



California
Native
Grasslands
Association

GRASSLANDS

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Grasslands Submission Guidelines

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. Photo submissions should be at least 300 dpi resolution and include a caption and credited photographer's name.

Send all submissions, as email attachments, to the Editor at grasslands@cnga.org.

Submission deadlines:

Winter 2024 15 Nov 2023

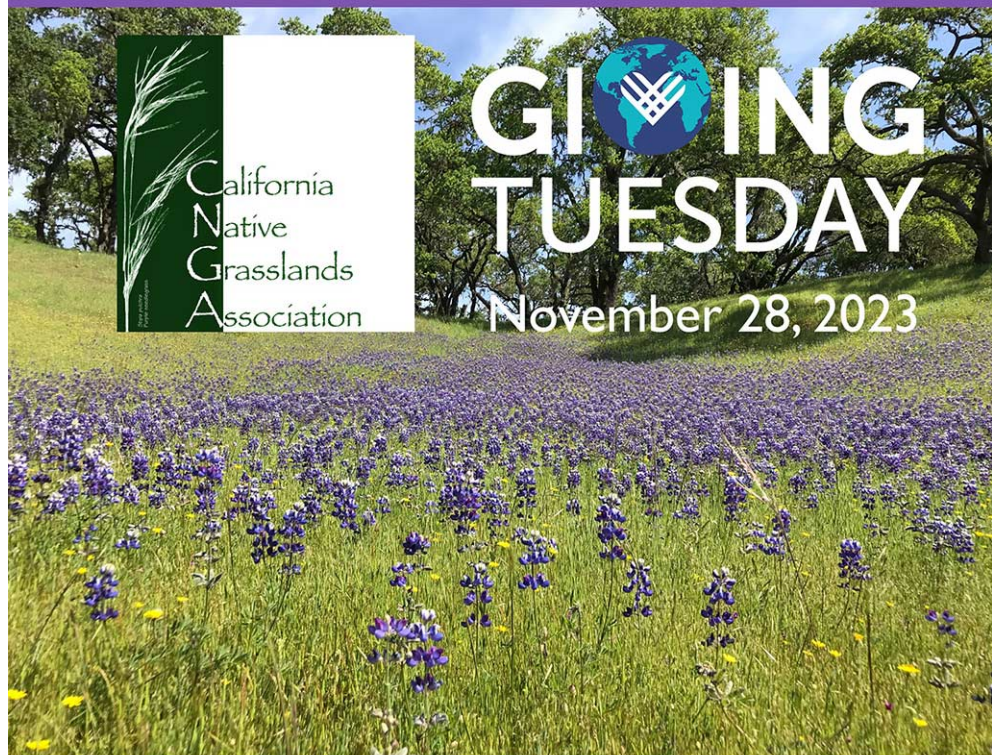
Spring 2024: 15 Feb 2024

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Fall 2024: 15 Aug 2024

Thank you for being a part of the amazing CNGA community.

Giving Tuesday is an exciting end of year giving opportunity.



#CaliforniaGRASS #GivingTuesday2023



"Grasslands rock! Of course, we know that, that's why we were there. Also, folks of all ages were present, which was wonderful to experience." — *Field Day Attendee*

CNGA's 15th Annual Field Day: Read all about it in the next issue!

From the President's Keyboard

Dear CNGA Members, Sponsors, Supporters, and Friends,

I hope you had a chance to enjoy the outdoors this year and visit some amazing grasslands. With such a wet winter, moderate temperature, and very little smoke, it has been a lovely spring and summer for outdoors enthusiasts.

Your Board Members have been working hard on advocating for the protection of native grasslands and have expanded their work to wider issues like fuel reduction bills or protection of multi-use land to protect historical native grasslands.

Our Workshop Committee put on the well-attended Field Day at Hedgerow Farms and Landscaping with Nature events, and we thank you for the great reviews. Back by popular demand, the virtual GRASS student research presentations are starting in a few days — you don't want to miss those!

We are thrilled to welcome the members of the newly created Advisory Committee whose invaluable expertise and insights will offer new guidance in shaping the future of our organization. The CNGA Advisory Committee is composed of grassland scientists, specialists, and previous CNGA Board Members who will provide strategic advice and encourage the exploration of new ideas to help us achieve our mission goals: Vic Claassen, Val Eviner, Andrew Fulks, Jim Hanson, Tanya Meyer, Chris Rose, Andrea Williams and Bryan Young. We are grateful to have these experts serving on our Advisory Committee and look forward to working with them. You can check them out here: <https://cnga.org/Advisors>.

Join our team of enthusiastic and passionate volunteers! We are looking for a few Board Members to continue the mission of CNGA. Please email us at admin@cnga.org to get more information and to apply. You can apply anytime, and elections take place in December.

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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.

Grasslands Journal

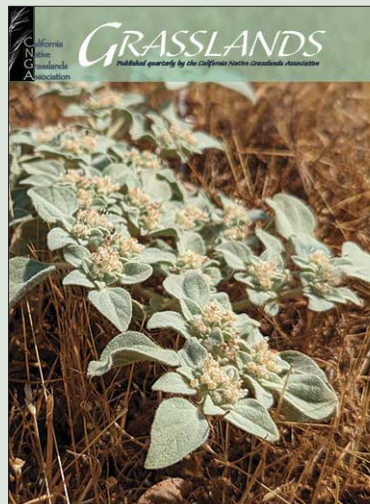
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MEET A GRASSLAND RESEARCHER **Julia Michaels**

Dr. Julia Michaels is the Restoration Ecologist at Hedgerow Farms and can be reached at juliam@hedgerowfarms.com.

What is your study system?

My graduate research focused on the effects of livestock grazing in vernal pool plant communities. This is a topic that I am passionate about and hope to continue studying in the future. However, my study system has expanded to include California grasslands across the state, and most recently, grassland species growing in an agricultural context. As the Restoration Ecologist at Hedgerow Farms in Winters, I now get to study our 300+ acres of farmland dedicated to growing native grasses and forbs to produce seed for restoration projects. Our fields at Hedgerow have a long history of serving as a working laboratory for grassland ecologists — providing opportunities to learn about how native plants respond to different management techniques.

What are your primary research goals?

In addition to my long-term interests in vernal pool ecosystems, I am currently pursuing research that improves native seed production and the restoration projects where this seed ends up. This year at Hedgerow Farms, we started a new study looking at the effects of three different field management techniques—mowing, swathing, and burning, on our fields of *Stipa pulchra* (purple needlegrass). Specifically, we are comparing untreated ‘old growth’ stands to plots that have had some combination of these three treatments, all of which have the potential to impact seed production and stand longevity. We have already observed that these treatments interact with one another—for example, mowing before burning can lead to a slower, lower-temperature burn. The timing also matters, so we are testing these treatments both in spring and fall. We are conducting this study in carefully replicated experimental field plots so that we can formally publish our data once we have analyzed it.

Who is your audience?

My current research is oriented toward both seed producers and land managers who are interested in how to increase re-seeding rates and stand longevity in their restoration projects. That includes state and federal agencies, nonprofits, environmental consulting firms, and landscape architects. But I love sharing my research with and learning from a wide range of audiences. On any given day I find myself talking about native plants with ranchers, high school students, erosion control specialists, or the random person sitting next to me on an airplane.

Who has inspired you, including your mentors?

So much of what I know about restoring grasslands has been shaped and inspired by the work of John Anderson, who founded Hedgerow Farms in the late 1980s. My advisor, Dr. Valerie Eviner, was a colleague and friend of John Anderson. I admire how Dr. Eviner can bring together a diverse group of stakeholders to pursue rigorous research questions. I am also inspired by the other wonderful researchers who served on my doctoral committee, including Dr. Susan Harrison and Dr. Kenneth Tate.



Finally, every day I am energized by my co-workers who are so knowledgeable and work around the clock to keep our native seed operation running. Alejandro Garcia and Manolo Sanchez, our two collections crew, travel all across the state to collect our wildland-sourced native seed. They can identify a wildflower through binoculars while driving 70 miles an hour on the freeway! Jeff Quiter, our farm manager at Hedgerow Farms, has figured out, through trial and error, how to take our wildland-collected seed and grow hundreds of native species in an agricultural context.

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”?

Native seed production is still a relatively new endeavor and is critical to the success of large-scale restoration. I hope that through my research, we can continue to increase the scale of native seed production for restoration while testing out some techniques that may be useful to managers.

Why do you love grasslands?

What’s not to love? Grasslands are resilient, dynamic, diverse, and totally underrated landscapes. Despite all the threats they face and how rapidly they have been converted, almost everyone in California still has a grassland in their backyard. There’s truly nowhere I’d rather be than in a grassland, preferably in a vernal pool, up to my ankles in mud, surrounded by carpets of yellow blooms, with the warble of a meadowlark in the background. Just writing this is getting me excited for next spring!



Double-Duty Landscapes

by Debi McCarthy, CNGA member¹

CNGA's workshop on *Landscaping with Nature* attracted a diverse crowd to the Putah Creek Lodge, at UC Davis on September 21st, 2022. Master Gardeners made up the largest group of participants, while landscape architects, native plant enthusiasts, watershed and restoration specialists, and a neurobiologist also listened for insights into gardens that nourish both people and animals.

Speakers emphasized that we can build beautiful gardens for humans and nature, gardens that are both attractive and support wildlife, even in suburban and high-density environments. Three of the speakers focused on native plants and planting designs to support key pollinators.

Professor Neal Williams in the Entomology Department at UC Davis is obviously enamored with wild California bees; his presentation inspired us to look at them in a new light. Not only are the 1,500 species of native California bees critical for plant pollination, but they're also frequently more polite than their better-known non-native relative, the European honeybee. California bees usually congregate in smaller, and less intimidating numbers. Experiments have shown that they tend to make good neighbors with few negative interactions with home gardeners and urban farmers.

We can easily manipulate our gardens to provide bee-nesting and overwintering sites. His research into combinations of native plants that best support a variety of bees is available at [Ranked-best-performing-native-wildflowers-for-orchard-landscapes.pdf](https://ucdavis.edu/linked-best-performing-native-wildflowers-for-orchard-landscapes.pdf) (ucdavis.edu).

Pat Reynolds of Heritage Growers built upon the native bee presentation to discuss other pollinators and an expanded planting palette. Attracting and supporting moths and butterflies creates the basis of a food web that feeds birds and other wildlife. Valley oaks are a key local species that are quick-growing and highly beneficial for wildlife as demonstrated in the Willowbank Habitat improvement program, a project that brought neighbors in Davis together while improving wildlife habitat (see *Grasslands* 29(1): 3–7).

¹Freelance writer Debi McCarthy, born in Northern California, has fond memories of rambling through nature while growing up in the Bay Area. She's especially interested in native California plant gardens created using landscape design principles for a stunning and beneficial environment. Contact her at debi@debimccarthy.com.



Workshop presenters from left to right: Julia Michaels, Haven Kiers, Pat Reynolds, Billy Krimmel, and Ryan Deering.

A high-value wildflower meadow needs several reinforcing plantings of perennials and annuals that flower at three different times, Reynolds explained. Their combination creates more diverse and resilient gardens which support pollinators. Perennial bunch grasses, in addition to being host plants for insects, provide structure that helps gardens stay attractive throughout the dry season while their deep roots help water infiltrate and be retained in the soil. Perennial flowering plants add diversity and color. Annuals add that spectacular pop that people and pollinators both appreciate.

Assistant Professor Haven Kiers in the Landscape Architecture and Environmental Design department at UC Davis, generalized from wildflower meadows to landscape design principles that help us think about how to create and maintain urban gardens that benefit people and wildlife alike. She discussed practices for sustainable gardening in our Mediterranean climate. Kiers suggested that when planting for biodiversity, also think about your ability to touch, smell, feel, or just sit among your native plants because access to nature has medically proven benefits. Using landscape design ideas can create California native gardens as beautiful as anything you have seen in a glossy coffee table gardening book.

Dr. Julia Michaels, a restoration ecologist at Hedgerow Farms and Pacific Coast Seeds, joined with Kiers to present a complementary overlap of landscape architecture and restoration concepts. For example, planting more of each native species and grouping them together in swaths appears more orderly and attractive to people and better benefits the insects that depend on them. While non-native

continued next page

Double-Duty Landscapes *continued*

drought tolerant plants can supplement a native garden, both presenters agree that natives are crucial for habitat specialists, such as monarchs and pipevine swallowtails which are dependent upon specific host plants.

Dr. Billy Krimmel of Miridae Landscape Architecture and Construction expounded upon that host plant–insect interaction. He reminded us that native insects coevolved with native plants, a relationship that can't be replaced with exotic plants. A vibrant interconnected landscape that forms habitat is more useful and dynamic than a mixture of unrelated low-water plants. Krimmel encouraged participants to join the Seed Pile Project, with free seed packets and instructions on how to monitor the pollinators they

attract. Miridae Mobile Nursery was also on-site with a lush supply of native plants for purchase.

The presentations ended with a ramble through the UC Davis gardens led by horticulturist Ryan Deering. Along the way, he pointed out his favorite native plants, planting designs, and shared his knowledge of irrigation techniques and adapting gardens to new conditions. Kiers wished us farewell with tea at a courtyard designed by a succession of her students to imitate native habitats and provide a place for students to hang out. That conjunction of wildlife habitat and people habitat perfectly sums up the theme of the day.



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the key is...

COMPLEX HABITAT PROVIDES

★ *most value* ★

Complexity

lots going on!
many interactions

11 Include coarse & woody debris
* adds organic matter

12 Have multiple substrates
mulched + bare soil

1 Use Native Species... whose

10 Include a Boulder (or 2!)
* keep branches & logs from tree work
ants, bees, wasps

* ground nesting bugs

2 Historic Range includes the site

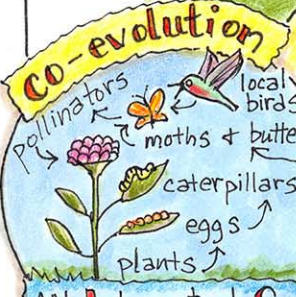
9 Add a Water Feature
* water for habitat

A KEEN sense of PLACE

3 Use Local Ecotypes
(ask the nursery where it's from)

8 Valley Oak is a GREAT habitat species!
* Deep roots for water infiltration
* builds soil & sequesters carbon

4 Use a diverse set of species
* varied flowering periods
3 early, 3 middle, 3 late



7 Use native bunch grasses

6 Use Perennials AND Annuals

5 Include moth & butterfly host plants
! required for their survival!



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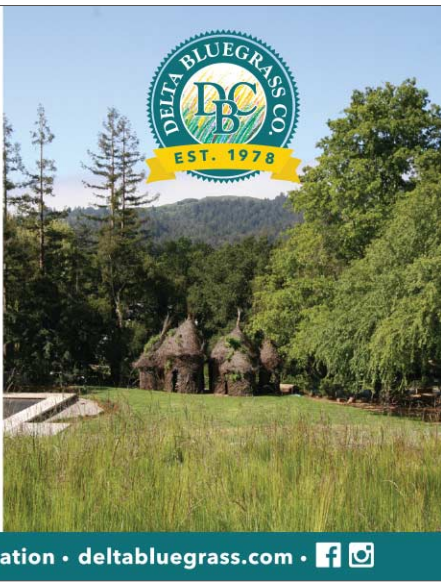
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Figure 1: A lone bloom of owl's clover (*Castilleja densiflora*) in an urban grassland near UCSB.

Figure 2: The inflorescences of owl's clover (*Castilleja densiflora*) are a kaleidoscope of tiny purple, white, and yellow flowers.

The Journey of Restoration: A case study of vernal pools, plants, and people by Joanna Tang¹

I stumble through a field, trying to avoid gopher holes, when a flash of purple catches the corner of my eye. I jolt to a stop. What is it? My heart begins to rise, and I recognize the brilliant bloom even as I bend down for a closer look. It's an owl's clover (*Castilleja densiflora*), whose bloom is an iridescent kaleidoscope of several small purple, white, and yellow flowers bundled together in a miniature bouquet. It's my favorite native plant! Just look at it there, peeping up amidst the grasses, waving hello at me in the gentle breeze. It seemed blithely oblivious to the fact that it was the only native plant surrounded by a sea of invasive European grasses.

I drop my equipment as I crouch down to examine the flower. I'm at my research field site collecting data on the local plant species. I'm a PhD student researching restoration ecology at the University of California, Santa Barbara (UCSB), and I'm currently investigating strategies for increasing the persistence and resilience of native species in vernal pool wetlands. Vernal pools are temporary wetlands that form in the winter when rainwater pools atop a subsurface impermeable soil layer, only to dry up completely during the dry, warm summer months of California's

Mediterranean climate. So, what was I doing standing in the middle of a field overrun by invasive grasses?

I had asked myself the same question the first time I arrived at UCSB, when my mentor, Lisa Stratton, offered to take me on a tour of the local vernal pools. Vernal pools are miniature ecosystems that often exist within rolling grassland landscapes. Yet, it still struck me how well these vernal pools blend in with their surroundings. The small grassland parcel is tucked within the dense residential area that houses the majority of UCSB students and has experienced myriad anthropogenic pressures, including grazing and relentless foot traffic. Granted, I was scrutinizing these "pools" in the autumn after a dry summer, when no pool is looking its best or even moderately wet. Yet, I felt as though the season of observation was not the only difference between these brown, crispy vernal pools and the variegated, lucid floral displays I have seen in restored vernal pools in the Central Valley grasslands. Fortunately, I was pleasantly surprised when the following winter rains allowed the crispy, small depressions to pool up and give rise to their own unique floral displays, like a "just add water" magic trick. Lush white and green popcorn flowers (*Plagiobothrys undulatus*), dwarf woolly heads (*Psilocarphus brevissimus*), and coyote thistle (*Eryngium yaveyi*) popped up and carpeted the bottoms of the vernal pools.

¹Joanna is a PhD candidate studying urban restoration ecology. Her goal is to bridge the gap between academics and practitioners so that best management practices are informed by innovative research. She can be reached at joannatang@ucsb.edu.

continued next page

The Journey of Restoration: A case study of vernal pools, plants, and people *continued*

However, it was like someone had started painting a vernal pool from the center outward, but had stopped midway through. The iconic Central Valley vernal pools have concentric rings of flowers, white shifting to yellow, gold, blue, and purple, before fading to green upland grassland. These pools in Santa Barbara also harbored robust populations of bottom-dwelling native species, but they were butted up against invasive grasses from the surrounding grassland. Where had the suite of transition zone species gone?

These observations sparked my graduate research to life. I wanted to know exactly what species were found in these Santa Barbara vernal pools, and how the plant diversity and composition compared to other vernal pools. To put numbers to my hunch that the pools were missing transition zone species, I organized a team including Lisa Stratton’s staff at the Cheadle Center for Biodiversity & Ecological Restoration and several undergraduate student interns, and together we surveyed over 60 local vernal pools. We found several endemic vernal pool species, such as popcorn flower, dwarf woolly heads, coyote thistle, and water pygmyweed (*Crassula aquatica*), as well as wetland indicator species, such as common spikerush (*Eleocharis macrostachya*) and brown-headed rush (*Juncus phaeocephalus*), in the bottom zones. However, the transition zones only harbored a few native wetland species such as needle spikerush (*Eleocharis acicularis*), common sedge (*Carex praegracilis*), saltgrass (*Distichlis spicata*), and Mexican rush (*Juncus mexicanus*). One pool had a small population of prickly coyote thistle (*Eryngium armatum*) in the transition zone, but that was the only transition zone endemic. There was no meadowfoam (*Limnanthes* spp.), no butter and eggs (*Triphysaria versicolor*), no calicoflowers (*Downingia* spp.); and goldfields (*Lasthenia* spp.) had not been recorded in the area since before 1980. When I asked the local vernal pool managers what they expected to see in the transition zone of vernal pools, they answered, “Italian rye grass” (*Festuca perennis*). Italian rye grass! This was the dominant invasive species that comprised the unrestored grassland parcels



Figure 3: A sea of invasive grasses surrounding a crispy vernal pool near UCSB.

surrounding the vernal pools, intertwined with ripgut brome (*Bromus diandrus*), soft brome (*Bromus hordeaceus*), wild oats (*Avena fatua*), seaside barley (*Hordeum marinum*), longbeak stork’s bill (*Erodium botrys*), and vetch (*Vicia* spp.). These exotic species, many listed by the California Invasive Plant Council as invasive species capable of displacing native species, were dominating the edges of the pools, and Italian ryegrass had even invaded through the bottoms of some pools.

My goal for my dissertation research was to examine and manipulate this transition zone. Were native species lying dormant in the seed bank, waiting for optimal conditions (e.g., high precipitation, low competition) to sprout? Would adding more native species to the seed bank allow them to out-compete exotics? Which native species would be able to survive in the transition zone under projected climatic conditions?

My advisor, Carla D’Antonio, did research with previous graduate students on the negative impact of invasive thatch on native species (Chen et al. 2018). Thatch can cause a decrease in native species performance and an increase in exotic grass performance, causing an invasive positive feedback (Molinari and D’Antonio 2020). Vernal pool communities are not adapted to germinating and growing in a layer of thatch, so I hypothesized that removing the invasive thatch layer would allow native species to recolonize the

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Figure 4: A vernal pool near UCSB in spring, with bottom-dwelling native vernal pool plants butted up against invasive grasses.

The Journey of Restoration: A case study of vernal pools, plants, and people *continued*

transition zone. I designed an experimental annual management regime to target and remove the invasive thatch build-up, with the goal of developing a feasible long-term management strategy to break the invasive feedback and allow native species to persist in the long term. If annual thatch removal causes a decrease in exotic plant species and/or an increase in native plant species, then managers can prioritize thatch reduction practices to maintain native plant assemblages in the long term. If thatch removal causes a decrease in exotic species, but does not affect native species, then this suggests that thatch promoted exotic populations, but that native populations are limited by another factor, such as propagule supply. If native plant populations are limited by native propagule supply, then annual native seed addition could increase native plant populations. Removal of thatch via grazing or prescribed fire has been shown to successfully decrease exotic species cover and increase native species cover in Central Valley vernal pools (Marty 2005; Cox and Austin 1990). Mechanical raking is a small-scale method for removing thatch, which is a feasible method in the small urban grasslands around UCSB. Although grazing and fire may pose safety issues in a densely populated urban area, the dense human population also provides benefits for restoration: people to perform restoration work! I assembled a dedicated crew of eager undergraduate students who devoted long hours in the hot summer sun raking out layers and layers of invasive thatch in a set of 15 local vernal pools. The piles of thatch mounded up above our knees by the time we were done. The hot, sweaty work was so rewarding when we looked back to see all the open niche space we had cleared, ostensibly just waiting for native species to come and fill it.

Will native species hidden in the seed bank emerge into this open space? Perhaps, but it is also possible that some native populations were so depleted during urbanization that they need an extra boost. I had another crew of interns meticulously sort, clean, count, and package seeds of seven native species I had collected from local vernal pools the previous spring. We added seeds of purple needlegrass (*Stipa pulchra*), meadow barley (*Hordeum brachyantherum*), common gumplant (*Grindelia camporum*), Western rush (*Juncus occidentalis*), toad rush (*Juncus bufonius*), coyote thistle, and Lemmon's canarygrass (*Phalaris lemmonii*) to half of each raked vernal pool, sowing them in before the first winter rains. If the raked and sown pools bloomed with more native species in the spring, then this raking and seeding method could be a viable management strategy to bolster native populations in the transition zone of restored vernal pools. If the raked but unsown pools also increased in native species and/or decreased in exotic species, then this would indicate that managers could focus on raking where native seed banks are already present.

To test my hypotheses that removing the invasive thatch layer may decrease exotic abundance and adding native seed may restore the transition zone in vernal pools, I found myself stumbling through my experimental field site, sampling equipment in hand and eyes peeled for treacherous gopher holes. I had my sampling quadrat — four pieces of meter-long PVC glued into a square — draped over my shoulder, which I laid down on my experimental plots to estimate plant diversity on each section of each pool that had been

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Figure 5: Interns Patty Park, Jessica Jagger, and Leila Mohammadi after a hard day's work raking out invasive thatch.

Figure 6: Common gumplant (*Grindelia camporum*), the only species that germinated from the seeding treatments.

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raked, sown, or both. I did the same for control plots that had not received any experimental restoration treatments, to be able to compare the effects of my experimental manipulations to a baseline.

Between two pools, I stumbled upon that beautiful owl's clover. My face lit up as I realized its seeds had been hiding dormant underground all along, waiting for just the right conditions to make their appearance. My spirits lifted all the more because I had not found many other native species that day in my experimental plots.

Despite removing the thick thatch layer the previous summer, more invasive grasses had sprouted and filled in the open niche space. Out of the seven species I had sown, only a few common gumplant had germinated in some of the plots. In truth, the winter rains had been so below average that the whole ecosystem suffered. When I crunched the numbers of native and exotic diversity from my quadrat sampling, I found that both total exotic and total native cover had decreased, regardless of raking or seeding treatment.

Exotic cover was lowest in raked and sown quadrats, which showed some promise for this raking and seeding treatment as a viable management method.

I have been conducting this thatch manipulation experiment for four years now, raking out thatch every summer and sowing native seed every fall with several cohorts of undergraduate student interns. Preliminary results are still inconclusive, with native and exotic cover oscillating but not significantly changing due to raking or seeding treatments. New questions pop into my mind as I watch and observe the pools throughout the seasons. Do the six other species I had sown need more winter rains to germinate? Will the seed I add ever compare to the seemingly endless seed bank of invasive species that allow grasses to keep proliferating, despite our efforts of raking out bales of thatch each summer? Are there other native species that would be better competitors against the invasive species?

The landscape may not have been greatly affected by my thatch manipulation treatments, but I have certainly been affected by working in the landscape. I have savored every minute of exploring every edge of each vernal pool and mapping out their extent using a precise GPS tracker; watching the pools shrink and swell with every rainstorm and recording their seasonal hydroperiod; waiting in anticipation to see what will spring to life and analyzing how vegetation composition changes; and brainstorming new ideas to

help transform crispy brown depressions into islands of biodiversity. Perhaps even more rewarding than discovering my favorite native species is helping others discover the wonderful ecosystems in their own backyards. I love seeing the excitement of my new interns when they realize that the brown field they trudge through every day

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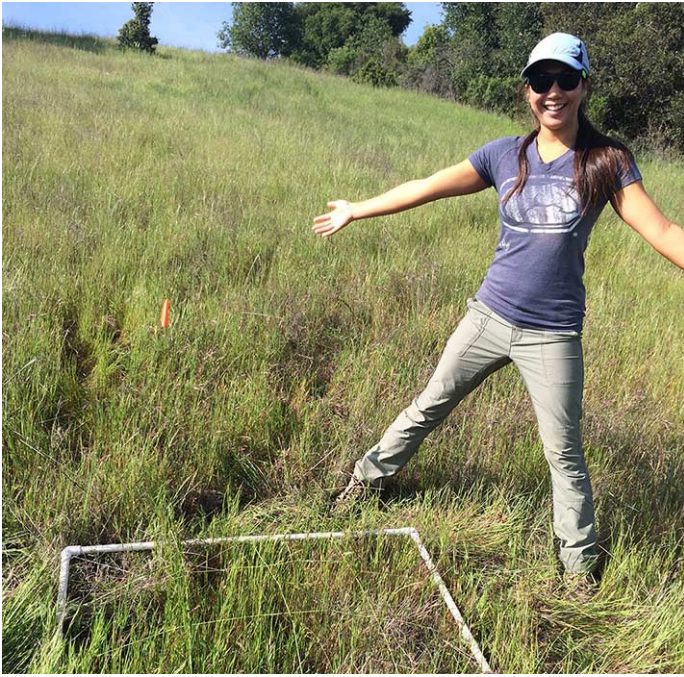


Figure 7: Joanna Tang vegetation sampling with her quadrat. Photo courtesy Wallis Robinson.

Figure 8: Restoring the connection between plants and people — in this case, popcorn flower (*Plagiobothrys undulatus*), dwarf woolly heads (*Psilocarphus brevissimus*), and water pygmyweed (*Crassula aquatica*).

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on the way to school is filled with endemic species found only in California. I love hearing their eagerness to better understand and steward the ecosystem. I love twirling grass stalks between my fingers to make sure I've identified the species correctly, and teaching others how to do the same.

This is what restoration means to me: restoring the relationship between humans and the environment, between people and plants. I do not know if I will ever figure out the perfect method to “completely restore” the vernal pools around UCSB, or if that is even possible, but I think the most important part of restoration is starting the process. Only when I begin to take a closer look at those brown fields do I discover discreet little vernal pools. Only when I watch water and species ebb and flow will I notice when something seems amiss. Only when I try and fail to “fix things” will I be humbled to listen and learn from others around me — human, animal, plant, scientist, elder, denizen. As a community coming together to observe, understand, care for, and steward our land, we can restore the unique ecosystems of California and also restore the joy of thriving in fraternity with nature.

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Front cover: *Croton setiger*, doveweed or turkey-mullein, can be seen in disturbed areas including roadsides, pastures, and grasslands throughout the state at lower elevations this time of year. See the Winter 2018 issue of *Grasslands* to read an article highlighting this species and its unique seeds. *Photo credit: Emily Allen, CNGA Board Member.*

Back cover: Carrizo plains, May 9, 2022. *Photo credit: Justin Luong, CNGA Board member.*

