

FREMONTIA

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HIDDEN TREASURES OF THE TEHACHAPI REGION
THE FOUND LANDSCAPE: A PHOTOGRAPHIC ESSAY
HABITAT RESTORATION FOR THE RIPARIAN BRUSH RABBIT
MISSION MANZANITA: IS THE SPECIES IN DECLINE?

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THE COVER: A 20-foot tall old-growth mission manzanita in Penasquitos Canyon, San Diego. With its signature smooth, reddish-brown bark, the species holds its foliage high above the ground. This specimen has been pruned of deadwood. Story begins on page 23. Photograph by Steve Miller.



Typical mid-elevation foothills in the Tehachapi region landscape are characterized by grasslands and blue oak (*Quercus douglasii*) woodland. This landscape is largely comprised of private working ranches lying between public and protected lands to the north and south. Photograph by Ian Shive.

HIDDEN TREASURES OF THE TEHACHAPI REGION

by Zachary Principe and Michael D. White

Imagine a part of California where diverse and unique natural resources are hidden within a couple hours' drive of over 15 million

people. That is a good characterization of the Tehachapi Mountains of California, sandwiched between the vast agricultural lands of the Great

Central Valley and the urban and suburban lands of the Greater Los Angeles area. The privately owned land in the region—much of it work-



ing ranches—has remained relatively intact, thus preserving amazing biodiversity and presenting enormous landscape conservation opportunities.

Known by many as a stronghold for the iconic California condor, the Tehachapi region is rich in rare and endemic species. It supports the last remaining unconverted grasslands or prairie in the extreme southern San Joaquin Valley as well as plant

communities from the western Mojave Desert, and is the lynchpin connecting foothill and montane habitats in California's Coast Range, Sierra Nevada, and Transverse Ranges (see close-up map on page 6). Long a target of conservationists, the Tehachapi region has been the focus of renewed conservation efforts over the last decade. This has stimulated development of regional conservation partnerships, working

lands conservation strategies, and novel private lands conservation and management approaches.

SCIENTIFIC HERITAGE

Intertwined with its biological value is the region's notable heritage of scientific exploration. Many renowned naturalists visited the Tehachapis during biological expeditions in the 19th and first half of

TABLE 1. RARE PLANTS OF THE TEHACHAPI REGION.

Botanical Name	Common Name	CNPS Rare Plant Rank
<i>Allium howellii</i> var. <i>clokeyi</i>	Mt. Pinos onion	1B.3
<i>Allium shevockii</i>	Spanish Needle onion	1B.3
<i>California macrophylla</i>	round leaved filaree	1B.1
<i>Calochortus palmeri</i> var. <i>palmeri</i>	Palmer's mariposa lily	1B.2
<i>Calochortus striatus</i>	alkali mariposa lily	1B.2
<i>Camissonia integrifolia</i>	Kern River evening primrose	1B.3
<i>Canbya candida</i>	white pygmy poppy	4.2
<i>Clarkia tembloriensis</i> subsp. <i>calientensis</i>	Vasek's clarkia	1B.1
<i>Clarkia tembloriensis</i> subsp. <i>tembloriensis</i>	Temblor Range clarkia	CBR
<i>Clarkia xantiana</i> subsp. <i>parviflora</i>	Kern Canyon clarkia	4.2
<i>Convolvulus simulans</i>	small flowered morning glory	4.2
<i>Delphinium gypsophilum</i> subsp. <i>parviflorum</i>	gypsum loving larkspur	3.2
<i>Delphinium inopinum</i>	unexpected larkspur	4.3
<i>Delphinium purpusii</i>	Kern County larkspur	1B.3
<i>Eriastrum tracyi</i>	Tracy's eriastrum	3.2
<i>Eriogonum breedlovei</i> var. <i>breedlovei</i>	Piute buckwheat	1B.2
<i>Eriogonum callistum</i>	Tehachapi buckwheat	1B.1
<i>Eriogonum gossypinum</i>	cottony buckwheat	4.2
<i>Eriogonum kennedyi</i> var. <i>pinicola</i>	Kern buckwheat	1B.1
<i>Eriophyllum lanatum</i> var. <i>hallii</i>	Fort Tejon woolly sunflower	1B.1
<i>Eschscholzia lemmonii</i> subsp. <i>kernensis</i>	Tejon poppy	1B.1
<i>Eschscholzia lemmonii</i> subsp. <i>lemmonii</i>	Lemmon's poppy	CBR
<i>Fritillaria brandegeei</i>	Greenhorn fritillary	1B.3
<i>Fritillaria striata</i> *	striped adobe lily	1B.1
<i>Githopsis tenella</i>	delicate bluecup	1B.3
<i>Hesperocyparis nevadensis</i>	Piute cypress	1B.2
<i>Heterotheca shevockii</i>	Shevock's golden aster	1B.3
<i>Layia heterotricha</i>	pale yellow layia	1B.1
<i>Layia leucopappa</i>	Comanche Point layia	1B.1
<i>Loeflingia squarrosa</i> var. <i>artemisiarum</i>	sagebrush loeflingia	2B.2
<i>Mimulus pictus</i>	calico monkeyflower	1B.2
<i>Mimulus shevockii</i>	Kelso Creek monkeyflower	1B.2
<i>Monardella linoides</i> subsp. <i>oblonga</i>	flaxleaf monardella	1B.3
<i>Navarretia peninsularis</i>	Baja navarretia	1B.2
<i>Navarretia setiloba</i>	Piute Mountains navarretia	1B.1
<i>Nemacladus secundiflorus</i> var. <i>robbinsii</i>	Robbins' nemacladus	1B.2
<i>Opuntia basilaris</i> var. <i>treleasei</i> **	Bakersfield cactus	1B.1
<i>Perideridia pringlei</i>	adobe yampah	4.3
<i>Streptanthus cordatus</i> var. <i>piutensis</i>	Piute Mountains jewelflower	1B.2
<i>Symphyotrichum defoliatum</i>	San Bernardino aster	1B.2
<i>Triteleia piutensis</i>	Piute Mountains triteleia	1B.1
<i>Viola pinetorum</i> subsp. <i>grisea</i>	grey leaved violet	1B.3

* California Threatened Species; ** Federal and California Endangered Species

Source: Zachary Principe, The Nature Conservancy, 2015.

the 20th centuries. First was John Charles Frémont, the “Pathfinder” explorer and amateur naturalist tutored by John Torrey and George Engelmann, who crossed the Tehachapis in 1844 collecting botanical specimens along the way. Adolphus Heermann was a naturalist on the



RIGHT: Joshua tree (*Yucca brevifolia*) woodland of the western Mojave Desert (foreground) converging with piñon (*Pinus monophylla*)–juniper (*Juniperus californicus*) woodlands on the eastern slopes of the southern Sierra Nevada. Photograph by Ian Shive.

1853 and 1855 railroad expeditions led by Robert S. Williamson, who was looking for routes from the San Joaquin Valley across the Sierra Nevada to the Colorado River. Williamson's survey team used a site in the southern San Joaquin Valley at Tejon Ranch as a base

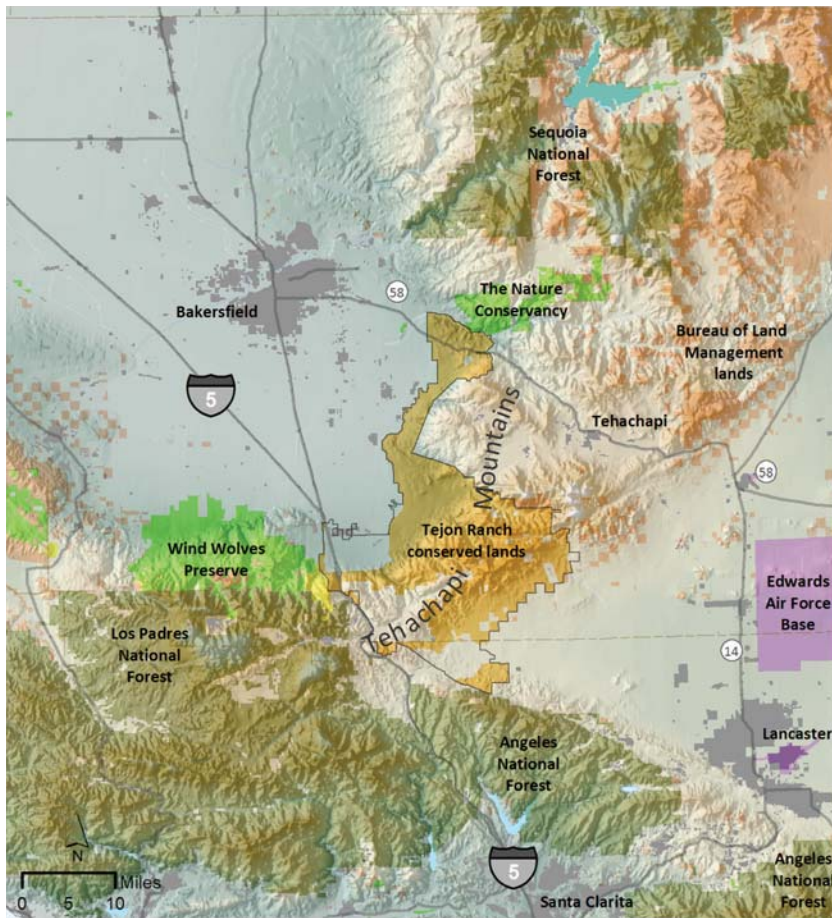
camp while surveying and collecting in the Tehachapi region, and a number of taxa such as Heermann's tarweed (*Holocarpha heermannii*) have been named in Heermann's honor.

Perhaps János (John) Xántus made the most extensive collections

in the region while stationed at Fort Tejon between 1857 and 1859, sending them to Spencer Baird at the Smithsonian Institution. Several taxa in the region have been named in Xántus' honor, including gunsight clarkia (*Clarkia xantiana*), Xántus' pincushion (*Chaenactis xantiana*), and



FIGURE 1: THE TEHACHAPI REGION SHOWING LOCATION OF THE TEHACHAPI MOUNTAINS.



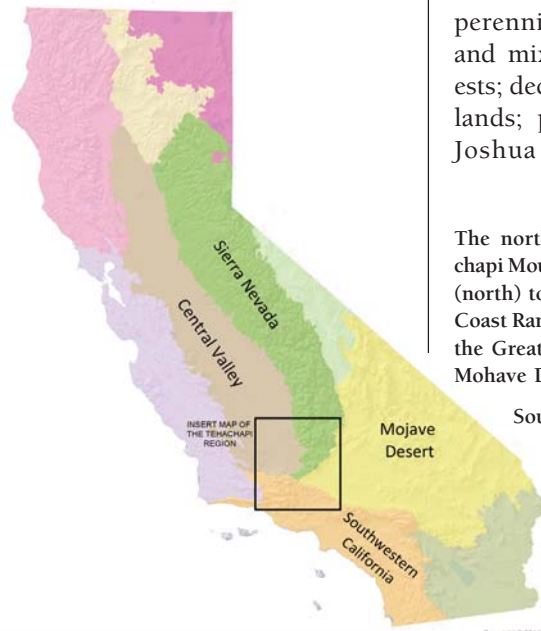
Conserved lands of the Tejon Ranch Conservancy and The Nature Conservancy now connect public and private *protected* lands to the north and south that, until 2008, were separated by a 50-mile gap of unprotected lands.

Source: Brian Cohen and Zachary Principe, The Nature Conservancy, 2015.

the genus of night lizards (*Xantusia*).

In the twentieth century, Joseph Grinnell made his base camp under an “immense white oak” (valley oak [*Quercus lobata*]) at the site of Fort Tejon in 1904 (Grinnell 1905), and W.L. Jepson collected as he crossed the Tehachapi Pass in 1935, noting that the “Tehachapis are wonderfully full of color.” In the 1950s and 1960s, Ernest C. Twisselmann, rancher, self-taught botanist, and author of *A Flora of Kern County*, explored and expanded our knowledge of the region’s flora and natural history. After a hiatus in scientific surveys, newly conserved private lands in the region are now being opened for exploration and discovery, evoking an earlier era in the region’s history.

FIGURE 2: FOUR CALIFORNIA FLORISTIC REGIONS THAT CONVERGE AT THE TEHACHAPI MOUNTAINS.



A CONFLUENCE OF FLORISTIC REGIONS

Geologically speaking, the Tehachapi Mountains are the southern tail of the Sierra Nevada, rotated into a northeast-southwest orientation by tectonic forces. Often considered the gateway to Southern California, the Tehachapi Mountains lie at the convergence of the Sierra Nevada, Central Valley, Coast Range, Transverse Ranges, and Mojave Desert. The area of their juxtaposition is characterized by a complex geology shaped by major fault systems, including the San Andreas and Garlock faults. Geologic processes have created a diverse terrain with broad elevation gradients, ranging from relatively flat alluvial fans at elevations near sea level in the San Joaquin Valley to steep, 8,000-foot mountain peaks, with an incredible variety of landforms and topography in between.

California’s floristic regions tend to align with the major mountain ranges and valleys of the state, and four floristic regions from the California and Desert Floristic Provinces—Sierra Nevada, Great Central Valley, Southwestern California, and Mojave Desert—converge at the Tehachapis (see statewide map on page 6). The Tehachapis encompass elements of each of these floristic regions, and thus support an impressive array of vegetation communities including annual and perennial grasslands; coniferous and mixed hardwood-conifer forests; deciduous and live oak woodlands; piñon-juniper woodlands; Joshua tree woodlands; desert

The northeast-southwest oriented Tehachapi Mountains connect the Sierra Nevada (north) to the Transverse (southeast) and Coast Range (southwest), while separating the Great Central Valley (west) from the Mohave Desert (east).

Source: Jepson Regions—University of California, Santa Barbara, California Gap Analysis.

scrubs; and coastal, desert, and montane chaparrals. This convergence of floristic regions results in some unique species assemblages. For example, valley oaks and Joshua trees (*Yucca brevifolia*) grow side-by-side in desert-draining canyons on the southeast side of the Tehachapis.

This varied and intact landscape not only supports amazing biological diversity, it is important for accommodating potential shifting plant and animal species distributions in response to climate change. Modeling conducted by The Nature Conservancy indicates that increased temperatures projected by 2065 will stress a majority of the characteristic species in the region. Unfragmented landscapes provide opportunities for species to move without barriers, and topographically heterogeneous landscapes support varied microhabitats that may provide climate refugia for some species as average conditions in the region warm.

The Tehachapi region supports a high diversity of rare and endemic species. For example, Vasek's clarkia (*Clarkia tembloriensis* subsp. *calientensis*), one of the rarest species in the region, is known from fewer than ten locations in a six-square-mile area (TOP). Temblor Range clarkia (*Clarkia tembloriensis* subsp. *tembloriensis*), another closely related endemic plant, overlaps with Vasek's clarkia at the east edge of its range (MIDDLE). Kern Canyon clarkia (*Clarkia xantiana* subsp. *parviflora*) has a distribution centered on Kern River to the north of the Vasek's clarkia's occurrences (BOTTOM). All photographs by Neal Kramer.

Thus, maintaining intact landscapes across broad elevational gradients is an important conservation strategy for this region.

For example, much of the distribution of black oak (*Quercus kelloggii*), a higher elevation species of the Tehachapis, is modeled to shrink as the climate warms until little to no habitat remains. However, recent research demonstrates that models of future climate conditions considering microclimates produced by complex terrain features allow for persistence of species as holdout populations in "islands" of suitable climate within a "sea" of unsuitable climate (Hannah et al. 2014). In the Tehachapis, black oaks are modeled to persist in small holdout populations in microclimate refugia, even in end-of-the-century, warmer climate scenarios.

AN EVOLUTIONARY HOTSPOT

Evolutionary biologists recognize the Tehachapis as a region of evolutionary divergence for many taxa. The slender salamanders (*Batrachoseps*) illustrate the fascinating evolutionary dynamics in this area (Jockusch et al. 2012). Over evolutionary time, slender salamander populations that were isolated from one another became increasingly distinct genetically, resulting in new species. As a result, the region supports one-third of all slender salamander species; the seven species in the Tehachapi region are endemic, including the California Threatened Tehachapi slender salamander (*Batrachoseps stebbinsi*).

Recent botanical surveys have found closely related plant taxa co-occurring in the Tehachapis, giving the sense of watching evolution at work. For example, on the Tejon Ranch, California poppy (*Eschscholzia californica*), Lemmon's poppy (*Eschscholzia lemmonii* subsp. *lemmonii*), and Tejon poppy (*Eschscholzia lemmonii* subsp. *kernensis*) grow



Many of the *Fritillaria* found in California have flowers with unique shapes and colors, and 80% are considered rare, including these two from the Tehachapi region. ABOVE WITH CLOSE-UP: greenhorn fritillary (*Fritillaria brandegeei*). Both photographs by Clyde Golden.

side-by-side, and Vasek's clarkia (*Clarkia tembloriensis* subsp. *calientensis*) and Temblor Range clarkia (*Clarkia tembloriensis* subsp. *tembloriensis*) occur within one mile of each other. The taxonomic richness of the region provides a natural laboratory to investigate both the products and process of evolution. A list of rare plant taxa found in the region is found in Table 1.

The Tehachapi region supports high levels of floristic diversity and many endemic or nearly endemic species, ranging from long-lived trees to annual wildflowers. Endemic species are those found only in a specific location and nowhere else on earth. Two locations exemplify the region's unique flora—the Piute Mountains in the north and the Tejon Hills in the southwest.

The Piute Mountains support the

BELOW, WITH CLOSE-UP: striped adobe lily (*Fritillaria striata*) found growing on clay soils throughout the region. Photographs by Clyde Golden (left) and Neal Kramer (right).





largest known stand of the narrow endemic Piute cypress (*Hesperocyparis nevadensis*). This relict species is closely related to the Arizona cypress (*Cupressus arizonica*) and Tecate cypress (*Hesperocyparis forbesii*). The Bodfish Grove of Piute cypress grows on clay soils derived from gabbro parent material. Two

other perennial, narrow endemic species in this area are Piute mountain jewel-flower (*Streptanthus cordatus* var. *piutensis*) and Piute buckwheat (*Eriogonum breddlovei* var. *breddlovei*). Kern County larkspur (*Delphinium purpusii*) is endemic to northern Kern and central Tulare counties, and the more widespread Piute Mountain navarretia (*Navarretia setiloba*), adobe (Pringle's) yampah (*Perideridia pringlei*), and Tracy's eriastrum (*Eriastrum tracyi*) also occur in the Piute Mountains.

The Tejon Hills lie at the southeastern edge of the San Joaquin Valley. The northern Tejon Hills comprised of alkaline sandy clay loams support populations of several special status plants including Tejon poppy, Comanche Point layia (*Layia leucopappa*), pale yellow layia (*Layia heterotricha*), cottony buckwheat

(*Eriogonum gossypinum*), alkali Mariposa lily (*Calochortus striatus*), and Bakersfield cactus (*Opuntia basilaris* var. *treleasei*). The heavy clay soils of the southern hills support Piute Mountain navarretia, small flowered morning glory (*Convolvulus simulans*), and striped adobe lily (*Fritillaria striata*).

CONSERVATION AND MANAGEMENT AT A LANDSCAPE SCALE

As early as 1930, H.L. Bauer identified the Tehachapi Mountains as the only montane linkage between the Sierra Nevada and Coast Range. However, before 2008, little of the Tehachapis were protected or in public ownership. The majority of these conserved lands were arrayed around the perimeter of the region with a 50-mile gap between protected and public lands. At that time, public and private protected lands were primarily administered by federal and state agencies and The Wildlands Conservancy.

Private land in the region is primarily large working cattle ranches threatened by conversion to rural residential and other land uses that could adversely affect sensitive habitat and wildlife. These large ranches provide excellent conservation opportunities. Conservation easements allow private landowners to continue to use their land for ranching but remove the threats of conversion or ranchette development. Well-managed ranching is often compatible with conservation goals in this region, and thus conservation easements can provide for protection of biodiversity while maintaining the rancher's livelihood—a win-win situation.

Since 2008, conservation in the Tehachapi region has advanced rapidly. The Tejon Ranch Conservation and Land Use Agreement was executed in 2008, resulting in conservation of almost 90% of the

TOP: Tehachapi buckwheat (*Eriogonum callistum*) is possibly the rarest species in the region with fewer than ten documented occurrences all located within a two-square-mile area. Photograph by Neal Kramer. • ABOVE LEFT: Calico monkeyflower (*Mimulus pictus*), a rare monkeyflower of the region, often found at the base of granitic rock outcrops in grasslands and blue oak (*Quercus douglasii*) woodlands. Photograph by Neal Kramer. • ABOVE RIGHT: In a landscape dominated by granitic soils, the rare Piute Mountain navarretia (*Navarretia setiloba*) is most often associated with clay soils scattered throughout the region. Photograph by John Game.



The convergence of floristic regions in the Tehachapis produces interesting mixtures of species: a canyon on the Mojave Desert-side of the Tehachapis supports Joshua trees (*Yucca brevifolia*), California juniper (*Juniperus californicus*), bigberry manzanita (*Arctostaphylos glauca*), and Valley oak (*Quercus lobata*). Photograph by Michael D. White.

270,000-acre Tejon Ranch. This groundbreaking agreement between the Tejon Ranch Company and a coalition of respected environmental resource organizations—Natural Resources Defense Council, Audubon California, Sierra Club, Endangered Habitats League, and Planning and Conservation League—protected 240,000 acres and created the Tejon Ranch Conservancy to hold conservation easements and steward the working conserved lands.

Soon after the Tejon Ranch agreement, The Nature Conservancy began working with ranchers to place conservation easements over working ranches to the north of Tejon, to date totaling 32,000 acres, and largely conserving a landscape-scale linkage between Tejon Ranch and protected land to the north, south, and

west. Today only a few gaps in this conserved linkage exist. However, the conserved lands do not adequately represent regional habitat diversity, so additional conservation and management are needed to ensure ecosystem function and connectivity for the full suite of species in the region. The conservation community and ranchers in the region are continuing to work together to promote a legacy that conserves the hidden treasures of this beautiful and unique landscape.

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THE FOUND LANDSCAPE: A PHOTOGRAPHIC ESSAY

by Suzanne Schettler

Nature often hides beautiful landscaping, but can we discover it? When planning a house site, a rural-residential property owner may clear the existing wild vegetation, build the house, and then create a landscaped setting for the home. Similarly, a purchaser of an existing home may clear the lot in order to landscape it. Sometimes this unintentionally removes aesthetic values that are available for free in the form of native plants already present on the site. It may not be necessary to clear the land and start from scratch to create a welcoming home site. The existing vegetation may con-

tain a beautiful landscape design waiting to be discovered, but simply hidden from view. This is “The Found Landscape.”

A Found Landscape can work at multiple scales. It may be as small as a single specimen or an area of a few hundred square feet that is a quiet retreat from the concerns of daily life. At a medium scale it may be an area immediately adjacent to a residence where vegetation is modified within a larger environment. Or it can address the whole parcel.

Some native plant habitats present especially good opportunities for finding a hidden landscape in the existing vegetation. Chapar-

als, mixed evergreen forests, and oak woodlands are particularly well suited to selective removal of existing vegetation in order to showcase the most beautiful features. This opens up views of the best elements, creates access to walk amid the retained vegetation, and makes possible an intimate relationship with one’s surroundings. The examples below are drawn from the Central West region of *The Jepson Manual*, 2nd edition, but the concept is applicable almost anywhere in the state.

The Found Landscape involves putting on protective gear and bush-whacking to find hidden beauty. The process is iterative and somewhat contemplative. The most desirable elements are likely to be identified early, and then the less desirable elements are gradually removed in subsequent passes. It is essential to stand back and assess the results along the way, perhaps on different days. It may take three or four careful passes, or even more, to prune away visual distractions and clutter by stages, keeping in mind that if too much is removed it cannot be put back. While this approach destroys some native vegetation, it also celebrates beautiful native vegetation that was previously unseen. The goal is to achieve the right aesthetic balance between the two.

The creation of a Found Landscape requires a poetic eye and patience. The process is something like learning the art of *ikebana*: students



ABOVE: Inspiration can be found in nature, sometimes created by accident. This Pajaro manzanita (*Arctostaphylos pajaroensis*), California Rare Plant Rank (CRPR) 1B.1, was bisected when a maintenance road was cut through chaparral, revealing the kind of structure that inspires bonsai artists. If planted from scratch, it would take decades to duplicate such character, not to mention the chartreuse lichen. All photographs by the author. • LEFT: Nature is an excellent designer of landscapes. This grouping, located near the previous photo, of a coast live oak (*Quercus agrifolia*) and three species of manzanita (*Arctostaphylos*), needs only a little tidying up to show off the interesting trunk and branches of the oak, to distinguish it from the anchoring understory, and to reveal a garden-worthy composition.

make floral arrangements, then the instructor comes by to evaluate the results and removes one or two elements to perfect the arrangement. It also resembles carving stone or wood, in that it is created by subtracting material that obscures a desired result.

The vegetation that is removed can be hauled off-site to a green waste or composting facility. It can be chipped for mulch or for path surfaces. Twiggy stuff can be left on the ground and trampled to decompose in place. Where safety permits, the cut material can be put in a burn pile. To minimize fungus problems, it is best to do the cutting during periods of dry weather.

Besides oaks and manzanitas, other species worth saving for their

variety of attractive features include toyon (*Heteromeles arbutifolia*), hazelnut (*Corylus cornuta* var. *californica*), coffeeberry (*Frangula californica*), gooseberries and currants (*Ribes* spp.), madrone (*Arbutus menziesii*), buckeye (*Aesculus californica*), and elderberry (*Sambucus* spp.). Among the taller *Ceanothus* species, the three-veined *Euceanotus* (one section of the genus) are mostly more graceful than the holly-leaved *Cerastes* (the other section). Some understory species may appear on their own in the first year or two, seemingly out of nowhere, after they receive increased sunlight. It is often preferable to wait and see what happens before adding additional plants. Good candidates to add include:

- manzanitas (*Arctostaphylos* spp.), low-growing
- wild ginger (*Asarum caudatum*)
- round-fruited sedge (*Carex globosa*)
- wild lilacs (*Ceanothus* spp.), low-growing
- native bulbs (*Calochortus* spp., *Fritillaria* spp., *Trillium* spp.)
- selected native annuals (clarkias, baby blue-eyes)

BEFORE (RIGHT): The owners of a property in the Santa Cruz Mountains walk by this site every day for their newspaper and mail. The foreground vegetation obscured a little oak grove until the dead bracken ferns and dead woody material were removed, and the canopy was “decluttered.” • AFTER (BELOW): The little oak grove was once an impenetrable thicket but is now a great place for children to play. This kind of natural setting stimulates imagination more than a lawn.





BEFORE (LEFT): A field technician is working to open up views into mixed evergreen forest. He dubbed this work “Wildland Zen Gardening” for its contemplative aspect. The dominant trees are redwoods (*Sequoia sempervirens*), Douglas firs (*Pseudotsuga douglasii*), tanoaks (*Lithocarpus densiflora*), and interior live oak (*Quercus wislizeni*). • AFTER (RIGHT): At the end of the work day, one can see into the forest. The view now has depth. The light-barked leaning tanoak and the redwood on the right are reference points for comparison with the previous photo.

- yerba buena (*Clinopodium douglasii*)
- bleeding hearts (*Dicentra* spp.)
- wild strawberry (*Fragaria vesca*)
- native irises (*Iris* spp.)
- June grass (*Koeleria macrantha*)
- bush monkeyflowers (*Mimulus* spp.)
- skullcap (*Scutellaria* spp.)
- modesty (*Whipplea modesta*)

In a conventional landscape, the larger woody plants are positioned first and each tree and shrub is expected to be a perfect specimen. In a Found Landscape, the best trees and shrubs are typically identified first, but retaining some imperfect specimens provides coherence and continuity of design to mimic the beauty and tranquility of nature.

Manzanitas in particular offer a wealth of aesthetic opportunity in chaparral and in gardens. They come in all sizes from perfectly flat ground-covers to small trees. They have good evergreen foliage, flowers that sustain hummingbirds in late winter, and richly colored statuesque trunks. Trunks are important because they are in scale with our human line of



ABOVE: *Arctostaphylos densiflora* ‘Howard McMinn’ is a natural hybrid cultivar that exemplifies the attractive foliage and flowers of manzanitas found in the wild. • RIGHT: *Arctostaphylos manzanita* ‘Dr. Hurd’, a tall manzanita selection, at an artist’s studio near Santa Cruz. It was planted by a previous owner and then retained by the new owner, using the principle of The Found Landscape.





This mature oak woodland contains superb makings for a Found Landscape.

sight, which tends to focus from knee-height to a short distance overhead.

Interesting trunks are also characteristic of oak woodlands, which contain rich landscape potential. The understory beneath the multi-trunked coast live oaks (*Quercus agrifolia*) at the site shown above has not been colonized by invasive species and comprises a number of native species. The first five of these are desirable in a garden context:

- native honeysuckle (*Lonicera hispidula*)
- round-fruited sedge
- bush monkeyflower

- native iris
- yerba buena
- native blackberry (*Rubus ursinus*)
- bracken fern (*Pteridium aquilinum* var. *pubescens*)
- Douglas fir (*Pseudotsuga menziesii*)
- poison oak (*Toxicodendron diversilobum*)

There is a wide spectrum of potential approaches to oak woodland sites like this, ranging from light manipulation to serious gardening. The simplest approach would be to use hand clippers and a rake to clear a path, possibly a loop trail that makes for a leisurely stroll. Yerba buena can be deliberately left on the

path where footfalls will occasionally release its minty fragrance. A more intensive effort would remove all sapling firs, dead woody material, blackberry, and dead bracken fern. Poison oak could be removed throughout, or retained in some locations to provide wildlife value and fall color. Alternatively, a dedicated native plant gardener might increase the best understory plants already present by propagating them from the immediate site. A bench or gazebo could be added to create a focal point.

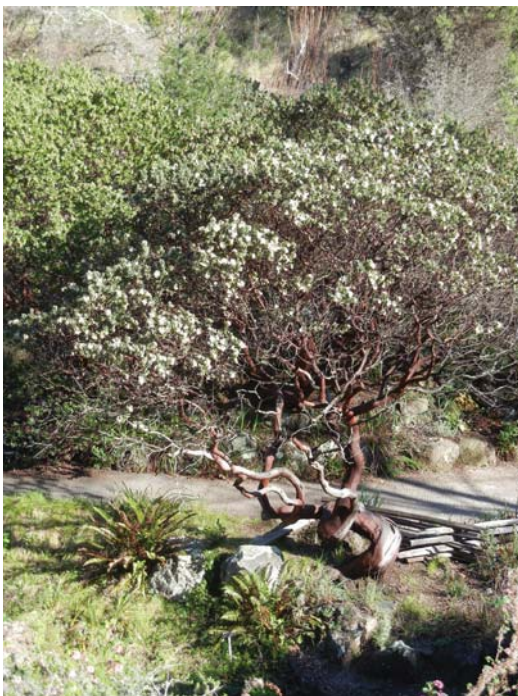
A Found Landscape is not the same thing as a shaded fuel break. The retained canopy may vary from



LEFT: At an office complex in sensitive habitat near Monterey, developers were required to preserve several existing native species outside the immediate building envelopes. The result is a Found Landscape, without the need for additional planting. Chamise (*Ade-nostoma fasciculatum*, center), common in much of California, often has a rangy growth habit but takes pruning well and can even be sheared. The lighter green shrubs are sandmat manzanita (*Arctostaphylos pumila*), CRPR 1B.2.

efits of The Found Landscape. It reduces the work and cost to establish a new planting. It conserves water, reduces soil disturbance and erosion, and minimizes disruption of wildlife habitat. It conserves not just the local native species but also the local gene pool and its site-specific adaptations—which can vary from place to place within a given species and even within a given watershed. It can contribute fire resistance when horizontal and vertical gaps are strategically located in the retained vegetation. It eliminates the initial raw look of an all-new landscape, and creates a settled appearance by retaining some mature elements. Perhaps best of all, it is a way for humans to integrate into and become at home within our natural surroundings.

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one spot to another, depending on the distribution of the most pleasing elements, and may average 50% or more overall. A shaded fuel break is more heavily thinned and may not necessarily be attractive. Although it seems intuitive that a shaded fuel break should be fire-resistant, there is disagreement as to whether it actually slows the progress of a wildfire. Some fire agencies claim the primary purpose of a shaded fuel break is to provide access to fight a fire. In either case, the purpose of The Found Landscape is not so much fire resistance, or even forest management. Its primary goal is aesthetic.

There are numerous ben-

ABOVE: Nature or horticulture? This could be a trail through a nature preserve or a path through the Tilden Regional Parks Botanic Garden in Berkeley. Shown here are Kings Mountain manzanita (*Arctostaphylos regismontana*), CRPR 1B.2, and western sword fern (*Polystichum munitum*).

BELOW: The goal of a shaded fuel break is usually fuel reduction rather than aesthetics.



LESSONS LEARNED IN HABITAT RESTORATION FOR THE RIPARIAN BRUSH RABBIT

by Julie Rentner

The ongoing recovery of riparian brush rabbit habitat along the Lower San Joaquin River is a model of integration of wildlife and plant restoration ecology. A highly functioning public-private partnership has been able to rapidly and successfully re-establish a new population of this endangered species across thousands of acres of new habitat in its historic range. This partnership has explicitly looked at the connections between the factors limiting the recovery of this rabbit and the factors limiting the recovery of its habitat, which consists of riparian shrublands dominated by native blackberry and roses. The restored habitat has proven to be resilient to the disturbances it will face into the future, including fires and floods.

The San Joaquin Valley once supported vast and complex wetland habitat types including diverse riparian woodlands. Woodlands ranged from mixed willow-cottonwood stands, to stately valley oak groves laden with dangling grape vines, to vigorous shrublands dominated by native blackberry and roses. These woodlands supported complex wildlife communities including salmon and steelhead trout, Neotropical migratory songbirds, antelope, deer, coyote, and bear. Just as many garden flowers develop seasonally through bloom, seed-set, and senescence, and over time require replanting, pruning, and training, wild riparian forest communities also change both seasonally and over the years.

In the past, springtime in the San Joaquin Valley has brought warm, slow flooding as a result of snowmelt from the Sierra Nevada, and rapid greening of the landscape.



Riparian brush rabbits bred in captivity and released into restored and remnant habitat areas are equipped with unique identifiers on eartags, and radio collars to facilitate location and identification during bi-annual trapping. Photograph courtesy of the Endangered Species Recovery Program at California State University, Stanislaus.

Historically, overbank inundation was the norm. This kept most of the San Joaquin Valley impassable throughout much of the year and supplied perennial species with deep waterings. As summer progressed, channels and sloughs would dry up, and late season vegetation and pioneering species would encroach in channels and banks. This drying phenomenon still occurs today in riparian forest remnants.

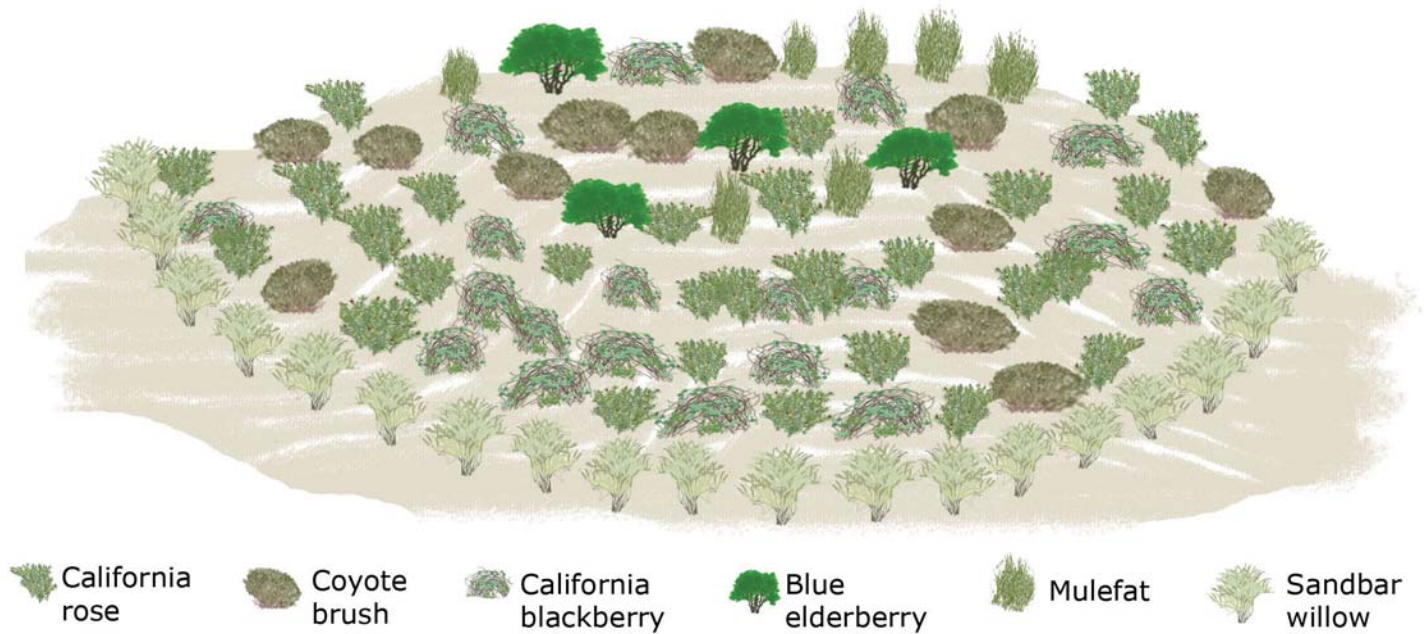
The effect of flooding on the phenology of native plants is so distinct that Oregon ash (*Fraxinus velutina*) from the Sacramento River Valley produces leaves on average one month before San Joaquin Valley ecotypes, presumably due to the longer time required for southern

Sierra snowmelt to drain to the valley floor. When drought renders sloughs and channels too dry for aquatic communities, terrestrial wildlife and plants proliferate. Extended wet periods reclaim those areas for aquatic species.

Just like the plants adapted to the drying and wetting dynamics of the San Joaquin River, so did the wildlife. Riparian bird and fish populations adopted a migratory strategy: they simply move into the area only when the season is right. Small mammals adopted a population survival strategy involving high fecundity: they simply reproduce abundantly only when conditions are good.

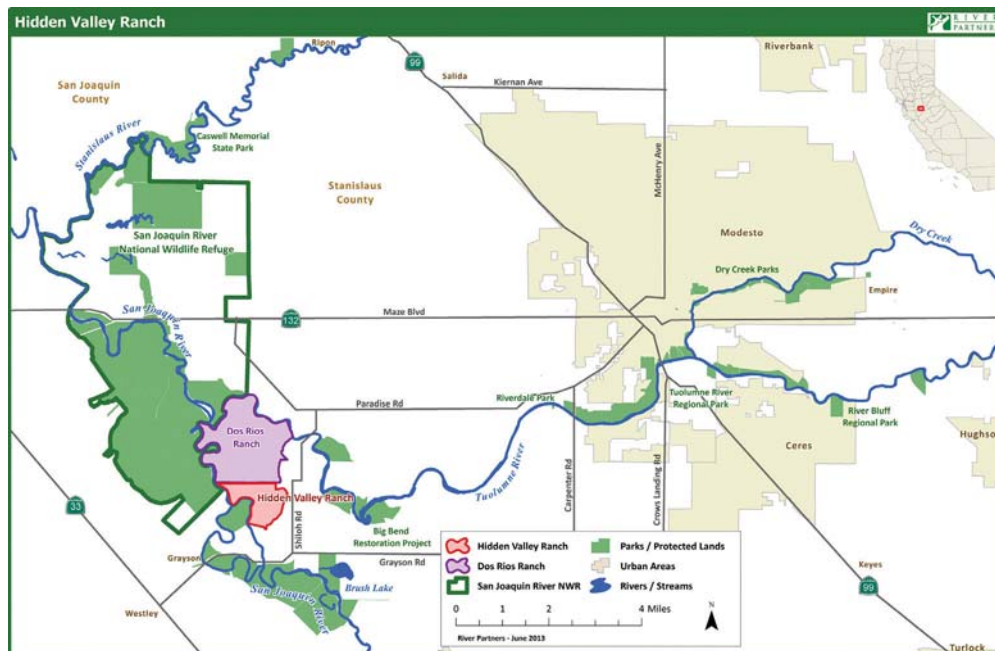
As humans settled the San Joaquin Valley we built dams, drains,

FIGURE 1: FLOOD REFUGIA OR "BUNNY MOUNDS."



Following a flood in 2006, project planners went back to the drawing boards and designed "bunny mounds" to protect the rabbits from predators in case of future flood events. The mounds were planted with a variety of native shrubs including a skirt of sandbar willow (*Salix exigua*) that serves as green rip-rap, reinforcing the mound base from erosion. Planting densities range from 227 to 845 plants per acre depending on target habitat conditions. Image courtesy of River Partners.

FIGURE 2. HABITAT RESTORATION AREAS IN STANISLAUS COUNTY.



Habitat restoration is focused on lands depicted in green at the San Joaquin River National Wildlife Refuge, as well as lands depicted in red and purple at Dos Rios Ranch and the adjacent Hidden Valley Ranch totaling over 5,000 acres at the confluence of the San Joaquin and Tuolumne Rivers.

Source: River Partners, 2014.

levees, and highways. We drained wetland complexes and severely altered the frequency and extent of flooding. We also cleared the riparian forests and shrublands along the river's edge, even resorting to dynamite to remove the massive root balls of ancient valley oaks. What stands in their place today are dairies, orchards, and occasionally a small city perched precariously next to the levee or drain. When the human-made river system of the San Joaquin Valley is overwhelmed, the resulting water damages exceed hundreds of millions of dollars. These constructed places are tenuously reliant upon aging, publicly maintained infrastructure for both flood safety (via dams and levees) and continued agricultural productivity (via reservoirs and canals).

In early January 1997 a warm storm dropped 30 inches of rain at elevations up to 11,000 feet on the southern Sierra Nevada while it was already laden with higher than average snow. Over the course of a few

days, this rain-on-snow event created runoff conditions that quickly overtopped the dams and punched holes in carefully engineered levees as if they were small mounds in a sandbox. Water stretched for miles from the foothills of the Sierras to the Coast Range along the lower San Joaquin River. It inundated vast expanses of farmlands and the straggly remnants of our native riverbank plant communities, drowning out their wildlife populations.

Researchers that had been carefully documenting the extent and abundance of a rare riparian rabbit for several years feared that these floods had finally driven the species to extinction. The riparian brush rabbit (RBR) (*Sylvilagus bachmani riparius*) once inhabited riparian woodlands from Stockton to Fresno, but due to vegetation clearing was now only known from one small population at Caswell Memorial State Park near Modesto. This species and another also found in the same area, the riparian woodrat (RW) (*Neotoma fuscipes riparia*), were proposed for listing in 1997, and listed as federally endangered in 2000. Thankfully the 1997 floods did not completely destroy the rabbit and woodrat populations, and a few scattered populations have been found since then.

If you've ever heard the phrase, "Never let a good disaster go to waste," this disaster proved a prime example. It was the birth of a successful recovery effort, successful because it linked agency and private sector partners; scientists and farmers; and wildlife recovery and horticultural restoration specialists in an adaptive management framework. Since 1997 this collaborative group, the Riparian Mammals Technical Group (see Table 1) has been working towards the recovery of endangered wildlife species through land acquisition and protection, habitat restoration, research, captive breeding, reintroduction, and integrated flood management. In 2002, the larg-

TABLE 1. PARTNERS IN THE RECOVERY OF THE RIPARIAN BRUSH RABBIT.

US Fish and Wildlife Service
 USDA Natural Resources Conservation Service
 US Bureau of Reclamation
 US Army Corps of Engineers
 California Department of Fish and Wildlife
 California Department of Water Resources
 California Wildlife Conservation Board
 Central Valley Regional Water Quality Control Board
 San Francisco Public Utilities Commission
 CSU Stanislaus Endangered Species Recovery Program
 River Partners
 Point Blue Conservation Science
 Stanislaus Audubon Society
 Tuolumne River Trust
 American Rivers
 Natural Resources Defense Council
 Natural Heritage Institute
 National Fish and Wildlife Foundation

Source: River Partners, 2014.

est contiguous riparian habitat restoration initiative in California was launched at the San Joaquin River National Wildlife Refuge, and in 2012 and 2013 more than 2,000 acres were purchased and permanently protected at Dos Rios Ranch in Stanislaus County, primarily to support recovery of RBR in coordination with improved flood management.

When the restoration began there were so few remaining stands of valley riparian forest that we lacked both solid reference sites and sufficient suitable plant material needed to propagate native trees and shrubs for this large-scale project. Fremont's cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), and Goodding's black willow (*Salix gooddingii*) serve as the megaflores for valley riparian forests. However, the vegetative complexity of the understory (shrubs and herbs such as California blackberry (*Rubus ursinus*)

and wild rose (*Rosa californica*), nettles (*Urtica dioica*, *Stachys ajugoides*), sedges (*Carex* spp.), mugwort (*Artemisia douglasiana*), and Great Valley gumplant (*Grindelia camporum*) may be even more important to wildlife recovery than those iconic tree species.

Restoration ecologists from River Partners, the US Fish and Wildlife Service, CSU Stanislaus' Endangered Species Recovery Program, and other agencies and organizations met to discuss habitat needs for the rabbit. In particular the team focused on the logistics of horticultural restoration to support the rabbit while considering the effects of today's dams, levees, canals, and diversions on the natural riverine landscape.

From 2002 to 2006, over 800 acres of habitat restoration was completed at the Refuge, including the cultivation of 22 native plant species in a variety of patterns designed



This series of images (CLOCKWISE FROM TOP LEFT) shows a restoration project from planting through three growing seasons. Seasonal variation in vegetation is evident in the bottom right image (springtime) and bottom left image (autumn). Photographs courtesy of River Partners.

to attract target wildlife. (See Table 2 for a list of plants used in the restoration project.) These restored forests are sometimes affectionately called “Franken-forests” because nowhere along the San Joaquin River today would you find such native

floral diversity in one location. We planted slow-growing valley oaks next to fast-growing cottonwoods and willows to provide forest cover today and for the next 100 years. We planted coyote brush (*Baccharis pilularis*) next to buttonbush (*Cepha-*

lanthus occidentalis) to provide continuous shrub cover during periods of drought and floods.

After two growing seasons caring for the trees and shrubs, helping them to develop deep root systems through flood irrigation, and per-



forming aggressive weed control around their bases, we seeded a native understory of creeping wild rye (*Elymus triticoides*), mugwort, and gumplant. These perennial species are abundant on undisturbed floodplains of the San Joaquin River, and grow fast enough to outcompete annual invaders.

In 2006 as an additional 300

acres were being prepared for restoration, a late spring flood event once again broke the levees and tested our restoration. Floodwaters persisted for over four months in some locations, helping to sort out the “Franken-forests” into more-natural mosaicked native plant communities based on each individual plant species’ tolerance to flooding. For example, in localized high-ground areas, flood-sensitive elderberries (*Sambucus nigra* ssp. *caerulea*) persisted and provided cover from predation for the rabbit and other ground-dwelling wildlife. In low-lying areas that were deeply flooded, the elderberries did not survive. In contrast, sandbar willow (*Salix exigua*) and buttonbush thrived and spread in localized wet areas. In dry years since then, we have seen a death of willows and buttonbush in higher elevation areas due to drought stress. Such sorting has made the restoration a mosaic of plant communities that are well-adapted to current on-site conditions.

At first, we were not able to restore vegetation on levees, which are maintained free of vegetation due to regulations of the US Army Corps of Engineers (USACE). In the flood of 2006, snakes, squirrels, foxes, and rabbits fleeing the rising floodwaters were stranded on levees and were easy pickings for the circling hawks and owls. Our restoration collaborative quickly realized that in order to recover a resilient rabbit population, additional work was needed to provide vegetated flood refugia for rabbits and other prey species. Following this 2006 flood event, we went to work fundraising and designing specific flood refugia restoration projects.

The Restoration Plan for the 300 prepared and flooded acres was changed to include excavation of wetland swales to support migratory waterfowl, and piling the excavated material into flood refugia or “bunny mounds” across the landscape (Figure 1). A topographic sur-

vey was performed showing those areas most appropriate for earth-moving. Bunny mounds were then planted with drought and flood tolerant shrubs and herbs, and protected from erosion by a dense planting of sandbar willow around the base—a sort of “green rip-rap.” With collaboration from the USACE and California Department of Water Resources, the previously denuded levee slopes were planted with woody shrubs on drip irrigation. In total, over 30 bunny mounds and 8 miles of levee slopes across more than 3,000 acres of SJR floodplains were vegetated with plants specifically targeting RBR and RW.

Restoration has continued to proceed in phases over the years as funding and permits allow. One benefit of restoration phasing was that our team was afforded the opportunity to analyze the performance of restoration actions and adapt the plan for the next phase to improve restoration success (our version of “adaptive management”). For example, in 2008 a fire swept across the Refuge, burning over 400 acres of previously restored and remnant riparian forests and shrublands. Our team was able to observe the response of the restored and remnant plant communities, altering the planting plans as a result of these observations.

We also learned over time about other wildlife species using the restoration areas. In 2006 and 2007, Least Bell’s Vireo (once the most abundant riparian songbird in the San Joaquin Valley, now near extinction and federally endangered) nested in our “Franken-forests.” We observed the nesting and replicated those conditions in other locations across the project area.

In total, over \$50 million in fee-title and easement acquisition and habitat restoration funding was garnered from more than a dozen different sources. Over 5,300 acres were protected for riparian forest restoration specifically targeting RBR, RW,

TABLE 2. PLANTS USED IN THE RESTORATION PROJECT.

High-Ground Flood Refugia	Floodplains	Bottomland Forests
Trees		
Arroyo willow	Valley oak	Valley oak
Box elder	Fremont's cottonwood	Fremont's cottonwood
	Goodding's black willow	Goodding's black willow
	Arroyo willow	Arroyo willow
	Box elder	Box elder
		Oregon ash
Shrubs		
Coyote brush	Coyote brush	Buttonbush
Mulefat	Buttonbush	Sandbar willow
California blackberry	California blackberry	California blackberry
California rose	California rose	California rose
Mexican elderberry	Golden currant	Golden currant
Golden currant		
Herbs and Grasses		
Mugwort	Mugwort	Mugwort
Great Valley gumplant	Great Valley gumplant	Great Valley gumplant
Creeping wild rye	Creeping wild rye	Creeping wild rye
Evening primrose	Evening primrose	Evening primrose
Spanish clover	Stinging nettle	Hedge nettle
Basket sedge	Telegraph weed	Stinging nettle
Salt grass	Spanish clover	Dogbane

Source: River Partners, 2014.



native fish, waterfowl, and Neotropical migratory songbirds. Phased restoration continues today, and is expected to be completed in 2025. By then this project will have increased the available habitat for RBR by more than 30 times its 1997 extent, and the restored habitat will protect the population from nearing extinction in inevitable future flood events.

Both vegetation and rabbit monitoring have documented our success. Survival of plantings never dropped below 80% after three years of growth, and vegetative cover continued to meet or beat expectations. The restored vegetation was also aggressive enough to outcompete invaders. Over time we have seen natural recruitment of native vegetation, showing that once the plant communities are established, they



Flooding along the San Joaquin River in March 2011 inundated restored habitat at the San Joaquin River National Wildlife Refuge and agricultural fields at Dos Rios Ranch in Stanislaus County. Photograph courtesy of River Partners.

are well adapted to the site. Although encouraging, plant survival and cover is only part of the story for this project to be deemed successful.

Starting in 2003, radio collars were deployed to monitor rabbits that had been bred in captivity and released into the restored areas. Through this monitoring, we found that the RBR preferred using the bunny mounds and other flood refugia to restored floodplains, even during dry years. Radio-collared rabbits also helped us to prioritize land acquisitions. Seasonal rabbit trapping showed us that the restoration was working, yielding higher frequency of trapping each year that the restoration matured.

Rising floodwaters in 2011 pro-

vided the real test of restoration success. While not a large flood year for most of the state, spring of 2011 brought enough snowmelt to the Lower San Joaquin River to overwhelm the flood control levees again and inundate the Refuge and Caswell Memorial State Park. This time vegetated flood refugia were available across the landscape for rabbits fleeing the rising waters. In fact, so many rabbits found their way to the flood refugia that they caused a dramatic denuding of the carefully restored vegetation during their stay. Concerned wildlife managers boated out with provisions for the stranded bunnies only to find some bunny mounds also hosting coyote, foxes, and weasels (predators of RBR).

Following the 2011 flood, RBR

trapping across the Refuge showed that not only had the bunny mounds preserved a small portion of the RBR population to serve as the founders for a repopulation, but that just two months after floodwaters had receded, RBR were venturing back out onto the floodplain. Today we describe the Refuge as a restored population of RBR. While we still expect flooding to cause periodic damage to the vegetation and the wildlife, we know that the plants and the bunnies are resilient and will now be able to weather such disturbances into the future.

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MISSION MANZANITA, QUEEN OF THE ELFIN FOREST: IS THE SPECIES IN DECLINE?

by Lee Gordon, Richard W. Halsey, Jon E. Keeley, Jon P. Rebman, Delbert Wiens, and Arne Johanson

Mission manzanitas (*Xylococcus bicolor*) have worried some botanists for years because there has been no reliable evidence that the species has been successfully reproducing. The species is common now, but are populations dwindling? This was on our minds in late January 2015 as we walked a trail to visit one of the largest and most beautiful mission manzanita specimens in San Diego County.

This tree stands 20 feet tall above Peñasquitos Canyon at the entrance to a mission manzanita elfin forest. This miniature forest extends hundreds of feet upslope to the east and west. The climb to get there is difficult, but the effort is well worth it.

Stands of mixed chaparral usually form impenetrable tangles of branches and leaves, but old-growth stands of mission manzanita monocultures are different. They hold their foliage high above the ground. Under the canopy, the forest opens up with vistas of smooth, slender, reddish-brown stems. You are inside an enclosed room, shut off from the world. This is a place to linger, to ponder, and to reflect. The plants' stems are the columns of an ancient cathedral which support the green leaves that form the roof above. A redwood forest creates this on a grand scale, while a mission manzanita forest does so in miniature.

Mission manzanitas, a prominent species in San Diego chaparral, deserve to be considered the queen of the elfin forest because of their ex-



Beneath the foliage, mission manzanita forests create a calm space for contemplative seclusion. All photographs by Lee Gordon unless otherwise noted.

ceptional beauty. Inside a mission manzanita forest you experience the halls of the elfin queen.

MISSION MANZANITA SPECIES AND HABITAT

Mission manzanitas are one of many members of the Heath family (Ericaceae) found in San Diego County. They were at first classified as true manzanitas (*Arctostaphylos*),

but now they have their own genus, *Xylococcus*. Mission manzanitas have smooth trunks like most true manzanitas, but their thin bark has a browner tint. The leaves have a shiny, deep-green top and a whitish matte underside, hence the species' name, *bicolor*. Another member of Ericaceae in San Diego County, summer holly (*Comarostaphylis diversifolia*), looks similar but has a rough trunk, serrated leaves, and red berries. The

FACING PAGE: A tall mission manzanita stands at the entry to a forest of mission manzanita in Los Peñasquitos Canyon, San Diego. Photograph by Steve Miller.

HOW TO GROW MISSION MANZANITAS FROM SEED

Mission manzanitas have been notoriously difficult to propagate from seed. Nearly all nursery plants are grown from cuttings, but plants grown from seeds better preserve genetic diversity. However, it turns out to be easy to get mission manzanitas to germinate. All they need is moisture and a period of cooler temperatures. The following is a short summary, and you can find more in Gordon (2015).

The first step is to remove the thin, fibrous, gooey outer layer of the fruit from the stone inside. If you put the fruits into water in a blender, it will take several minutes at high speed to clean the stones of this outer material. High speed blending leaves stones less than a year old intact. Sharp wire cutters can then be used to break the stones apart to release seeds. Because stones are brittle, around half the seeds can be released undamaged and fertile.

Seeds that are damaged in this process are susceptible to fungus and other pathogens, which can travel through a batch and kill them all. You can reduce this by soaking them for a day in a solution of 0.3% hydrogen peroxide and copper soap. The water soak also accelerates germination. Seeds germinate best when stratified at 55°F. They will not germinate at room temperature. You can stratify the seeds in small refrigerators by packing the lower half of small plastic food storage containers with fine, moist potting soil and laying the seeds on top of the soil. About half typically germinate in less than two weeks.

When radicles appear, move the seeds directly to pots containing a commercial potting soil mixed with additional perlite to improve drainage. At this point they are delicate and they need shade and periodic mist. In a few weeks cotyledons rise and expand inside fibrous sheaths. When the sheaths fall off, you can remove them from the mist, but they still need some time in the shade as their roots develop.

This method is slow and laborious, and not well suited for nurseries. We need to find a less labor intensive procedure that triggers uniform germination. The stone creates a nearly impenetrable barrier for water. A valuable improvement will come if we can find a physical or chemical procedure that enables water to penetrate.

—Lee Gordon

Mission manzanita propagation from stone to seedling. • TOP PHOTO, CLOCKWISE FROM TOP LEFT, stone and seed: A whole stone with the thin layer of fruit removed; stone broken longitudinally to reveal five seeds, two of which remain inside; a seed; a piece of stone showing the seed cavity. The grid is 0.1 inch. • OTHER PHOTOS, TOP TO BOTTOM: After 13 days of stratification, a radicle begins to protrude. • In a few weeks, the cotyledons begin to eject a fibrous sheath. • Real leaves grow above the cotyledons after about 6 weeks. • This seedling germinated in May 2014 and by February 2015 had become nine inches tall.



rare Baja California bird-bush (*Ornithostaphylos oppositifolia*) is a third in-

teresting member of the Ericaceae in the county. The species is restricted to one mesa and slope area just north

of the California-Baja border, although it is more common further south. It differs from the mission manzanita in that it has a whitish bark and smaller white flowers.

Like other Ericaceae, mission manzanitas produce white to pinkish urn-shaped flowers that make quite a show when they are in full bloom. Their berry-like fruits are drupes, a fruit with seeds inside a hard stone. Mission manzanita drupes are roughly 1/4" in diameter, red/green in the spring and then brown by the fall. The drupes tend to hang on the plant until the following year. The name *Xylococcus* comes from the Greek words "wood berry" which refers to the hard stones that can hold up to five seeds each.

Mission manzanitas are most common in the western half of San Diego County, with isolated populations in Los Angeles and Riverside Counties and Catalina Island. Their range also extends into northwestern Baja California from Tijuana south to El Rosario and on Cedros Island in the Pacific. They also occur on sky islands farther south on the peninsula. The isolated populations suggest the species was once more widespread. Distribution maps also show them extending into Tulare County, but after a careful investigation, Keeley concluded that this was likely the result of misidentification. Individual shrubs grow best on north slopes, which are cool and moist during the growing season, but they can also be found on hotter, flatter exposures. They grow in both sandy and clay soils as long as there is adequate drainage.

Mission manzanitas grow to 20 feet tall, but most are less than 10 feet. Their wood is tough and hard, decaying slowly, so it is common to find decades-old dead branches on live specimens. Mission manzanitas resprout from an underground lignotuber or burl after the above ground portion of the plants have been burned and killed during high-intensity crown fires that are char-

acteristic of the chaparral ecosystem. The magnificent tree we found in Peñasquitos Canyon was able to attain its size because the area has been free of fire for at least 80 years. It is unusual for chaparral populations to go this long without fire given the increasing frequency of human-caused ignitions.

ARE MISSION MANZANITA POPULATIONS IN DECLINE?

Mission manzanitas have long puzzled scientists, because although they produce abundant fruit, botanists and chaparral ecologists have reported never finding seedlings in the field (e.g., Keeley and Davis 2007). In addition, seeds are difficult to germinate with traditional propagation techniques. Hence, as is the case with the propagation of many native shrubs, nursery plants are nearly all grown from cuttings.

Intrigued by the mystery, in 2004 Halsey began searching for mission manzanita seedlings throughout San Diego County by establishing study quadrats in stands on Cowles and Bernardo Mountains and along Del Dios Highway near Lake Hodges. He also conducted post-fire surveys after the 2007 Witch Creek Fire, but found no seedlings. This confirmed previous observations by others, in-



LEFT: The delicate-looking, bell-shaped flowers of mission manzanita hang in small clusters. Photograph by Steve Miller. RIGHT: Red-green berry-like fruit are from January 2015, and brown fruit are a year older. Photograph by Lee Gordon.

cluding Keeley and P. Zedler (personal communication, 2014).

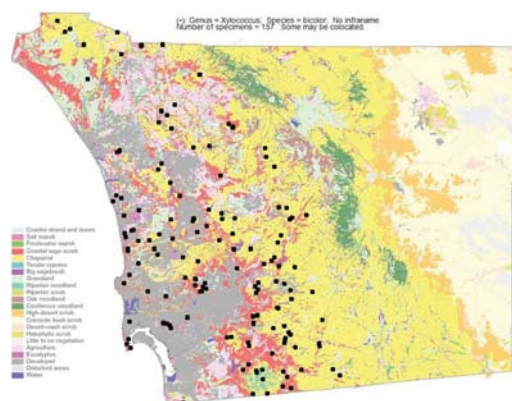
Wiens, et al. (2012) observed that each chaparral fire kills a small proportion of the red shanks (*Adenostoma sparsifolium*) population, but red shanks do not appear to reproduce as a result of fires. Human-caused ignitions have greatly increased the frequency of chaparral fires, and red shank's natural reproduction rates has been insufficient to sustain its population in the face of this increase. The same process could lead to a slow decline in mission manzanitas. Wiens found red shank's low reproduction rates to be associated with a high rate of seed abortion (about 97%) and the inability of the rare seedlings to survive. In 2011, Wiens investigated the viability of mission manzanita seeds from five San Diego County sites. He found that 61% of the stones had at least one seed filled with live endosperm. In contrast to red shanks, mission manzanitas appear to have no problem regarding seed viability.

Another hypothesis suggested that the seeds needed to be scarified by passing through the gut of the now extinct grizzly bear. Or alternatively, the seeds needed to be released from the hard stones by the bears' strong teeth during mastication (Halsey interview by McFee, 2008). Of course considering the antiquity of this plant there are a slew of potential seed dispersers that are now extinct that could have played a similar role.

Field observations offered another possibility—the plants may depend on vegetative reproduction through root sprouts. Halsey found one such sprout on a lateral root approximately six feet from a mother plant in Mission Trails Regional Park, San Diego.

The search for the answer to the mission manzanita mystery accelerated after a fortuitous discovery during the May 2008 Bioblitz in San Diego. The Bioblitz is a 24-hour biological survey by volunteers to count as many species as possible in a particular area. During the event, Rebman found two possible mission manzanita saplings in Florida Canyon, an open space area near the San Diego Natural

FIGURE 1. DISTRIBUTION MAP OF MISSION MANZANITAS, SAN DIEGO COUNTY, 2015.



Source: This map is based on specimens collected and deposited in the San Diego Natural History Museum Herbarium as part of the San Diego County Plant Atlas project: sdplantatlas.org.

History Museum in Balboa Park. He brought Halsey to the site where they found another possible sapling and 53 seedlings growing in the leafy litter under a medium sized mission manzanita shrub. As they continued their search, a few more seedlings were found under other manzanitas, but at lower numbers than under the first plant. A survey

the following February found none of the 2008 seedlings, but did find a smaller number of new ones. None of these survived a full year.

EXCAVATION OF A YOUNG PLANT

Mission manzanitas are common in the Artesia Creek watershed

southwest of Lake Hodges in San Diego County, where they grow in consolidated clay sandstone with hot sunny exposures. Many of the plants there are small, less than a foot tall, and have no obvious burl. Gordon, Halsey, and Johanson wondered what the roots of a small mission manzanita would look like. They found a small, desiccated, scruffy

MISSION MANZANITAS IN LANDSCAPES

To learn about mission manzanitas in garden landscapes, we contacted some well-known native plant landscape designers including Clayton Tschudy (horticulturalist at the Water Conservation Garden at Cuyamaca College, El Cajon), Greg Rubin (California's Own Native Landscape, Escondido), Scott Jones (Plants Comprehensive, San Diego), and Wes Hudson (North Park Native Plants, San Diego). Designers have mixed feelings about mission manzanitas in their designs because they grow slowly and are finicky about the soil they grow in. If they are not cared for properly, some may consider them less than attractive. Rubin, Hudson, and Jones use them in their designs,

but they are all careful about the sites they select, how they are planted, and how they are watered (see Rubin and Warren 2013).

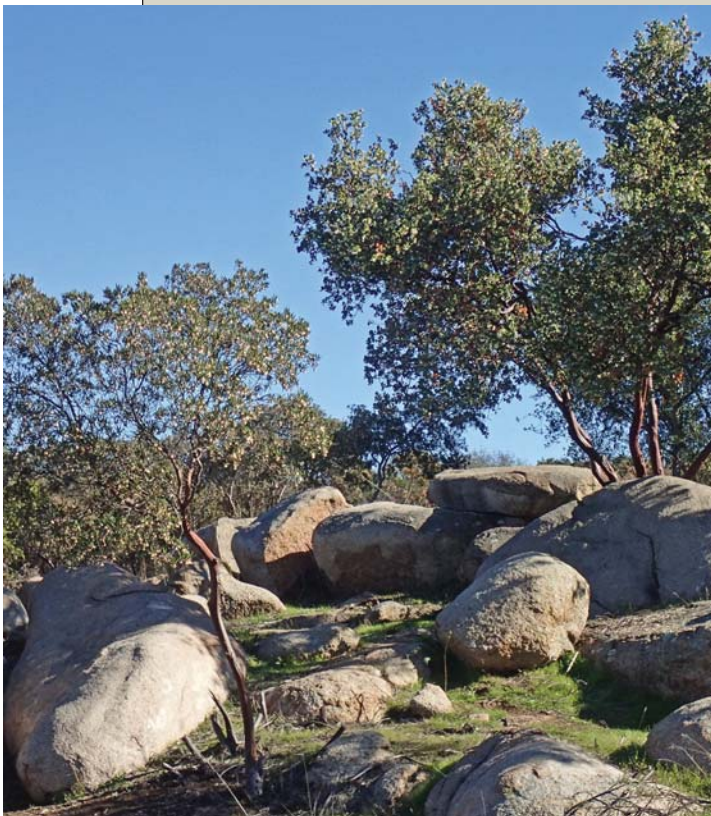
Mission manzanitas are exceedingly drought tolerant, so they need little dry season irrigation, but infrequent summer irrigation keeps them green and attractive and accelerates their growth. Greg Rubin recommends that you "make them feel like they have been in a thunder shower." When you water the plant, also water the area around it, then leave it alone for long intervals. In optimal situations, mission manzanita grows six inches to a foot each year to become an attractive foundation plant. People who are willing to take the long view include them in their gardens and are rewarded for their patience. Mission manzanitas can be one of the most beautiful plants you can grow in a garden.

Some people are fortunate enough to have native mission manzanitas already growing in their yards. Fire regulations require that vegetation be thinned and trimmed near homes, but not that you remove all vegetation. Mission manzanitas are ideal plants for vegetation management zones because they naturally hold their foliage high above the ground. They are beautiful, require little care, and are relatively fire resistant if properly thinned.

—Lee Gordon



The glossy green foliage and large berries of mission manzanita are attractive in gardens. Photograph by Ed Rubin.



A mission manzanita at the left and a big berry manzanita (*Arctostaphylos glauca*) at the right have been trimmed by a homeowner who is designing his landscape around selected plants growing in native chaparral.

plant at the side of a dirt road where it cut into the hill.

The plant could not have been older than the road, but they wondered: did it grow from a seed or did it sprout from the root of a neighboring plant? The road provides access to power transmission towers and is approximately 30 years old (SDG&E technician, personal communication, 2015). They knew the plant would be killed sooner or later by future road grading, so it was removed for further study. A few months later, the road was graded and the spot where the plant once stood was obliterated.

After washing the soil from its roots, the authors were surprised to discover that the plant was much older than it appeared. Under the soil, it had grown a one-inch secondary burl at the base of a larger one that had burned eleven years earlier. Given the relative sizes of the two burls, they speculated the specimen was about the same age as the road. Its roots all radiated downward, not sideways, and it had nothing like the lateral root sprout Halsey had once found. They concluded that it had germinated from seed in the bare dirt of the road bed and had grown to a stately 12 inches. This plant offers the possibility that mission manzanitas are still capable of regenerating from seed and surviving.

The specimen spent the summer in a three-gallon pot, and in the fall of 2014 sprouted leaves both from the branches and the burl. It is now a beauty, covered with deep green leaves and growing vigorously in a habitat restoration area. Its success demonstrates the durability of the species.

HOW OLD CAN MISSION MANZANITAS BE?

The largest mission manzanita we have found thus far is located in central San Diego County. It is growing out of a 63" x 58" burl, as measured by the portion exposed at the



This mission manzanita in San Diego's Mission Trails Park grows out of a five-foot diameter underground burl. Photograph by Richard Halsey.

surface. We estimate its stems to be around a century old, based on the average 21.4" stem circumference. Our estimate is based on growth ring studies we have performed on other stem samples. The underground burl is likely much older than the stems themselves.

Burls develop over time in a cycle of growth and fire. The small plant from the Artesia Creek watershed demonstrates that new growth can start at both the top and the bottom of a burl. Most burls that survive fire are charred on the top with new shoots arising at the periphery of the old burl. In time, these new stems enlarge at the base to replace the old burls. The burl expands step-by-step as this process repeats itself.

It is difficult to quantify the age of an old mission manzanita because burls do not have neat tree ring histories as do bristlecone pines or redwoods. In addition, the stems can only be dated to the last fire event. On the other hand, there is no obvious limit to the age of individual mission manzanitas. The burl of the largest specimen we found in San Diego County is clearly ancient. We know of no reason why the species cannot grow for hundreds of years.

SURPRISE IN THE ELFIN FOREST

When we climbed up to the mission manzanita specimen we found in Peñasquitos Canyon in January 2015, there was a surprise awaiting us. There under its canopy grew a dozen tiny seedlings. We clambered further into the forest beyond and found many more. Later, we visited Mission Trails Regional Park, Balboa Park, a hill in Scripps Ranch, and Torrey Pines State Park. We found seedlings in all the sites we searched, though seedlings were present only under some of the shrubs at each site. Most were under parent plants, but a few were as far as 20 feet from the nearest individual.

We found seedlings growing in all kinds of conditions. Some were in shade, while others were in the open. Some grew in bare clay soil, some in bare sandy soil, and others in six-inch deep composting leaf litter. What they had in common, however, was exposure to the recent weather pattern. August and September thunderstorms may have provided the initial stimulus. A wet December kept the soil moist through all of a dry January. De-

ember frosts may also have been a factor.

There is no doubt now that mission manzanitas can grow from seeds, but there is still much to learn about how they develop into mature plants. With seedlings sprouting in so many different areas this year, it will be interesting to see which, if any, survive. Do these seedlings need summer rain? Most of the seedlings we found were directly under a parent plants' canopy, and we have



TOP: A small mission manzanita, removed from the ground in March 2014 to study its roots. A one-inch live burl grows next to a larger older burl that was burned in a 2003 fire. • BOTTOM: It was replanted in November 2014 after new sprouts appeared from its branches (top and left) and the burl (bottom). The burned burl is visible at the bottom. The photograph was taken in mid-January 2015.

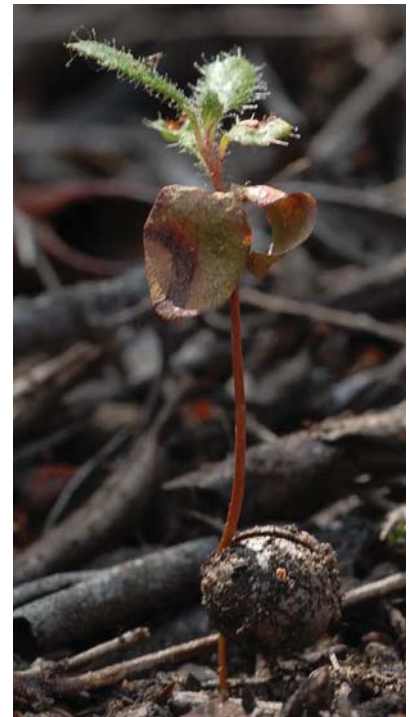
found no evidence that seedlings under mature shrubs ever live beyond the first year. In the six weeks since we found seedlings, the majority have already disappeared. It remains a mystery what conditions result in significant reproduction of this species, and it is obvious that it persists by its ability to vigorously resprout from substantial basal burls.

Keeley and Halsey returned to the field again in early March 2015 to survey eight different populations of mission manzanitas in San Diego County, for a total of 100 shrubs. They found seedlings too, but they were considerably less widespread than what we saw in January. Five populations had none at all. In general they were only present on moist north-facing slopes or in ravines.

We know now that mission manzanitas can produce seedlings, but we are still searching for evidence that its seedlings survive to become mature plants. Given that mission manzanitas can potentially live for centuries, they may have sustained their populations in the past in spite of a low rate of reproduction. Our concern for the future is whether the increasing frequency of chaparral fires will cause mission manzanitas to slowly decline. In the meantime, we must exercise good stewardship over the open spaces where the species now lives.

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Mission manzanita seedlings are usually found under a parent plant. This seedling discovered in San Diego's Balboa Park was among the first to be reported. Photograph by Richard Halsey.

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NEW CNPS FELLOW: SARAH JAYNE

by Dan Songster

In the mid-1980s the young Orange County Chapter of CNPS was considering dissolving. Its demise, though unthinkable now given how active the chapter is, may have occurred if a new member named Sarah Jayne, along with a few others, had not changed the conversation.

Due to their efforts it not only remained alive, it slowly prospered. Today it is a robust chapter that serves its members and the county by providing consistently interesting general meetings, numerous and well planned field trips, engaging outreach events, inspiring native garden tours, annual plant sales, and an informative newsletter. Almost all of these things (and many more) Sarah either originated, currently runs, or has had a hand in.

Sarah has served and inspired the Orange County Chapter and CNPS for 30 years and her contributions are all-encompassing. She has been a chapter board member without interruption since the mid-1980s, and served two terms as chapter president (2004–2008). She has also been chapter secretary (1996–1999 and 2002–2005), field trip chair (1991–2005), plant sales chair and co-chair (1988–2002), Chapter Council delegate (2004–2008),



Sarah Jayne and good friend Steve Hampson keying out the alpine gentian (*Gentiana newberryi*) at timberline in Mineral King subalpine valley, Sequoia National Park, August 2000.

chapter webmaster (1999–2012), and outreach chair (2000–2009).

Since 2013 she has been serving as chapter vice-president, and incredibly has also held a number of other positions, including hospitality chair (for several years in the 1990s and again since 2010), chapter native garden tour chair (since 2002), OC-CNPS awards committee member since 2007, and education chair (since 1990). No wonder that in 2007 Sarah was awarded the first “Native Perennial Award” from the Orange County Chapter for her long and energetic support of CNPS and the Orange County Chapter. Despite her involvement and leadership in so many areas of chapter life, she is always willing to share the work and especially the credit for program successes. She has recently transferred her chapter Web duties and is in the process of handing off her job as education chair, both to particularly qualified chapter members, while grooming others to share garden tour duties.

Sarah is also known for her ser-

vice to CNPS state programs and goals. She has served as Chapter Council secretary (2006–2008), CNPS Executive Board Member and CNPS Board of Directors Secretary (2010–2011), member of the CNPS Statewide Reorganization Committee (2010–2011), CNPS Planning and Evaluation Committee (2011–2012), CNPS Education Program Committee (2009–2012), and CNPS Membership Committee (2011–2012). In 2011 Sarah was publicly recognized by the CNPS Board of Directors for her tireless work as Secretary of the Board and member of the Executive Committee.

Sarah is a selfless leader and mentor. She does everything that needs doing regardless of its perceived level of importance, whether organizing an event, editing the chapter newsletter, or baking cookies for a chapter meeting. Her engagement is contagious, and with her quiet but generous nature she encourages others, especially new members, to increase their involvement in CNPS at all levels. Due in large part to Sarah’s en-



Sarah Jayne, Laura Camp, and Jennifer Mabley in 2009 at Rogers Gardens (Corona Del Mar) at the awards ceremony for the California Friendly Garden Contest. The event showcases gardens that use sustainable gardening practices.

couragement and guidance, two of our chapter's board members have become CNPS presidents. Laura Camp, chapter board member and CNPS State President, stated, "Sarah's mentorship is one of the main reasons I'm involved in CNPS leadership today. She is always ready for any task, however small, but always thinking about the big picture as well." Sarah's work in education, conservation, and native plant horticulture

extends beyond CNPS. From 1996 to 2008 she worked as a naturalist/docent at Laguna Coast Wilderness Park and Crystal Cove State Park, taking park visitors on weekly hikes on the trails, pointing out our native plants, and discussing their role in the environment. In 2002 she co-created (with Brad Jenkins) the M.A.D. (Move, Adapt, or Die) educational program for the Orange County Department of Education, which demonstrates the links between native plants and the communities in

which they are found, and the consequences of improper development of wildlands. As chapter education chair she helped redesign and expand our grants and scholarships program for deserving young people and college students in Orange County.

Sarah was part of our conservation committee's successful involvement with other environmental groups in the 2003 litigation against a massive, poorly designed develop-

ment planned in our foothills abutting the Cleveland National Forest. As Chapter board member Dori Ito commented, "After working with Sarah I have come to the realization that what's hidden beneath that soft-spoken woman of grace is actually an eco-warrior armed with knowledge, conviction, and passion for our state's native plants."

Sarah is well known for her involvement in all aspects of our chapter's horticultural programs, and administers our Acorn Grant Program, which provides funds and direction to local elementary schools starting native plant gardens. In addition, for many years she served as a weekly volunteer at UC Irvine Arboretum, and currently volunteers at both Golden West College Native Garden, Laguna Coast Wilderness Nursery, and the Heritage Garden at Concordia University. Also, in the last decade she has redesigned, replanted, and continues to help maintain the prominent native garden at Vista Verde K-8 School in Irvine, CA.

Whether leading discussions regarding new chapter projects and goals or doing all the little things that keep the chapter running smoothly, Sarah has always been there to lead the way. She is supportive, friendly, caring, quietly determined, and has had a significant, lasting influence on every aspect of the Orange County Chapter. Sarah Jayne's goals have been, and continue to be, relatively clear-cut: She wants CNPS and its Orange County Chapter to promote native plants, encourage their conservation, and help people see the many ways these plants are essential to so many facets of our lives and our environment. As chapter board member Thea Gavin observed: "Sarah's example of advocating for native plants over a lifetime, in all kinds of roles, sends a much-needed message that persistence and dedication can make a difference." Thank you, Sarah, and congratulations!

A Special Offer for CNPS Members



Pacific Horticulture is the only quarterly publication written by and for gardeners and plant lovers who understand the need for responsible gardening in the summer-dry climates of the West Coast states. The magazine features California natives and other non-invasive mediterranean-climate species, superb color photography, in-depth book reviews, scientific reports, and a regional garden events calendar. Visit us at www.pacifichorticulture.org.

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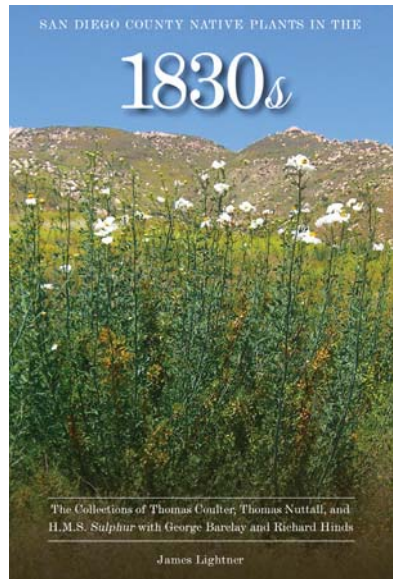
BOOK REVIEW

San Diego County Native Plants in the 1830s: The Collections of Thomas Coulter, Thomas Nuttall, and H.M.S. Sulphur with George Barclay and Richard Hinds by James Lightner. 2014. San Diego Flora, San Diego, CA. 54 pages, \$11.00, softbound. ISBN #978-0-9749981-4-5.

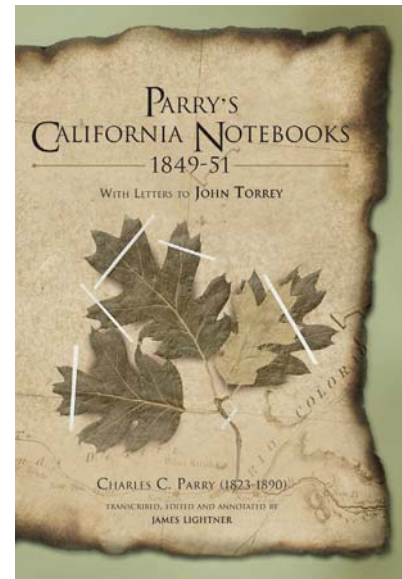
Parry's California Notebooks 1840-51 with Letters to John Torrey by James Lightner, ed. 2014. San Diego Flora, San Diego, CA. 170 pages, \$40.00, hardcover. ISBN #978-0-9749981-6-9.

San Diego author Jim Lightner has published two new books on the historical roots of California botany. The first, a small paperback focused on San Diego County, evolved from an extended lecture that Mr. Lightner presented to the San Diego chapter of the California Native Plant Society in early 2013. The book that grew out of that lecture is filled with fascinating anecdotes about San Diego County in the earliest days of exploration by scientists and trained plant collectors. Right from the start, the book grabs you. From the introduction:

For historians of California, the 1830s is the decade of secularization. Anti-Spanish sentiment, competition for wealth, and general anarchy conspired to ruin the Catholic missions. Sixty years of religious work unraveled in one unruly decade. . . . For botanists of California, the 1830s are the decade when famous United Kingdom collectors, including David Douglas, explored the territory and discovered hundreds of native plants. The west coast of North America became a rich new source of species.



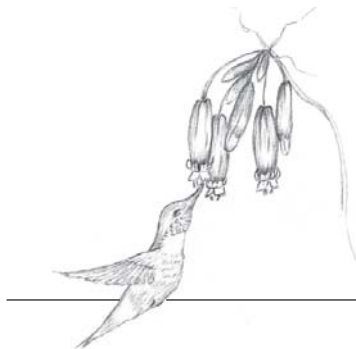
The subtitle of the book, "*The Collections of Thomas Coulter, Thomas Nuttall, and HMS Sulphur with George Barclay and Richard Hinds*," drops names. All of these individuals took part in expeditions from the United Kingdom during the 1830s, and all were trained botanists who collected and observed in the same way we do today. Their journeys followed different routes, and hence they were



exposed to differing floras along the way.

In addition to a wonderful narrative, Lightner's book contains various illustrations including a number of excellent herbarium sheet images courtesy of the Kew Herbarium in London. The text is carefully annotated throughout and contains a useful list of native plants collected by the explorers between 1832 and 1839. This little book is a

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quick read, but absolutely packed with information for California botanists and history buffs with an interest in this remarkable period in the state's history.

The second book, *Parry's California Notebooks 1840–51*, is a painstaking transposition by Lightner from the original, hand-written field notes that he discovered buried in the archives of the Iowa State Uni-

versity library. The notes read like a diary—one that I found hard to put down. In addition to presenting a detailed image of life in the mid-1800s, Parry was not afraid to record strong opinions: “March 7 – Leave for town again rather a disgusted individual.”

Both of Lightner's books are worthy volumes in any natural historian's library. All of us owe a debt

of gratitude to him for bringing these fascinating events to life from the archives. Had he not discovered them, and written about them, they might have well disappeared to the ravages of time. The books preserve much more than botanical notes of the day. They present a vision of California that is not entirely gone, to an audience working to conserve it.

—Vince Scheidt

WHAT SHAPED YOUR LOVE OF NATURE?

Jason Wong

[Editor's Note: Fremontia readers are invited to send in stories of what shaped your love of nature. If you are motivated to send us yours, it can be about 250 words, and should be emailed to bhass@cnps.org. Be sure to include a high-quality headshot, or a photograph of yourself in a natural place you love, and the name of the photographer who took it.]

DEE WONG Santa Clara Valley Chapter

I was born and raised in the bustling city of Hong Kong. Although Hong Kong was a city of high rises and a concrete jungle, I was very fortunate to have lived in the Peak (the highest neighborhood in the city), surrounded by large expanses of natural jungles and magnificent views of Victoria Harbor. My childhood days were spent exploring these jungles, not knowing the dangers of the very poisonous green bamboo snakes that thrive there. I would hear and try to find the barking deer, shy Asian deer that bark much like dogs. Although my father was not a gardener, he loved to have living plants all around our home.

I moved to the Bay Area in 2000. I fell in love with my first native plant, common jewelflower (*Streptanthus glandulosa* ssp. *glandulosa*) in April 2009 while hiking Stile



Dee Wong on a birthday trip with son Jason (taking the photo) at Bumpass Hell, Lassen Volcanic National Park, August 2013. The two often go nature exploring, and in 2010 actually got lost in Death Valley for three days. A blog about the experience is at: calnativehortgal.blogspot.com/2010/12/wrong-turn-surviving-death-valley.html.

Ranch Trail in San Jose. I fell on my knees and gazed at this amazingly beautiful plant. My love of nature has led me to my current career as a landscape maintenance manager specializing in California native plant gardens at The Village Gardener in San Carlos.

In my free time I photograph wildflowers and native plants, and

enjoy botanizing with others in my CNPS chapter. I have a degree in environmental horticulture and landscape design from Foothill College, and am a published photographer. I was previously chapter treasurer and am currently the chapter field trip chair. You can view some of my photos at dswongclick.zenfolio.com.



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Jon E. Keeley is a research scientist at the USGS, and an adjunct professor in the Department of Ecology and Evolutionary Biology at UCLA.

Zachary Principe is a stewardship ecologist with The Nature Conservancy and has also worked as a land manager in Southern California.

Jon P. Rebman is curator of botany at the San Diego Natural History Museum.

Julie Rentner is a forester and arborist who has been restoring wetland habitat areas in California since 2005.

Suzanne Schettler is a licensed landscape contractor specializing in the restoration of native plants and in finding beauty in the wild. She is the owner of Greening Associates, a life member of CNPS, and a former CNPS state president.

Dan Songster is a longtime Orange County chapter board member currently serving as co-vice president alongside Sarah Jayne. He is also a founding director of the Golden West College Native Garden in Huntington Beach.

FROM THE EDITOR

There now appears to be a consensus on the part of most scientists in the US and around the world that climate change exists, that these changes are in large part caused by human activities, and that this process is largely irreversible. The Intergovernmental Panel on Climate Change (IPCC), under the auspices of the United Nations, is the leading international scientific body working on issues of climate change. Its latest report (fall 2014), produced by hundreds of scientists around the world, synthesizes the most current state of scientific knowledge relevant to climate change. It confirms that human activities are the primary cause for global warming over the past 50 years. It will be of great interest to CNPS members, and I strongly encourage you to download it at ipcc.ch/index.htm and read it.

Closer to home, our own National Academy of Sciences produces a report on climate change every four years. Its latest report in 2013, available at nca2014.globalchange.gov/report, details the wide-ranging impacts that climate change is having on every region of the US and throughout our economy. More extreme weather events are prominent, and these are significantly impacting plants, animals, and humans. Other reports simply reconfirm this burgeoning body of scientific findings, including one by the National Audubon Society in September 2014 (climate.audubon.org).

Climate change is a grim reality for those of us who attempt to keep up with it, and certainly not one we ever thought we would be passing on to our children or grandchildren. But that is what we are doing, and it always amazes me that the small but highly vocal group of US politicians who continue to deny that climate change exists somehow manage not to think about what young people in their own families will have to deal with in the coming decades.

—Bob Hass

(continued on inside back cover)



CALIFORNIA NATIVE PLANT SOCIETY

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Dear Friend,

We hope you enjoy this publication. It is full of great articles and beautiful photos, all contributed by dedicated volunteers, and is just one of countless benefits offered by the California Native Plant Society. CNPS is dedicated to understanding, saving, and celebrating California's wild plants and places.

You likely already know and appreciate CNPS. You love our beautiful flowers, and probably glad CNPS is saving them. You may make a field trip once in a while to reconnect with a favorite landscape that replenishes your sense of wonder, and you are happy we have laws to protect these special places. You love seeing native plant gardens springing up in front of homes and businesses, and you point out the butterflies and hummingbirds to friends. You get it; you understand: you are a CNPS-er.

With your help, we can do much more. ***Will you please join us?***

Here are some of the reasons you should use the enclosed remittance form to join CNPS.



The rare *Calochortus plummerae*, Plummer's Mariposa Lily, Photo: Amber Swanson

35 chapters across California and in Baja offer hikes, public programs, plant sales, restoration events, garden tours, workshops, and camaraderie.

The **Conservation Program** continues to fight for California's places. CNPS has been the voice for plant conservation during development of a 30 year plan that will cover 23 million acres of desert. We successfully pushed to map vegetation on 5.5 million acres, and are using these data identify areas that should be avoided by industrial scale energy projects in the region.



Cephalanthus occidentalis, Buttonwillow and skipper. Photo: Paul G. Johnson

The **Rare Plant Treasure Hunt (RPTH)** teams volunteer Citizen Scientists with trained botanists to discover and map rare plants. RPTH volunteers have mapped more than 2,500 rare plant populations –1/3 of them new discoveries!



Carrizo Plain National Monument.
Photo: Julie Evens

Once you join, you will receive a CNPS membership card that **entitles you to discounts at dozens of nurseries, stores, and businesses.** We'll also send you the latest flower-filled issues of *Fremontia* and the *CNPS Bulletin*. You'll learn about talks and hikes in your local chapter. ***Most of all you will help*** to save rare plants and places, train young scientists, and replace thirsty lawns with wildlife-friendly native plant gardens.

Please join CNPS and help us make a real and lasting difference!

Thank you for your help,

Dan Gluesenkamp
Executive Director



CNPS members on field trip at Yolo Bypass. Photo: Gary Hundt



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- Gray Pine (business/org, 3-6 employees) - \$500
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Pine Hill Flamebush
Fremontodendron decumbens
by Mary Ann Showers, CDFW

The mission of CNPS is to conserve California native plants and their natural habitats,
and increase understanding, appreciation, and horticultural use of native plants.

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