# Symposium on the Management of Southern California Grasslands for Rare Species
# Escondido, California

*March 22, 2012*

**GOAL:** *Share information and lessons learned on the adaptive management and restoration of grasslands for rare species, including burrowing owl, Stephens' kangaroo rat, Otay tarplant, and Quino checkerspot butterfly.*

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SAN DIEGO ZOO INSTITUTE FOR CONSERVATION RESEARCH

San Diego Management & Monitoring Program

CONSERVATION BIOLOGY INSTITUTE

*With funding from SANDAG's TransNet Environmental Mitigation Program*

# *PROGRAM*

| SPEAKER | TOPIC | TIME |
|---|---|---|
| REGISTRATION AND POSTERS | Coffee, tea, bagels | 8:30-9:00 |
| Jerre Ann Stallcup<br>Conservation Biology Institute | *Welcome and opening remarks* | 9:00-9:10 |
| Richard Minnich,<br>UC Riverside | *Historical perspectives on California's wildflower prairies* | 9:10-9:40 |
| Lance Criley<br>Cleveland National Forest | *Grazing management for conservation benefits* | 9:40-10:05 |
| Grey Hayes, Elkhorn Slough Nat'l Estuarine Research Reserve | *Adaptive management of grasslands: lessons from California's coastal prairies* | 10:05-10:30 |
| BREAK | | 10:30-10:45 |
| Stuart Weiss<br>Creekside Center for Earth Observation | *Atmospheric nitrogen deposition and conservation of the Bay checkerspot butterfly* | 10:45-11:10 |
| Debra Shier and Bryan Endress<br>Inst. for Conservation Research | *Effects of grassland management on Stephens' kangaroo rat – translocation success and native plant establishment* | 11:10-11:35 |
| Brian Shomo<br>Riverside Habitat Cons. Agency | *Use of sheep in management of Stephens' kangaroo rat, burrowing owl, and other species* | 11:35-12:00 |
| LUNCH (provided) | Seating inside and outside | 12:00-1:00 |
| Scott McMillan and<br>Lindsey Cavallaro, AECOM | *Restoration and management of Quino checkerspot butterfly habitat* | 1:00-1:25 |
| Mark Dodero<br>RECON | *Translocation, restoration, and management methods for Otay tarplant (Deinandra conjugens)–challenges and lessons learned* | 1:25-1:50 |
| Carl Bell, Marti Witter, and John Ekhoff; UC Agricultural Extension, NPS, and CDFG | *Control of invasive annual grasses with herbicides aids restoration of purple needlegrass* | 1:50-2:15 |
| Sara Jo Dickens and Edith Allen<br>UC Berkeley and UC Riverside | *Belowground perspectives in southern California grassland restoration* | 2:15-2:40 |
| BREAK | | 2:40-2:50 |
| Trish Smith<br>The Nature Conservancy | Moderated Panel Discussion | 2:50-3:30 |

| POSTERS/UNSTRUCTURED MEETINGS & DISCUSSION | TOPIC | 3:30-4:30 |
|---|---|---|
| Dickens, S.J., S. Mangla, K. Preston, and K. Suding; UC Berkeley and Nature Reserve of Orange County | *Orange County invasive plant management: determining threshholds for sustainable invasive plant control and wildland restoration* | |
| Spring Strahm San Diego State University | *A conceptual model for Deinandra conjugens* | |
| Cheryl Brehme U.S. Geological Survey | *Monitoring and Habitat Management of Stephens' kangaroo rat on MCB, Camp Pendleton* | |
| Cathy Chadwick Earth Discovery Institute | *Reviving our grasslands with community stewards* | |

# *Abstracts of Talks and Biographies of Speakers*

## *Historical Perspectives on California's Wildflower Prairies*

***Richard A. Minnich, Ph.D.***
**Professor and Chair, Department of Earth Sciences**
**University of California, Riverside**

In the 18th century, the Spaniards saw springtime California covered with spectacular and extensive carpets of wildflowers. But by the Gold Rush, Spanish-introduced Franciscan black mustard and wild oats displaced coastal wildflowers, and interior flower fields were displaced a century later by bromes and slender wild oats. Fredrick Clements and others in the early 20th century proposed the perennial bunch-grassland (*Nassella)* model as the aboriginal vegetation baseline, and that these grasslands were destroyed and converted to modern exotic grasslands by overgrazing. They built their case on the exclusive use of botanical collections that began in the mid-19th century, ignoring the Spanish record. But the first botanists saw already widespread exotic annual grasslands. The role of grazing should be viewed in geological time scales because the evolution of the California flora coincided with a diverse megafauna that exerted a cattle-like disturbance until the end of the Pleistocene. Packrat middens document that wildflowers have been part of California's heritage since at least the last ice age. Because of a flawed hypothesis that bunch grasses were pervasive in the past, Californians took for granted the rapidly fading wildflower heritage. The bunchgrass story has prevented us from observing, doubting, and searching for alternative evidence to construct alternative stories. The restoration of California's wildflower flora will require management strategies involving the entire landscape, with a historical perspective. Potential avenues for effective management and conservation include spring burning, seasonal grazing by domesticated livestock, and use of Old World pathogens as biological controls of invasive species.

*Dr. Minnich joined UCR in 1980, after receiving his doctoral degree from UCLA. His research focuses on historical ecology and environmental history of the Mediterranean ecosystem in Southern California and northern Baja California, Mexico to trace long-term change in ecosystems as the result of wildfire, climate change, and biological invasions. Dr. Minnich has studied the patterns of forest die-off from drought and how global warming has influenced these patterns. He is the author or coauthor of over 60 refereed papers*

*and book chapters, as well as two books, including California's Fading Wildflowers: Lost Legacy and Biological Invasions.*

## *Grazing Management for Conservation Benefits*

***Lance Criley, M.S.***
**Rangeland Management Specialist**
**Cleveland National Forest**

Creating and maintaining a successful grazing management program to meet land management/conservation goals requires creating measurable objectives, monitoring to determine grazing intensity and timing, developing a sustainable relationship with the livestock operator, and avoiding common pitfalls. The goal is to summarize the kinds of questions that need to be asked when developing a grazing program and how to connect with resources to get those questions answered.

*Lance Criley has worked as a Rangeland Management Specialist on the Cleveland National Forest for 7 years, administering the forest grazing program. He is also the noxious weed program coordinator for the Forest. Before that, he worked in natural resource management for the Department of the Navy doing habitat restoration projects, noxious weed management and grazing plan development. He has a B.A. degree in Environmental Biology and Anthropology from the University of Colorado, Boulder and a M.S. in Environmental Science, Policy and Management from the University of California, Berkeley.*

## *Adaptive management of grasslands: lessons from California's coastal prairies*

***Grey Hayes, Ph.D.***
**Coordinator, Coastal Training Program**
**Elkhorn Slough National Estuarine Research Reserve**

Long-term research on coastal prairies in Santa Cruz County has focused on:

- Disturbance factors associated with grazing vs. mowing (e.g., soil disturbance, nutrients, vegetation clipping, litter removal, timing variation) and how these may influence management decisions
- Reintroduction of Santa Cruz tarplant
- Variability of community composition response between sites, and how this can help inform the scale at which we manage
- Disturbance response of various guilds of plants (annual vs. perennial, grass vs. forb)

The research has implications for deciding the kinds of questions one should ask when formulating objectives and refining goals for restoration and management. Variation in objectives may suggest varying management regimes across the landscape. Between-year variation in plant response and length of time before response can affect monitoring regimes and metrics.

*For the past 24 years, Dr. Hayes has focused on agroecology and natural systems ecology of California's central coast. His research and management experience includes work with the Ohlone tiger beetle (Cicindela ohlone) and red-legged frog (Rana aurora draytonii), as well as restoration and management of coastal prairie, coastal scrub, riparian, and maritime chaparral ecosystems. He is author or co-author of numerous publications including management plans for protected natural areas and peer-reviewed articles in scientific and popular journals. As coordinator of the Coastal Training Program, he has focused on bridging the gaps between regulators, land managers, and researchers by fostering dialogue and increasing ecological literacy. Contributions of this program include improved protection for maritime chaparral and coastal prairie throughout the central coast of California, recreation management in protected natural areas, and independent scientific review of environmental decision-making in regulatory branches of government. Dr. Hayes also facilitates the Central Coast Rangelands Coalition.*

## *Atmospheric Nitrogen Deposition and Conservation of the Bay Checkerspot Butterfly*

***Stuart B. Weiss, Ph.D.***
**Chief Scientist**
**Creekside Center for Earth Observation**

Serpentine grasslands in the San Francisco Bay Area support a dazzling array of native wildflowers and bunchgrasses and are home to many imperiled species, including the threatened Bay checkerspot butterfly. These grasslands have been threatened by direct urban development but more insidiously by atmospheric nitrogen deposition. Urban smog deposits 10-20 kg-N/ha/year, which allows non-native annual grasses to readily invade the formerly nutrient-poor soils and crowd out the native forbs that the butterfly needs. Moderate cattle grazing provides landscape-scale control of the annual grasses. In small areas where grazing is infeasible, well-timed mowing maintains native grassland diversity. Additional management issues include control of barb goatgrass, which is both biologically and institutionally challenging. A regional HCP/NCCP is close to adoption and promises to provide the resources to scale up existing endowed mitigation programs. Similar atmospheric nitrogen deposition issues extend across much of California, especially the South Coast, and should be considered in developing management plans for low biomass ecosystems.

*Dr. Weiss is a conservation ecologist with experience in the full panoply of conservation biology, including restoration, conservation planning, statistical analysis, GIS, ecological modeling, and grassroots rabble-rousing. He received his Ph.D. from Stanford University and is an internationally recognized expert on atmospheric nitrogen deposition and climate change impacts on biodiversity in California. Everything he ever learned in ecology and conservation he learned first from the Bay checkerspot butterfly.*

## *Effects of Grassland Management on Stephens' Kangaroo Rat–Translocation Success and Native Plant Establishment*

***Debra M. Shier, Ph.D.*** *and* ***Bryan Endress, Ph.D.***
**Brown-Endowed Scientist** **Director, Applied Plant Ecology**
**Institute for Conservation Research** **Institute for Conservation Research**

Stephens' kangaroo rat (SKR) is endemic to Riverside and San Diego counties and inhabits open native grasslands to sparse scrublands. Reserves within its historic range are covered with thatch by nonnative European grasses and must be restored if they are to be used as translocation release sites for the species. We examined the effects of mowing, grazing, and controlled burns coupled with native plant restoration on translocation success and the development of grassland dominated by native grassland species. Kangaroo rats released onto controlled burn subplots dug more burrows and showed higher survival and reproductive success compared to those released onto mowed or grazed subplots. Establishment and survival rates of native grass were high, though cover of native grass species remains low due to the slow growth of these species. Preliminary results suggest that SKR may thrive in restored areas, though it remains unclear if their role as "ecosystem engineers" will increase resistance to exotic plant reinvasion.

*Dr. Shier runs a growing local field program on threatened and endangered small mammals. For the past 17 years she has been studying the ways in which an understanding of animal behavior and behavioral ecology can be applied to conservation strategies such as reintroductions and translocations. In general, her research has focused on using basic theory to create effective and efficient relocation methods by encouraging settlement, dampening stress, and increasing post-release fitness. More recently, her research has expanded into local grassland restoration and examining anthropogenic effects on wildlife behavior. Dr. Endress' research focuses on habitat restoration, plant-animal interactions, and natural resource management.*

## *Use of Sheep in Management of Stephens' Kangaroo Rat, Burrowing Owl, and Other Species*

***Brian Shomo, M.S.***
**Natural Resources Manager**
**Riverside County Habitat Conservation Agency (RCHCA)**

Grazing animals have always been an integral force in changing California's landscapes. Before European settlement, antelope grazed in large numbers and moved continuously throughout the region for forage and predator avoidance. This resulted in a relatively moderate disturbance to the landscape. More recently, European colonization displaced the native grazers with millions of domestic sheep and cattle which ate grass much differently, causing an intense level of disturbance. The RCHCA has been experimenting with using domestic sheep to mimic historical native antelope grazing behavior. Specifically, we wanted to know if we could graze sheep in such a manner that allows native forbs to thrive while impacting the seed heads of non-native annual grasses and thereby decreasing the long-term exotic cover.

*At the RCHCA, Brian Shomo is responsible for managing grassland habitat for Stephens' kangaroo rats (Dipodomys stephensi) and other sensitive species in western Riverside County. Prior to managing the RCHCA's lands he worked as an ecologist at Fort Irwin Army Base and the National Training Center in the Mojave Desert. He is interested in using traditional management tools and techniques in new ways to achieve landscape-level results.*

## *Restoration and Management of Quino Checkerspot Butterfly Habitat*

***Scott McMillan and Lindsey Cavallaro***
**Restoration Ecologists**
**AECOM**

The Quino checkerspot butterfly (QCB) may have been one of the most abundant butterfly species in southern California, but as a result of habitat loss and fragmentation, prolonged drought in the late 1980s and early 1990s, and the recent fires in 2003 and 2007, the butterfly has declined to a limited number of populations in Western Riverside and San Diego counties, as well as Baja California. QCB habitat is comprised of vegetation communities with relatively open areas that typically include patches of plantain (*Plantago* spp.), the QCB host plant, and adult nectar sources. These open areas, often associated with heavy clay soils, are found in grasslands, coastal sage scrub, and chaparral habitats. QCB was listed as Endangered by USFWS in 1997; since then, a number of restoration projects have targeted QCB habitat, both for mitigation and conservation. We review three QCB restoration projects conducted in San Diego County, including the restoration goals, methods for non-native plant control and native seed bank establishment, development of specific monitoring designed to track QCB habitat recovery, results, and lessons learned. We contemplate the future of QCB habitat restoration, management, and conservation, including the potential for introduction of QCB larvae into restoration sites.

*Scott McMillan has over 20 years of experience with Southern California's native flora and fauna. Scott has worked on almost every type of habitat that our region has to offer, but in the last fifteen years, much of Scott's work has involved the restoration of native habitats, particularly those habitats that support sensitive plant and animal species. Scott's specialty is the assessment, restoration, and management of vernal pool habitat, native grasslands, and clay soil endemics, including many projects targeting the Quino checkerspot butterfly. Lindsey Cavallaro has worked with Scott for over 6 years on numerous vernal pool and Quino checkerspot butterfly habitat restoration projects in San Diego County.*

## *Translocation, Restoration, and Management Methods for Otay tarplant (Deinandra conjugens)–Challenges and Lessons Learned*

***Mark Dodero***
**Senior Restoration Biologist**
**RECON Environmental Inc.**

Otay tarplant, a clay soil endemic found in southern San Diego County and extreme northern Baja California, is a State Endangered and Federally Threatened species. A translocation and restoration program was required as mitigation for impacts to 0.75 acre of Otay tarplant habitat and 500 individuals in the Otay area. A 3-acre Otay tarplant translocation program began in January 2000, and the 5-year maintenance and monitoring period ended in 2004. An additional 5 years of population monitoring continued for a total of 10 years until 2009. The translocation and habitat restoration project included salvage of native bunchgrasses and other grassland plants and an intensive weeding program to ensure project success. Despite below-average rainfall in 9 out of the 10 monitoring years, after the implementation year, the Otay tarplant translocation program exceeded the performance standards in all but one year (2002), which was the driest year on record for San Diego. Selected techniques used in this translocation program can be applied to management and restoration of natural populations, and these methods will be discussed.

*Mark Dodero, a native San Diegan, has been interested in biology since his childhood days. Mark has Bachelor's and Master's degrees from San Diego State University. His previous work experience includes studying reptiles while in the San Diego Natural History Museum Herpetology Department and assisting with monitoring and management programs as an Environmental Services Intern at State Parks. At RECON, Mark has successfully implemented habitat restoration projects for vernal pools, Otay tarplant, and other rare plants as well as restored maritime succulent and coastal sage scrub habitat for cactus wrens and coastal California gnatcatchers. His current duties include being the Biologist/Steward for the Otay Ranch Preserve that is owned and managed by the City of Chula Vista and the County of San Diego.*

## *Control of Invasive Annual Grasses with Herbicides Aids Restoration of Purple Needlegrass*

***Carl E. Bell, M.S.***
**Regional Advisor – Invasive Plants**
**University of California Cooperative Extension**

Purple needlegrass, a native perennial bunchgrass of lower elevation grassland, chaparral, and oak savannah communities in California, was thought to be the dominant species on over several million ha. Purple needlegrass is still present, but these landscapes are now dominated by exotic annuals. This displacement is believed to be the result of intensive grazing, more frequent fires, rodents, cultivation, and competition from introduced exotic plants. Restoration of grassland in California is often synonymous with recovery of the purple needlegrass population. Methods that have been investigated to shift the dominance in grasslands back to purple needlegrass have included fire, livestock grazing, clearing and planting, and mowing, but these practices are not commonly used. Selective use of herbicides is a method that is showing promise in field trials in Southern California. Selective in this context means herbicide application in the spring over all plants present in an area, killing the invasive annuals without significant injury to purple needlegrass. Spring time applications kill the non-native annuals and thereby eliminate competition with purple needlegrass.

*Carl Bell is responsible for applied research on invasive plants (weeds of natural habitats) and extension education in six southern California Counties (San Diego, Orange, Los Angeles, Riverside, Ventura, and San Bernardino). The principle audiences that he educates are land owners/land managers of public and private preserves and the people that support their activities. His research focuses on practical and effective methods to control non-native plants that have invaded natural habitats, particularly as an aftermath of*

*wildfire. Much of his research has been evaluating herbicides for control of invasive plants, but has also included grazing with goats and use of non-herbicide options. He maintains a website with information on invasive plants and research results (http://ucanr.org/sites/socalinvasives/). In addition, he frequently advises policy makers and stakeholders on the impacts of invasive plants in natural areas and on weed control practices.*

## *Belowground perspectives in southern California grassland restoration*

***S.J.M. Dickens, Ph.D.*** *and* ***E.B. Allen, Ph.D.***

**University of California, Berkeley and Nature Reserve of Orange County**

**Professor and Cooperative Extension Specialist
Department of Botany and Plant Sciences
University of California, Riverside**

Exotic annual grasses and forbs that dominate the seed bank are capable of altering biotic and chemical characteristics of soil. Restoration of grasslands is a challenge because the native seed bank has been depleted in many areas, and the exotic seed bank is difficult to control. We report a series of studies that test the effects of invasive species on soil chemistry, microorganisms, and seed banks and their potential for recovery after restoration. Mycorrhizal fungi differed in species composition in *Stipa pulchra* and exotic annual grassland, but recovered within a growing season upon restoration. Plants performed equally well with mycorrhizal inoculum from annual or perennial grassland. The rate of nitrogen cycling increased in *Stipa* grasslands invaded by exotic annuals, and invasion also decreased soil moisture and increased soil temperatures. Removal of exotic annuals led to rapid recovery of soil characteristics. Bark mulch immobilized excess nitrogen in invaded soils and enabled preferential establishment of native species. Spring fires are effective to control the exotic grass seed bank, as at the Santa Rosa Plateau. Autumn fires may not be as effective, but will reduce the exotic seed bank enough to provide a window of opportunity for restoration. Many restoration techniques in addition to fire have been successfully tested to control the exotic seed bank, including herbicides, grazing, mowing, and solarization. However, exotics will continue to reinvade, and any restoration technique must be reapplied after about 5 years to maintain native vegetation. Soil microbial and chemical characteristics can be restored once exotic grasses are removed, but depleting the exotic seed bank may be the greatest challenge to restoration of southern California perennial grasslands.

*Dr. Dickens is a Postdoctoral researcher in the Department of Environmental Science, Policy, and Management at the University of California, Berkeley. She obtained her B.A. in Biology from the University of Colorado, Boulder and her Ph.D. in Plant Biology from the University of California, Riverside. Her research focuses on exotic plant invasion, soil and restoration ecology. Sara Jo is interested in assessing plant soil feed-backs and their role in invasive species impacts and potential roles for ecosystem restoration. She is a co-founder of the Student Chapter of the California Invasive Plant Council where she served as the co-chair 2008-2010.*

*Dr. Allen's main areas of research are soil ecology, restoration ecology, and invasive species ecology. She has worked in a variety of ecosystems, including sites disturbed by anthropogenic activities, grazing, invasive species and frequent fire. Many of these disturbances have severely disturbed soils and have prompted research into mycorrhizal fungi, including their roles in plant nutrition, diversity, competition and successional dynamics. The most challenging restoration problems—those caused by invasive species—have been the focus of her research in the past 15 years. Nitrogen deposition originating from automobile and agricultural emissions increases the productivity of invasive species, and negatively impacts native biodiversity as well as nutrient cycling. Dr. Allen has published over 100 research articles and served as an editor for Restoration Ecology and Invasive Plant Science and Management. She has served on numerous grant review panels, is past president of the Soil Ecology Society (SES), and received the professional achievement award from the SES.*

## *A Conceptual Model for Deinandra conjugens* *(poster)*

***Spring Strahm, M.S.***
**Senior Research Scientist and Lab Director**
**Department of Biology**
**San Diego State University**

*Deinandra conjugens* is an endangered annual forb endemic to southern San Diego County. It has been extirpated from its presumed population center on Otay Mesa and now exists as fragmented populations around the fringe of this inferred range. A sporophytically self-incompatible breeding system increases the risk that habitat fragmentation and isolation pose to the species. The 2004 USFWS recovery plan for *Deinandra conjugens* emphasizes the importance of connectivity and genetic mixing and lays out basic information for projects designed to benefit the species. This conceptual model was created using that information and was designed for use during grassland restoration and rehabilitation projects funded by The Nature Conservancy (TNC) and TransNet and directed by the Conservation Biology Institute (CBI). The primary goal of this model is to facilitate the development of project objectives and the selection of monitoring targets, and to provide a basis for designing potential management treatments and interpreting the results.

*Spring Strahm earned both Bachelors and Masters of Science degrees from San Diego State University and has been working in Southern California as an ecologist since 1997. Her employment history includes working for a restoration group, for a professional consulting firm, and managing one of SDSU's research field stations. She has worked for Dr. Douglas Deutschman, of the Institute for Environmental Management and Monitoring, since 2007 on developing sampling methods for coastal sage scrub, chaparral, and grasslands, sampling oak woodland demographics and diseases, surveying populations of the rare Hermes copper butterfly, and developing a Dahlem workshop for local conservation stakeholders.*