California Native Grasslands Association

GRASSLANDS

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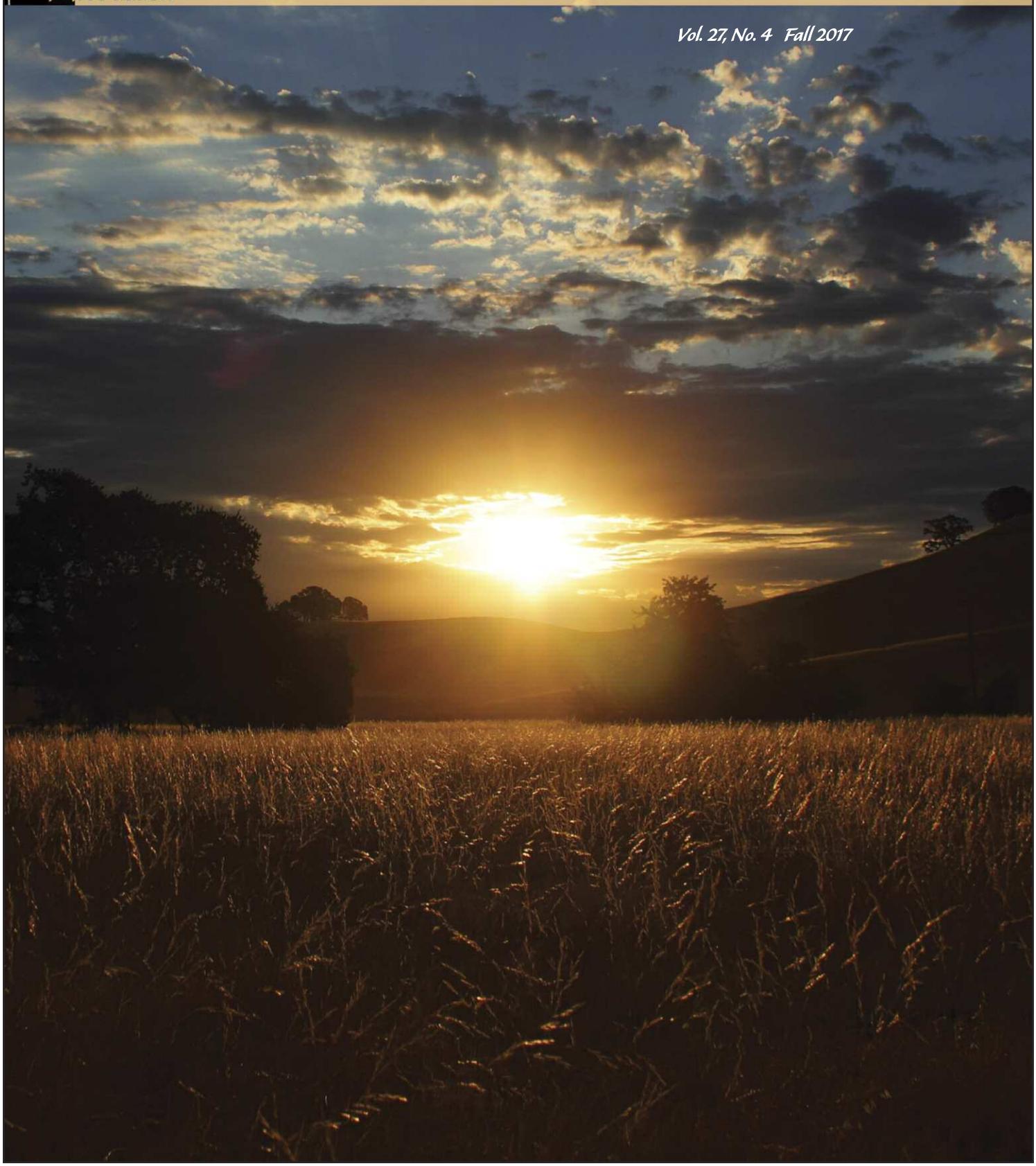

California Native Grasslands Association

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.

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From the President's Keyboard

From the heart… I am struggling with the writing of this column. As I write today, there are crises all around us. The West is on fire. The Southern states are impacted by tornadoes and flooding. Some regions are impacted by devastating earthquakes. Climate change, although denied by our government, is a reality and we see the impact on our native environment daily. At the local level, I have seen a shift in the phenology of our grasses, going through their life cycles earlier and more quickly, and it seems to have some impact on wildlife, including birds. Native grasslands throughout California are in decline, with the pressure of development to sustain more inhabitants and now the possible shrinkage of some of our national monuments. More than ever we need to stand up and do what we can to promote the use and the preservation of natives in restoration projects and open spaces. Their ability to sustain through fire and flooding and their benefits to wildlife have been demonstrated, as has their ability to provide erosion control and a longer foraging season than non-native annual grasses. To that end, CNGA is developing new workshops to educate attendees on implementation and management techniques, plant identification, and monitoring.

Financially, although the organization led by our Administrative Director and your Board of Directors is doing well, we need more support from our corporate sponsors and individual members. Our future goal is to employ our administrative director or an executive director full-time to better serve you and to advocate at the state level. To meet this goal, we need more members and more donations. I encourage you to donate more, sign-up for a higher level of membership, or be a new corporate sponsor. Having a full-time operational officer will surely put CNGA on the map, help preserve our native grassland ecosystems wherever possible, and implement and deliver new quality workshops.

As your President, I had a vision of a piece of land managed by or managed according to CNGA standards that could be visited, or otherwise utilized by our members as a place of learning and enrichment. If you own a piece of land, or know someone who does and who might be interested in doing this, let me know. I think this would be an amazing outreach and teaching opportunity for our members and the overall community.

This is my last journal as your president. It's been a pleasure to serve you for the past two years and I thank you for your continuous support to our organization. We wouldn't exist without your contributions, so again, thank you. Lastly, I want to personally thank all of our amazing instructors who have implemented and delivered many well-attended workshops.

JP Marié, President

CNGA BOARD ELECTION FOR 2018

Election time for the 2018 Board of Directors is almost here!

On-line election voting will be open December 1–20, 2017. When the polls open, go to **www.cnga.org**, sign in as a member, and click on Election 2018.

On December 1st, we will send an email to all members with:
1) Directions to create your account if you have not done so already, and 2) Access to election information and ballot.

If you have any questions, please email admin@cnga.org or call 530.902.6009.

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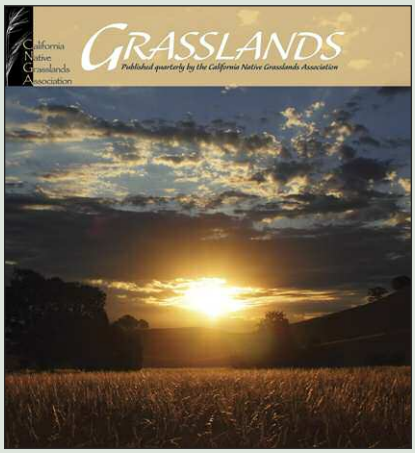

Grasslands Submission Guidelines

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:

Winter 2018: 15 Nov 2017 ❊ **Spring 2018**: 15 Feb 2018 ❊ **Summer 2018**: 15 May 2018 ❊ **Fall 2018**: 15 Aug 2018

BLM Veg Ecologist Jennifer Wheeler talks grasslands on Prosper Ridge to Mattole Restoration Council grass class.

Field Trip Report: *Native Grasses with the Mattole Restoration Council*

by Andrea Williams[1], CNGA Vice President

One does not come upon the "Lost Coast" without meaning to, but it is worth the trip. Few roads lead west to Petrolia and the King Range from Highway 101 in Humboldt County — fewer still after the storms of winter 2016–2017. On invitation from the Mattole Restoration Council, I made the trip to talk about native grasses and grassland restoration with members of the local community.

The Mattole Restoration Council does tremendous work in the Mattole watershed, mostly around salmon habitat improvement, but also invasive species removal and native plantings. They collect and grow local plants, particularly native grasses and riparian plants, and work with local landowners and the Bureau of Land Management on restoration design and projects. As part of a series of grant-funded workshops, the Mattole Restoration Council organized a day's activities and asked CNGA to lend additional expertise.

We started the day at the community center with a workshop on grasslands of California, another on grass morphology, and a third on tips for grass identification. Afterwards, we visited the native plant nursery to see their grasses, and then the seed-drying building where lots of fescue was drying down for storage.

In the afternoon, we carpooled up to Prosper Ridge in the King Range with BLM Vegetation Ecologist Jennifer Wheeler. Walking out into the wilderness grassland, we were greeted by sweeping vistas of summer-gold grasses dotted with late-season wildflowers. The group gathered around stalwart spikes of blue wild rye (*Elymus glaucus*), noting the simple inflorescence and flagged leaves. We found a wall of Lemmon's needlegrass (*Stipa lemmonii*), spent stalks of California brome (*Bromus carinatus*), and restoration plantings of tufted hairgrass (*Deschampsia cespitosa*). The second flush of California poppies (*Eschscholzia californica*) and farewell-to-spring (*Clarkia amoena*) provided floral interest; we also found several praying mantis patrolling the hillside and an unlucky cicada caught in a spider's web. We ended the afternoon talking about restoration and fire ecology before hiking back to our vehicles for the return trip to the community center.



Western Meadowlark (*Sturnella neglecta*). Left: *Photo courtesy Gary Kramer, USFWS* Center: Foraging in a restored perennial grassland (primarily *S. pulchra*), in Zamora, Yolo County. *Photo courtesy Kristina Wolf* Right: *Photo courtesy Krista Lundgren, USFWS*

SPECIES SPOTLIGHT:

The Neglected Western Meadowlark *(Sturnella neglecta)*

by Diana Jeffery[1], Administrative Director, CNGA

Western Meadowlarks are perhaps the quintessential grassland bird. Easily recognized by their bright yellow breast crossed by a black V-shaped band, they are most often seen perched on a fencepost or nearby shrub. They forage on the ground in grasslands, prairies, fields and pastures, nesting in small depressions in the soil, sometimes even a hoof print. They often conceal their nest by weaving the surrounding grass stalks into a dome or tunnel-like structure; industrious birds construct an entrance tunnel reaching up to several feet long.

Western Meadowlarks are year-round residents of California grasslands. Once thought to be the same species as the Eastern Meadowlark (*Sturnella magna*), the Western Meadowlark was eventually recognized as a separate species and subsequently given the name *neglecta* by John James Audubon. Both species live, nest, and forage in grasslands. They are almost identical, with the same black V-shaped marking on bright yellow breasts, differing almost imperceptibly in bill and tail shapes, but each species has its own distinctive melodic songs and calls. It is reported that in areas where the species overlap there is some interbreeding and the males learn the songs of both species. Western Meadowlarks feed primarily on seeds and insects (e.g., beetles, crickets, grasshoppers, caterpillars, ants, bees, wasps) using bills with strong muscles that allow them to force open bark and pry into soils to reach grubs, worms, and insects that other birds cannot access.

Worldwide, all grassland birds are at risk because of degraded and mismanaged grasslands. Western Meadowlark populations have declined 42% since 1970 (North American Breeding Bird Survey via Partners in Flight, 2017). Other birds have fared less well: the Grasshopper Sparrow (*Ammodramus savannarum*) has lost 68% of its population over the last 40 years (Partners in Flight, 2016). Programs offered by the USDA Farm Service Agency and the Conservation Reserve Program have previously offered incentives

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Some Recommended Actions for Bird Conservation (Adapted from Partners in Flight, 2017)

- Implement conservation practices to reverse or sustain grassland bird populations. Reduce the use of pesticides, and improve your knowledge about the role of pesticides in declines of beneficial insect and bird populations.
- Reduce and prevent collisions with buildings and other structures by making windows less reflective and more visible to birds (e.g. apply decals, bird tape, bird safety film, or install awnings, etc.).
- Remove feral cats from public lands and keep pet cats from roaming freely — make them an indoor cat or add a bird-protective cover to their collar.
- Preserve greenspace and use native plants in urban and suburban landscaping.

Diana is a plant and grassland ecologist. She has a current project with *Trifolium amoenum*, an endangered clover, and is co-author of the website, *California's Coastal Prairies,* a project of the Sonoma Marin Coastal Grasslands Working Group.

Western Meadowlark

continued

and funding to land owners for using conservation practices and for providing habitat. The future of programs, such as the Upland Bird Habitat Buffer Initiative (CP-33), is unsure.

There are ways, however, in which land managers, ranchers, and farmers can alter their practices to benefit both themselves and grassland birds. The first step towards conservation management is to learn about the plants and animals living there. Western Meadowlarks' nesting season is March through August. Adjusting the timing, extent, and intensity of activities such as haying, grazing, and mowing can make management operations more compatible with Western Meadowlarks and other grassland inhabitants (Cornell Lab of Ornithology, 2009).

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Upcoming CNGA Workshops & Events

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

October 20, 2017, 8:00 am–4:30 pm (October 27 rain date)
UC Davis Putah Creek Reserve, Davis CA

$155/CNGA members | $180/Non-members | $95/Students with ID

Register online at **cnga.org** or contact Diana Jeffery at admin@cnga.org or 530.902.6009

CNGA at the Cal-IPC Symposium: Grassland Invaders

Riviera Palm Springs Resort, October 24–27, 2017

CNGA will host the "Grassland Invaders" session on Wednesday, October 25th from 3–5 pm, featuring speakers from around the state. Other grassland-related talks appear throughout the conference. Join us in Palm Springs for some of the latest news in grassland research. Conference registration fees apply. Register online at **http://cal-ipc.org/symposia**

CNGA at the California Native Plant Society 2018 Conservation Conference

Los Angeles Airport Marriott— Workshops & Field Trips January 30–31, Conference February 1–3, 2018

CNGA will present its grass identification workshop, "An Introduction to Grass Identification: You Can Totally Do This!" on January 31st, 1–4:30 pm. Board members Jennifer Buck-Diaz and Michele Hammond will chair the "Grasslands and Prairies" session, and Andrea Williams will chair "Managing Lands for Native Plant Conservation". Find more details at **cnga.org** and **conference.cnps.org**. Get more information on workshop & conference registration fees and register online at **conference.cnps.org**

Coming this Winter:

Pasture Walk—See How Nature Grows Topsoil and How You Can Too

Introduction to Grazing Planning

Landscaping with Nature — Designing, Building and Maintaining Beautiful Landscapes that Support Wildlife and Reduce Water Usage

Coming this Spring:

Grassland Monitoring Methods and Techniques

Register online at **www.cnga.org** or contact Diana Jeffery at **admin@cnga.org** or 530.902.6009

Get the latest workshop information at: **cnga.org**

VISITING CALIFORNIA'S GRASSLANDS: **Point St. George, Del Norte County**

by Andrea Williams, CNGA Vice President

Grasslands are not a uniform thing, with strict boundaries and standards. Like so many things in the world, vegetation communities are an assemblage of diversity which we often attempt to parse, bound, and codify. Point St. George is an area where such diversity is apparent everywhere you turn.

Del Norte County is the northwestern-most county in the state, and Point St. George the northwestern-most grassland in the county. Coastal prairie, bluffs, wetlands, dunes, and scrub continue up the coast to Tolowa Dunes State Park, and south past town to Enderts Beach in Del Norte Coast Redwoods State Park (part of Redwood National and State Parks). North coastal prairie is one of the most diverse of all grasslands, and at Point St. George one can see a plethora of plants found almost nowhere else in California.

The main parking lot and the end of North Pebble Beach Drive have several trails leading from it — some down to the beach, others through grasslands and wetlands to the bluffs. Within a few steps I crouched down to see the shockingly blue leaves of tough coastline bluegrass (*Poa confinis*) — to my eyes, the smallest of the beach bluegrasses. With it was low-growing seashore lupine (*Lupinus littoralis*), with even its inflorescences truncated by the near-constant winds off the ocean. Nearly constant was the buzzing of native and non-native bees, visiting a surprising number of wildflowers blooming in late July: creamcups (*Platystemon californicus*), sea-thrift (*Armeria maritima*), coastal angelica (*Angelica hendersonii*), yarrow (*Achillea millefolium*), non-native hawkbit (*Leontodon saxatilis*), and rare sanddune phacelia (*Phacelia argentea*).

Away from the dessicating winds on the bluffs, areas presented taller and more wetland species, where rushes, horsetails, and Pacific reedgrass (*Calamagrostis nutkaensis*) dominate. Color is provided by water parsley (*Oenanthe sarmentosa*) and beach silverweed (*Potentilla anserina*), as well as the showy red bracts of twinberry honeysuckle (*Lonicera involucrata*). Heading further towards the coast or moving to areas with different wind or sun exposure yields new and interesting plants and views.

In addition to exciting plants, Point St. George offers excellent tide-pooling opportunities, and cultural sites from the Tolowa shell mounds to the residences of lighthouse keepers when they weren't in the lighthouse six miles offshore (bring binoculars and hope for clear weather to see it). The lighthouse provides the final superlative to Point St. George: it's the tallest on the west coast.

Left: Project Partners assess livestock water sources in the Sunol Regional Wilderness for rehabilitation and redistribution. Right: A non-functional water trough and adjacent seep made this site an ideal candidate for repairs, including the installation of a sturdier trough further away from the spring's drainage area. *Photos courtesy Alameda County Conservation Partnership*

Re-watering Rangelands for Drought Resilience: *Improving Habitat, Grazing Viability, and Management Opportunities by Augmenting Water Resources on Grazed Uplands*

by Rachelle Hedges[1], Ian Howell[2], Leslie Koenig[3], and Jackie Charbonneau[4]

Introduction

The Alameda County Rangeland Resilience Pilot Project ("Project") began in 2015 in response to a growing need for water storage and distribution solutions on Bay Area rangelands. Multiple years of drought forced many ranchers to reduce herd sizes due to low forage production, and left available forage out of reach due to a lack of developed upland water resources. Grazing on California's rangelands is an important tool in keeping the grassland ecosystem functioning properly, and has been shown to help limit populations of non-native plants, slow or stop the encroachment of woody shrubs into grasslands, and maintain habitat for grassland birds, mammals, and amphibians (Barry et al. 2007, Rissman et al. 2007, Barry et al. 2015). Well-managed grazing can also lessen the risk of wildfire on grasslands by keeping residual dry matter at lower, safer levels (Bruegger et al. 2016).

The Project seeks to repair and redistribute water resources on naturalized annual grasslands in the San Francisco Bay Area's East Bay hills, to help maintain appropriate grazing levels for rangeland ecosystem health. Water distribution is a valuable tool for regulating grazing, as cattle movement across a landscape is closely tied to the location of water (Ganskopp 2001, Barry et al. 2016). When water is not adequately distributed, grazing may become concentrated near available water sources, while forage in areas without water may become overgrown and prone to encroachment by undesirable vegetation, reducing habitat for some wildlife (Barry et al. 2015, 2016). As water sources become less reliable in the face of predicted climate stressors, more livestock water options must be made available on California's rangelands. Comprised of three major components, the Project is aimed at increasing resilience to climate uncertainties and improving grazing practices through: 1) Rehabilitation and redistribution of water resources — focusing on developed springs and existing livestock ponds; 2) Monitoring of rehabilitated areas for efficacy of watering facility improvements; and 3) Outreach to inform land managers of the Project outcomes, and how these outcomes might guide best management practices for grazing on naturalized annual grasslands.

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[1]Rachelle Hedges is a Resource Conservationist with the Alameda County Resource Conservation District and acts as the communications and outreach specialist for the agency.

[2]Ian Howell is a Resource Conservationist with the Alameda County Resource Conservation District and acts as the project manager for the Rangeland Resilience Pilot Project ("Project") and Climate Ready Grant.

[3]Leslie Koenig worked for the Alameda County Resource Conservation District from 2007-2017, and served as the original project biologist. She currently works as a biologist for Swaim Biological, Inc.

[4]Jackie Charbonneau is an Ecologist with the USDA Natural Resources Conservation Service in Alameda County. She serves as the ecologist for the Project, and works closely with the ranching tenant in the Project Area.

Project history

The Alameda County Resource Conservation District (ACRCD) has served East Bay farmers and ranchers for over 40 years, working closely with the USDA Natural Resources Conservation Service (NRCS) as the Alameda County Conservation Partnership (Conservation Partnership) for much of that time. The Conservation Partnership has formed close working relationships with private landowners, public agencies, and grazing operators in the community, which has allowed them to successfully identify natural resource needs and opportunities within Alameda County.

In 2015, the Conservation Partnership, along with East Bay Regional Park District (EBRPD), San Francisco Public Utilities Commission (SFPUC), AECOM Technical Services (SFPUC's rangeland monitoring and grazing plan consultants), and a joint grazing tenant of EBRPD and SFPUC, identified a need for water resource improvements in the Sunol Regional Wilderness, an area jointly managed by EBRPD and SFPUC in the East Bay hills. For over 100 years, the lands that now comprise the Sunol Regional Wilderness were used for ranching (East Bay Regional Park District 2017). Due to limited water resources, however, some upland areas are no longer accessible for livestock grazing. Monitoring conducted by the Conservation Partnership indicated that limited grazing in these areas has increased residual dry matter while reducing native plant community diversity. Inadequate water resources also increased pressure on riparian systems and wetlands because surface water sources (such as streams and ponds) often provide the only livestock water (Barry et al. 2016).

The Conservation Partnership recognized that the needs of land managers in the Sunol Regional Wilderness — to improve distribution of livestock water resources and reduce dependence on surface water sources — could be addressed in a way that matched the goals of the State Coastal Conservancy's Climate Ready Program. Specifically, one of the aims of the Climate Ready Program is to assist coastal communities in preparing for, and adapting to, the effects of climate change — including extended drought on rangelands. An application was submitted by the Conservation Partnership for Climate Ready Grant funds to improve watering facilities and increase drought resilience across 6,200 acres of the Sunol Regional Wilderness (Project Area); in 2015, funds were awarded to assist with accomplishing these goals (grant no. 14-051). EBRPD and SFPUC are providing cash match to the Climate Ready Grant, as well as services in-kind. NRCS is providing significant technical assistance and funding through its Environmental Quality Incentives Program (EQIP), which leverages the federal Farm Bill to promote conservation on agricultural lands. AECOM Technical Services has also been actively involved, assisting with planning and technical assistance for the Project.

Rehabilitation and redistribution of water resources

Upon receiving grant funds, the Project partners and grazing tenant identified water resources in need of rehabilitation, with efforts focused specifically on spring redevelopment and rehabilitating existing livestock ponds to provide more off-stream water sources. The grazing tenant was instrumental in providing detailed information about the condition and location of water sources throughout the Project Area, and in assisting the partners with prioritizing watering facilities in areas that are currently under-grazed due to lack of water. Five springs were identified for redevelopment and associated trough improvement projects, and four livestock ponds selected for restoration.

The Conservation Partnership leveraged its Permit Coordination Program to assist with securing permits for each project identified; the Permit Coordination Program provides streamlined permitting

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Drought Resilience *continued*

from five different regulatory agencies aimed at simplifying the complex regulatory process for landowners and land managers pursuing voluntary conservation projects. Three of the five spring re-development projects and associated livestock trough improvements will be completed at the time of publication. Two livestock pond restoration projects — one requiring sediment removal and a second needing dam and spillway repair — are also in progress, with anticipated completion in October 2017. The final two spring improvement projects will begin in the coming days, and will be completed before November 2017. Construction on the two additional pond projects will begin in the summer of 2018.

Monitoring

Prior to the implementation of the livestock watering facility improvements, surveys were conducted to establish baseline conditions for vegetation in the Project Area. Two methods were used to assess vegetation communities: point intercept surveys and estimating residual dry matter (RDM). These surveys supplemented existing data from the Project Area —including evaluations of vegetation composition and remaining biomass at the end of the annual growing season — which has been routinely collected by EBRPD and SFPUC for the last 10 years. Prior to construction, AECOM Technical Services also documented livestock impacts (e.g., presence of cow manure and evidence of trampling) in riparian areas, quantified woody plant recruitment by counting seedlings and saplings along transects, and measured herbaceous plant richness and percentage of bare ground. Wetland and riparian areas were also inventoried near the spring redevelopment projects to evaluate the long-term effects of the improvements. Wetland plant composition, height, and cover (using belt transects) were assessed, and permanent photo points were established.

At this time, as-built surveys and photos have been collected for the finished spring redevelopment and pond restoration projects. Post-construction monitoring, however, has yet to begin as these projects have just reached completion. Plans for post-construction monitoring will be developed this winter, once the construction season has ended. Any post-construction monitoring data collected will be compared against baseline data to assess the efficacy of the watering facility improvements.

Point Blue Conservation Science, partnering with NRCS, is also conducting monitoring in the Project Area via their Rangeland Monitoring Network Program ("Program"). Measures of plant diversity and abundance, bird diversity and abundance, and soil attributes (bulk density, organic carbon, and water infiltration) will be collected in order to better understand ecological function of rangelands. Program data from sites across California will be aggregated and used to measure the variation in ecological function across rangelands, identify the relationships between management practices and ecological function, establish a baseline to understand how ecological functions change over time, and provide ranchers and other land stewards with the tools to conduct ecological monitoring on their own.

Construction to repair the spillway of one livestock pond is underway. *Photo courtesy Alameda County Conservation Partnership*

Outreach

The final component of the Project is outreach targeted at land managers and recreational users of working public lands. In early 2017, a workshop was held that focused on grassbanking as another potential strategy within the Project for adapting to prolonged periods of drought on Bay Area rangelands. Trailhead signage is currently in development for the Sunol Regional Wilderness, with materials expected to deploy in early October 2017. The signs, intended for recreational visitors, are designed to explain the work being done to implement the rehabilitation and redistribution projects in the area.

A second workshop, targeted at local ranchers, is planned for the summer of 2018. This field-based workshop will provide information on grazing strategies and the critical role of developed stock water resources as demonstrated by the Project. Upon completion of construction (Fall 2018), information describing the outcomes of the Project will be provided to Bay Area land managers to help inform best management practices on grazed rangelands. Digital presentations and printed materials summarizing learnings from the Project will be produced and disseminated to stakeholders via distribution hubs such as partner offices and websites. Interpretive signage designed to inform recreational users at the Sunol Regional Wilderness about the Project and its outcomes may also be deployed in 2019.

Discussion

The livestock water improvements are expected to have a wide variety of positive impacts throughout the Project Area on water quality, wildfire risk, and wildlife. Water quality is anticipated to improve as cattle can be more evenly distributed across the landscape, reducing soil compaction and erosion — both of which can lead to increased sediment inputs and turbidity of associated streams. Improving off-stream watering facilities also curtails cattle reliance on stream and wetland water, reducing cattle impacts on aquatic habitat. Wildfire risk is expected to decrease, as grazing is

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anticipated to reduce fine fuels, while increasing fine fuel moisture (Davies et al. 2015). Improvements to stock ponds are also anticipated to benefit aquatic habitat for several native amphibian species, including threatened and endangered species like the California red-legged frog (*Rana draytonii*) and the California tiger salamander (*Ambystoma californiense*). Additionally, when the troughs associated with springs are improved, drinking water becomes available to a variety of wildlife species found within the Project Area, such as birds, bats, bobcats, and deer — especially during extended drought when other water sources may dry up.

The redistribution and rehabilitation of water sources will also benefit the grazing tenant and land managers (EBRPD and SFPUC). The presence of adequate watering facilities is expected to increase economic sustainability and herd size stability for the grazing tenant by providing more ways for the grazing tenant to face management challenges, including extended drought. Decreased wildfire risk also positively effects the grazing tenant, as wildfires disrupt grazing operations by reducing the season's forage and posing a direct risk to livestock when burning. There may also be direct benefits associated with the Project for EBRPD and SFPUC, as leveraging grant funding and streamlined permitting allows these agencies to address maintenance needs that may have otherwise been deferred for many years. Upon completion of construction and monitoring, the effectiveness of the project in producing the benefits outlined above will be examined and reported upon.

Conclusion

When rangelands are healthy, they can provide multiple ecosystem functions, including wildlife habitat, carbon sequestration, water quality enhancement, pollination, forage, open space, and cultural amenities (Dailey et al. 1997, Havstad et al. 2007, Brunson and Huntsinger 2008). The Alameda County Rangeland Resilience Pilot Project seeks to improve grazing practices on, and thus the health of, the naturalized annual grasslands in the Bay Area. This will be accomplished directly through the rehabilitation and redistribution of water resources in the Sunol Regional Wilderness, but will have a much larger indirect impact after the effectiveness of these improvements is determined, and information about the Project's outcome is circulated to land owners and managers throughout California.

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GETTING TO KNOW GRASSLAND RESEARCHERS:

Ed Pandolfino

What is your study system?

I am particularly focused on the grasslands and open habitats of the Central Valley and the surrounding foothills.

What are your primary research goals?

I want to detect and understand population trends of grassland and open country birds. In particular, I want to understand the key habitat associations so that particular areas can be prioritized for conservation.

Who is your audience?

The general public (at least those with some interest in the natural world); field ornithologists; resource agencies; and land trusts and other conservation organizations.

Who has inspired you, including your mentors?

I am inspired by those who seek to create a love for and concern about preserving wildlife among the public. Especially those who do so by using science combined with an infectious enthusiasm (instead of haranguing with portents of doom). John Muir and David Attenborough (the 'John Muir' of our age) are my main heros in this regard.

How has or will your research align with the mission of CNGA "to promote, preserve, and restore the diversity of California's native grasses and grassland ecosystems through education, advocacy, research, and stewardship"?

My published work has documented the continental importance of the Central Valley grasslands for several species of raptors and other birds and revealed population trends of those species. The Central Valley Winter Raptor project and the publications coming out of that work have revealed the key habitat associations of wintering raptors and shown how important grasslands are for several of those birds.

Why do you love grasslands?

A large part of my love of grasslands is due to their "orphan" status among California habitats. It is easy to get people excited about saving the majestic Sierra forests, lush wetlands, verdant riparian corridors, and spectacular coastal habitats. Our grasslands are largely dominated by non-native plants, are brown and dry for much of the year, and simply don't inspire much reverence from the general public. The importance of these habitats for wildlife requires a deeper understanding and a closer, "getting-down-to-the-details" approach. I enjoy shaking up people's pre-conceived notions about which habitats are really crucial to preserving the species most at risk. Grasslands are just not inherently "sexy", which is why I have focused on raptors. Raptors ARE sexy, people are naturally drawn to them, and they serve as an effective vehicle for getting folks to re-think their attitudes toward grasslands.

Figure 1. Tumbleweed skeletons on flats and on the slopes in the distance.

Progress Report: Tumbleweed on California's Central Coast

by Devii Rao[1], Elise Gornish[2], Richard Smith[3], and Josh Davy[4]

During California's recent drought, Central Coast ranchers observed noticeable increases in the density and distribution of tumbleweed on dry annual rangelands. Also known as Russian thistle (*Salsola* sp.), this plant can create dense monocultures (Figure 1), threatening agricultural and native ecosystems (Orloff et al. 2008). Mature tumbleweed plants become dry skeletons and blow in the wind, lending them the name "tumbleweed". Although several control options are available, they are often too expensive for most ranchers to implement. Control methods include mechanical removal, livestock grazing, biological control, and herbicide (DiTomaso and Kyser 2013). Because of the high cost, effective control of tumbleweed continues to be a challenge in both natural and working landscapes. Some local ranchers burn tumbleweed skeletons to prevent them from catching on fences or damaging vehicles. However, by the time tumbleweed plants are dry, seeds have already been dropped, increasing the seed bank. Therefore, the practice of burning only reduces the nuisance caused by tumbleweed skeletons and does not control the invasion. Ranchers do not typically treat tumbleweed with herbicide because the plant can become widespread and is generally too expensive to control with this method. However, ranchers have observed that tumbleweed is less dominant in areas that are moderately grazed, particularly areas grazed into the summer. Cattle eat tumbleweed when it is small, before it becomes spiny. Thus, while livestock grazing is the primary control method used by ranchers on the Central Coast, tumbleweed continues to be a management challenge.

To address this emerging ecological and economic issue, a research project was developed to investigate tumbleweed control options and assist ranchers in reducing tumbleweed populations, while improving forage for livestock. The project was replicated on nine plots, in groups of threes, established on two ranches in San Benito County, CA, located predominantly on mixed dry annual

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[1]Devii Rao, Livestock and Natural Resources Advisor, University of California Cooperative Extension. Devii conducts research and is an educator in livestock and range management in San Benito, Monterey, and Santa Cruz counties.

[2]Elise Gornish, Restoration Ecology Specialist, University of Arizona Cooperative Extension. Elise conducts research state-wide in a variety of ecosystems, with an emphasis on arid and semi-arid rangelands.

[3]Richard Smith, Vegetable Crop & Weed Science Advisor, University of California Cooperative Extension. Richard has many years of experience in weed management on row crops on California's Central Coast.

[4]Josh Davy, Livestock, Range, & Natural Resources Advisor, University of California Cooperative Extension. Josh focuses on practical research to assist ranchers in Tehama, Colusa, and Glenn counties.

Tumbleweed *continued*

grassland, oak savanna, and chaparral, and covering flatlands to steep rugged slopes. The terms "replicate" and "plot" are used interchangeably here. The term "subplot" refers to 2.5 m x 2.5 m portions of a plot that received a particular treatment (Figure 2). Average annual precipitation at nearby Pinnacles National Park is 16.55 inches (Western Regional Climate Center 2016).

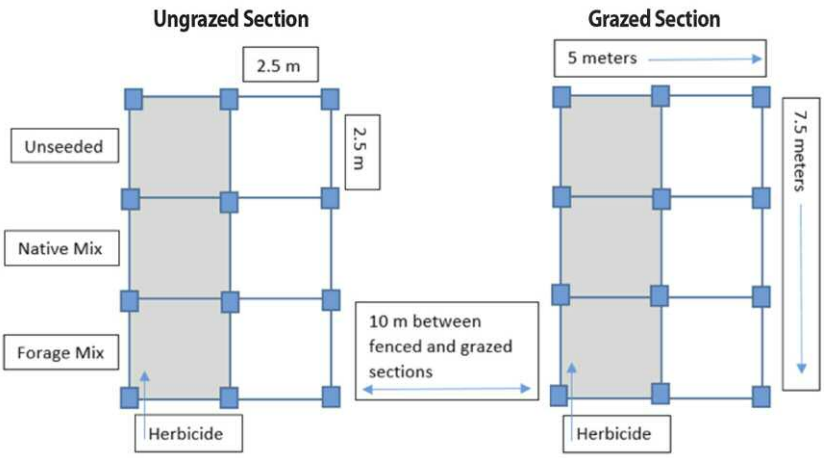

Figure 2. Plot layout illustrating one replicate with an ungrazed section and a grazed section. Each replicate has 12 subplots, six in the ungrazed section and six in the grazed section.

This project was initiated to test four hypotheses: 1) moderate cattle grazing will reduce tumbleweed cover, 2) herbicide (a combination of Telar and 2,4-D) will kill tumbleweed plants, thereby reducing seed production and tumbleweed cover, 3) seeding with native grasses will increase competition for tumbleweed and limit its ability to germinate and establish, and 4) seeding with non-native forage grasses will increase competition for tumbleweed and limit its ability to germinate and establish. *Salsola* sp., *Hordeum murinum* L. (wall barley), non-native bromes, and *Erodium sp.* (filaree) were common species in plots at the start of the experiment. No native grasses were observed in the plots. Three replicates (1–3) on Ranch A are on Mocho loam, 2–9% slopes; three replicates (4–6), 0.58 miles away in the same field on Ranch A, are on Docas clay loam, 2–9% slopes; and three replicates (7–9), under separate ownership on Ranch B, are on Sorrento silt loam, 0–2% slopes. Each replicate (Figure 2) has a fenced ungrazed section, paired with a grazed section. Two strips are located within each section: one received an herbicide treatment and the other received no herbicide (Figure 3). Both treatments were split into 2.5 x 2.5 m subplots that receive no seeding, native seed mix, or forage seed mix treatments (Figure 2).

The herbicide treatment was applied March 22, 2016 at Ranch A and April 4, 2016 at Ranch B using a backpack sprayer at 2.0 oz/ac of Telar XP combined with 4 pt/ac of 2,4-D DMA. Treatment subplots were seeded (excluding unseeded controls) on November 8, 2016. On the same day prior to seeding, 2% v/v of Roundup PowerMax was sprayed on herbicide treatment subplots to limit competition for the native and forage mix seeding. Native subplots were seeded with a mix of *Elymus glaucus* Buckley (blue wild-rye), *Bromus carinatus* Hook. & Arn. (California brome), and *Poa secunda* J. Presl (Nevada blue grass), and forage plots with *Festuca arundinacea* Schreb. (Flecha tall fescue, a cultivar). *E. glaucus* Buckley and *B. carinatus* Hook. & Arn. seed was donated by Hedgerow Farms (Yolo Co.); *P. secunda* J. Presl seed was collected in San Benito County by Bureau of Land Management staff; and *F. arundinacea* Schreb. was donated by L.A. Hearn Seed Company (Monterey Co.).

Although it can be difficult to establish native grass species, *E. glaucus* Buckley and *B. carinatus* Hook. & Arn. were chosen because they are fairly robust and may compete with tumbleweed for space (Seabloom et al. 2003). *Poa secunda* J. Presl was added to the mix because although it is a much smaller-statured grass, it may establish better and recruit more successfully long-term than the other two native species in the dry local environment (R. O'Dell, *pers. com.*). *F. arundinacea* Schreb. was chosen as the forage treatment because it is robust and may compete well with tumbleweed considering its successful establishment and persistence in long-term studies (e.g. Davy et al. *in press*).

The native and forage mixes were seeded into sub-plots by hand. *B. carinatus* Hook. & Arn., *E. glaucus* Buckley, and *P. secunda* J. Presl were seeded at 10, 10, and 5 pounds per acre, respectively (see Koukoura and Menke 1995). Seed from all three species were mixed and seeded together in each native seeding plot for a total seeding rate of 25 pounds per acre. *F. arundinacea* Schreb. was seeded at a rate of 10 pounds per acre. *B. hordeaceous* L. (soft chess) will be added to the forage seeding plots in the fall of 2017.

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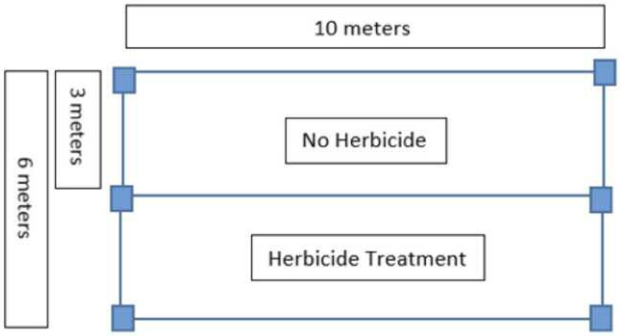
Figure 3. Ungrazed tumbleweed plot. No herbicide on the left. Herbicide treatment on the right.



From left: Figure 4. Herbicide treatment on the late-season spray plots. Figure 5. Plot layout for late-season spray experiment. This illustration represents one replicate. All replicates are grazed (unfenced).

Tumbleweed *continued*

Because *B. hordeaceous* L. is an annual grass, it is expected to outcompete the perennial *F. arundinacea* Schreb. Therefore, *F. arundinacea* Schreb. was seeded in year one to allow it to establish before seeding *B. hordeaceous* L. On March 29, 2017 2 pints/acre of 2,4-D DMA were sprayed in the herbicide treatment subplots to reduce competition from broad leaves that had already germinated.

A second set of plots were deployed at the request of Ranch A to test the hypothesis that herbicide treatment later in the season will also provide tumbleweed control. These plots were located in an adjacent field to replicates 1–6 from the original experiment. The herbicide treatment was conducted on May 27, 2016, about two months after the original treatment (Figure 4). Replicates for this experiment are 3 m by 10 m (Figure 5). All replicates were grazed (unfenced). A mix of 1.3 ounces/ac of Telar XP combined with 4 pints/ac of 2,4-D DMA was sprayed using a backpack sprayer.

In spring 2017, species composition and percent cover data were collected from all plots (from both experiments) using standard methods in an aerial survey. The data have not yet been analyzed, but based on initial observations, the 2016–2017 rain year has been a good one: Annual grasses that were already on-site, primarily *Hordeum murinum* L. and *Bromus* spp., have grown dense and tall, and appear to have limited the ability of tumbleweed to flourish. Some native and forage plants that were seeded did germinate, but are generally quite low in cover at this time. Stay tuned for initial results in 2018!

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SNAPSHOT: Sticky Plants in Your Garden *by Billy Krimmel*[1]

Sticky plants are widespread in summertime throughout California. The oils and resins secreted at the tips of their ***glandular trichomes*** often shine in the hot sun, and in many instances are strongly fragrant (see definitions below). Some scientists have argued that UV reflectance may have been why plants evolved glandular and non-glandular trichomes in the first place—to mitigate the effects of the hot sun drawing out water from the plant's stomata (tiny openings through which plants breathe). Others have argued that plants secrete ***glandular exudates*** as a way to detoxify (Schilmiller et al. 2008), while still others argue that they evolved as a way to repel or defend against would-be insect herbivores (e.g., Duke 1994, Fernandes 1994). Glandular trichomes are found among diverse plant taxa — an estimated 30% of all vascular plant species have them — and likely evolved in response to a diversity of environmental drivers (Duke 1994).

DEFINITIONS

Glandular trichome: Plant epidermal hairs with glands that produce and secrete glandular exudates

Glandular exudate: Substances secreted by glandular trichomes with a wide variety of chemical constituents, performing myriad functions, and including biologically active compounds such as fatty acid derivatives, phenylpropanoids, polyketides, and terpenoids.

Adaptations to sticky plants by insects

Regardless of how these sticky hairs evolved, they carry out a fascinating array of functions. And because they are so abundant, many insects and other arthropods have evolved intricate adaptations that allow them to thrive on the sticky plant surface (Wheeler and Krimmel 2015). By virtue of being sticky, these plants accumulate a diversity of materials on their surface, from dust to pollen to dead insects that became entrapped and unable to escape. The insects that live and feed on sticky plants tend to be widely omnivorous, feeding on these different resources as well as the plant itself and other live insects (Figure 1) (Wheeler and Krimmel 2015).

These insects also tend to be long-legged — in some cases tip-toeing around the surface to carefully avoid getting caught up, and in other cases slogging through with strong leg muscles (Voigt et al. 2007). Plant bugs in the subfamily Dicyphini (Hemiptera: Miridae: Dicyphini) have specialized hooks on their legs that enable them to latch on to trichomes near the tips so they can walk on top of the trichome canopy and avoid contact with sticky droplets at the tips (Voigt et al. 2007). Some of these bugs also possess the ability to secrete grease along the bottom of their abdomens, so that if they do contact sticky exudates by accident, they can slough it off and move on without becoming entrapped (Voigt and Gorb 2008).

Another common visitor of sticky plants is a group of assassin bugs in the subfamily Harpactorini (Reduviidae: Harpactorini). Females in many species have specialized storage structures on their abdomens for collecting and storing sticky exudates from plants. As females in these species lay eggs, they coat the eggs with these exudates. Newly hatched nymphs then spread the exudates from their egg onto their body—the functions of which is still a bit of a mystery. Investigators speculate that it might provide camouflage, better grip to the plant for the insect, anti-microbial functions, better attachment to prey, some combination of these functions, or something completely different (Law and Sedigi 2010). Perhaps a *Grasslands* reader will solve the mystery through observation and experimentation of

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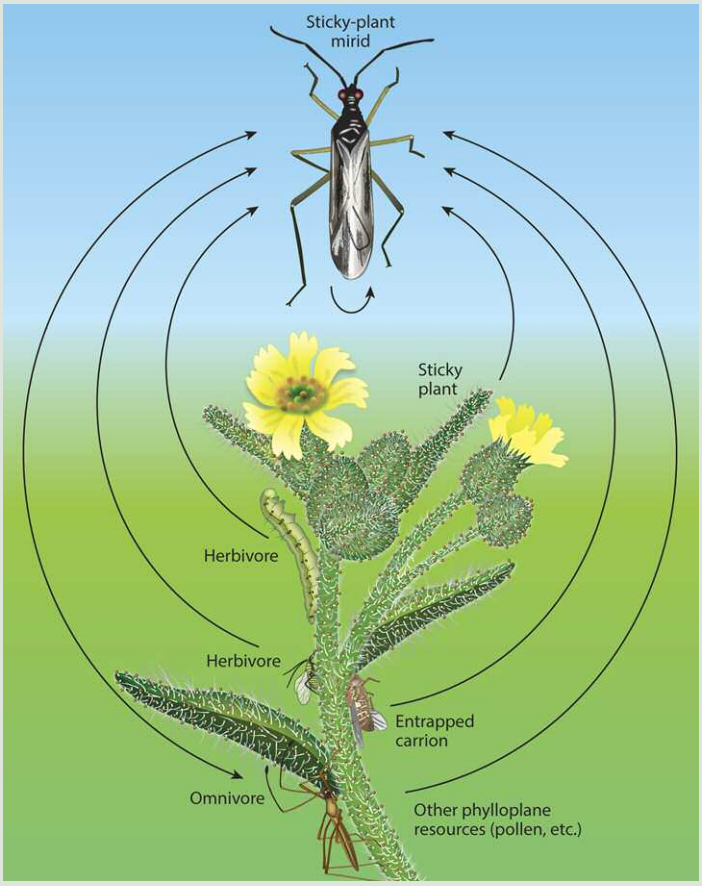

Figure 1. A theoretical food web for a sticky plant. Mirids feed as broad omnivores on sticky plants, consuming resources stuck to the plant surface (e.g., carrion), herbivores, other omnivores, and their host plants. Species in graphic are a simplified representation of the arthropod community on slender tarweed (*Madia gracilis*; Asteraceae) and are meant to depict a "typical" sticky-plant food web rather than formally quantified interactions. *Image courtesy Wheeler & Krimmel 2015*

[1]Billy Krimmel holds a PhD in Ecology from UC Davis, serves on the Board of Directors for CNGA and is the owner of Restoration Landscaping Company

Figure 2. The sticky plant surface. *Hoplinus echinatus* and a dicyphine mirid forage for whitefly corpses stuck to *M. elegans* in a garden in Davis, CA. *Photo courtesy the author*

Sticky Plants *continued*

sticky plants in her garden.

Many of the arthropods living on sticky plants feed on the corpses of entrapped insects attached to the plant surface. Even caterpillars that feed on sticky plants, like the tobacco budworm (*Heliothis virescens),* feed on this carrion, consuming it as they chew on leaves and buds and also seeking it out as they forage (Krimmel and Lopresti, in prep).

Carrion-mediated indirect defense on sticky plants

By entrapping small insects on their sticky hairs, sticky plants provide food for predatory arthropods. This food may be particularly important for young predators that are too small to capture large, mobile prey. As they grow, these predatory arthropods begin hunting live prey, which includes the herbivores of the sticky plants. The end result is enhanced defense against herbivores via increased predator abundance, an interaction called indirect defense.

In a study of common madia (Asteraceae: *Madia elegans*), increased carrion on the plant surface (Figure 2) increases the abundance of a suite of predatory arthropods, including the stilt bugs *Jalysus wickhami* and *Hoplinus echinatus*, the assassin bug *Pselliopus spinicollis*, and two species of spider. This translates into less herbivory by the caterpillar *Heliothodes diminutiva*, which feeds on the buds and flowers of *M. elegans*. Results showed that *M. elegans* plants with more carrion experienced more fruit production (Figure 3) (Krimmel and Pearse 2013).

In the case of serpentine columbine (Ranunculaceae*: Aquilegia eximia*), the plants take this a step further. The sticky substances they produce release odors that lure insects to land on the plant and get stuck, effectively playing a 'siren song' to unsuspecting passers-by (Lopresti et al. 2015).

Good sticky natives for the garden

The trait of stickiness has evolved many different times among many different native plant taxa (Wheeler and Krimmel 2015). Some good examples of sticky native plants suitable (and available) for gardens include common madia, serpentine columbine, seep monkeyflower (Phrymaceae: *Erythranthe guttata*), scarlet monkeyflower (Phrymaceae: *Erythranthe cardinalis*), and coyote tobacco (Solanaceae: *Nicotiana attenuata*).

Species snapshot: Common madia

Common madia is a deep-rooted annual with seeds germinating in the early winter and most plants flowering from summer into fall. In the early morning, the flowers of *M. elegans* are wide open and conspicuous. As the summer days heat up, the flowers shrivel and close and plants become less conspicuous. In the late

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Sticky Plants *continued*

summer it is one of few abundant species flowering and growing during a time when many native and non-native plants are dormant or have already set seed and senesced. As such, it is an important habitat plant for many native pollinators and other arthropods. Even ladybeetles, not particularly well-suited for walking around on the sticky surface, visit *M. elegans* in the late summer to feed on aphids, which are otherwise scarce (Krimmel and Pearse 2013). Furthermore, native bees can be seen collecting resins from the glandular trichomes of *M. elegans*, which they presumably use as an additive to soil when constructing partitions for their nests; these resins have been shown to fortify nest partitions in certain species such that parasitic wasps cannot break through (Mathews et al. 2009).

Keep an eye out for dead insects stuck to the sticky hairs of *M. elegans*, and for the long-legged arthropods that are able to move around on and among the hairs. These arthropods include stilt bugs (Hemiptera: Berytidae), dicyphine mirids (Hemiptera: Miridae: Dicyphinae), green lynx spiders (Aranae: Oxyopidae), harpactorine assassin bugs (Hemiptera: Reduviidae: Harpactorinae), aphids and tree crickets (Orthoptera: Oecanthinae). Watching long enough, one can observe many of these arthropods feed on entrapped insects on the plant surface.

Some added bonuses of growing *M. elegans* include its smell — a sweet, citrusy fragrance — and highly nutritious seeds. California ground squirrels (*Otospermophilus beecheyi*) may be seen standing on hind feet to chew off ripened seed heads, their faces encrusted with oils. Gold finches and other seed-feeding birds hop around on *M. elegans* plants, and humans can eat the seeds too. These high-protein seeds were traditionally a staple crop for the Pomo people, and its congener *Madia sativa* was grown briefly in Asia as a seed oil crop.

Figure 3. Clockwise from upper left: (1) *Hoplinus echinatus* scavenges on a dead fly on *M. elegans*. (2) *Pselliopus spinicollis* scavenges on a dead fly on *M. elegans*. (3) *Pselliopus spinicollis* feeds on the caterpillar *Heliothodes diminutiva on M. elegans*. (4) *H. diminutiva* feeds on a flower bud on *M. elegans. Images courtesy Krimmel & Pearse 2013*.

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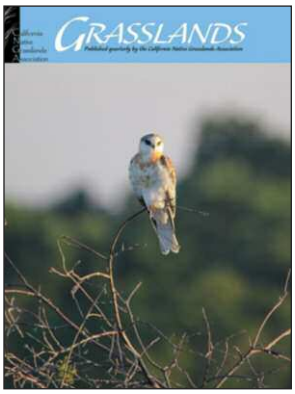

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Celebrating and conserving the ecological richness of California's native grasslands.

Front cover: *Stipa pulchra* (purple needlegrass) gleams as the sun rises over the restored grassland of the Yolo Land and Cattle Company. *Photo: Ryan P. Bourbour, UC Davis*

Back cover: Western bluebirds utilize a water trough similar to those being installed as part of the Alameda County Rangeland Resilience Pilot Project (see article page 6) on nearby rangelands in Sunol. *Photo courtesy Clayton Koopman*