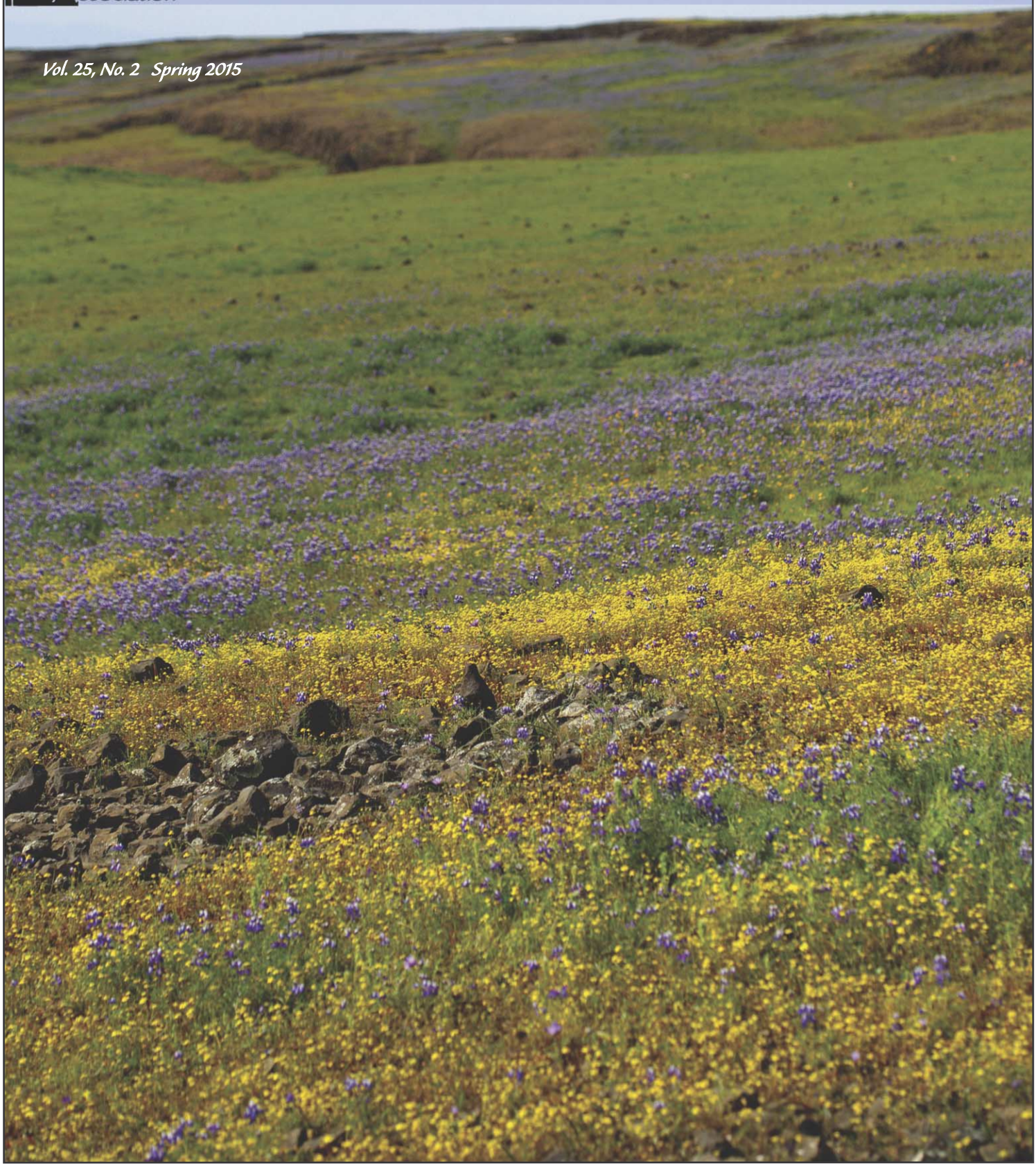
California Native Grasslands Association

GRASSLANDS

Published quarterly by the California Native Grasslands Association

Vol. 25, No. 2 Spring 2015



California Native Grasslands Association

Mission Statement

The mission of the California Native Grasslands Associationis 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
www.cnga.org
530.297.0500 admin@cnga.org

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

Grasslands is published quarterly by CNGA.
 ISSN No. 1540-6857
Layout editor: Julie St. John

From the President's Keyboard

Spring Brings CNGA Workshops and Blooming Wildflowers *by Jon O'Brien*

CNGA is busy in the midst of our spring workshop season. We recently offered an important workshop in Woodland entitled "Pesticide Safety and Herbicide Use in Grassland and Riparian Restoration." Not everyone present was in favor of using herbicides, but these products can be an appropriate tool in certain habitat projects, especially in California where the weed pressure is high.

On March 20, we offered another great workshop covering all things "habitat restoration" titled "Nuts and Bolts of Restoration and Revegetation: Using Grasses and Graminoids," and held in Winters. JP Marié, Bryan Young, and Chris Rose taught the class. The field equivalent "Grasslands Restoration and Revegetation" workshop is coming up this fall. Finally, CNGA partnered with Hedgerow Farms for the 8th Annual CNGA Field Day at Hedgerow Farms on April 24.

Registration is now open for the upcoming Grass Identification workshop on May 16 at Point Reyes Station. Visit www.cnga.org to register.

On another front, CNGA continues to discuss a joint statewide initiative with the California Department of Water Resources (DWR). CNGA will work with DWR in offering lawn conversion workshops throughout the state. These workshops are extremely important in helping people convert their high-water use lawns to low-water use native landscapes. We will keep you posted as the planning unfolds.

For those of you who like to spend time outdoors, now is a great time to visit a California grassland and view wildflowers in full bloom. Past issues of *Grasslands* have information about grasslands to visit around the state, and in this issue, we feature the Carrizo Plain. Another grassland loaded with native wildflowers in the greater Sacramento area is Bear Valley at the corner of Highway 16 and Highway 20 in Lake County. As Emerson wrote, "The earth laughs in flowers . . ." Now is the best time of year to get out in the field to experience and celebrate California's wildflowers.

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. Contact the Editorial Committee Chair for formatting specifications: grasslands@cnga.org.

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. Photos are selected to reflect the season of each issue. Send photo submissions, as email attachments, to Ingrid Morken at grasslands@cnga.org. Include a caption and credited photographer's name.

Submission deadlines for articles: **Summer 2015** — May 15, 2015 **Fall 2015** — Aug 15, 2015 **Winter 2016** — Nov 15, 2015 **Spring 2016** — Feb 15, 2016

Upcoming Workshops from CNGA

Register online at www.cnga.org or contact Rebecca Green at 530.771.7332, or admin@cnga.org

Identifying and Appreciating the Native and Naturalized Grasses of California

CNGA Point Reyes Grass Identification Workshop

Saturday, May 16, 2015, 8:30 am to 5:30 pm *Point Reyes Dance Palace (503 B Street, Point Reyes Station)*

Grasses are fun and easy to identify! Our goal is to learn the basic skills of identifying grasses and provide an overview of native grass distribution in California. We will learn about California's grassland ecology, the qualities of specific native grasses for restoration, and become skilled at recognizing the basic groups and common species by working with plant samples in the classroom. We will review both the Hitchcock's tribe method of identifying grasses as well as the artificial key methodology, which focuses on the important distinguishing traits. A class syllabus and basic keys will be provided. An afternoon field tour will round out this full day of learning.Pre-order your lunch through CNGA for $12 (includes choice of sandwich, chips or granola bar, fruit, and cookie or brownie), or bring your own lunch. Restaurants tend to be too busy on Saturdays to get lunch in town. *Instructor: Michelle Cooper*

$130/CNGA members, $150/Non-members, $85/Students with ID

Coming Soon!

CNGA's "California's New Front Yard: Creating a Low-Water Landscape

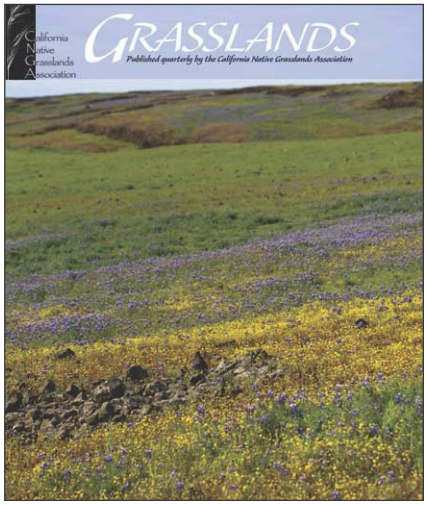
CNGA is taking this popular workshop on the road with workshops offered this year in Sacramento, San Joaquin Valley, Solano County, and the Central Coast.

With lower precipitation in recent years, we now realize the limits to our fresh water. Reducing water use in our landscapes is a principal way to combat water shortages. Does this mean that our yards and outdoor public spaces will be dead and brown? Certainly not!

Come to one of these workshops to find out more about landscape alternatives, including using native plants, grasses, and forbs in the low-water landscape. Workshops will include the latest research and practice on design, installation, and maintenance of a low-water landscape, as well as proper plant selection, lawn removal methods, and watering and long-term care.

For more information, call 530.771.7332.

In this issue



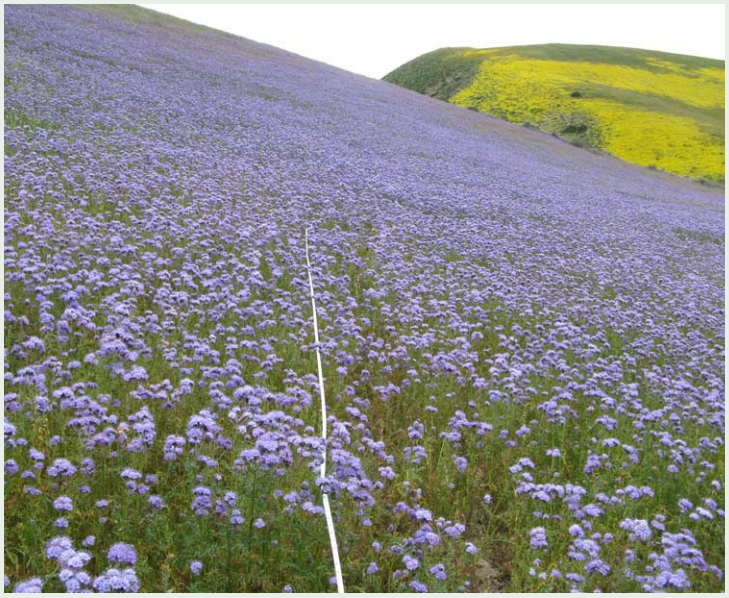


Figure 1. Alternating fields of purple and gold in the Temblor Range. *Photo: Jennifer Buck-Diaz*

Figure 2. Poa secunda emerges from a solid layer of goldfields. *Photo: Diana Hickson*

VISITING CALIFORNIA'S GRASSLANDS: The Shifting Mosaic of Carrizo Plain

by Jennifer Buck-Diaz[1], Vegetation Ecologist, California Native Plant Society, jbuck@cnps.org

Spring has sprung, and for those who love sweeping vistas of native California wildflowers, excitement is in the air. At the top of my list of places to see showy grasslands in the state is the Carrizo Plain. Each year brings a unique display to this amazing semi-desert landscape. The plain is located in northeastern San Luis Obispo County, and a large portion of it is managed by the Bureau of Land Management as a national monument.

At 50 miles long and 15 miles across, you will have plenty of room to spread out and explore the myriad of grassland types that assemble in this region. Start in the low alkali playa of Soda Lake with its rare goldfields (*Lasthenia ferrisiae*) and peppergrass (*Lepidium jaredii*). Meander through bands of iodine bush (*Allenrolfea occidentalis*) and saltgrass (*Distichlis spicata*) to reach the dotted saltbrush scrub (*Atriplex spinifera*) that gives cover to pronghorn antelope. Your eyes will light up with the brilliant sun-tracking heads of coreopsis (*Leptosyne calliopsidea*) and fields of tidy tips (*Layia munzii*).

Head up into the hills of the Temblor Range and step over the San Andres Fault as you explore the gaudy flower-covered slopes that come alive in the early spring. In certain years, you can investigate alternating, almost pure stands of purple *Phacelia* and gold *Monolopia* (Fig. 1), each thriving on a particular combination of slope, aspect, and soil profile. Keep your eyes open for blazing patches of desert candle (*Caulanthus inflatus*) and flat terraces of the fragrant thistle sage (*Salvia carduacea*) above ephemeral streams. Swing over to the other side of the Plain to climb the low hills of the Caliente Range, where you can step lightly through dense carpets of blue grass (*Poa secunda*) (Fig. 2) and waving patches of needlegrass (*Stipa cernua*).

Each year brings different timing and amounts of precipitation to this region, and repeat surveys have shown stability as well as variance across the different grassland communities (Buck-Diaz et al. 2013). Some years are breathtakingly showy like the spring of 2010; others are dry and dusty with exposed bare soil churned from rodent activity. In 2015, reports are good for an early bloom, and whether you catch the display this year or sometime in the future, be sure not to miss an opportunity to witness the amazing diversity of grasslands within the Carrizo Plain.

[1]Jennifer Buck-Diaz is a vegetation ecologist and botanist with the CNPS Vegetation Program where she surveys, classifies, and maps vegetation across California. She has recently focused her work on the classification and description of grassland vegetation, including the study of spatial and temporal dynamics in these systems. She earned both a B.S. and a M.S. degree in Plant Biology from UC Davis, where she participated in a state-wide classification project that looked at fine-scale vegetation in vernal pools.

References

Buck-Diaz, J., J. Ratchford, and J.M. Evens. 2013. "California Rangeland Monitoring and Mapping: Focusing upon Great Valley and Carrizo Plain Grassland Habitats." Final Report to the Natural Resources Conservation District. California Native Plant Society, Sacramento, CA. **http://cnps.org/cnps/vegetation/pdf/grassland_nrcs_report-2013c.pdf**

Soil Microbes and Grassland Restoration

by Taraneh Emam[1]

A large proportion of life on earth is composed of microscopic organisms, or "microbes." Within soil, microbes are diverse and abundant; pasture soil has been estimated to contain 10 billion cells of prokaryotes (such as bacteria) in a cubic centimeter of soil volume (Horner-Devine et al. 2004). Other types of soil microorganisms include fungi, protozoa, cyanobacteria/algae, viruses, and microscopic animals such as nematodes. Although we cannot see soil microbes without the help of a microscope, they have large effects on the plant communities we admire, cultivate, and rely on. In this article, I discuss how soil microbes affect plants and their role in grassland restoration.

How Do Soil Microbes Affect Plants?

Soil microbes affect plants in many crucial ways. They can affect soil structure and nutrient content. For example, microbes break down organic matter and transform nutrients into forms that are usable by plants, such as by fixing atmospheric nitrogen (N_2) into ammonium (NH_4^+) in the soil. Microbes can compete with plants for nutrients as well and can act as pathogens causing plant diseases. Some microbes even influence plants by producing hormones that stimulate plant growth.

One particularly noteworthy relationship occurs between plants and a type of soil microbe known as mycorrhizal fungi. Over 90% of plant families (including Poaceae, the grass family) form a symbiosis with mycorrhizal fungi, and this symbiosis is thought to date back to the origin of terrestrial plants (Wang and Qiu 2006).

There are several types of mycorrhizal fungi. The tasty truffles and chanterelles found in forests are produced by ectomycorrhizal fungi, which colonize the exterior of plant roots. Conversely, grasslands are dominated by endomycorrhizal fungi, particularly arbuscular mycorrhizal (AM) fungi, which grow into root cells. Inside plant roots, AM fungi produce arbuscules, specialized structures where nutrients are exchanged between fungus and plant, and vesicles, fungal storage sacs (Fig. 1). AM fungi use thread-like hyphae to colonize roots and scavenge the soil for nutrients and new hosts. AM fungi can reproduce by producing spores, or through fragments of hyphae, but they cannot grow without a plant host. Conversely, most (but not all) plants can still grow without mycorrhizal partners.

AM fungi provide plants with increased access to soil nutrients, particularly phosphorus. In exchange, the fungus receives plant carbon. Plants can also receive other benefits from AM fungi, such as protection from fungal pathogens and increased tolerance of heavy metals or drought. However, the type and level of benefits received by both parties depend on the plant species, the fungal species, and environmental conditions. One plant species may respond very positively to a particular type of AM fungi, while another plant species may respond negatively to that same fungal species. Recent research has shown that there are mechanisms in place to penalize "cheating" by either the plant or fungal partner. Plants are able to sanction AM fungi by reducing carbon flow to fungi that are not providing sufficient phosphorus; likewise, AM fungi give more phosphorus to roots that provide the most carbon (Kiers et al. 2011).

Soil microbes can affect plant communities on a large scale in ways that we are only beginning to understand. For example, AM hyphae can connect multiple plants in a "hyphal network." New evidence suggests that these networks may allow the transfer of nutrients, carbon, or even molecules involved in communication between plants (e.g., signals related to plant defense; Barto et al. 2012, Simard and Durall 2004). In addition, researchers have found that AM fungi and other soil microbes can affect plant competition and dominance, and even influence the diversity and productivity of plant communities. For example, AM fungi have been shown to increase diversity of some plant communities, but may also decrease diversity if they disproportionally promote the growth of a few dominant species (van der Heijden et al. 2008, Wagg et al. 2011).

continued next page

[1]Eman completed her Ph.D. degree in the Graduate Group in Ecology, Department of Plant Sciences, UC Davis, in March 2015.

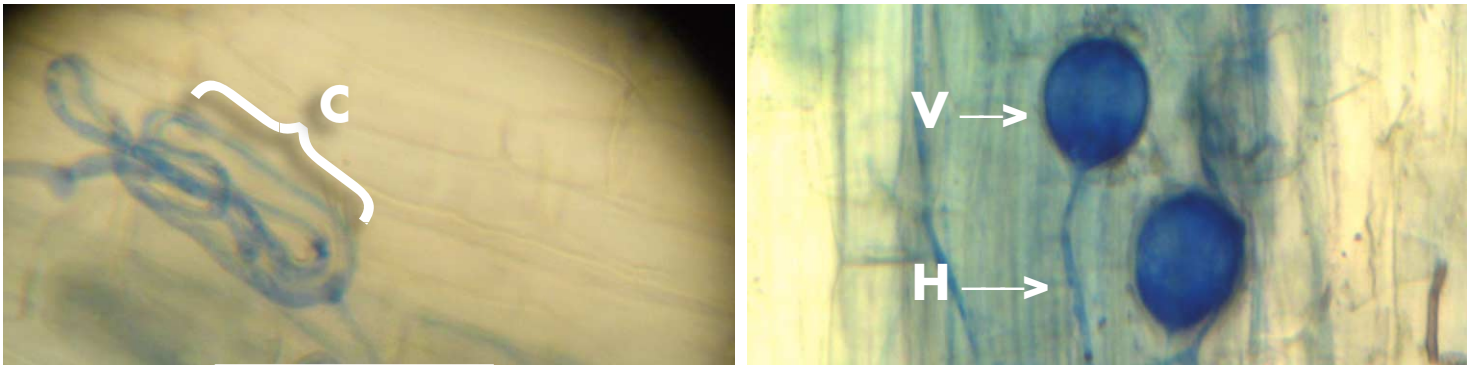


Figure 1. Longitudinal views of grass roots with arbuscular mycorrhizal structures. C = coiling hyphae inside root cell, V = vesicle, H = hyphaenative. *Photos: Taraneh Emam*

Role of Soil Microbes in Native Grassland Restoration

Soil disturbance (e.g., due to development, agricultural tilling, or mining) has been shown to alter the microbial community and can drastically reduce AM colonization of plants (Paluch et al. 2013). Many microbes easily disperse without human assistance; therefore, a microbial community may recover on its own after disturbance. However, some circumstances may prevent or slow the recovery of the soil community. For example, during mining, soil may be removed and stored in stockpiles until re-application. This high level of disturbance, when coupled with soil storage without access to plant hosts, can cause populations of AM fungi to drastically diminish (Harris et al. 1989, Miller et al. 1985). Insufficient AM fungal populations can detrimentally affect native plant recovery and may favor invasion by weedy, non-mycorrhizal plant species.

One possible tool that has been used in restoration is to apply commercially produced AM fungal inoculum at restored sites, with the hope of mimicking natural systems and encouraging native plant growth. However, results of commercial AM fungi use have been varied, with several studies showing few, if any, positive effects on native grass growth (e.g., White et al. 2008, Salyards et al. 2003). Commercial AM fungal inocula may not benefit native plants for several reasons. First, commercially produced AM fungi are typically cultivated in artificial conditions that do not represent native grasslands. Second, the species used in commercially produced inoculum are usually generalists that are able to colonize the roots of many types of plants. However, this ability does not necessarily reflect the benefits received by the plant host. For example, the species of AM fungi that are typically used in commercially produced inocula are often those that thoroughly colonize plant roots, but this may not correspond with the nutritional benefits received by plants (Maherali and Klironomos 2007). Finally, factors such as soil conditions, season, climate, and plant characteristics are also known to affect how native plants respond to AM fungi.

Researchers have emphasized the importance of using locally adapted native plant seed for restoration (McKay et al. 2005); the same is likely to be true of AM fungi and other soil organisms. AM fungi that are "ecologically matched" are better able to provide benefits to plant hosts (Ji et al. 2010), which means that AM fungi from a specific ecosystem and soil type are more effective at promoting native plant growth in that ecosystem than foreign AM fungi (although negative effects of local AM fungi on native plants can also occur; Klironomos 2003). Using local grassland soil as an inoculum source may be a more useful tool than commercial products for restoring the grassland soil community. Likewise, using restoration practices that maintain healthy soil communities (e.g., alternatives to stockpiling) may enable resilience of the soil community and reduce the need for soil inoculation.

Terms

Arbuscular mycorrhizal (AM) fungi – A specific type of endomycorrhizal fungus that forms arbuscules within plant roots

Arbuscule – A structure formed by AM fungi that allows nutrient exchange between the plant and the fungus

Ectomycorrhizal fungi – Mycorrhizal fungi that colonize the exterior of plant roots

Endomycorrhizal fungi – Mycorrhizal fungi that colonize the interior of plant roots

Hyphae – Threadlike strands of fungi that grow within the soil and plant roots

Hyphal network – A linkage formed when multiple plants are connected by the same organism of mycorrhizal fungi

Inoculum – Material containing soil organisms, which serves to introduce these organisms to a new environment

Microbe – An organism small enough that a microscope is needed to view it

Non-mycorrhizal – Plants that do not form a symbiotic relationship with mycorrhizal fungi

Spores – Propagules formed by mycorrhizal fungi during sexual reproduction

Vesicle – An energy storage structure formed by arbuscular mycorrhizal fungi

Potential Effects of AM Fungal Inoculation on Non-Native Plants

Prior to using soil inocula, it is important to consider how the addition of soil microbes might affect non-native or invasive species. The majority of plant species form mycorrhizal symbioses, including some non-native, invasive plant species. These species may therefore benefit from AM fungal inoculum (produced either commercially or from local soil). For example, research on spotted knapweed (*Centaurea maculosa*) has shown that this invader is able to consume more phosphorus when linked to native grasses via hyphal networks (Zabinski et al. 2002). Both native and non-native invasive grasses are typically mycorrhizal, although whether they significantly benefit from AM fungi depends on the combination of plant species and fungal species. However, many invasive plants in California are non-mycorrhizal, meaning they do not form these relationships with mycorrhizal fungi. Examples of California grassland invaders belonging to typically non-mycorrhizal families include Brassicaceae species such as perennial pepperweed (*Lepidium latifolium*) and black mustard (*Brassica nigra*); Chenopodiaceae species such as halogeton (*Halogeton glomeratus*); and Amaranthacae (e.g., *Amaranthus* species). These non-mycorrhizal invaders are not likely to benefit from AM fungi inoculation.

continued page 7

Please donate to CNGA on May 5 as part of the Big Day of Giving

CNGA is joining hundreds of other local nonprofits in this opportunity for you to give to the organizations that enhance this place we call home.

Please consider making a donation to CNGA on May 5 — anytime from midnight to midnight! Go to www.cnga.org for more information.

Are you a night owl?

Then help us win an extra $5,000!

If you are the first person to give at midnight May 5, or the last person to give at 11:59 pm, just before May 6 — CNGA could win $5,000!

On May 5, log on to www.bigdayofgiving.org!

Best Practices For Inoculum Use During Restoration

Soil inoculation is not necessary in many restoration sites; when possible, it is recommended to conduct analyses of AM fungi or other microbes in order to determine the potential utility of inoculation (some analytical labs offer this service). If soil inocula are used during restoration, it is advisable to use local microbes in order to produce the greatest benefits to native plants and to avoid the potential consequences of introducing non-native organisms (Schwartz et al. 2006). It is also important to identify whether any noxious weeds at a given site are mycorrhizal and to use methods of application that target native plants and avoid benefitting invasive plants. For example, soil inocula may be used during nursery growth of seedlings or grass plugs, or they can be directly applied to plant roots, furrows, or planting holes when seedlings are transplanted. Broadcast application, such as scattering inocula throughout a site or mixing inocula with water during hydroseeding, should be avoided when there is the potential to increase growth of mycorrhizal weeds.

In summary, soil inocula are a potentially useful tool in the restoration of disturbed sites, but one must consider how the inoculum type, application method, and site conditions might affect outcomes.

References

Barto, E.K., J.D. Weidenhamer, D. Cipollini, and M.C. Rillig. 2012. "Fungal superhighways: Do common mycorrhizal networks enhance below ground communication? *Trends in Plant Science* 17:633–637.

Harris, J.A., P. Birch, and K.C. Short. 1989. "Changes in the microbial community and physico-chemical characteristics of topsoils stockpiled during opencast mining." *Soil Use and Management* 5:161–168.

Horner-Devine, M.C., K.M. Carney, and B.J.M. Bohannan. 2004. "An ecological perspective on bacterial biodiversity." *Proceedings of the Royal Society B: Biological Sciences* 271:113–122.

Ji, B., S. Bentivenga, and B. Casper. 2010. "Evidence for ecological matching of whole AM fungal communities to the local plant–soil environment." *Ecology* 91:3037–3046.

Kiers, E.T. M. Duhamel, Y. Beesetty, J.A. Mensah, O. Franken, E. Verbruggen, C.R. Fellbaum, G.A. Kowalchuk, M.M. Hart, A. Bago, T.M. Palmer, S.A. West, P. Vandenkoornhuyse, J. Jansa, and H. Bücking. 2011. Reciprocal rewards stabilize cooperation in the mycorrhizal symbiosis. *Science* 333:880–882.

Klironomos, J. 2003. "Variation in plant response to native and exotic arbuscular mycorrhizal fungi." *Ecology* 84:2292–2301.

Maherali, H., and J.N. Klironomos. 2007. "Influence of phylogeny on fungal community assembly and ecosystem functioning." *Science* 316:1746–1748.

McKay, J.K., C.E. Christian, S. Harrison, and K.J. Rice. 2005. "How local is local?— A review of practical and conceptual issues in the genetics of restoration." *Restoration Ecology* 13:432–440.

Miller, R.M., B.A. Carnes, and T.B. Moorman. 1985. "Factors influencing survival of vesicular–arbuscular mycorrhiza propagules during topsoil storage." *Journal of Applied Ecology* 22:259–266.

Paluch, E.C., M.A. Thomsen, and T.J. Volk. 2013. "Effects of resident soil fungi and land use history outweigh those of commercial mycorrhizal inocula: Testing a restoration strategy in unsterilized soil." *Restoration Ecology* 21:380–389.

Salyards, J., R. Evans, and A. Berry. 2003. "Mycorrhizal development and plant growth in inoculated and non-inoculated plots of California native grasses and shrubs." *Native Plants Journal* 4: 143–149. **http://npj.uwpress.org/content/4/2/143.short**

Schwartz, M.W., J.D. Hoeksema, C.A. Gehring, N.C. Johnson, J.N. Klironomos, L.K. Abbott, and A. Pringle. 2006. "The promise and the potential consequences of the global transport of mycorrhizal fungal inoculum." *Ecology Letters* 9:501–515.

Simard, S., and D. Durall. 2004. "Mycorrhizal networks: A review of their extent, function, and importance." *Canadian Journal of Botany* 82:1140–1165.

van der Heijden, M.G.A., R.D. Bardgett, and N.M. van Straalen. 2008. "The unseen majority: Soil microbes as drivers of plant diversity and productivity in terrestrial ecosystems. *Ecology Letters* 11:296–310.

Wagg, C., J. Jansa, M. Stadler, B. Schmid, and M.G.A. van der Heijden. 2011. "Mycorrhizal fungal identity and diversity relaxes plant–plant competition. *Ecology* 92:1303–1313.

Wang, B., and Y.-L. Qiu. 2006. "Phylogenetic distribution and evolution of mycorrhizas in land plants." *Mycorrhiza* 16:299–363.

White, J., J. Tallaksen, and I. Charvat. 2008. "The effects of arbuscular mycorrhizal fungal inoculation at a roadside prairie restoration site. *Mycologia* 100:6–11.

Zabinski, C., L. Quinn, and R. Callaway. 2002. "Phosphorus uptake, not carbon transfer, explains arbuscular mycorrhizal enhancement of *Centaurea maculosa* in the presence of native grassland species." *Functional Ecology* 16:758–765.

SPECIES SPOTLIGHT: **Clustered Field Sedge (*Carex praegracilis*)**

by Emily Allen, Sales Manager, Hedgerow Farms, Inc., eallen@hedgerowfarms.com

First described in 1753, the *Carex* genus is the largest genus in the *Cyperaceae* (sedge) family with 11 recognized groups (Baldwin et al. 2012). *Carex* species are important components of wetlands, riparian zones, meadows, prairies, roadsides, and bioswales. All *Carex* species are perennial monocots and, like many wetland species, most spread by rhizomes or stolons although some form tufts (Wilson et al. 2014).

The genus is incredibly diverse, and keying out individual species can be very challenging. One of the unique characteristics of *Carex*, and the related genus *Kobresia*, is the presence of perigynia (often shortened to *peri*). A peri is a specialized bract that encloses the ovary and achene, wherein the seed is located (Wilson et al. 2014). These structures are usually crucial for distinguishing *Carex* species, and the fact that they are not present year round adds to the difficulty of keying out *Carex* specimens.

The Carex Working Group (CWG), based in Washington State, is an excellent resource for identifying sedges in the Pacific Northwest. In 2014 CWG released the second edition of their reference book, *Sedges of the Pacific Northwest* (Wilson et al. 2014), which is a valuable resource for learning to identify sedges.

Carex praegracilis is a common sedge with a wide range across North America (Reznicek and Catling 1987). In California it can be found along the coast, in the Central Valley, and in both the coastal and inner mountain ranges. It is usually found at low and moderate elevations, but it can be found above 10,000 feet elevation, according to the Calflora website: **www.calflora.com.** It is found in a range of communities, including grasslands, coastal scrub, pine and fir forests, wetlands, and riparian areas.

A distinguishing feature of *C. praegracilis* is black rhizomes (Wilson et al. 2014), and it grows in dense clumps or forms a mat depending on management. It has soft, narrow leaves and can be from 1 to 3 feet tall; if left to grow tall, the foliage may fall over. *Carex praegracilis* is dioecious, with each individual having either male or female flowers but almost never both. It blooms from May through June (Calflora 2014) with very noticeable, soft brown inflorescences (Fig. 1).

Tolerance to fire, partial shade, moderate foot traffic, low temperatures, grazing (Wilson et al. 2014), flooding, and drought make *C. praegracilis* very adaptable, and this tolerance has contributed to the species being useful in a wide range of restoration, revegetation, and landscaping projects in California. It is also tolerant of a variety of soils, including alkaline (Baldwin et al. 2012), serpentine (Wilson et al. 2014), saline, sand, and clay. A long list of common names for this

continued next page

Figure 1: Carex praegracilis has attractive soft brown inflorescences. *Photo: Emily Allen*

Figure 2: A short production field of *C. praegracilis* in spring. *Photo: Emily Allen*

Clustered Field Sedge *continued*

plant reference different key features, including black creeper, freeway sedge (Baldwin et al. 2012), field sedge, clustered field sedge (Calflora 2014), deer-bed sedge, and slender sedge. A few of the planting areas in which *C. praegracilis* has recognized value are in managed landscapes as a turf alternative, for filtering and stabilizing areas with water runoff, and as forage for livestock (Catling et al. 1994).

Some sedge species, including *C. praegracilis,* stay green almost year round with infrequent deep irrigation, and this trait makes them good candidates for low-water-use turf alternatives. *Carex praegracilis* left unirrigated may go dormant in the summer or winter but will quickly regrow from rhizomes after water is applied. Mowing a few times a year will keep *C. praegracilis* at a reasonable height, and it can take light-to-moderate foot traffic (Fig. 2). Currently, the quickest and most effective method of establishing a lawn of *C. praegracilis* is by planting small transplants.

Transplants of *C. praegracilis* are usually planted from 6 to 12 inches on center in a diamond pattern, rather than a grid, to give a softer look. The denser the planting, the faster the plants will fill in, but there will also be higher labor and plant costs.

continued next page

Clustered Field Sedge *continued*

Bioswales, roadsides, and field edges are also excellent areas to utilize *C. praegracilis*. Its ability to grow in harsh and saline-alkaline soils has permitted its spread along roadsides and expansion into eastern areas in the United States where salt is used on icy roads (Reznicek and Catling 1987). *C. praegracilis* also has potential in bioswale applications because of its ability to tolerate flooding and drought.

Some promising research shows that *C. praegracilis*, along with other native grass species, can assist in nitrate removal from runoff (Riesenfeld 2014). It establishes well on canal banks and levee edges, and because it can be kept short with limited mowing, it has potential for use in bioswales and roadsides where driver visibility is a safety concern.

Carex praegracilis can be utilized as forage, and it can play an important function in a grazing regime because it is able to grow well on harsh sites and is green when other desirable species are not present or palatable (Wilson et al. 2014). Tests of populations of *C. praegracilis* from Ontario show "higher values of crude protein and acid-pepsin digestibility and lower acid detergent fiber values . . . equivalent to good quality grass hay in their potential forage value" (Catling et al. 1994). The crude protein measured in the study ranged from 8.1% to 16.8% (Catling et al. 1994). Grazing can benefit the plant by stimulating its growth and preventing thatch buildup, although heavy grazing can lead to *C. praegracilis* becoming dominant and native plant diversity becoming reduced (Wilson et al. 2014).

One of the restrictions to *C. praegracilis* being used more widely is the difficulty of establishment from seed. Some of the complications with seed germination are the light, heat, and moisture requirements for germination of sedge seed (Tilley 2010). Establishment techniques that have shown promise include pre-germination of seed before hydroseeding and using a landscape fabric covering to retain moisture and keep temperatures high (Tilley 2010). Using transplants is currently the most reliable method of establishment, but this is usually more costly than seeding.

References

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken, eds. 2012. *The Jepson Manual: Vascular Plants of California,* 2nd edition. Berkeley: UC Press.

Catling, P.M., A.R. McElroy, and K.W. Spicer. 1994. "Potential forage value of some eastern Canadian sedges (*Cyperaceae: Carex*)." *Journal of Range Management* 47:226–230.

Calflora. 2014. "Information on California Plants for Education, Research and Conservation." The Calflora Database. Accessed February 15, 2015. **www.calflora.org**

Riesenfeld, R.2014. "Using Vegetation to Reduce Nitrogen Runoff in California Caneberries." Master's Thesis, San Jose State University, CA.

Reznicek, A.A., and P.M. Catling. 1987. "*Carex praegracilis* (*Cyperaceae*) in eastern North America: A remarkable case of rapid invasion." *Rhodora* 89:205–216.

Tilley, Derek. 2010. "Investigations of Wetland Seed Establishment." Presentation at the National Native Seed Conference, Snowbird, UT, May 2010.

Wilson, B.L., R. Brainerd, D. Lytjen, B. Newhouse, and N. Otting. 2014. *Field Guide to the Sedges of the Pacific Northwest,* 3rd ed. Corvallis: Oregon State University Press.

GETTING TO KNOW GRASSLAND RESEARCHERS: **Taraneh Emam**[1]

by Meghan Skaer Thomason, CNGA Board Member

What is your study system? What are your primary research goals?

The goal of my doctoral research has been to explore how soil microbes influence grassland restoration, plant stress tolerance, and invasion by non-native plants. My work has mainly focused on the restoration of grasslands disturbed by mining here in California at the McLaughlin Natural Reserve in Napa County, as well as at coal mines in Montana and Wyoming. During mining, soil microbes and other organisms are often lost. Some of these microbes, such as mycorrhizal fungi (a type of symbiotic fungus that inhabits plant roots and soil), are very important to plant growth and to the functioning of grasslands and other ecosystems. My research has shown that adding microbes back to the soil can help native grass species and can either help or hinder non-native species depending on the species and the method used (see "Soil Microbes and Grassland Restoration" in this issue for more on this topic). I just completed my Ph.D. in March, and I am hoping to go on to a career in restoration ecology or environmental consulting.

Who is your audience?

I have always been most interested in doing applied research that will help guide decision making in restoration and land management — I always want to solve problems and make improvements. I enjoy doing presentations at the SERCAL and Cal-IPC conferences and consulting on restoration projects for colleagues. The ecological principles behind the applied work are also fascinating, and I have appreciated the academic side of things as well during graduate school.

continued next page

[1]In March 2015, Emam completed her Ph.D. degree in the Graduate Group in Ecology, Department of Plant Sciences, UC Davis. Her academic advisor was Kevin Rice. She has been involved in grasslands research for 7 years.

Figure 1. Taraneh points out a research plot at McLaughlin Natural Reserve. *Photo: Lian Rother*

Taraneh Emam *continued*

Who has inspired you, including your mentors?

I have had some wonderful mentors in science and ecology at my undergraduate institution (Mills College), in jobs and internships (such as a summer program at the Bodega Marine Reserve and working in a grassland lab at the University of Nevada Reno), and in my graduate work. However, I also have to give a lot of credit to Carl Sagan, who first inspired my desire to be a scientist!

How has or will your research promote 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"?

The main goals of my research are to add to our knowledge of plant–soil interactions in order to improve restoration success. California grasslands are subject to a lot of conversion, disturbance, and invasion, and knowing what tools are needed to manage and restore them will help protect grasslands for the future.

Why do you love grasslands?

They are such an important part of California's history, culture, and economics, yet they are also one of the most imperiled ecosystems. I also love the huge diversity of tiny things that can be found in them — grasses, wildflowers, insects, and of course, soil microbes.

CNGA to Host Grasslands Restoration Session at SERCAL Conference

by Andrew Rayburn, CNGA Board Member

The California Society for Ecological Restoration (SERCAL) is a non-profit organization dedicated to facilitating the recovery of damaged ecosystems by advancing and promoting the field of ecological restoration. The mission of SERCAL is complementary to the mission of CNGA, and the two organizations often partner together in conferences and symposia. For the past several years, CNGA Board members have been pleased to support the annual SERCAL conference by chairing conference sessions on the restoration and management of grasslands and other upland communities.

The 22nd Annual SERCAL Conference, themed "Restoration for the Next Generation," will be held May 12–14 in sunny San Diego. Field trips on May 12 will showcase restoration projects in the area, including vernal pool mitigation sites and a tour of restoration under way at the San Diego National Wildlife Refuge. Concurrent presentation and poster sessions on May 13–14 will cover a diverse range of restoration-related topics, including grasslands, special-status plant species, mitigation banks, wetlands and waters, urban areas, and use of restoration to achieve non-restoration goals. CNGA Board members have assembled an engaging set of speakers for the Grassland Session on May 14, including academic researchers, private-sector consultants, and nonprofit scientists.

Please join us at the 2015 SERCAL Conference. For more information and to register, visit the SERCAL website: **www.sercal.org**

Corporate Members

Muhlenbergia rigens

Hedgerow Farms
S & S Seeds

Stipa pulchra

Delta Bluegrass Company
Pacific Coast Seed
Restoration Resources

Poa secunda

All American Hay & Grain
Dow AgroSciences
Ecological Concerns Inc
Hanford Applied Restoration & Conservation
Olofson Environmental Inc
Sacramento Area Flood Control Agency
Sun City Lincoln Hills Community Association
Suncrest Nurseries
WRA Environmental Consultants

Associate Members

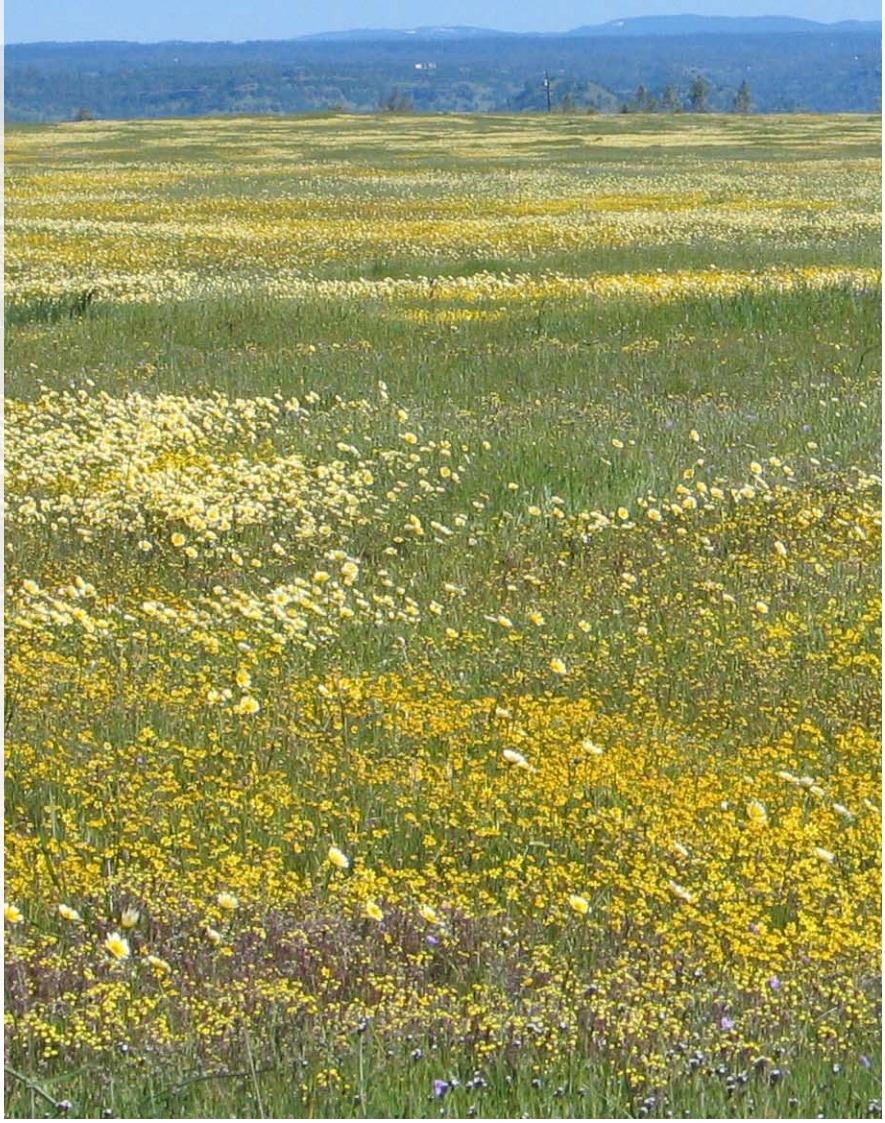
Cachuma Resource Conservation District
Carducci Associates Inc
City of Davis
CNPS, Los Angeles Chapter
Contra Costa Water District
County of Santa Clara Parks & Recreation
East Bay Regional Park District
Integrated Environmental Restoration Services Inc
Larner Seed Company
McConnell Foundation
Mission Livestock Management
New Irvine Ranch Conservancy
Orinda Horsemen's Association
Peninsula Open Space Trust
Pure Live Seed LLC
Putah Creek Council
Ransom Seed Laboratory
Restoration Design Group
Roche + Roche Landscape Architecture
Sacramento Regional County Sanitation District
San Luis National Wildlife Refuge
Saxon Holt Photography
Security Seed Services
Sequoia Riverlands Trust
Solano County Water Agency
Sonoma County Ag Preservation & Open Space District
Sonoma Mountain Institute
Sonoma Mountain Ranch Preservation Foundation
Stork Peterkin International Foundation
Truax Company Inc
Watershed Nursery
Westervelt Ecological Services
Yolo County Resource Conservation District
Zentner and Zentner

CNGA's Bunchgrass Circle

A Special *Thank You* to our Bunchgrass Circle Members! Your support for CNGA is much appreciated.

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.

Welcome to our newest Life Member:
Val Eviner, Dept of Plant Sciences, UC Davis



Dove Ridge in Butte County. *Photo: Matt Wacker*

Not a member? That's easy to fix! *You can also join online at www.cnga.org*

CNGA members have voting status, and receive the quarterly *Grasslands* publication, discounts at workshops, and latest grasslands news.

- - - - Detach and mail this form with check made out to CNGA. Send to CNGA, P.O. Box 72405, Davis, CA 95617 - - - -

Individual Membership

- ❒ **REGULAR:** $45/year
- ❒ **SUSTAINING:** $60/year
- ❒ **JOINT CNGA+SERCAL:** $80/year (save $10)
- ❒ **STUDENT:** $30/year *Please send photocopy of current ID.*
- ❒ **RETIRED:** $30/year
- ❒ **LIFE:** (one-time payment) $500

Corporate Membership and Benefits

All employees of a corporate member receive member pricing when registering for CNGA events. All membership benefits are good for 2015. All copies of *Grasslands* will be sent to the main contact at the organization.

Name _____

Title _____

Organization _____

Street _____

City _____

State _____ Zip _____

Phone _____

Fax _____

Email _____

Check one:	Membership Level	Annual Cost	Online (color) Ads w/link to member website		*Grasslands* (B&W) Ads (currently 4 issues/year)	*Grasslands* Subscriptions
❍	*Muhlenbergia rigens*	$1,000	At top of CNGA sponsor page	—LARGE—	B&W version of online ad	4
❍	*Stipa pulchra*	$500	Below *Muhlenbergia* listings	—MEDIUM—	B&W version of online ad	3
❍	*Poa secunda*	$250	Below *Stipa* listings	—SMALL—	B&W version of online ad	2
❍	Associate/Agency	$125	Text listing below *Poa* sponsors	—NO AD—	Text listing in *Grasslands*	1

If there is more than one Corporate member per level, the members will be listed alphabetically. Employee memberships include all the benefits of a personal membership, the organization determines the recipients of Grasslands *subscriptions. [3]Company may opt for fewer subscriptions.*

Production fields of California poppy (*Eschscholzia californica*) and lupine (*Lupinus* sp.) at Hedgerow Farms during Field Day, 2012.
Photo: Andrew Rayburn

California Native Grasslands Association

P.O. Box 72405
Davis, CA 95617
www.CNGA.org

NON PROFIT ORG
U.S. POSTAGE
PAID
TUCSON, AZ
PERMIT NO. 3341

Support CNGA on May 5's Big Day of Giving! *see p. 6*

Front cover: Blooming spring flowers at Table Mountain, Butte County. *Photo: Emily Grau*

Back cover: Close up of flowering blue dicks (*Dichelostemma capitatum*) at Table Mountain in Butte County. *Photo: Emily Grau*