California Native Grasslands Association

# GRASSLANDS

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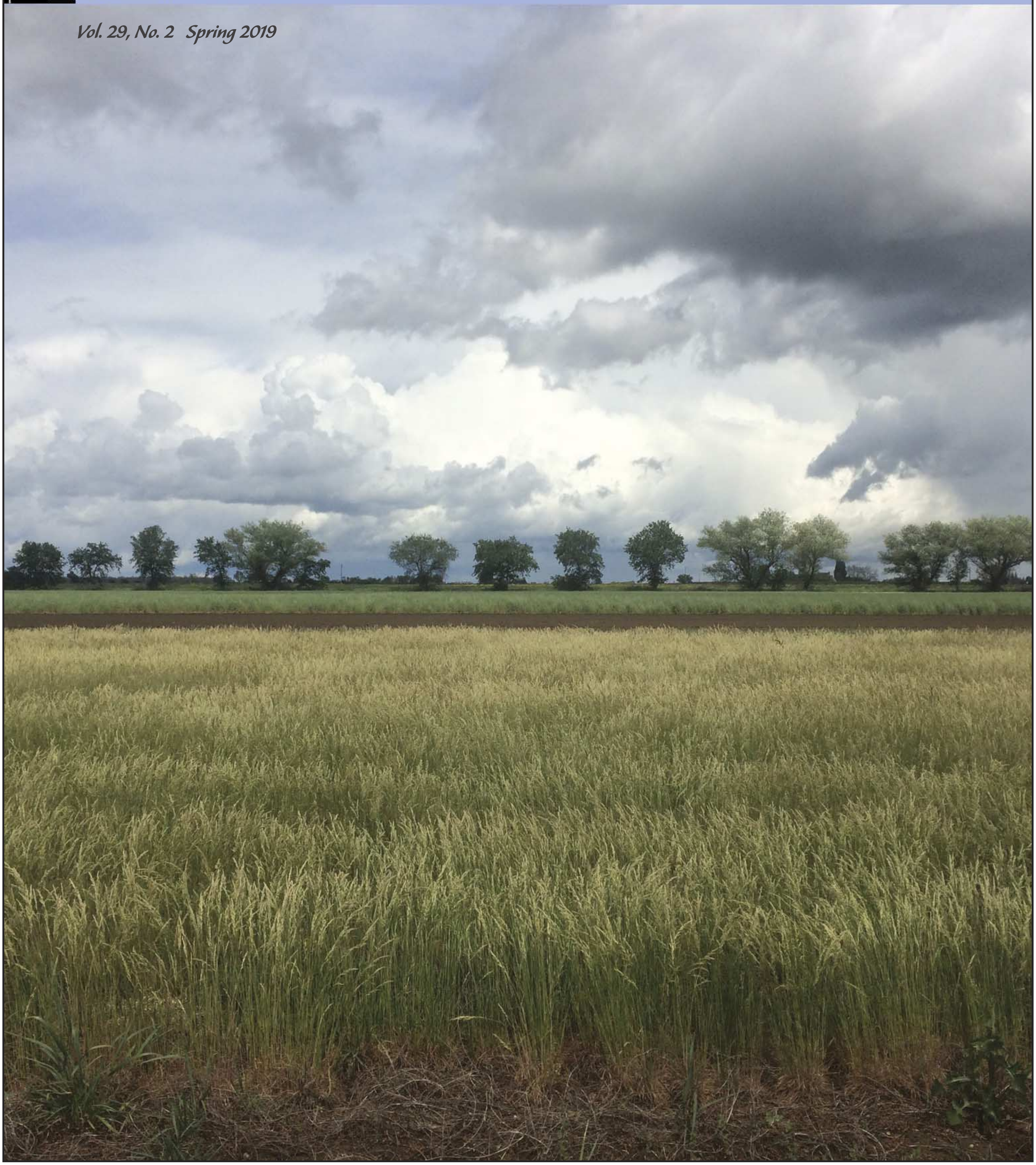

California
Native
Grasslands
Association

**Mission Statement**

*The mission of the California Native Grasslands Association is to promote, preserve, and restore the diversity of California's native grasses and grassland ecosystems through education, advocacy, research, and stewardship.*

P.O. Box 72405, Davis, CA 95617
**cnga.org**
530.902.6009 admin@cnga.org



For membership and other organization information, contact CNGA Administrator via admin@cnga.org.

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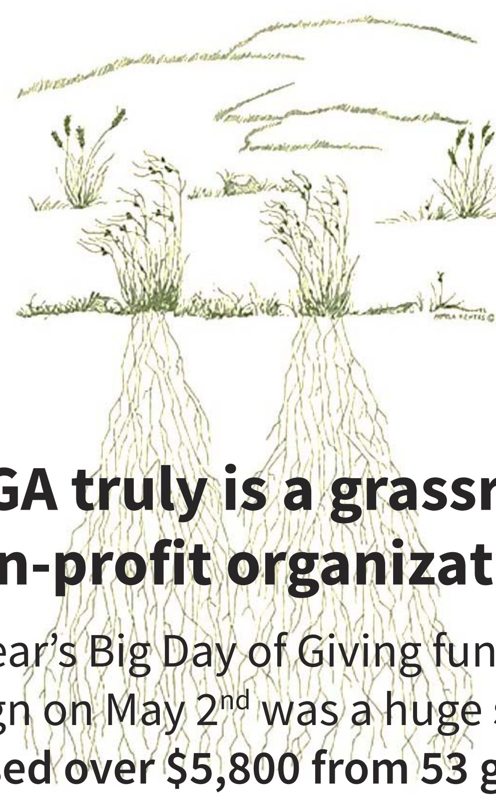
# From the President's Keyboard

Spring is a busy time in California's grasslands, and for the California Native Grasslands Association. We all come out of our winter dormancy: plants blooming; animals setting up territories and readying to reproduce as well; CNGA preparing to disperse information to spread understanding and appreciation of native grasses and grasslands.

CNGA is continuing its work and outreach with *Grasslands*, and our ever-popular grass identification courses and Field Day at Hedgerow Farms. This year we partnered with SERCAL to present grass identification in Santa Barbara, extending our reach south; and reviving and revising our grassland monitoring techniques class. Field Day focused on the importance of local genotypes, and it seems fitting that an event showcasing local biodiversity kicked off this year's City Nature Challenge (**http://citynaturechallenge.org/**) on April 26. What started as San Francisco versus Los Angeles a few years ago is now an international competition pitting over 150 urban-ish areas worldwide against each other to see who can get the most people to record the most observations of the most species over one weekend—and if you want the most biodiversity, head to a grassland!

I hope you can join us at one of our upcoming events! And thanks to all of you who contributed to CNGA during the Big Day of Giving on May 2!

*Andrea Williams, President*



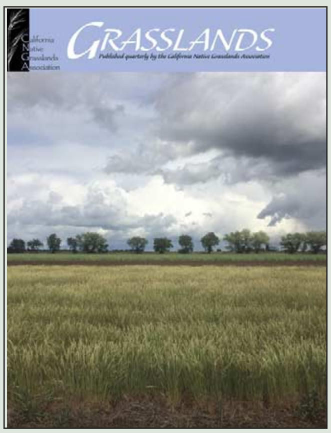
## CNGA truly is a grassroots non-profit organization!

This year's Big Day of Giving fundraising campaign on May 2nd was a huge success — **we raised over $5,800 from 53 generous donors.**

Thank you to our donors and members for 'rooting' for us and supporting our work.

# In this issue






### *Grasslands* Submission Guidelines

Send written submissions, as email attachments, to **grasslands@cnga.org**. All submissions are reviewed by the *Grasslands* Editorial Committee for suitability for publication. Written submissions include peer-reviewed research reports and non-refereed articles, such as progress reports, observations, field notes, interviews, book reviews, and opinions.

Also considered for publication are high-resolution color photographs. For each issue, the Editorial Committee votes on photos that will be featured on our full-color covers. Send photo submissions (at least 300 dpi resolution), as email attachments, to Kristina Wolf at grasslands@cnga.org. Include a caption and credited photographer's name.

***Submission deadlines for articles:***

**Summer 2019**: 15 May 2019 ❊ **Fall 2019**: 15 Aug 2019 ❊ **Winter 2020**: 15 Nov 2019 ❊ **Spring 2020**: 15 Feb 2020 ❊

*Photo: © Saxon Holt*

# Upcoming CNGA Workshops

***Get the latest workshop info at:***
**cnga.org**
**Register online**
or contact Diana Jeffery at **admin@cnga.org** or 530.902.6009

June 21, 2019

## Grassland Restoration, Part 1:

**Nuts & Bolts of Restoration and Revegetation: Using Grasses and Graminoids**

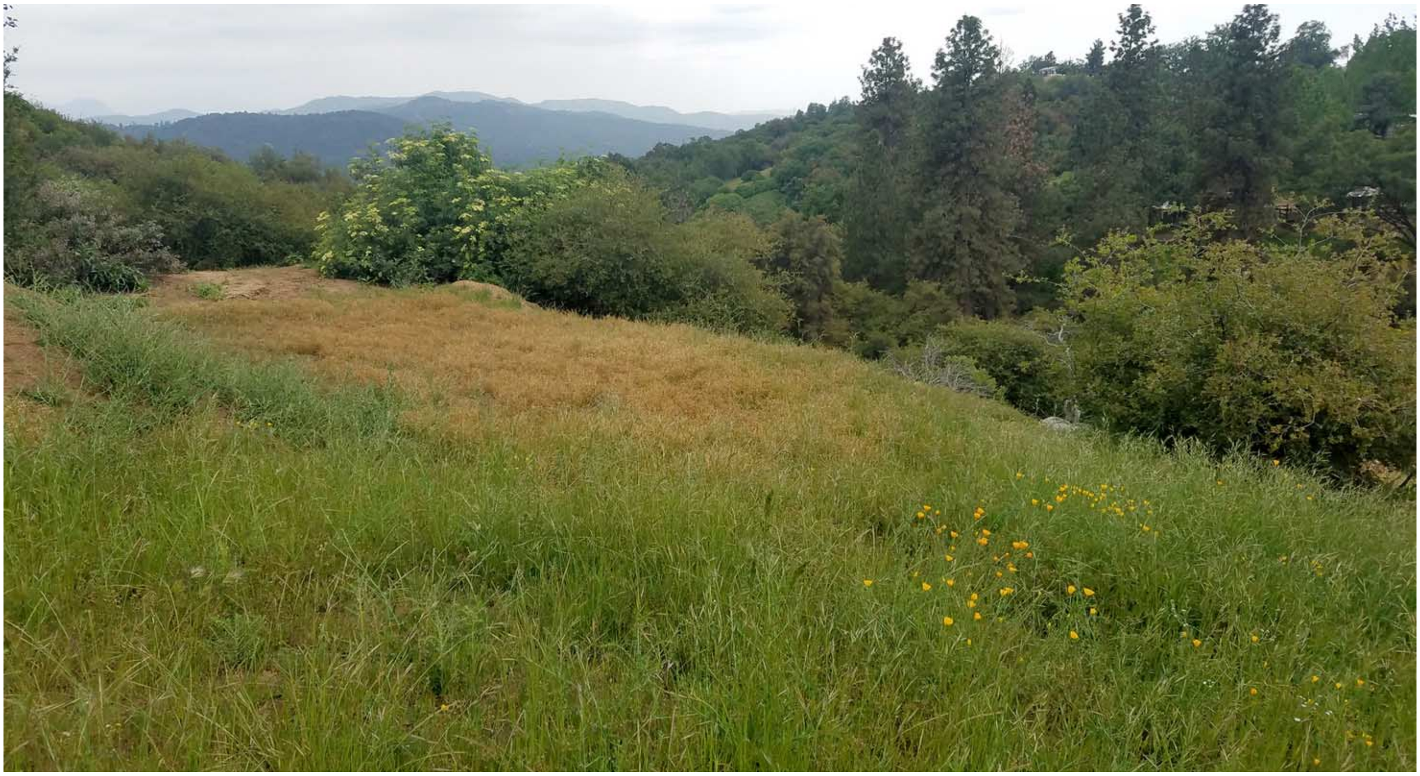
Yolo County location — ***Registration opens soon!***

# Coming this Fall:

## Grassland Restoration, Part 2:

**Field Practices: Hands-on Restoration Implementation and Maintenance**

Location TBD



Upland native planting with a view of the Sierras.

# Restoring Native Grasslands for Wildlife and Grazing

*by Robert Evans*[1] *Photos courtesy the author*

There's a first time for everything, including planning and establishing native grasses. This is especially true for myself and a client of mine for whom I was helping develop a Conservation Plan. I'm sure that there are a lot of stories like this out there, maybe a bit different, maybe established for a different reason, or under different conditions, but I'd wager that they all relied on multiple efforts of many people surrounding a common goal: Getting native grasses back on the landscape.

A little background first: My career with the Natural Resource Conservation Service (NRCS) started in Fresno, CA; before, I had previously worked in Tennessee with native warm season grasses, and not in the capacity of having much, if any, responsibility for the project beyond helping calibrate a seeding drill or perhaps operating a drip torch. That all changed after I met John Lewis. John is a rancher in the Foothills of the Sierra in Fresno County, near the Tulare County line. The land there is very rugged: steep slopes, lots of brush, thick forest, and perennial creeks.

I first came out to John's property in 2012, when I was working with Paul Roche, Jr., another rancher who leased John's land to graze cattle. We were looking at brushing, the mechanical reduction of brush species such as ceanothus and manzanita (*Arctostaphylos* spp.), that Paul had recently completed for an older NRCS contract. The land is beautiful, very close to Sequoia National Monument, and the view from his ridge is very striking. The experience was breathtaking as the retired Forest Service Forester and fulltime mountain goat was well-adapted to a lifetime on the terrain was testing my mettle on the steep slopes. I nearly came to regret wishing to map that area for the field check-out, and pondered alternative methods to measure the area between gasps. Fortunately, I survived the survey and not long after I began working with John.

A little about John: his 9-to-5 is more like to 9pm to 5am. He works at night driving a tandem truck to Los Angeles, breeds hunting dogs, trains puppies, manages a Kiko goat operation, and competes on the national bird dog circuit (as seen on TV). Needless to say, his hours are long and he works tirelessly to maintain his ranch, dogs, job, and competitive status on the bird dog circuit, and his time is limited and valuable.

Somewhat to my surprise, John's operation reminded me a lot of the cow-calf operations of East Tennessee: the size, scale, slopes, annual precipitation, and John's job away from the farm were all familiar to me. John discussed his needs, interests, goals, and inventoried his existing resources. He was primarily interested in developing water

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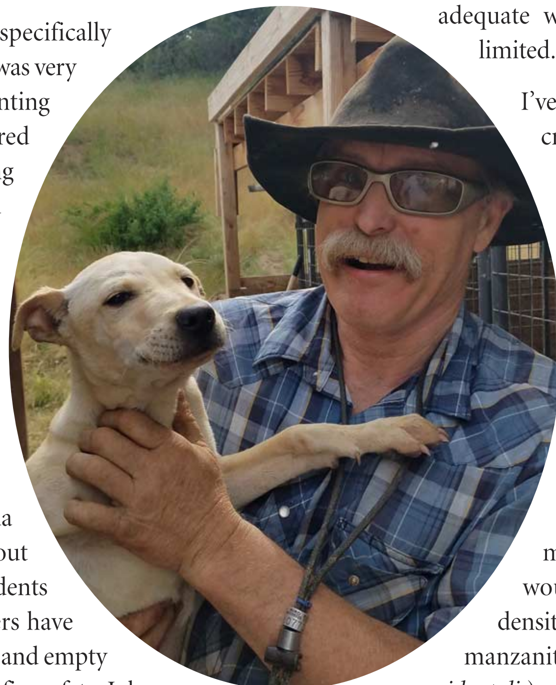
[1]Soil Conservationist, USDA NRCS. Robert is the lead range planner in Fresno County, and is working with multiple ranchers on establishing native grasses primarily in riparian areas and their surrounding uplands. Robert has been a CNGA Director since 2016.

sources for the cattle and his own goat herd. Naturally, that's where our discussion began — water. We also discussed hunting, conservation, and habitat, among other things, as we walked the entire field looking at the grazing, fencing, gates, roads, topography, etc. At the time, his only water source was a small, seasonal (and becoming even more so) pond in the southwest of his property opposite the gate that was left open for his neighbor's cattle. As a result, forage not immediately inside John's perpetually open gate or adjacent to his pond were underutilized by cattle that largely preferred the cool, forested, perennial creek outside of gate in the valley below.

John's passion for upland game birds, specifically California Quail (*Callipepla californica*), was very apparent. I was new to upland game hunting and had only just recently encountered actual quail for the first time since moving to California. The hard lessons had already been learned in Tennessee, where the native Bobwhite Quail (*Colinus virginianus*) have long been a fading memory, along with the native warm season grasslands they depended on, as progressively more and more pastures were converted to non-native fescue (*Festuca* spp.), orchard grass (*Dactylis* spp.), and occasionally Bermuda grass (*Cynodon* spp.). Conversations about birdlife in the valley with longtime residents has confirmed to me that quail numbers have dropped, as farmland is kept "weed free" and empty grassland areas are routinely plowed for fire safety. John certainly had quail and adequate habitat, but he was interested in creating enhanced habitat to help them flourish.

We identified a few issues during our walk together. On the forefront, the continuing drought meant that John's water security was becoming highly compromised. There was no power from the grid available to operate an electric pump for a new well. The location of the pond resulted in uneven grazing distribution, a condition that can be favorable for medusa head (*Elymus caput-medusae*) and ripgut brome (*Bromus diandrus*) to take over. Medusa head and ripgut were present onsite in a few small patches, but were not yet appreciably out of control; in the absence of disturbance, these unpalatable forages are able to continuously reseed and create a thick thatch. The area around the pond was being slightly over-utilized and surface run-off from above was causing sheet and rill erosion and depositing sediment into the pond. Also, with high predator pressure, namely mountain lions, it was important that John's goats could graze inside the fence with the added security of a guardian animal. This made a reliable water source critical.



Inset: John with his Vietnamese Pig Dog.

We planned to install a well, a solar-powered pump, troughs, and tanks; a fairly standard application for a solar/gravity-powered system in which many ranchers who approach NRCS in my county are interested. We planned the troughs to promote better grazing distribution to less utilized areas and placed them in areas that would be less vulnerable to erosion and mud issues. Having a livestock water system in the field meant that the cattle could be fenced in with reliable water. This new water distribution facilitates better utilization of forage for improved grazing management. We spread out grazing to reduce erosion, increase plant productivity and health, and provide adequate water where livestock water was previously limited.

I've assisted folks in fencing out quite a few ponds, creeks, and sinkholes over my career. Usually, I suggest a 33-ft buffer between a fence and the bank of a waterbody to allow for vegetation to reduce surface runoff into the water. John elected to fence out 4.7 ac around the pond to provide more adequate space for quail to nest, forage, and seek cover. John and I discussed excluding and/or limiting the pond from livestock access via a cross fence to create a wildlife area around the pond. This would largely exclude it from year-round grazing, establish improved habitat, and manage it primarily for wildlife. This crossfence would also support flash grazing (high stocking density for a short duration of time). The patches of manzanita, ceanothus, Western redbud (*Cercis occidentalis*), and other brush onsite were already perfect for cover for quail. Adding native grasses would allow for the quail and their covey to run between the intermittent clusters of perennial bunch grasses, and safe to forage for food.

The cross fence would be wildlife friendly: a smooth bottom wire 16″ from the ground to allow for fawns to pass under, a smooth top wire, and 12″ between the top wire at 42″ and next highest wire to allow for mature adults to safely jump across or even between. The NRCS standard wildlife fence is a total of four strands, with two strands of barbwire, but John wished to do a three-wire fence consisting of two smooth and one barbed (the fence is functioning well several years later, but does not receive what I would consider high pressure from livestock). The spacing of the wires allows for local fauna to pass freely through the fence to the wildlife management area while holding back the cattle from disturbing the areas surrounding the pond. The fence addresses several key issues: it reduced sediment being deposited into the pond, created undisturbed nesting habitat for quail, and allowed for the establishment of the native grasses to further enhance wildlife structure for the quail.

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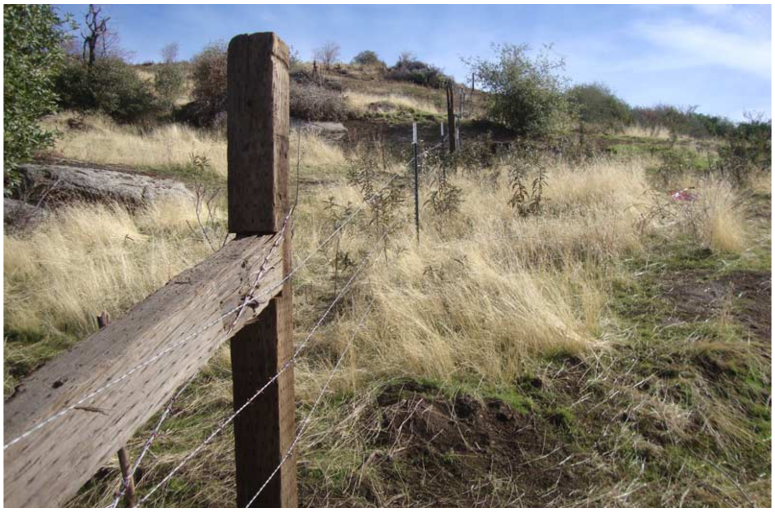
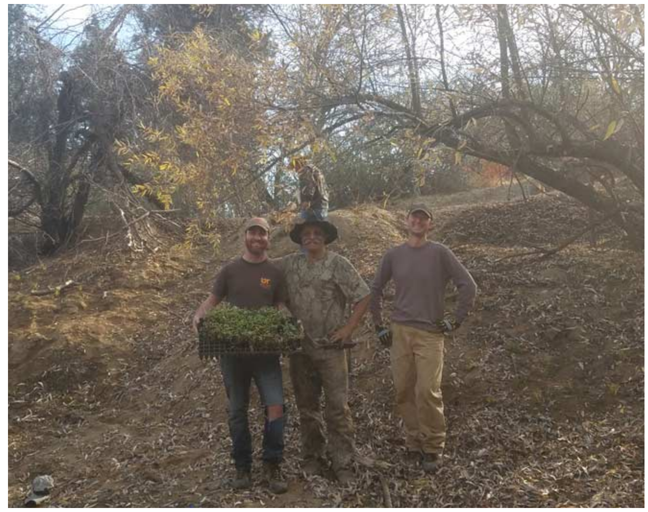



From left: Smooth fencing wires on top and bottom allow wildlife to pass through without harm. (L–R) Bobby Evans, John Lewis, and Jesse Bahm.

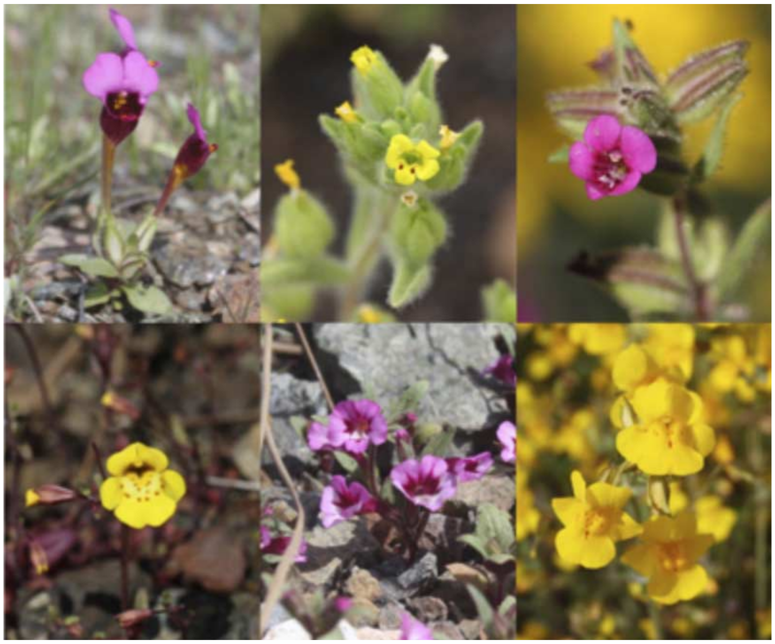
## Restoring Native Grasslands for Wildlife and Grazing *continued*

I was pretty comfortable with the concept of managing native grasses for wildlife and grazing, but as a new conservationist, I hadn't personally planned a project like this on my own. I sought help from NRCS Area III Biologist, Jesse Bahm. Jesse helped me select native species and recommended seeding rates for the uplands and plugs to plant around the wetted edge of the pond. Jesse selected the following plugs: creeping wildrye (*Elymus triticoides*), narrow-leafed milkweed (*Asclepias fascicularis*), mugwort (*Artemisia douglasiana*), deergrass (*Mulenbergia rigens*), Western goldenrod (*Euthamia occidentalis*), purple needlegrass (*Stipa pulchra*), Santa Barbara sedge (*Carex barbarae*), common yarrow (*Achillea millefolium*), and meadow barley (*Hordeum brachyantherum* ssp. *brachyantherum*). We also planned to broadcast blue wildrye (*Elymus glaucus*), California brome (*Bromus carinatus*), purple needlegrass, and pine bluegrass (*Poa secunda*) in the uplands. I planned a multiyear chemical treatment for the wildlife area. John would treat the area with herbicide for 2 years prior to establishing the native plants to control invasive annuals that had a firm foothold on the site. After that, John would prepare the uplands with a rake drug behind his ATV, sow seed with a cyclone seeder, and plant the plugs around the pond area to get quick cover. Well, that was the plan anyway. There were trials and tribulations along the way.

The first issue was the timing of the project and the continuing drought. Another issue arose the first time John sprayed, as the chemical mix failed to kill the nonnative annual grasses. A second treatment was required and succeeded. The second year, the same issue occurred, and it took two passes to control the annuals. However, there was one plant that wasn't even phased by the treatment. We identified it as a weedy native, mare's tail (*Hippuris vulgaris*), and glyphosate did nothing to control it. Another of John's neighbors, a pest control advisor who had excellent knowledge of herbicides, recommended 2,4-D which worked very well. The fence was established and functioning well, the spacing of the brush looked great, and the annuals were being acceptably controlled.

Then the dam broke. Literally, the pond's dam busted. A trespasser had stuffed the primary spillway of the pond with plastic, presumably to raise the level of the water higher than the overflow allowed. In a sick twist of irony, the water overflowed the top of the dam, cutting a sizable gully through the middle and resulting in a lower pond level than before. The surface area of the pond decreased as well, slightly changing the anticipated footprint of the plug planting, but not enough to stop the planting altogether. There was also an issue with the plugs John received, as they had been very stressed when John received them. John's wife was able to care for the plugs, and nurse the majority of them back to health. Now we were up against time. We had plugs we needed to get in the ground and then rain to keep the plugs alive into the next season. With a busy life working, training, competition that required frequent travel, and a ranch and herd to manage on top of that, John's "spare time" is always limited, and usually spent working. I was able to get a small crew of volunteers from NRCS including yet another one of his neighbors get the plugs into the ground during John's vacation, and just before one of the first rains of the season.

The plan took a long time to develop and execute, but has been well worthwhile. Quail numbers seem to be increasing and the native grass plugs have persisted thus far. I'm excited to see what the future holds, especially in the upland areas planted with native seed, and what lessons remain to be learned. Annual non-native competition is my biggest concern at this point, but continued treatment of problem areas could prevent it from reverting to a solid stand of invasive annuals again. Or maybe, it will be like other sites I've seen, where there is a strong native perennial component amongst other nonnative annual grasses. Time will tell as the seasons continue to change.



From left: Figure 1: Some of the diversity of monkeyflower (formerly *Mimulus*, now *Diplacus, Erythranthe*, and *Mimetanthe*) which can be found in close proximity at McLaughlin Reserve in Lake County, CA. Clockwise from top left: *D. douglasii, M. pilosus, D. bolanderi, E. guttatus, D. layneae, E. nudatus*. Figure 2: The diversity of leaves and flowers in the author's favorite genera: *Abronia* and *Tripterocalyx*. Top row (L-R): *Abronia nana* rosette, Nevada; *A. latifolia* foliage, California; *A. pogonantha* plant. Middle row (L-R): *A. bigelovii* rosette, New Mexico; *A. maritima* flowers, California; *A. alpina* flowers, California; Bottom row (L-R): *A. latifolia* flowers, California; *Tripterocalyx carneus* flowers, New Mexico; *T. micrantha* flowers, Wyoming.

# Grow a Genus! *The excitement of looking at evolutionary radiations in your garden*

*by Eric LoPresti[1] Photos courtesy the author*

Because they occur over long time and large spatial scales, the evolutionary processes that shaped the fantastic diversity of life on earth are often difficult to observe in action. Yet, a native plant gardener can observe and enjoy the diversity generated by this evolutionary process. Due to extreme rainfall, elevational, and climatic gradients, California has unique and hyper-diverse flora: the splashes of colored forb flowers you can see in early spring in many grasslands across California wonderfully demonstrate this phenomenon. Many of these interesting, beautiful, and easy-to-grow native genera are a fun and exciting gardening project to view these evolutionary radiations.

Both across and within habitats, evolutionary processes have shaped species in a single genus to be different in many traits, including floral morphology, flowering time, growth habit, and communities of associated animals. Coastal Northern California has places where three lupines (*Lupinus* spp.) grow in abundance: coastal bush lupine (*Lupinus arboreus*), a purple flowered shrub; silvery lupine (*L. chamissonis*), a hairy, yellow flowered shrub; and the miniature, purple-flowered annual, sky lupine (*L. nanus*). Across California, dozens of other lupine species grow from low deserts to the high mountaintops. Lupines are not unique in their great morphological and species diversity. Pink, yellow, purple, orange, and red-flowered monkeyflowers (genera *Diplacus* and *Erythranthe*, formerly *Mimulus*) grow as shrubs, herbaceous perennials, and small annuals across the state, and even in a single watershed their diversity can be substantial (Figure 1). Grasslands are studded with *Clarkia* species with cupped, upright flowers, such as farewell-to-spring (*Clarkia amoena*), and open horizontal flowers with varying morphologies all the way to the finely dissected petals of the aptly named red ribbons (*Clarkia concinna*). Various sages (*Salvia* spp.) range from deserts to coasts and have amazing variation in plant morphology, flower color, and, quite strikingly, scent! The leaves, flowers, and habit of manzanitas (*Arctostaphylos* spp.) and California lilacs (*Ceanothus* spp.) differ greatly across each genus; each is a diverse genera of beautiful flowering perennials that may be prostrate groundcover or large shrubs.

Of course, most native plant nurseries do not carry every, or even many, species in a single genus. Many are rare, difficult to grow, or have never been propagated, and some genera may have multiple

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[1]Dept. Plant Biology, Michigan State University. While Eric grew up in the northeast and currently resides in the Midwest, he tells us his botanical nerd developed while a graduate student in Ecology at UC Davis.

species that are easier to find in cultivation, with sages and manzanitas being two of the better. Perhaps more rewarding, this spring and summer, go out and collect some seeds and experiment! Do this responsibly, minding local and state laws about collecting seeds and refer to the CNPS status of each species you plan to collect (**https://www.cnps.org/**). Small quantities of common species are easy and legal to collect on many public lands and roadsides. Marjorie Schmidt and Kartherine Greenberg's "Growing Native California Plants" (2012) is a useful reference for propagation. Many other gardening books, and, of course, communities of gardeners on the internet, can also be counted on for help. Once you have seedlings from collections or nurseries in your garden, this is where the fun starts!

Whether you envision this collection to be a window box with a few species of monkeyflowers, or an expansive backyard collection of sage shrubs, the reward will be similar. Continued observation, across the season, across the day, and in both your garden and while in nature can give you clues to the evolutionary processes which shape the diversity you have collected. For instance, pollination is an important ecological interaction that is fun to observe in your garden. Fairy fans (*Clarkia breweri*) attracts moths, flies, and bees, due to its highly scented light pink flowers, yet the closely related red ribbons (*C. concinna*) attracts only the flies and bees, as it lacks the strong scent necessary to attract moths (Miller et al. 2014). The small-flowered monkeyflower (*Erythranthe nasutus*) attracts few pollinators, instead self-pollinating, whereas the closely related common yellow monkeyflower (*E. guttatus*) attracts bees to assist with pollination. Many of the differences in their ecology are due to this divergence in pollination style (Brandvain et al. 2014). In addition to pollination, herbivory (which plants get aphids or caterpillars?), habitat preference (which thrive in shade? which wilt in the sun?), morphology (do some grow upwards and others out? are some waxy and others sticky?), even smell (sweet or foul?), and seasonality (which flower first? which bloom until late fall?) are also fun and informative to note.

Take careful notes, build your collection, spend time with them, and you, too, might become a convert, or even a proselytizer of gardening with a single group of plants.

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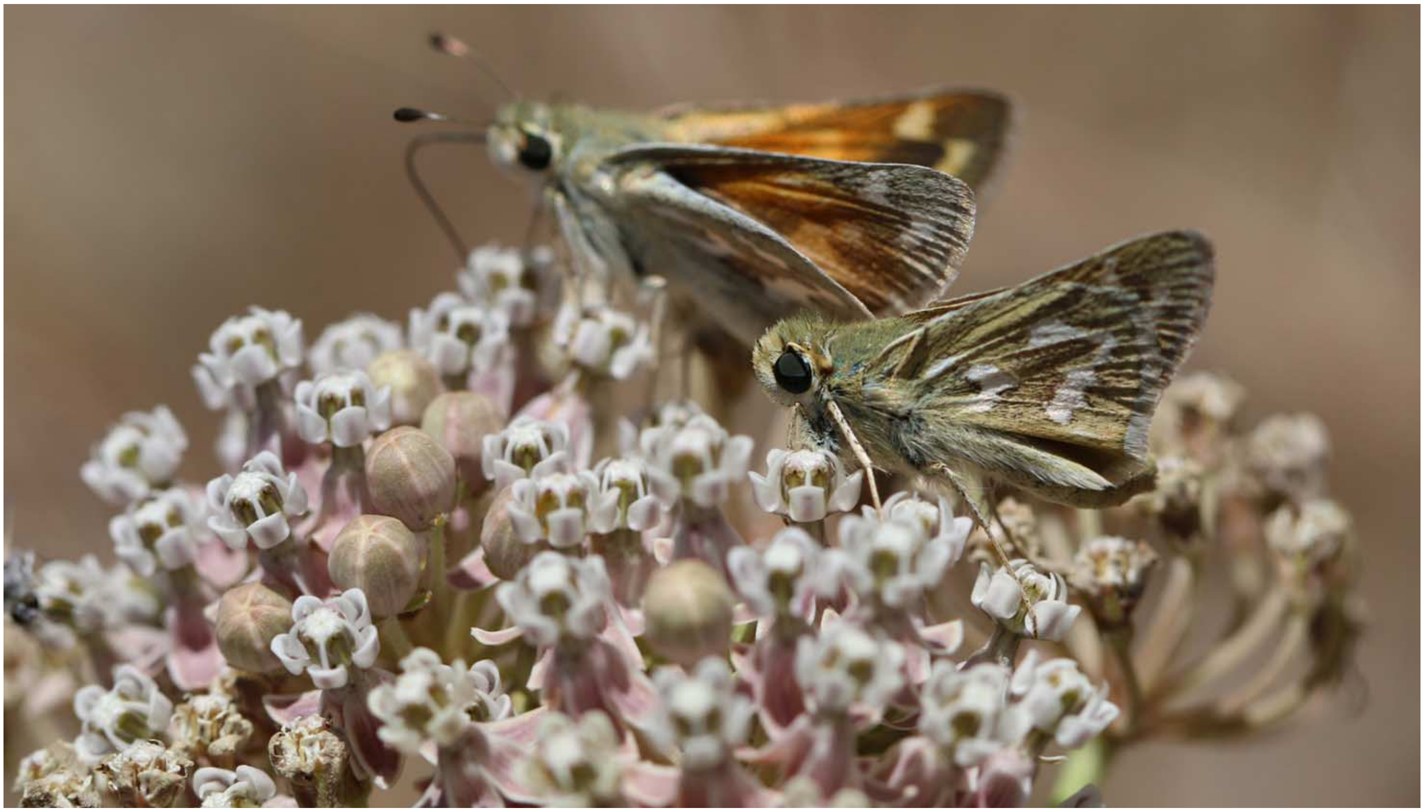

Two *Hesperia colorado* on narrowleaf milkweed. *Photo: Stephanie McKnight/The Xerces Society*

# Climate Change and Grass-Specialist Butterflies of the Central Valley

*by Angela Laws*[1]

Declining biodiversity has been making its way into the news more and more as researchers continue to record declines in plant and animal populations. Insects are no exception, and several recent studies have used long-term datasets to show sharp declines in insect abundance. For example, a 27-year dataset in Germany found a 75% decrease in the biomass of flying insects (Hallmann et al. 2017), and similar declines have been recorded for moths in Great Britain (Conrad et al. 2006). Here in California's Central Valley, 35 years of survey data also show declines in butterfly species richness and abundance (Forister et al. 2011). Most recently, a long-term study from Puerto Rico found that insect biomass had declined 4–8 times in sweep net samples and 30–60 times in sticky trap samples between 1976 and 2012 (Lister and Garcia 2018). Two things make this recent study from Puerto Rico unique. First, they show how declines in insect abundance cascade through the food web, leading to similar declines in lizards, birds, and frogs that eat insects. Second, declines in insect populations are often linked to factors such as pesticide use and habitat loss, but this study rules out those issues, showing that these dramatic declines in insect abundance are most likely due to climate change. Pesticide use in Puerto Rico declined 80% during the study period and the Luquillo Experimental Forest, where the study took place has been protected since 1930, limiting effects of habitat loss or fragmentation on the study area. However, insects have declined at the study site as temperatures have increased, and this response was observed across a broad range of taxa despite reduction in predators. These findings, combined with other studies showing that tropical insects should be particularly vulnerable to climate change (Deutsch et al. 2008, García-Robledo et al. 2016), indicate that climate change is the most likely cause for the observed arthropod declines.

Climate change can have a variety of effects on insects like butterflies. While some species may benefit from climate change, many will be negatively affected. Climate change can affect species distributions as species move to track optimal climate. Shifting distributions of several butterfly species have already been observed, often with a shrinking in the southern portion of their ranges (Parmesan et al. 1999). Phenology, or the timing of biological events, can also vary

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[1]Monarch and Pollinator Ecologist, The Xerces Society for Invertebrate Conservation. Angela has over 15 years of experience studying arthropods in grassland habitats, including studies of how climate change can affect species interactions. She received a MS in Ecology from Utah State University, and a PhD in Biology from the University of Notre Dame.

Table 1. Grass specialists in the Central Valley come from the skipper family (Hesperiidae) and the brush-footed family (Nymphalidae). The conservation status for each species is listed, based on NatureServe's conservation status ranks. Data from Butterflies and Moths of North America (www.butterfliesandmoths.org). Species with an asterisk in the status column were declining in long-term surveys conducted in the Central Valley (Forister et al 2011). Known native host plants are listed.

| Common name | Scientific name | Conservation Status[1] | Larval host plant family | Known native larval host plants |
|---|---|---|---|---|
| **Skippers** (Family: Hesperiidae) | | | | |
| Common Roadside Skipper | *Amblyscirtes vialis* | G5 | Poaceae | *Agrostis* spp., *Poa* spp. |
| Sachem | *Atalopedes campestris* | G5* | Poaceae | *Distichlis spicata* |
| Arctic Skipper | *Carterocephalus palaemon* | G5 | Poaceae | *Calamagrostis purpurascens* |
| Orange Skipperling | *Copaeodes aurantiaca* | G5 | Poaceae | *Bouteloua curtipendula* |
| Dun Skipper | *Euphyes vestris* | G5 | Cyperaceae | *Cyperus esculentus* |
| Western Branded Skipper | *Hesperia colorado* | G5 | Poaceae, Cyperaceae | *Festuca* spp., *Stipa* spp., *Andropogon* spp., *Poa* spp., *Bromus* spp. |
| Columbian Skipper | *Hesperia columbia* | Unknown | Poaceae | *Koehleria macrantha, Danthonia californica* |
| Juba Skipper | *Hesperia juba* | G5 | Poaceae | *Deschampsia elongata*, *Stipa* spp. |
| Lindsey's Skipper | *Hesperia lindseyi* | G3 | Poaceae | *Festuca idahoensis*, *Danthonia californica* |
| Sierra Skipper | *Hesperia miriamae* | G2 | Poaceae | *Festuca brachyphylla* (potential) |
| Nevada Skipper | *Hesperia nevada* | G4 | Poaceae | *Stipa occidentalis*, *Elymus elymiodes* |
| Fiery Skipper | *Hylephila phyleus* | G5 | Poaceae | |
| Eufala Skipper | *Lerodea eufala* | G5* | Poaceae | |
| Julia's Skipper | *Nastra julia* | G4 | Poaceae | |
| Rural Skipper | *Ochlodes agricola* | G4 | Poaceae | |
| Woodland Skipper | *Ochlodes sylvanoides* | G5* | Poaceae | *Phalaris* spp., *Elymus* spp. |
| Yuma Skipper | *Ochlodes yuma* | G5 (G3 in CA) | Poaceae | *Phragmites australis* |
| Umber Skipper | *Poanes melane* | G4* | Poaceae, Cyperaceae | *Deschampsia caespitosa*, *Bromus carinatus*, *Carex spissa* |
| Sandhill Skipper | *Polites sabuleti* | G5 | Poaceae | *Festuca brachyphylla*, *F. idahoensis, Agrostis scabra*, *Distichlis spicata* |
| Sonora Skipper | *Polites sonora* | G4 | Poaceae | *Festuca idahoensis* (likely) |
| Alkali Skipper | *Pseudocopaeodes eunus* | G4 | Poaceae | *Distichlis spicata* |
| **Brush-footed Butterflies** (Family: Nymphalidae) | | | | |
| Small Wood-Nymph | *Cercyonis oetus* | G5 | Poaceae | *Poa* spp. |
| Common Wood-Nymph | *Cercyonis pegala* | G5 | Poaceae | *Tridens* spp. |
| Great Basin Wood-Nymph | *Cercyonis sthenele* | G5 | Poaceae | |
| Common Ringlet | *Coenonympha tullia* | G5* | Poaceae, Juncaceae | |
| Ridings' Satyr | *Neominois ridingsii* | G5 | Poaceae | *Bouteloua gracilis* |
| Chryxus Arctic | *Oeneis chryxus* | G5 | Poaceae, Cyperaceae | *Carex spectabilis* |
| Great Arctic | *Oeneis nevadensis* | G5 | Poaceae | |

[1]NatureServe Conservation status ranks: G1= Critically imperiled, G2= Imperiled, G3= Vulnerable, G4= Apparently Secure, G5= Secure

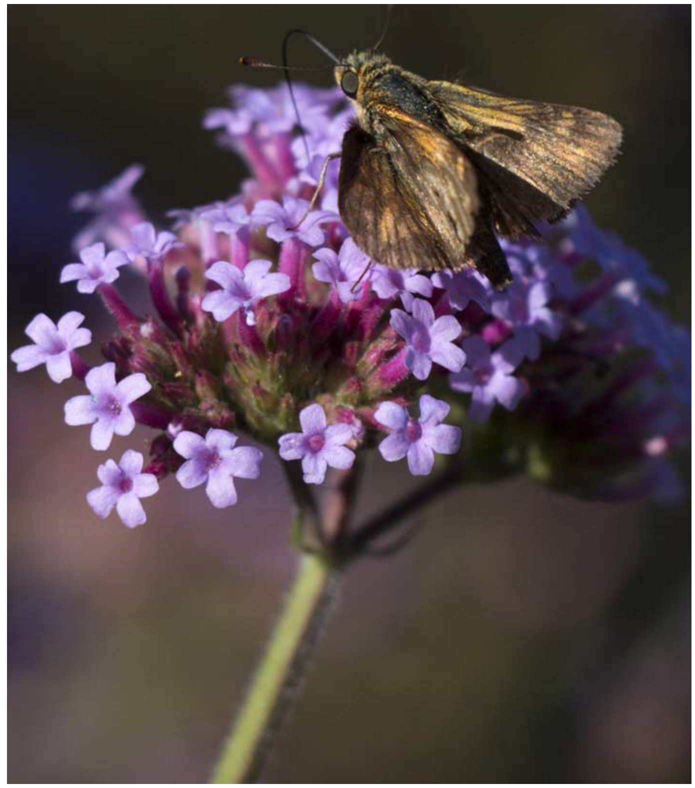
# Climate Change and Grass-Specialist Butterflies of the Central Valley *continued*

with climate change. One concern with butterflies is that the phenology of butterflies and their host plants can become misaligned, leaving caterpillars with little to eat (Hegland et al. 2009, Forrest 2015). Climate change may also affect butterfly populations through changes to plant communities. For example, increases in drought frequency and severity, which are predicted for California (Hayhoe et al. 2004, Pierce et al. 2018), will affect the amount of nectar available to adult butterflies. Finally, climate change can interact with other stressors, such as pesticide use and habitat loss, magnifying their impact (Potts et al. 2010, González-Varo et al. 2013). For example, exposure to a particular pesticide may not be lethal for a butterfly, but pesticide exposure combined with stress from a heatwave or drought may become lethal.

One of the best ways to protect butterflies and other insects from negative impacts of climate change is to increase habitat availability and habitat connectivity. Larger patches of habitat can support larger populations, which are generally less prone to extinction than smaller populations. Increasing habitat connectivity provides a number of benefits: it allows for larger populations, enables species to shift their distributions to places with more favorable climates, and also increases gene flow. The last item can be beneficial because it increases the amount of genetic variation in the population, meaning that it is more likely that there will be genes in the population that are better adapted to a warmer climate (Sgrò et al. 2011). Based in Sacramento, my job with The Xerces Society is to work with a variety of different partners to increase the area of pollinator habitat, improve connectivity, and find ways to incorporate climate change into our restoration work in the Central Valley.

California is home to over 280 species of butterflies (Opler 1999). These lovely insects can be found in a variety of habitats from deserts to forests to grasslands. Butterfly larvae are leaf-chewing insects, while adult butterflies feed primarily on nectar, but may also feed on rotting fruit, sap, or dung. While adult butterflies are usually generalists, feeding on a variety of plants, the larvae may be specialists. Some butterfly specialists use only a single host plant species for their larvae. Others are slightly less selective, choosing plants from a single genus or family. In contrast, species like the painted lady (*Vanessa cardui*) are generalists, and their larvae will feed on a large variety of host plants from many plant families (Opler 1999).

Of the more specialized butterfly species that occur in the Central Valley, over 25 use grasses, sedges, or rushes as larval host plants (Table 1). The bulk of these species are skippers (family Hesperiidae), and these come primarily from the subfamily Hesperiinae, aptly called "grass skippers" (Opler 1999). These are small butterflies, usually orange or brown in color. The remaining butterflies come from the brush-foots (family Nymphalidae), in the subfamily



Golden skipper. *Photo: Justin Wheeler/The Xerces Society*

Satyrinae: the satyrs, browns, and ringlets (Opler 1999). These are usually brown, medium-sized butterflies. While the larvae of these species specialize on grasses, sedges, and rushes, adults of these species are generalists, feeding on nectar from a variety of plant families.

Most of these grass-specialist butterflies are smaller, nondescript, and easily overlooked. As such, there is much less known about their natural history than about their flashier relatives. Native host plants are unknown for many of these species, but some of them have been found to feed on exotic grasses such as Bermuda grass in captivity (Lotts and Nauberhaus 2017). Learning more about the natural history of these butterflies, including more information about preferred native host plants, will aid in their conservation. This is an area where careful observation by citizen scientists (especially those like CNGA members that are familiar with native plants) can make important contributions to conservation.

One piece of the puzzle in understanding how to buffer butterflies and other insects against negative effects of climate change is to predict which species might be most affected by climate change. Species most likely to be vulnerable to climate change include both species that are specialists and species that are already declining (McKinney 1997). Specialists may be particularly vulnerable to climate change because they rely on the presence of a small number of host-plant species to persist. This means that climate change-driven shifts in plant community composition, especially changes in the abundance of important host plants, can have strong effects on

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specialist butterflies. Species that are already declining are at greater risk, because the effects of climate change can interact with and amplify other stressors like habitat loss which are causing the species to decline.

We are working on a database of Central Valley butterflies and their host plants for specialist butterflies and butterflies known to be declining. Effective conservation requires an understanding of the natural history of at-risk species. Knowing which host plants to use in restoration efforts to support these butterfly species is a valuable restoration tool. It will enable us to incorporate these plant species into restoration efforts, hopefully minimizing some impacts of climate change on these butterflies.

Climate change is a threat to biodiversity (Thomas et al. 2004), but we can minimize that threat by working to reduce the magnitude of climate change (Warren et al. 2018, Masson-Delmotte et al. 2018), and also through habitat restoration. Habitat restoration can help to mitigate the effects of climate change in multiple ways. First, intact ecosystems like grasslands serve as carbon sinks, sequestering carbon from the atmosphere, and serving as "Natural Climate Solutions" (Griscom et al. 2017) that help us meet carbon emissions targets. Second, restoring and protecting existing grasslands and improving habitat connectivity among grassland remnants is key to protecting grassland biodiversity, including butterflies and other grassland invertebrates, from negative effects of climate change. I hope we can work together to protect California's grasslands, and the many fascinating animals that call these grasslands home.

*The Xerces Society is a donor-supported nonprofit focused on protecting invertebrates and their habitats.*

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# Options for Prescribed Fire on Private Lands in California

*by Jeffery Stackhouse[1] and Lenya Quinn-Davidson[2]*

For many years, as county-based University of California Cooperative Extension advisors, we have fielded questions from landowners about prescribed fire. Prescribed fire, or the use of fire to meet specific land management goals, has been identified as a necessary tool for treating fuels and restoring fire-adapted landscapes (Ryan et al. 2013). Private landowners have voiced interest in using fire to improve range resources, enhance wildlife habitat, reduce fuels, manage invasive species, and increase biodiversity, but the options for burning on private lands in California have been unclear. With this paper, we aim to clarify the options for prescribed fire on private lands in California.

California's ecosystems have been shaped by fire for millennia. The fire historian Stephen Pyne (2016) said that 54% of California's ecosystems are fire-dependent, meaning they need fire to persist, and most of the remaining areas are fire-adapted. This makes sense given that approximately 4.5 million acres burned annually in California pre-1800 (Stephens et al. 2007) by a combination of lightning and human-ignited fires. Even as recently as the 1950s, approximately 100,000 to 225,000 acres of permitted burns were conducted by private ranchers each year to reduce fire hazard and improve grazing (Biswell 1999). In more recent decades, the California Department of Forestry and Fire Protection (CAL FIRE) has been the leader in private lands burning. In the 1980s, the Vegetation Management Program (VMP) peaked at around 30,000 to 65,000 acres of prescribed burning annually, but in recent decades, those numbers have consistently fallen short of 10,000 acres a year (FRAP 2019). CAL FIRE is currently revamping the VMP, with new goals of treating 50,000 acres a year, but it has become clear that landowners need more options for accomplishing their prescribed fire goals and moving California toward fire resiliency. This paper presents the four primary options for private lands burning in California, including a short description of each option, as well as a comparative analysis of all four (Table 1).

**Option One: CAL FIRE's Vegetation Management Program (VMP)**

CAL FIRE is the state's fire suppression agency. CAL FIRE implements prescribed fire projects on private lands through the VMP, which has been in existence since 1982 (CAL FIRE 2019). Under the VMP, landowners enter into a contract with CAL FIRE, and CAL FIRE plans and implements the project, providing most or all of the funding and assuming liability for the burn. Historically, VMP contracts had a

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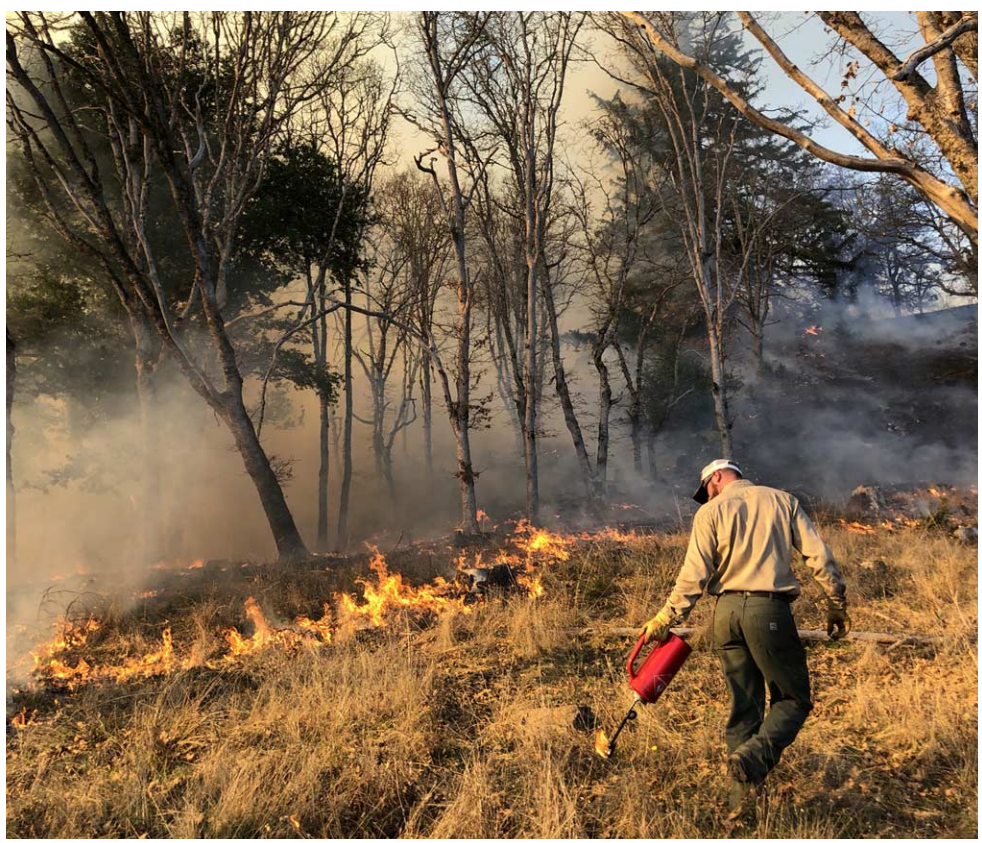
[1] University of California Cooperative Extension, Humboldt and Del Norte Counties, Eureka, CA; Livestock and Natural Resources Advisor; California Certified Rangeland Manager #113. Stackhouse is a wildlife biologist and range ecologist with research experience in a wide variety of habitats, from North Dakota to California. His current research program focuses on woody encroachment of coastal prairies and finding economically viable options for resetting late seral habitats to promote biodiversity and early seral beneficial forage plant species for livestock and wildlife. [2] University of California Cooperative Extension, Humboldt, Mendocino, Siskiyou, and Trinity Counties, Eureka, CA; Area Fire Advisor. Quinn-Davidson has a background in fire ecology and social science, and is interested in the effects of fire suppression on biodiversity in California's fire-adapted ecosystems and in empowering Californians to bring fire back into the land management toolbox.



Right: Do-it-yourself winter burning in oak woodlands, Humboldt County, CA. *Photo: L. Quinn-Davidson* three-year window, which — because of narrow burns windows and competition for resources — was often an insufficient period to complete contracts. In the fall of 2018, Senate Bill 1260 extended VMP contracts to 10 years and removed cost-share requirements (SB-1260 2018) in an effort to accelerate the pace and scale of CAL FIRE-led prescribed fire projects.

The VMP greatly incentivizes private lands burning, but those incentives come at the cost of relatively long planning timeframes; this is due in large part to environmental compliance requirements, and limited agency capacity to complete projects. Projects that involve state funding or have a state agency in a lead role require compliance with the California Environmental Quality Act (CEQA), which requires field surveys, reporting, and other work by specialized staff who have already limited time. Even when projects are planned, CEQA-compliant, and ready to burn, the agency's capacity can be a major limiting factor. The best burn windows in northern California often overlap with the active fire season in southern California, pulling resources away from prescribed burns. Likewise, even when resources are available, there is a limit to how many projects an individual CAL FIRE unit can complete. We suggest that VMP projects concentrate on more complex, high-risk projects that necessitate the expertise and resources that CAL FIRE brings.

### Option Two: Hire a contractor

The second option for private landowners is to hire a private contractor to plan and implement prescribed fire projects. There are few private companies that specialize in prescribed fire, but those that do are fire professionals with the highest levels of qualifications and expertise for both prescribed burns and wildfire. Prescribed fire contractors also carry insurance and can help landowners obtain permits. Hiring a contractor for prescribed fire projects may also alleviate some of the environmental compliance hurdles associated with the VMP, depending on the source of project funding. The ultimate downside of hiring a contractor is cost. Although highly variable, prescribed burning can cost more than $10,000 per day. These costs are tied more closely to the complexity of the burn and associated resource requirements (e.g., crews and engines) than to the size of the project. For example, a 5-acre forest understory unit may require more resources—and therefore be costlier — than a 200-acre grassland unit. Landowners interested in using contractors should remember that treating large areas with low perimeter-to-area ratios minimizes boundary treatment and per acre costs (Sneeuwjagt et al. 2013). Although hiring a contractor is the most expensive option, some landowners in the Midwest have found it economically viable at large scales.

### Option Three: Do it yourself

Arguably, the most attainable option for prescribed fire is to do it yourself (Photo 1). California landowners have the right to use prescribed fire on their properties, granted they meet permit requirements (air quality permits year-round, plus CAL FIRE permits during declared fire season). Many landowners conduct prescribed burns on their properties by themselves or with friends and family. With this model, landowners must secure their own permits, prepare the unit, and ensure they have adequate resources to safely implement the burn. The landowner is also fully liable if something goes wrong. The biggest limitation with this option is scale. Most do-it-yourself burning is small-scale and implemented in the off-season when CAL FIRE permits are not required. For projects that require in-season burning to meet objectives (e.g., early summer burning to eradicate medusahead [*Elymus caput-medusae*] or starthistle [*Centaurea* spp.]), the do-it-yourself model may not be feasible.

### Option Four: Prescribed Burn Associations

A prescribed burn association (PBA) is a group of local landowners and other interested individuals that form a partnership to conduct prescribed burns (Weir et al. 2010) (Photo 2). PBAs provide training, equipment, and labor to safely use fire and meet permit requirements, facilitating the application of fire as a tool and reducing the associated risks (Toledo et al. 2013). These associations also build networks and social capital among landowners and other community members, resulting in changes in attitudes toward fire and enhancing the social acceptability of using prescribed fire as a management tool (Toledo et al. 2013). PBAs are a great, low-cost way for community members to gather and share tools and equipment, and to work together to advance prescribed fire training and expertise. They also encourage a neighbors-helping-neighbors approach, which can alleviate liability concerns and facilitate cross-boundary projects that take advantage of landscape features, rather than property boundaries, as control lines.

Table 1: Overview of private land burning options and general considerations for California.

| Option | Cost to Landowner | Success Rate |
|---|---|---|
| CAL FIRE (VMP) | Low: Sometimes involves cost-share, but cost-share is no longer required (per SB1260) | Variable |
| Private contractor | High: >$10k per day | High: Only economically feasible at large scales |
| Do-it-yourself | Low: Equipment, time, labor, unit preparation | High: Likely only at small scales |
| Cooperative burning (PBA) | Low: time, labor, unit preparation, lunch for volunteers | High |

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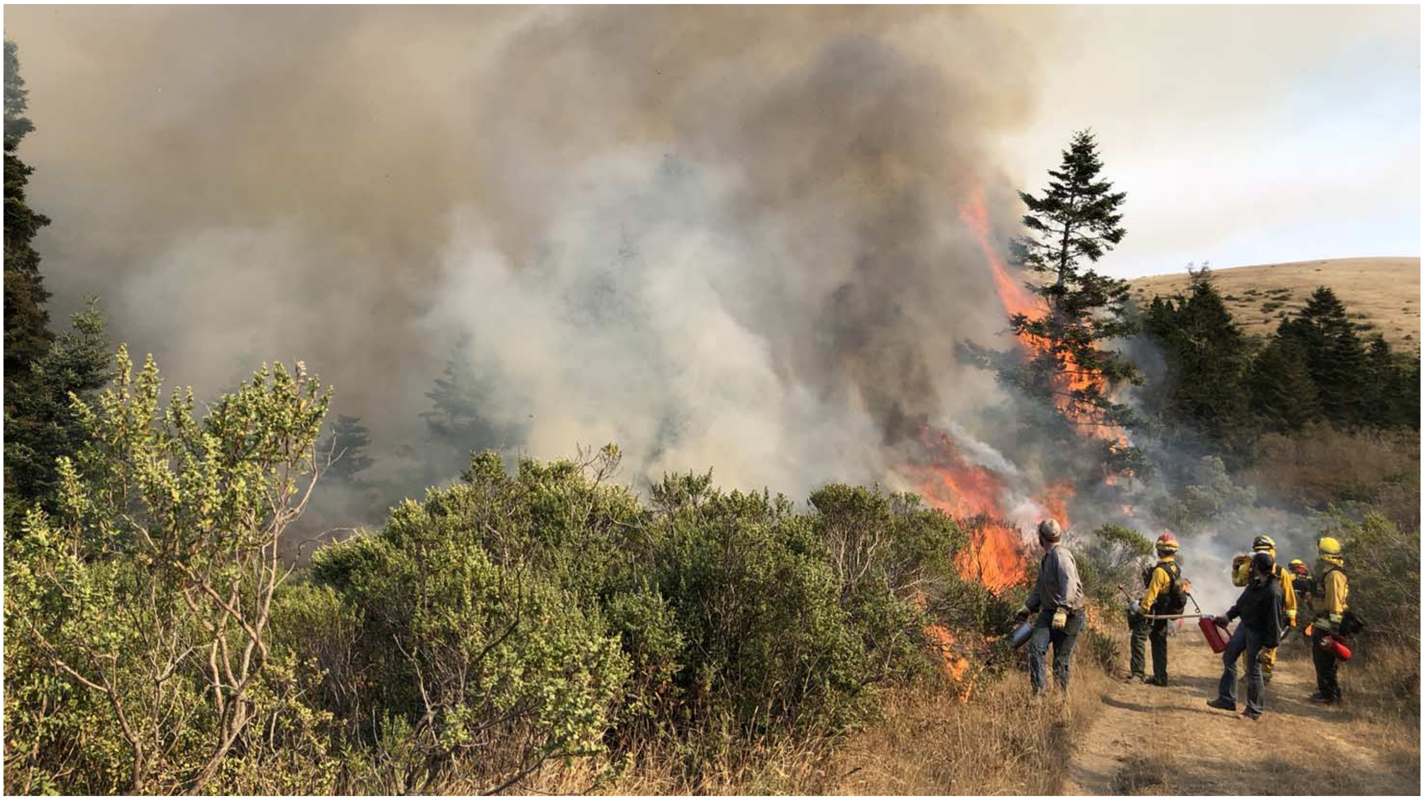

Prescribed Burn Association burning in encroached coastal prairie, Humboldt County, CA. *Photo: L. Quinn-Davidson*

# Options for Prescribed Fire on Private Lands in California *continued*

A 2012 survey of 27 Midwest PBAs reported 1,094 burns totaling 472,235 acres (432 acres/burn average) since their establishment, with an average of 8 years since establishment (Weir et al. 2015). The PBAs reported an escape rate of 1.5%, which is comparable to rates reported by the U.S. Forest Service (Dether and Black 2006). In all 1,094 burns, only one minor injury was reported, and no insurance claims had been filed against any of the PBAs or their members. As with the do-it-yourself option, PBAs empower landowners to burn when and how they want. However, PBAs are more efficient in accomplishing prescribed burns because they can effectively organize resources and crews, allowing for more complex, larger-scale projects (Weir et al. 2015). The value of forming a PBA is realized not just by individuals, but entire communities. PBA burns may address a range of objectives, promoting healthy ecosystems, improving wildlife habitat, reducing hazardous fuel loads, and increasing profitability of local ranches and timberlands (Diaz et al. 2016).

PBA burns also provide a rare opportunity for live-fire training to landowners and other community members. This model has been extremely successful across the Great Plains and other parts of the United States. California's first PBA was formed in Humboldt County in March 2018 and has treated almost 700 acres on seven different properties in its first year. Similar efforts are brewing across the state. If you are interested in forming a PBA, contact the authors or your local University of California Cooperative Extension or Resource Conservation District office.

## Conclusions

California's century-long fire deficit, and subsequent fuel loading has increased the recognition of prescribed fire as a valuable tool for improving ecosystem function and promoting resilience. However, relying on fire agencies alone to meet statewide prescribed fire needs is unrealistic, and private landowners need additional pathways for bringing fire back into the toolbox. This paper summarizes the four primary options available for private lands burning in California, answering the questions that so many people have been asking, and perhaps whetting the appetite of other private lands managers who are less familiar with fire as a tool.

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Side-blotched lizard in the southern San Joaquin Valley.

SPECIES SPOTLIGHT: *by Felix Ratcliff* *Photos courtesy of UC Berkeley Rangeland Ecology Lab*

# Side-blotched Lizard

Strolling through open grasslands on a warm day in central or southern California, you will likely see tiny beige-brown lizards darting along the ground, seeking cover in burrows or under bushes. If you can, creep up and get a closer look: these humble grassland denizens are more ornate than they appear from afar. Their tiny, granular dorsal (back) scales are often flecked with blue, orange, or yellow, and many lizards have a bold blue-ish black "side-blotch" behind each foreleg that looks like it was made with a Sharpie pen.

Markings on male side-blotched lizards tell us more than their identity—they are a window into their behaviors and reproductive strategies. Males have one of three distinct throat colors: yellow, orange, and blue. Orange-throated males are highly aggressive and defend large territories, breeding with multiple females in their territory, although they have a hard time keeping an eye on their whole territory. Males with blue throats are much less aggressive, defend smaller territories, and closely guard the females they mate with from other aspiring males. Yellow-throated males resemble females and are able to sneak into the territories of orange-throated males to mate with females—but they get chased away by blue-throated males when they approach their territory. Each strategy has an evolutionary advantage and weakness. If any one of these male morphs becomes more abundant than the others, another one of the morphs will exploit its weakness for their own benefit. This is often referred to as an evolutionary game of "rock-paper-scissors" (Sinervo and Lively 1996).

Side-blotched lizards typically only survive long enough to breed once (Stebbins and McGinnis 2011). If the weather is good and there are plentiful beetles, ants, spiders, and grasshoppers to eat (CalHerps 2019), they can produce many offspring in a single year. Females lay up to eight clutches of one to eight eggs each year. The hatchlings, when they emerge, are small—a little under an inch long (Stebbins and McGinnis 2011). Though numerous, the fate of side-blotch hatchlings is uncertain. Both adults and juveniles are an important food source for snakes, larger lizards, and birds. Only 15% to 43% of hatchlings survive to 9 months of age, and that number is largely dependent on the number of predators in their area (Turner et al. 1982).

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[1]Felix Ratcliff is a rangeland consultant with LD Ford Rangeland Conservation Science, and a postdoctoral researcher at the University of California, Berkeley.

## Side-blotched Lizard *continued*

Despite this tenuous existence, side-blotched lizards are not listed as threatened by any state or federal agencies or international organizations. Their abundance in California grasslands, however, is affected by management practices. This species lives in open habitats with bare soil or rock substrate (Stebbins and McGinnis 2011). Much of California's grasslands are now dominated by non-native annual grasses which can form dense cover and a thick, persistent 'thatch' layer. This change in physical structure reduces habitat quality for many species that are adapted to more open environments, and species which evolved in more open habitats often benefit from grassland management practices such as livestock grazing that reduce plant height and cover of annual grasses (Germano et al. 2012). A study on Tejon Ranch in 2014–2015 showed that side-blotched lizards also benefit from cattle grazing, increasing in number as the number of cattle in an area increased (Ratcliff 2017).

Though tiny, common, and widespread, these beautiful lizards are worthy of our attention. The next time you see a tiny beige blur flitting across the open ground, try tiptoeing closer and see if you can catch a glimpse of its throat color, and get a window into the life of these amazing creatures.


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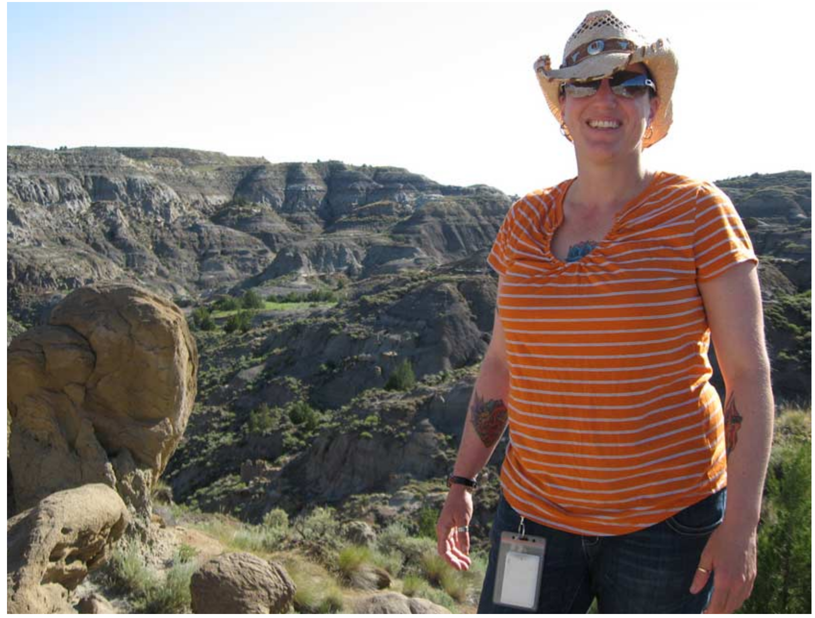
Inset: Typical side-blotched lizard habitat in a San Joaquin Valley grassland.

MEET A GRASSLAND RESEARCHER

# Three Ecologists Remember Dr. Erin Espeland

*by Taraneh Emam[1], Beth Leger[2], and Kevin Rice[3]*



Erin in Makoshika State Park, Montana, in July 2009

For the three of us, meeting Erin Espeland was literally a life-changing experience, either through our relationships with her as a mentor, co-worker, mentee, or friend. Below, we reflect on Erin's contributions to the field of grassland ecology, as well as how she affected those around her.

***Kevin Rice:***

As she was in life, Erin was absolutely fearless in her research. She had an incredible capacity to think across a wide range of disciplines and, more importantly, was able to discover new insights in her own research by thinking way, way outside the "box." A prime example of this was her discovery that the expression of facilitation in populations of dotseed plantain (*Plantago erecta*) in serpentine habitats depends on whether *Plantago* populations are locally adapted to this stressful soil type. Facilitation was being intensively studied at the time, but no one, until Erin's work, had ever thought to combine evolutionary and ecological concepts and apply them to this phenomenon. To this day, I remember vividly the moment when she came into my office with this incredible discovery. It remains as one of the best experiences of my entire academic career. Erin was incredibly creative and really, really smart but she always remained humble. Egotism was just not part of her behavioral repertoire. She was all about the joy of discovery and her love of science was positively infectious. She was a constant reminder to me of what is really important in academia, where grant deadlines and faculty meetings can sometimes make you wonder why you ever got into this business.

***Beth Leger:***

I met Erin when she joined Kevin Rice's lab as a graduate student at UC Davis in 2005. We both shared a love of poppies, so that was an instant connection, and we became fast friends, talking equally about the Big Ideas and the small ones. Erin joined my lab as a post-doc at the University of Nevada, Reno in 2006, and our working together laid the foundation for my research program today. Erin always went big, and almost 13 years later I am still benefiting from her exuberant ordering (helping me set up my lab with start-up funds); she gave me the 4WD lessons needed to drive the roads of the Great Basin; and Erin is the only person besides my sister for whom I have a phone number programmed into every phone; I cannot bring myself to delete them. We were talking and texting about Big Science and small details, all the way to the end.

***Taraneh Emam:***

I first met Erin in 2006, when I was in my junior year at Mills College — she taught the Plant Biology course I was taking at Mills (which was also her alma mater) while the professor was on sabbatical. At first, I didn't know what to make of her exuberant personality and brightly colored outfits, but by the end of the semester I had developed a deep respect and admiration for her. When I graduated from Mills, Erin helped get me a position in the Leger lab as a research assistant — we spent a summer sampling grassland plots in the field (while trying to avoid rogue bulls), experiencing small-town Nevada, processing samples in the lab, and crunching data together. In the following years, she served as a wonderful mentor, providing me a summer job in her lab in Montana when an injury waylaid my field research plans, shepherding me through the graduate school application process, and introducing me to the Rice Lab (where I then pursued my own doctorate), collaborating with me on research projects and publications, and advising me during the ups and downs of graduate school, career, and life. I now often find myself reflecting on the incredible gift of her mentorship and friendship over the past twelve years.

**Erin's story**

Originally a music major, Erin developed a passion for native plants during a summer job with the San Mateo Parks Department. She then completed a research fellowship in rare plant ecology at Lawrence

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[1]Taraneh Eman is Project Manager/Biologist at ECORP Consulting, Inc., and served on the CNGA Board of Directors from 2013 to 2014.
[2]Elizabeth Leger is Professor & Associate Director of the Ecology, Evolution, and Conservation Biology Graduate Program at University of Nevada, Reno. [3]Kevin J. Rice is Professor Emeritus at Department of Plant Sciences, University of California, Davis.

Livermore National Laboratory under the direction of Tina Carlsen. There, she studied the effects of fire and granivory on restoration of the rare large-flowered fiddleneck (*Amsinckia grandiflora*), and characteristics of two of the only three known populations of the diamond-petaled California poppy (*Eschscholzia rhombipetala* — a species so rare it was considered extinct for many years).

Erin then pursued a doctorate in the "Big Science" lab of Kevin Rice at UC Davis, where she studied interactions between plant populations and environmental conditions. While examining *Plantago erecta* populations, she found that those adapted to lower stress conditions were more likely to perform better in the stressful conditions of low-nutrient serpentine soils if they were planted densely — the presence of other plantain plants facilitated their growth. Erin was also a superb research mentor for various undergraduates that worked within the Big Science lab. She was exemplary in the way she introduced the students to the overall concepts and goals of a particular research project and always made sure that they understood the rationale for each aspect of an experiment. She was always *extremely* patient and, as usual, instilled a feeling that science could be a whole lot of fun.


After completing her PhD, Erin joined the lab of Beth Leger as post-doctorate at the University of Nevada, Reno, where she studied interactions between native and invasive species such as *Bromus tectorum* (cheatgrass) in Great Basin rangelands. Her research with Beth showed that cheatgrass invasion altered the phenology of native grass species, causing native grasses to flower earlier. However, some populations of native grasses growing alongside cheatgrass were able to compete better with it than the grasses from uninvaded grasslands — demonstrating that native plants could successfully adapt to the presence of invaders.

Erin became a research ecologist for the USDA Agricultural Research Service in Eastern Montana in 2008. During her 10 years in this position, she was a prolific researcher and writer, collaborating with others on research topics including restoration of coal strip mines and oil fields in the Northern Great Plains, and ecology of the invasive tree Russian olive (*Eleangus angustifolia*). She also continued her research in California on inter- and intra-species competition and facilitation, and the invasion of California grasslands by barbed goatgrass (*Aegilops triuncialis*).

In 2015, Erin was diagnosed with Atrophic Lateral Sclerosis (ALS); she passed away in August 2018. She continued to be devoted to her research and to supporting other scientists, continuing her collaborations with almost everyone she crossed paths with, and her work continues to be published posthumously. To the end, Erin demonstrated her incredible capacity for synthesis in her invited commentary for *New Phytologist* (a top journal on plant evolution and ecology). In her commentary, Erin describes how biological invasions can be used to experimentally study long-standing evolutionary and ecological questions about species coexistence. In a little over two pages, Erin provides enough challenging research questions to keep graduate students (and maybe some hardy professors) busy for decades; research questions, that if she were still with us, Erin would have gladly and joyfully pursued.

Eternally passionate about research, Erin inspired and mentored students and junior scientists throughout her career, and formed collaborations with a wide range of researchers and professionals in grassland ecology, restoration, and agriculture. In addition to her research, Erin was known for her warm and outgoing nature, characteristic laugh, and talent on the banjo. She is fondly remembered by many in the grassland research community, and dearly missed by many more.

Inset: Erin outside her home in Sidney, Montana in 2010

*Donations in Erin's memory can be made to the Erin Espeland Internship Fund at:*
***https://www.cnps.org/education/students/erin-espeland-internship***

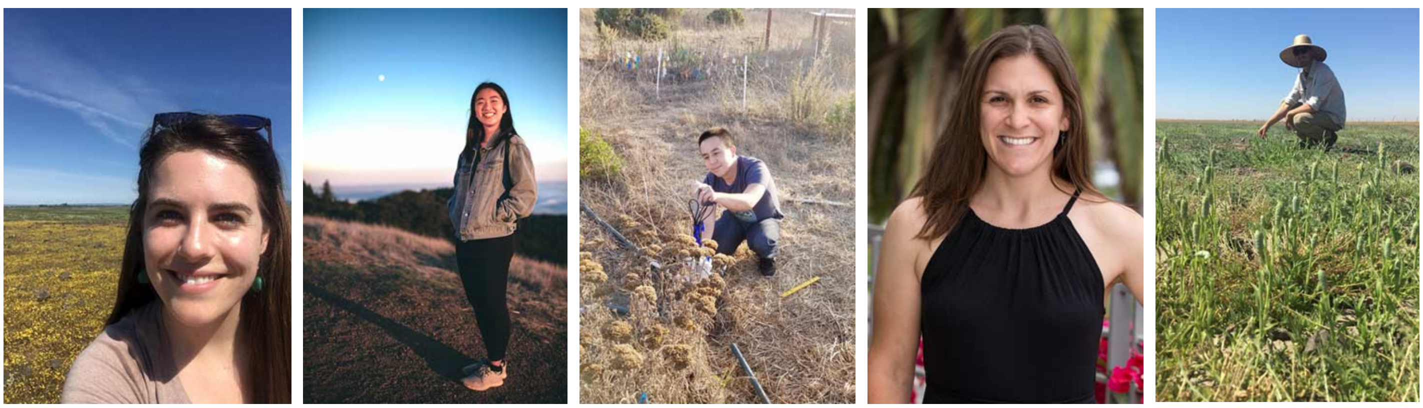
# Meet the 2019 Grassland Research Awards for Student Scholarship (GRASS) Recipients

CNGA kicked off our newest program, GRASS, in January 2019. The program offers competitive research funds to promote undergraduate and graduate student research focused on understanding, preserving, and restoring California's native grassland ecosystems in accordance with the CNGA Mission and Goals.

We received eleven applications for the four $500 scholarships we were offering for 2019. Because we exceeded our November 2018 Giving Tuesday fundraising goal of $2,000, we were able to fund five instead of four students. Thank you to those who donated to support the next generation of grassland researchers and congratulations to the 2019 award recipients!

We are now accepting donations for next year's student research scholarships. Our goal for 2020 is to raise $4,000 so we may fund up to eight research projects!

Make your donation online at **cnga.org**, mail your check to CNGA, PO Box 72405, Davis CA, or call (530) 902-6009 to pay over the phone.



CNGA 2019 GRASS Award Recipients, from left: Sarah Gaffney, Edith Lai, Justin Luong, Madeline Nolan, and Daniel Toews.

### Thanks to your generous donations, we were able to award these five grassland researchers:

**Sarah Gaffney**, UC Davis, "Plant Soil Feedbacks May Drive Persistence of Invasive Grasses" *Major Professor: Valerie Eviner.*

I am a Ph.D student in Valerie Eviner's lab in the Graduate Group in Ecology at UC Davis with a focus on restoration ecology. I am studying mechanisms of community assemblage in California's highly variable annual grasslands, and their role in medusahead and goatgrass invasion and native restoration persistence.

**Edith Lai**, UC Berkeley, "*Lasthenia gracilis* Flowering in Response to Declining Biodiversity in California Grasslands" *Supervisors: Rachael Olliff Yang (PhD Candidate) and David Ackerly (Professor).*

I'm Edith, a student at the University of California, Berkeley. I study ecology and environmental health with hopes of attending graduate school and continuing down the path of research. My research interests include biodiversity, climate change, community dynamics, and infectious diseases. Currently, I am working on a project investigating the effects of declining biodiversity on phenology in multiple *Lasthenia gracilis* populations. I hope to clarify population-level differences in flowering responses to environmental stressors. In my free time, I also enjoy baking, playing soccer, and traveling with friends!

**Justin Luong**, UC Santa Cruz, "What Happens to Restored California Coastal Prairies?" *Advised by Drs. Michael Loik and Karen Holl.*

As a Californian native, I slowly migrated up the coast from Irvine to Santa Barbara where I attended college and finally ended up at UC Santa Cruz for grad school. After graduating, I worked for several years on vernal pool, grassland and endangered species restoration. After seeing all the effort and passion that went into restoration, I was curious to learn more about improving current restoration methods and decided it was time to leave the Cheadle Center for Biodiversity and Ecological Restoration and go back to grad school. I am broadly

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## Grassland Research Awards for Student Scholarship *continued*

interested in community ecology, restoration ecophysiology and the interactions between plants their environment and humans. I want to further understand how forecasted changes in precipitation will impact future restoration efforts. Currently, I am especially concerned with coastal prairies which are rapidly disappearing even in areas where restoration is mandated for coastal development. I will explore whether past restoration projects have fared, whether they meet their original project goals and how they can inform developing projects. I also am working on improving restoration planting through incorporating plant functional traits and phylogenetics to better adapt projects for climate change.

**Madeline Nolan**, UC Santa Barbara, "Are Populations of *Stipa pulchra* Adapted to Local Climates?" *Major Professor: Dr. Carla D'Antonio.*

I am a PhD candidate in Ecology, Evolution and Marine Biology at the University of California, Santa Barbara. Her research is focused on the restoration of native grass communities in Southern California. I study how different restoration techniques influence the survivability and growth of native California grasses, such as *Stipa pulchra*, after being restored. This information will be used to inform and improve grassland restoration projects.

**Daniel Toews**, UC Merced**, "**Using eDNA Metabarcoding Sequencing to Quantify Biodiversity in California Vernal Pool Plant Communities" *Advisor: Dr. Jason Sexton.*

I am a 4th year PhD student in the Environmental Systems Graduate Group at the University of California, Merced. I am advised by Dr. Jason Sexton at UC Merced whose research centers on understanding the vulnerabilities and adaptive responses of plants to a rapidly changing world. My research interests are conservation oriented and focused on understanding the patterns of plant diversity and plant adaptation across complex environments. Specifically, I use a combination of metagenomics (environmental DNA barcoding) and field experimentation to better understand ecological and biogeographical effects that shape plant diversity and local adaptation in vernal pools wetlands. In between extracting plant DNA from environmental samples or measuring vernal pool plant traits, I work as an environmental consultant and have developed somewhat of an obsession with *Neostapfia colusana*. I enjoy spending time with my wife and twin boys, botanizing, and mountain biking.

# CNGA's Bunchgrass Circle

## A Special *Thank You* to our Bunchgrass Circle Members!

As a nonprofit organization, CNGA depends on the generous support of our Corporate and Associate members. Ads throughout the issue showcase levels of Corporate membership ($1,000, $500, $250). Associate members ($125) are listed below. Visit **www.cnga.org** for more information on joining at the Corporate or Associate level.

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**Hedgerow Farms**
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### *Stipa pulchra*

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California Native Grasslands Association

P.O. Box 72405
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**"Grass is the forgiveness of nature." — Kansas Senator John James Ingalls, 1872**

*Front cover*: Production field of *Poa secunda* at Hedgerow Farms. *Photo: Emily Allen, Restoration and botanical consultant based in Ukiah, Mendocino County. CNGA board member.*

*Back cover*: Bunchgrass after fire recovery at Pepperwood Preserve, Santa Rosa, 2017. *Photo: © Saxon Holt*