah have likely weakened its foothold on our planet once again.

One reason for its fragility is that the Siler pincushion cactus only grows on gypsiferous soils (soils high in the whitish mineral, gypsum) in southern Utah and northern Arizona. It cannot be cultivated in a nursery or grown from seed in a lab. As Kristine Crandall, a volunteer working with Wellard, put it, "This incredibly rare cactus just happens to love this exact place."

Problem is, the particular patch of gypsiferous soil on which Wellard is standing has been slated for development. So, it's time for the cactus to go, something most plants need a little help doing.

On this quickly warming October morning, The Nature Conservancy has arrived on-site to survey and excavate as many of these pincushion cacti as possible before the bulldozers arrive, the timeline for which remains unclear. So far, Wellard and others working with TNC have tagged 67 cacti for removal, marking each with a thin metal stake topped with a blue number tag. Over the next week, they expect to transport up to 75 of these spiky globes to a new home in the White Dome Nature Preserve, where protections enabled by TNC should prevent them from having to uproot again.

Although the federal Endangered Species Act usually protects critical habitat for listed species from development, the state of Utah has chosen to exempt land owned by the Utah School and Institutional Trust Lands Administration (SITLA) from this requirement, Wellard explained. That includes this gypsiferous expanse of gently rolling hills, crusted with biological soils and dotted with the woody shrub known as Mormon tea.

Blake Wellard holding Siler pincushion cactus near the White Dome Nature Preserve Wednesday, October 21, 2020. The species moved from endangered to threatened in 1993, however, the numbers are slow to increase as development moves in on their habitat.
Photos in this article by Chris Caldwell.

The spiky globe Wellard holds in his hand is pincushion cactus number 15. He has extracted it from the place where it has spent its approximately decade-long life as carefully as if he was working on an archaeological dig. First the scientists dig a trench a few inches deep around the cactus in a circle about two feet in diameter. Next they use fingers and trowels to tease the brittle but vital roots free from the soil.

Utah state botanist Mindy Wheeler says she does occasionally get pricked by cactus spines. But she doesn't seem to mind. For her, the chance to save one of Utah's approximately 300 sensitive plant species is worth it.

"This is not easy work. Even thinking about this last night, I was stretching out a bit," Wheeler said. "But biodiversity is really our friend. We're all connected in terms of how we

support each other. This cactus could have some really interesting DNA sequence or something that we have yet to learn, that could really boost science in a direction we never thought of."

The team is aiming for a 60% success rate with these uprooted cacti thriving after relocation. In addition to having to tap into a new underground network of water, nutrients and beneficial fungi at the next site, the cacti will have to put down new roots to keep from blowing across the landscape like so many tumbleweeds. They will then face the hazard of rodents gnawing at their tissue for its moisture and the risk that their pollinators may not get their forwarding address.

But the fact that the odds are stacked against the Siler pincushion is precisely the reason Wellard is spending his morning kneeling in the dirt trying to save it. He has been charmed by this species "hedging its evolutionary survival on these isolated gypsum soils." Though he's been working with cacti for over a decade, he hadn't yet had a chance to get his hands on this beauty. For him, today is a passion project.

"It actually kind of hurts to have to dig these up at all," Wellard said, blowing some dust off the top of cactus number 15 so he could examine and show off its faded yellow blooms. "But I'm so grateful that we have an opportunity to save these, because so often there's not opportunities to save endangered plants before development."

Wheeler hauls over a black plastic bin from the truck, already brimming with baseball-sized cacti that the botanists estimate are eight to ten years old and football-sized cacti that might be up to thirty years old. Cactus number 15 is surprisingly heavy, having collapsed much of its tissue down to a denser state to cut back on its water needs over the winter.

It has also scaled back activities like photosynthesis and nutrient transport between its tissues, Wheeler explains. This ability to power down or go dormant through periods of drought is one strategy desert plants have adopted in order to survive St. George's infamous hot and dry spells.

The hope is that, next spring, cactus number 15 will swell. Having had its roots surgically inserted into new gypsiferous soils by the careful hands of Wellard, Wheeler, Crandall and others, it will wake up in a new place and hopefully not know the difference. It will draw up spring moisture through its root network, plumping existing tissue and pushing out new flower buds. The bees that specialize on cactus pollination will visit the yellow blossoms atop spiky globes that dot this unique landscape. And the resulting seeds will then rise as the next generation of Siler pincushion cactus, observable from the public trails through the White Dome Nature Preserve. •

Joan Meiners is an Environment Reporter for The Spectrum & Daily News through the Report for America initiative by The GroundTruth Project. Follow her on Twitter at @beecycles or email her at jmeiners@thespectrum.com.

Bill King wrote a fine article about Andrew Lafayette Siler in the May 2008 issue of the *Sego Lily*. Also, there is a short *Update on White Dome Nature Preserve* article by Elaine York in the same newsletter.

Fairy Slipper Orchid

by Steve Hegji—Steve is an amateur botanist and nature, landscape, and nightscape photographer. He is the author of "Wasatch Wildflowers" (book) and "Flora of the Wasatch" (app).

Globally, the two most species rich plant families are Asteraceae and Orchidaceae. A small political (not ecological) division, like the state of Utah, does not reflect global statistics and Utah natively hosts very few species in the Orchid family. In fact, "A Utah Flora" and "Intermountain Flora" list only 21 species of Orchidaceae in Utah; while there are an estimated 18,000 species worldwide. Prior to 2020, I'd only consciously seen and photographed seven of the 21 orchids; but finally this spring I had a chance to see the beautiful Fairy Slipper Orchid (*Calypso bulbosa*) in the western Uinta Mountains with a small group of other UNPS members.

In 1732, Linnaeus made an expedition to Lapland, as a result of which he listed and described eight species of orchids in his published account of the Lapland flora. *Calypso bulbosa* is missing from that account (although the type specimen is from Lapland) because it was not seen by Linnaeus himself. However, he included it in his book on the authority of his mentor, Olof Rudbeck the Younger, who had seen and described it during his own exploration of Lapland in 1685. Linnaeus reproduced the illustration that Rudbeck had published previously. The genus Calypso is named for the sea nymph Kalypso, of Homer's Odyssey, and the name means "hidden or covered." We were given GPS coordinates for its location, yet it took us 5-10 minutes to spot due to its short stature and the other plants growing in association.

In Utah we find the Fairy Slipper orchid in the Uinta, La Sal, and Abajo Mountains. Globally it is found in North America and Eurasia, with four recognized varieties:

- *C. bulbosa v. bulbosa* – a denizen of northern Eurasia from Scandinavia and extending across the boreal forest regions of Russia to the Korean Peninsula and northern Japan.
- *C. bulbosa v. speciosa* – confined to the high mountains of western China, parts of inner Mongolia and central Japan (limited to high elevations of the Southern Japanese Alps; Yamanashi, Nagano, Shizuoka, and Saitama Prefectures).
- *C. bulbosa v. americana* – found across the entire boreal region of North America from the Atlantic to Pacific, as well as the mountainous regions of the western US (in Canada it is widespread in forested regions, in the US from northern Maine, Vermont, Michigan, Wisconsin, Minnesota, South Dakota (Black Hills), Montana, Idaho, Wyoming, Washington, Utah, Colorado, New Mexico, Arizona, Alaska; historically N.Y. (last seen in 1969) and New Hampshire.
- *C. bulbosa v. occidentalis* – confined to western North America from California to Oregon, Washington, Idaho, Montana, British Columbia, and Alaska. In the south it is found exclusively in cool, "fog-belt" coastal forests, and further north (Idaho and Montana and northward) it can be seen in moister inland mid-elevation mountains as well. It is a characteristic plant of the Pacific Northwest rain forest belt often seen near sea level, and flowering earlier than most other varieties.

The plant can be 6-20 cm tall - the specimen shown in photograph #1 was about 14 cm. You can see in the photograph two sheathing bracts (2-3) on the stem, with a single leaf (broad, green, veined) emerging from the

Photograph #2 shows a nearly face-on view of the flower. The five "petals" on the upper side of the flower are actually 3 sepals (middle and two outer) and 2 petals (between the sepals). The third petal is the lip and column forming the "slipper" portion of the flower. Photograph #3:The column is held horizontal to the ground, is relatively long and has a broad hood. The lip is striated with white and various shades of darker purple, or purple brown veins and spots.

ground to the right of the stem. The leaf arises from the corm in the fall, persists through winter, and finally withers in summer. The flower is usually solitary - which was the case with the population we saw.

Photograph #2 shows a nearly face on view of the flower. The five "petals" on the upper side of the flower are actually 3 sepals (middle and two outer) and 2 petals (between the sepals). The third petal is the lip and column forming the "slipper" portion of the flower. The petals and sepals are typically pink-purple. Behind the upper sepals and petals you can see a pale pink floral bract.

The lip is slipper-like, similar to a lady slipper (genus *Cypripedium*), but more elongated with a frilled front plate with upward curling margins. At the base of the lip are two horn-like projections - you can just see these two horns peeking out below the lower lip in photograph #3. The column is held horizontal to the ground, is relatively long and has a broad hood. The lip is striated with white and various shades of darker purple, or purple brown veins and spots. Variety *americana* is the one found in Utah, and is known for a bright yellow patch in the area where the bristles protrude, making it perhaps the most attractive of the four known varieties.

Fairy slipper orchids provide no reward but rely on bright color, anther-like hairs, and sweet smell to deceive naive pollinators, mainly newly emerged queen bumblebees. It is monoecious and cannot self-pollinate. The seed pods develop in an upward standing position and can contain between 10 and 20,000 seeds. The seeds require one of a number of different mycorrhizal fungi in the 1st stage of seed germination. The orchid also regenerates asexually by creating new corms – usually one per year. Individual corms remain viable for 2-4 years.

This plant is easily disturbed. If you go looking for it, learn to recognize the leaf and tread carefully through the forest. Finding it in bloom is quite exciting and a real treat.

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The Heart of Penstemon Country:

A Natural History of Penstemons in the Utah Region

Sweetgrass Books, Helena, Mt 2020, 394 pp $65.00

A Book Review by Bill and Cathy King

An important new book on the genus *Penstemon* was published in August of 2020. It is of particular interest to residents of Utah, since the focus is on some 76 species of this state of the 300 known species, but it has broad appeal to anyone who has ever appreciated this particularly attractive genus and wants to learn more about it.

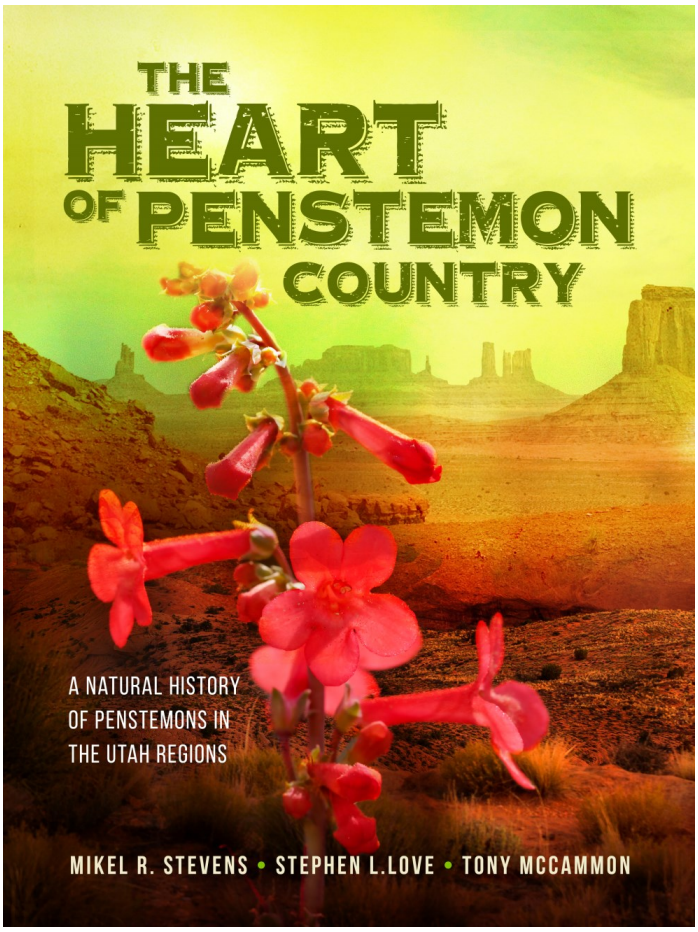
Falling somewhere between a monograph or as the authors describe it, a treatise, and possibly a textbook, *The Heart of Penstemon Country* is packed full of useful, interesting, and intriguing information, the culmination of over ten years research both in the field and from source materials. This is probably one of the best researched books on a single genus of flowers that we've encountered.

Introductory information about the genus *Penstemon* is offered in the opening chapters of the book. The foreword written by well-known *Penstemon* expert Noel Holmgren is followed by a preface and introduction from the three co-authors, horticulturists Dr. Mikel Love (BYU), Dr. Stephen Love (University of Idaho) and ethnobotanist Tony McCammon.

The following chapter covers geographical distribution and categorization and the botanical explorers that discovered many of the *Penstemon* species in Utah. Plant explorers of previous centuries and into the current century have contributed tremendous work to science, quite often at great personal risk and physical discomfort. Adding historical details to the penstemon story only makes it intriguing, especially as it continues to the present day.

Ethnobotany is seldom included in plant books like this but adds another element to the uses and purpose of growing penstemons. A number of the individual *Penstemon* species have a section devoted to ethno-botanical uses. It was surprising to discover that so many *Penstemon* species have been used for ethnobotanical purposes by native peoples.

For those who are new to penstemons, the chapter on "Penstemon Diversity and Taxonomic Classification" is well worth reading to understand how to identify one.



One of the most remarkable features of this chapter is the detailed photographic section of penstemon flowers and their parts which will prove useful to experienced botanists as well for plant identification. This chapter is followed by a dichotomous key for further identification.

Arranged in alphabetical order, information about individual species is easy to locate. There are three to five pages of information about each species with details about habitat and cultivation included. Also provided are the scientific name and common name(s), who first identified the species and its history, the taxonomic classification, morphologically similar species that are found in Utah, the range of the species in Utah, the bloom period, a general and technical description of the species, and its conservation status.

Coverage of some species includes ethnobotanical uses, breeding and cultivars. In addition to this, each species has a large distribution map. There are several photos of the species and its habitat, including a close-up shot. All of this information is laid out in a well- organized manner.

The "Notable Contributors to the Study of Utah Penstemons" chapter offers short biographical sketches from the early days to the present in the style of Joseph Ewan.

We, the reviewers, have had the pleasure of meeting many of the contemporary botanists and have high regard for their work.

The book wraps up with an extremely useful list of references, an equally useful illustrated glossary (especially for the uninitiated) and the necessary index.

The format looks and feels like a combination textbook/ coffee table book, with its durable, glossy hard cover and its oversize format, a little over 9" x 12", almost an 1½" thick and weighing in at just under 6 lbs, not likely something you'd carry in your backpack on a field trip but certainly something to bring along in the car.

While *The Heart of Penstemon Country* is exhaustively complex and complete in so many ways, one can't help but wonder why three horticulturists wouldn't have felt compelled to include a chapter on the use of penstemons in the modern xeric garden, particularly in these days of climate change and drought.

We found a few issues with graphic design that would have made the book easier to use. The distribution maps, while a great idea, were made more difficult to read by using a light yellow color that wasn't easy to see. The use of low contrast images under the text of every page also just made it harder to read for our aging eyes. But these are minor issues that matter little overall.

A few years ago, a botanic garden called and wanted us to stop by and identify the penstemons in their garden which had lost the identifying tags. We graciously demurred, as it would have been a daunting, if not nearly impossible, task. But now, with this wonderful new book, most anyone could identify these species in the garden, if the penstemons were from Utah and in flower. Hopefully, others will see this fine book and write similar books for other states.

Unusual because it covers some of the most rudimentary information to some of the most complex, *The Heart of Penstemon Country* is one of those rare books that will prove valuable to a wide variety of readers, from the most amateur of budding botanists to the most experienced. From classroom to herbarium to field trip to coffee table, this book will become a classic.

Available from your favorite bookseller or it can be ordered directly from Mikel Stevens, contact him at mikel.r.stevens@gmail.com

Note: The publication of *The Heart of Penstemon Country* was partially funded by grants from both the Utah Native Plant Society and the American Penstemon Society. In the interest of full disclosure, authors of this review are members of both organizations.

Canyonlands Chapter Report *by Diane Ackerman*

Hello Plant Enthusiasts. Hope everyone is hanging in there and maintaining sanity in our crazy world. We have missed our 2020 field trips and I don't anticipate convening this fall/winter for chapter meetings. I'm open to new ideas and vision when we return to our regular meetings. I'd love to hear about your botanical interests and endeavors that might be of interest to our members. Some of us have remained grounded this year nurturing our public native plant garden. We can always use additional folks to help!

Canyonlands Chapter received recent recognition from the Solid Waste Special Service District for the efforts and dedication at the Native Plant Garden located at the Community Recycle Center on Sand Flat Road.

Noted in the letter accompanying the plaque: "...appreciation in the planning, development, and constant care of this environmental feature, along with the many ecological, structural and visual benefits it provides". It's nice to know this little piece of real estate is not only a ray of inspiration, but actively engaged in natural processes!

I flushed a large group of small birds last week that were probably searching out the ripening seeds of the numerous, large four-wing saltbush. There is not much vegetation in the red rock landscape nearby and what we observe in this small island provides sanctuary for lizards, bees and butterflies during the warm season.

There are a couple different lizards that come running to drink from the basins around the plants when we water. We have seen them sipping water droplets from foliage. Rocky Mountain bee plant (*Cleome serrulata*) and native sunflowers have blown in on the wind and find spots to put down roots.

We planted 5 new plants this spring in the garden. Two each of single-leaf ash and fendlerbush (*Fendlera rupicola*) and one desert mahonia filled out the garden down to the tall electric pole.

If you have not seen this garden, here is your chance to come and visit and learn about what is growing there. We are scheduling for a work day to spread mulch at the Native Plant Garden on Saturday, November 7 starting at 9 AM--Noon.

Pinus edulis:
A conifer to be cherished

by Mackenzie G. Jones – D. Gary Young Research Institute

A beloved native conifer, *Pinus edulis* Engelm., also known as, "two-needle pinyon pine," can be found throughout Utah and all over the arid West. *P. edulis* is typically a stout tree but can grow to 15 meters tall in the right conditions, sometimes appearing shrubby, with two needles per fascicle that are yellowish green in color. Male cones tend to be inconspicuous, unlike their female counterpart that bear edible, wingless, hard-shelled seeds, which gave them their Latin name, "*edulis,"* meaning, "edible." These trees can live up to 1,000 years while reproducing for most of that time. They play a key role in their environment by serving as a source of shelter and food for many critters. The main attraction of this conifer is the seeds, which are a delicious adornment to a dish or by themselves, rich in protein, vitamins, and minerals. These seeds, colloquially known as "nuts," have co-evolved with some species in which they rely on for seed dispersal (Van Buren, p. 118-119). However, these seeds are enjoyed by species of bird, mouse, and human alike. Pine embryos encased in endosperm. Yum.

Native People have been utilizing this cherished tree for centuries in an array of applications. Pinyon pine has been a source of wood to use as construction material and fuel fires. The resin serves as a great water repellent, sealant, and was often used for medicinal purposes. Even the pollen was utilized in some tribes for religious rituals. Pine nuts have played a large role in Southwestern Native People's diets, offering seven out of nine essential amino acids. Some archeologists suspect that *P. edulis* was the preferred "nut", having discovered the seed coat and cone remnants in caves and at old tribe sites throughout the Southwest. These Native People have respected this versatile plant by using it to its full potential, with some who still forage for these hardy seeds from pinyon and pinyon mixed forests to consume or to sell for others to enjoy (Bye, 1985).

With such prized seeds, the tree must do its very best to deter herbivory before the finished development of the embryo. To achieve this, similarly to many other plants, two-needle pinyon pine evolved to emit volatile compounds. Rich in terpenes, *P. edulis* secondary metabolites include α-pinene, β-pinene, limonene, sabinene, and many more. Volatiles are effused

Photograph taken by Tyler Wilson, May 6, 2018, in Tabiona, Utah.

throughout different organs of the plant and recent research has determined the differences of these compounds with steam distillations of the trunk, limbs, needles, and cones (thank you for your contribution to science my photosynthetic friends). Each part was distilled separately and analyzed by gas chromatography. Cones were rich in α-pinene, β-pinene, and sabinene and produced the highest yield of any plant part. Each compound present in the cones was typically found in other plants parts, albeit in different amounts (Poulson et al., 2020). These findings suggest that the tree wants to protect the most vied part: the seeds.

Pinyon pine forests, unfortunately, cannot be protected by their volatile compounds alone. Many forests have been cleared to create space for grazing cattle. These trees should be protected since they serve as a key organism in their ecosystem and have the potential to be used as a sustainable crop in pine nut production, as demonstrated by the Native People for centuries. Most of the pine nuts consumed in America are imported from other countries, like China and Russia, when we have an abundance of available pine nuts at our disposal (INC, 2019). To help this cause, seek out pine nuts from local vendors. Perhaps sneak a few *Pinus edulis* seeds into the ground when you do buy them so future pinyon pines can flourish and help feed animal-life alike. As John Muir once said, "When one tugs at a single thing in nature, he finds it attached to the rest of the world," so, please, snack responsibly and enjoy this beloved conifer to its full potential! Fulfilling your homemade pesto dreams is attainable, my friends.

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Photograph taken by Tyler Wilson.

Taking Vineyard Native

by Amber Rasmussen

Vineyard City, just a decade ago a small farming town, is now a burgeoning city. Boasting the fastest growth rate of any city in the USA, thousands have moved into the rapidly growing neighborhoods filling up with homes and high-density housing complexes. With the prospect of a coming town center that will be unrivaled by any other developments within the county, there is a lot to look forward to in the coming decade. Led by a mayor and city council that value thoughtful planning, the new development will be a highly connected, walkable, multi-use center with plenty of parks and greenspace. But the new town center isn't even the most attractive feature for me, a Vineyard resident of three years. Despite the coming influx of businesses and culture, what strikes me most is the possibility for environmental rehabilitation, thoughtful planning of natural spaces, and the need to recognize the secret floral treasures mixed in with the abundant invasive species that have crowded our city and Utah Lake shoreline.

In my time living here, I have come to gain a better understanding of how a city operates. As an involved citizen, I have witnessed the interplay of city government and civilians, observed the efforts that go into creating a city plan, and watched the slow but steady growth of housing, business, and the infrastructure required to run it all. Though this experience has left me feeling fascinated and enthusiastic about participating in the political process, my heart truly lies with the natural landscapes of the city, and I have found myself scanning the empty lots of rabbitbrush, poking around the lakeshore, and trying to formulate a complete picture of what this place could be.

I never expected to become known as the Vineyard plant lady, but as my enthusiasm for the wonderful world of plants has grown, that is just what I have become. First taken in by gardening while living in a townhome some six years ago, moving into my first home in 2017 opened a new world for me. I now had the responsibility of landscaping my own yard! I soon learned that doing so would be much different than simply perusing the plant aisles of a local nursery or hardware store. Groups such as the Utah Water Conservancy and Localscapes were

trying to spread the word about the need for us to appropriately landscape with waterwise plants and minimal grass. That sounded simple enough, and for me it was the beginning of a new passion for plants I had never considered before.

What are native plants and why do they matter? Although I have been working to understand the answers to these questions over the last few years, I have yet to find a suitable answer. Depending on your resource, local can mean something that grows in the United States, something that grows in the West, something that grows in the state, or something that grows in the limited region in which you reside. These differing definitions have complicated the goals of going native, making it difficult for consumers to know what plants fit the bill for providing ecological benefits. Further complicating the matter is the limited resources for native plants and seeds, and the confusion added by businesses marketing plants as natives using questionable criteria. What is a budding environmentalist looking to improve the environment to do in the face of this confusion and limited information?

My love of gardening is closely tied to my love of people, and in order to tie them together nicely I decided to complete the Utah State University Master Gardener program earlier this year. Obtaining vast amounts of information that would assist me in gardening gave me the ability to lead and teach others, and I started a Facebook group titled "Gardening in Vineyard" to do just that. While the program itself was very informative, the amount of knowledge available on the topic is quite extensive, and I have followed up with hundreds of hours of study, course taking, and hands-on experimentation to enhance my foundation. Interacting with my growing group, now around 450 members, has provided insight into what residents around me need when building their gardens, and what information so many of us lack. It has highlighted how little many of us know of the world around us, how separate we feel from nature, and how much we try to control the living creatures around us rather than gently encouraging their healthy growth.

Whilst venturing through the city, you will discover it is populated with a large number of parks and undeveloped plots, and there are plans for many more parks and open areas in the future. Abutting neighborhoods and trails, these spaces provide access to nature for every citizen. Developing trail systems create ease in traversing them, and their presence in neighborhoods can provide a bit of openness that is lacking in the tiny yards. Many residents are determined to see these spaces maintained. Talk of altering them can meet strong resistance, indicating the value of their preservation. In looking out across trees, shrubs, and other greenery that grow here, one might think they are spaces untouched, valuable habitat for birds, deer, and other less conspicuous lifeforms. Further investigation will alter that perception, however, as many of the plants that populate these places are invasives, from Russian Olive trees (*Elaeagnus angustifolia* L.), to phragmites (*Phragmites australis*), tamarisk (*Tamarix ramosissima* Ledeb.), and many others. These landlocked isles of plant life lack the food and habitat needed by our native fauna, their potential benefit tragically limited.

After learning about proposed plans to put in a grassy park in the 11-acre farmland directly behind my home, I quickly jumped into action, throwing together a simple alternative to the standard water-consumptive dead zones that so often make up our parks. In my head I had a vision of a nature park where people could explore and recreate, learning about the flora and fauna that live (or once lived) around us and enjoying the benefits that nature has to provide. Little did I know that this foray into city affairs would alter the trajectory of my existence, leading me to becoming a Vineyard Planning Commissioner a year later, where I would be labeled as the plant lady. With the hopes of elaborating on the plans for the aforementioned farmland as well as some wetland to the south, I reached out to the Utah Native Plant Society for help, coming into contact with Tony Frates. With his kind willingness to answer my questions, along with my glimpse into this world around me that I had for so long ignored, my mission was set.

As spring turned to summer and my gardening group grew, I saw a recurring issue come up. Many people asked why their fruit and vegetable plants weren't producing abundantly. Despite careful watering, adequate sun, and thoughtful care, berries and other edibles were limited. What could cause this? A lack of pollination. Another key element of our local ecosystem was pollinators. I myself had lacked awareness of the importance of pollinators some years prior, but as I began to experiment with planting in my yard, I started to witness bees, butterflies, beetles, spiders, and many other arthropods congregating. Tiny sweat bees easily missed by a casual glance, vibrant green bees, fluffy bumble and carpenter bees, and many others found their favorite flowering plants and offered me glimpses into the world I had neglected to see. While other residents were being swayed by door-to-door pest control salesmen, I was observing an incredible diversity growing around my home, inspiring me to begin a photographic journey that I could share with others.

Becoming a force for good before being fully prepared, I began spending my free time learning more about gardens, plants, and the natural world. Armed with the

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helpful skill of Internet research, I could discover worlds of information to assist in forming a plan for the city. Rows of trees that had been planted by developers were suffering in our clay and alkaline soils. Weeds crept up between the landscaped neighborhood entrances. There were no bees. One of the city council members had created a manual of plants that could be installed in future city landscaping projects after recognizing the difficult environmental restrictions we had. Public Works had tried low-water grasses and plants. What may have been a difficult topic to broach in other communities was already being discussed in Vineyard, and I had a great opportunity to join forces with others already working on our landscape while guiding them in a new direction.

Wetlands transforming into uplands. Plant communities. Elevation. Microclimates. There were so many subjects to delve into when it came to rebuilding an ecosystem, and I wasn't familiar with any of them. Plugging along as well as I could with three small children at home, I spent more time trying to understand where and how to begin with my project of turning the city native. How could we eradicate the pernicious invasives? How could we determine what plants should go where? How do we get natives established? How "native" should we be? In order to make headway with the city while still learning, I looked again to Tony Frates, sending pictures of the plants in the wetlands, seeking more information about UNPS and its goals, and desperately wanting knowledgeable assistance. I attended webinars from New Directions in the American Landscape where they discussed the best ways to use natives in home landscapes and methods of native establishment. I started Utah Master Naturalist Courses, learning about our mountains and watersheds. I experimented with plants in my yard, being charmed by the apache plume (*Fallugia paradoxa*), fernbush (*Chamaebatiaria millefolium*), golden currant (*Ribes aureum*), and many others that grew so easily, using very little water and attracting innumerable insects and birds. During all this, I wavered internally, having moments of self doubt, feeling my task was monumental, and wishing someone with experience might take my place.

Fast forward to September. Over the summer I had assisted the city in pushing developers to choose natives in some of their projects. I had spent countless hours sharing articles and information with my gardening group. I had further examined some of the city open spaces and had begun to identify a few natives. I still battled inside myself, still confused about what constituted a true native and grappling with the expansive needs of our city. As my enthusiasm waned and self doubt redoubled, I had the opportunity to see my hope renewed. It came upon me suddenly in the night after having ridden in the back of a pickup to find a suitable location for seed collecting in the grand expanse of the Walkara Way project. Led by resident Jake Holdaway, this 1,300 acre conservation project has made progress working with local and state government to create a nature preserve of sorts, where wildlife can be sustained and the shoreline can be restored. Deeply familiar with the area, Jake led us to an area he knew contained species that would be of interest to us.

Left to our own devices, my companions and I descended a weedy slope. Heavily vegetated with an assortment of invasive plants intermingled with natives, it was a prime example of a landscape modified by the changes that accompany centuries of human settlement. Unequipped with specific knowledge about what to seek but prepared with tools for collecting, my partners began presenting me with their finds, trampling through the degrading fall foliage. Aster and goldenrod were abundant, and cracked milkweed pods were set with seeds ready to drift. We immersed ourselves in our task of gathering native seeds that could be used in other parts of the city.

One of my assistants, the Vineyard Water Operator, Sullivan Love, courteously assisting me through the more precarious sections of the landscape, immediately discovered a vast expanse of native aster (*Symphyotrichum lanceolatum* var*. hesperium*). My other companion, Community Development Director Morgan Brim, who had kindly arranged for this excursion, photographed the various specimens of interest, filling and carrying Ziploc bags we filled with seeds. Relying on technology only to assist us with our mission and filling the quiet air with tales of the past and an occasional burst of warm-hearted laughter, we existed momentarily away from the nagging pressures of modern life, like curious cats prowling a meadow. Being in the field gave me a taste of what it meant to be in nature. It was intriguing and confusing, quiet and thought-provoking. It was a glimpse of what life could be for young and old alike, providing a field of intriguing flora and fauna. It was a perfect example of what made our city so special, and what magnificent potential it held.

At present, as the frosts arrive and the greenery fades to shades of brown, I have a moment of reprieve. Leaving the garden to winter dormancy, I have moved my focus to further study. Preparing for the coming year, I am attempting to grow some of the native seeds I collected. With hopes of successfully growing *Asclepias incarnata, Helianthus nuttallii, Solidago lepida var. salebrosa*, *Eutrochium maculatum* var*. bruneri*, and other species locally gathered, I hope to provide residents and the city itself with natives that come directly from our city. I have

yet to determine the best definition for what constitutes a native, or what our definition should be. I have yet to determine the best courses of action for restoration. I have what seems like years of literature and videos to study on native plants, ecosystems, integrating nature into the city, and human interaction with native spaces. But I do have a clear source of motivation. I have seen the wonders of bringing the appropriate plants to appropriate spaces, watched them attract the life that surrounds and sustains us, and marvelled at their unrivaled ability to withstand our harsh elements. I have seen the meaning nature provides, unmatched by modernity, and I can't wait to share it with the rest of the city.

In spite of the lingering questions around native plants, I have already witnessed the beauty and vigor they provide to the landscape. Members of my garden group are making plans to add natives and pollinator plants to their gardens to improve their yields, efforts are being made to reduce the use of pesticides and herbicides, and wildlife is being welcomed home.

To continue this positive trend and see our city become thriving and floriferous, it is imperative to continue efforts in public outreach. The common standards that many of us practice, such as planting expansive lawns, eradicating crawling and flying creatures, and attempting to force plants to thrive in conditions they are not suited to are no longer the marks of status and success they once were. We must move forward as part of the natural world, not in spite of it. We should admire the living creatures that surround us, recognizing our great fortune at living in a place with diverse and rich natural wonders, a place that nurtures webs of intricate relationships between the many lifeforms that have thrived here for millions of years. In learning to work with nature instead of trying to control it, we can help restore a resilient environment and provide generations of people the opportunity to learn about our unique natural surroundings and appreciate the vast web of life of which we are a part.

For anyone keen to explore for themselves, Vineyard welcomes you. Whether you desire to simply meander through or actively investigate, there are many locations worth venturing to. You may request a tour through the Walkara Way project on their Facebook page. For anyone with answers to the questions that revolve around natives and habitat restoration, I can be reached by email. I look forward to furthering my experience and knowledge, and my enthusiasm will be redoubled with help from a like-minded community.

Your Membership

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*.

Cold weather is here… 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 often difficult). 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 or cathy.king@gmail.com.

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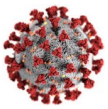
The Sego Lily is a quarterly publication of the Utah Native Plant Society, a 501(c)(3) not-for-profit organization dedicated to conserving and promoting stewardship of our native plants.



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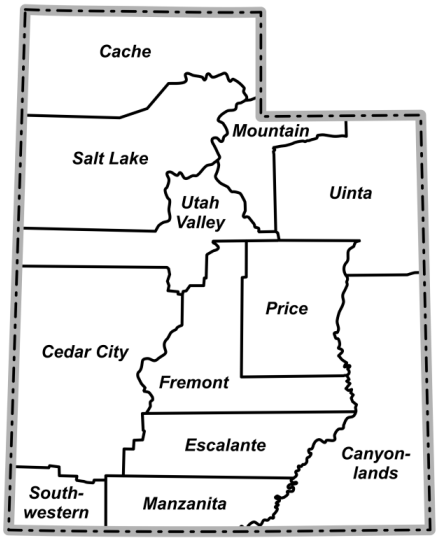

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