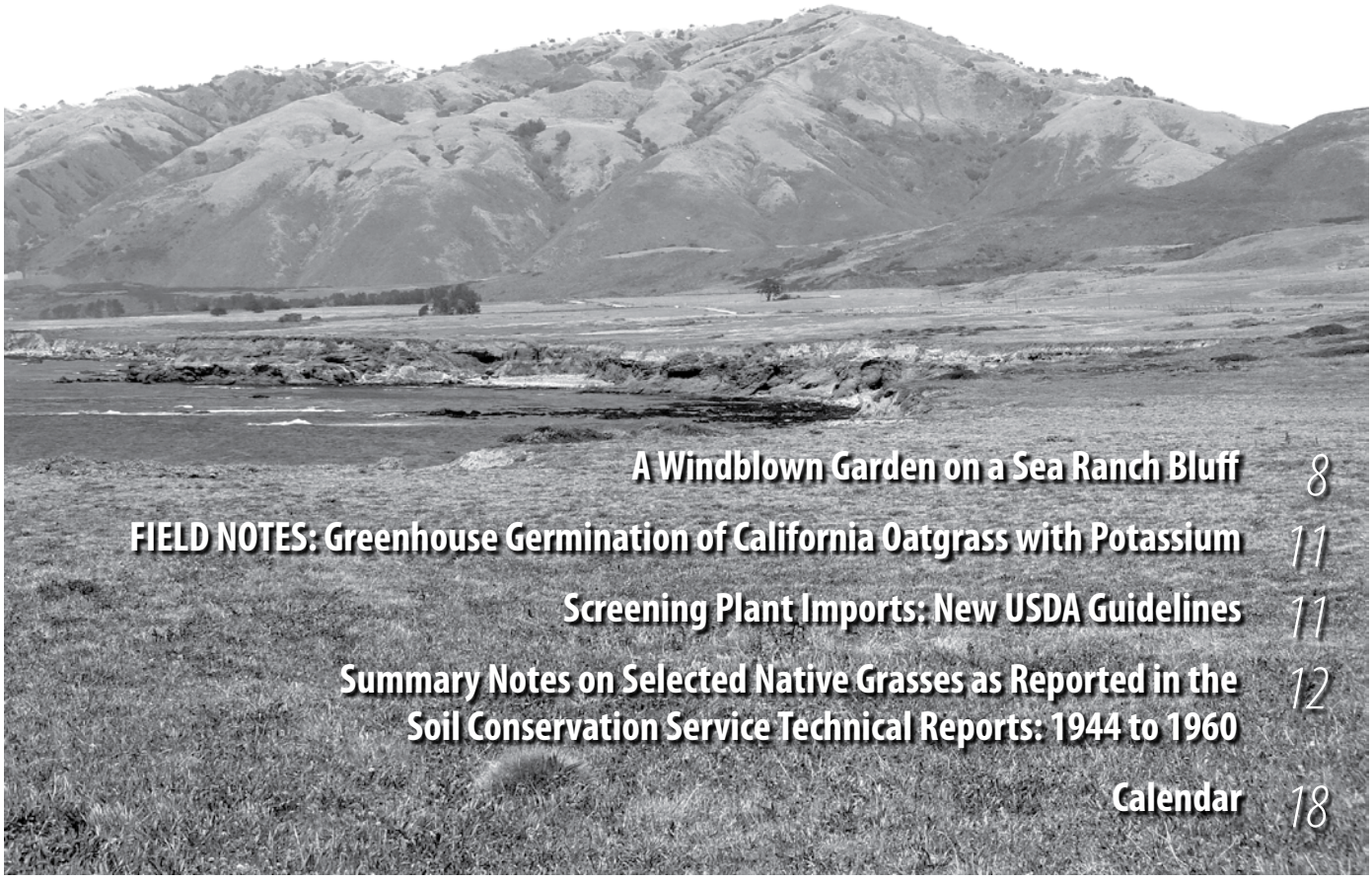
Vol. XIX, No. 4 | Fall 2009

California Native Grasslands Association

Grasslands

Published quarterly by the California Native Grasslands Association

Conservation Management of *California's Coastal Prairie* 5



California Native Grasslands Association

P.O. Box 8327
Woodland, CA 95776
530-661-2280
ADMIN@CNGA.ORG | HTTP://WWW.CNGA.ORG

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

For advertising rates and instructions, or membership and other organizational information, contact CNGA Administrative Director: ADMIN@CNGA.ORG.

For program information related to tours or training workshops, contact CNGA Administrative Director: ADMIN@CNGA.ORG.

Grasslands **is published quarterly by CNGA.**

ISSN No. 1540-6857

Grasslands Submission Guidelines

Send submissions to:
Editor: MRODGERS@MACNEXUS.ORG.

Submissions include peer-reviewed research reports and non-refereed articles, such as progress reports, observations, interviews, book reviews, and opinions.

All submissions are reviewed by the *Grasslands* Editorial Committee for suitability for publication.

Submissions are accepted electronically as e-mail attachments. Contact the editor for formatting specifications.

Submission deadlines for articles:
Winter 2010: Nov. 15, 2009; **Spring 2010:** Feb. 15, 2010 ;
Summer 2010: May 15, 2010; **Fall 2010:** Aug. 15, 2010

From the President's Keyboard

David Amme

At our 2008 Annual Meeting in Santa Rosa, the status and preservation of California's coastal prairie was a hot topic, spurred on by the Sonoma–Marin Coastal Grasslands Working Group. Kathleen Kraft and Linda Esposito of the Ocean Song Farm and Wilderness Center joined with Claudia Luke at the UC Davis Bodega Marine Laboratory to organize the first Coastal Prairie Workshop on November 6th, 2006, and published the proceedings in June 2007. Last year, Drs. James Bartolome and Peter Hopkinson of UC Berkeley were asked by the Sonoma County Agriculture Preservation and Open Space District to write a review of coastal prairie management, which is presented in this issue of Grasslands (see p. 5).

Native coastal prairie grasslands once covered much of the terraces and grassy plains of coastal California from the Del Norte coast, south through the San Francisco Bay region, and as far south as San Luis Obispo and Santa Barbara Counties. Prior to the entrance of the white man, elk were the primary ungulates that grazed in both the forest edges and the adjoining coastal grasslands. The morphology of the mouth of elk is similar to that of cattle, so grazing of cattle in these remnant grasslands can have a similar effect on the habitat if properly managed. The following quote (William Heath Davis, *Seventy-five Years in California*, 1889) gives a glimpse of the past:

> "On Mare Island I often saw in the years from [1840] to '43 as many as two or three thousand elk, it being their habit to cross and recross by swimming between the island and the mainland, and I remember one occasion, when on the schooner Isabella, of sailing through a band of these elk, probably no less than a thousand, which were then crossing from Mare Island to the mainland. It was a grand and exciting scene. The captain of the boat wanted to shoot at some of them, but I prevented him from doing so because we could not stop to get the game on board and I did not like to see the elk wantonly destroyed."

PRESIDENT'S KEYBOARD, continued on page 3

Big Sur coastal prairie *Photo: David Amme*

PRESIDENT'S KEYBOARD, continued from page 2

The California coastal prairie plant community shares many of the same plant species of the mid- to higher-elevation slopes of the Sierra Nevada. The same genera and species of grasses, sedges, shrubs, and trees found on Tuolumne Meadows in Yosemite National Park are found on the Fort Bragg coast. The prairie grassland and associated forest, wetlands, and slack-dune vegetation are representative of northern Arcto-Tertiay flora. Examples include California oatgrass, tufted hairgrass, red fescue, fir, spruce, lodgepole pine, corn lily, Labrador tea, manzanita, ceanothus, and oso berry, to name a few.

California oatgrass (*Danthonia californica*) epitomizes the coastal prairie grassland as far inland as the cool, foggy coastal environment from the bald hills of Northern California to Rio Vista in the Sacramento River Delta and south to coastal prairies of San Simeon in San Luis Obispo County. *Danthonia* is perhaps the only native perennial bunchgrass that has seed that lives for many years in the soil seed bank. Soil compaction, periodic close grazing, disturbance, and fire are processes that encourage the establishment and vigor of turf-like stands of this tasty grass (Amme and Micallef, *Grasslands*, Summer 2008).

There has been an alarming loss of diversity in key coastal grasslands over the last 30 years. Few extensive coastal prairies still exist. But more and more "postage-stamp"-sized prairies are the norm, islanded by development with their original crucial soil profile still intact.

It is important to note that coastal prairie has no legal protection status in California. Intact prairie areas may be wantonly disrupted by agriculture expansion or development with only a token, if any, offer of limited mitigation, which may or may not be carried out. Primary threats to the coastal prairies are (1) invasive European perennial grasses, (2) land development, (3) erosion, (4) non-grass invasive species such as gorse and French broom, and (5) poor or no management (permanent rest). The proper management of this valuable plant community is extremely important.

The coastal prairie includes an incredibly rich assortment of 28 perennial grasses: *Agrostis blasdalei* (Blasdale's bentgrass), *A. densiflora* (California bentgrass), *A. pallens* (Seashore bentgrass), *Alopecurus aequalis* var. *sonomensis* (Sonoma short-awn foxtail), *Bromus maritimus* (maritime brome), *Calamagrostis nutkaensis* (sand reedgrass), *Calamagrostis stricta inexpansa* (Thurber's reedgrass), *Danthonia californica* (California oatgrass), *Deschampsia caespitosa holciformis* (tufted hairgrass), *D. caespitosa beringensis* (Bering hairgrass), *Elymus glaucus* (Blue wildrye), *E. virescens* (maritime wildrye), *Festuca idahoensis roemeri* (Roemer's fescue), *Festuca rubra* (red fescue), *Hordeum brachyantherum* (meadow barley), *Koeleria macrantha* (junegrass), *Leymus mollis* (dune wildrye), *L. pacificus* (Pacific wildrye), *Nassella lepida* (foothill needlegrass), *N. pulchra* (purple needlegrass), *Panicum acuminatum* (Pacific panicgrass), *Phalaris californica* (California canarygrass), *Phleum alpinum* (alpine timothy), *Poa unilateralis* (sea-bluff bluegrass), *P. confinis* (beach bluegrass), *P. douglasii* (Douglas's bluegrass), *P. macrantha* (seashore bluegrass), and *Trisetum canescen*s (nodding trisetum).

The growing list *and* rapidly expanding populations of naturalized perennial and annual exotic grasses constitute a major threat to the survival of this precious resource, including: *Ammophila arenaria* (European dunegrass), *Agrostis capillaris* (browntop), *Anthoxanthum odoratum* (sweet vernalgrass), *Arrhenatherum elatius* (tall oatgrass), *Brachypodium distachyon* (annual false brome), *Briza maxima* (rattlesnake grass), *Bromus diandrus* (ripgut), *B. hordeaceus* (soft-chess), *Cortaderia jubata* (Pampas grass), *Ehrharta erecta* (panic veldtgrass), *E. calycina* (perennial veldtgrass), *Festuca arundinacea* (tall fescue), *Holcus lanatus* (velvetgrass), *Lolium multiflorum* (annual ryegrass), *Nassella manicata* (South American needlegrass), and *Pennisetum clandestinum* (Kikuyu grass). Perhaps the most endangering exotic grass to the coastal prairie is velvetgrass (*H. lanatus*).

Field Notes

Recently, we received an interesting short note from Marsha Sleeth of Seaside, California, that fits in our *Grasslands* "Field Notes" category: experimental trials and layman efforts to figure out how grasses and grasslands tick (see p. 11). This kind of article wouldn't stand up to the rigor of scientific scrutiny but nonetheless makes one take notice and try new techniques.

Since moving to the Monterey Peninsula, Marsha has become impassioned about the restoration of natives, the organic management of pests, and incensed about the wastefulness of water. She began studying horticulture and landscape design and recently launched a business: Water-Wise Garden Design. She is developing a nursery that will focus on native plants and has begun a native grass research project driven by the need for a turf replacement (Amen, that). She is expecting that water rationing will begin to hit the Monterey Peninsula and is hoping to identify native grasses that will be effective for replacing the water-guzzling lawn. (Marsha Sleeth at Water-Wise Garden Design & All Organic Pest Management can be reached at SLEETHDESIGN@ATT.NET.) —DA

Grazing California Grasslands—Take Two: Mountain Meadows

In the last issue of *Grasslands* I wrote about the proper management of California grasslands, particularly the low- and mid-elevation grasslands of California, where properly timed grazing can be beneficial if not required to maintain grassland health

GRASSLAND NOTES, continued on page 4

GRASSLAND NOTES, continued from page 3

and diversity. The rules change when one climbs into the higher elevation grasslands and alpine meadows from 7,000 to 10,000 feet, such as exists at Highland Lakes where CNGA has been hosting our summer Sierran retreats. At these elevations, the meadows and grasslands have not been subject to grazing by large ungulates since the last ice age. The lush meadows stay green late into the summer and rarely are grazed by more than an occasional small, traveling deer herd. Many of the meadows are de-facto bogs and fens where the soil has turned into peat, the result of thousands of years of carbon sequestration. This is really sensitive habitat.

Many of these areas had been severely impacted in the late 1800s by uncontrolled summer sheep and cattle grazing, and by the 1930s there was a call to stop this type of grazing, when clouds of dust (soil) on the mountaintops could be seen for miles during drought years.

Today, our National Forests are still running high meadow grazing allotments in these sensitive high mountain meadows. Grazing for 3½ months from July to early October can certainly result in deleterious effects to these grassland meadows, especially if they are not deferred from grazing every 2 or 3 years to give the meadows time to recover and regenerate.

Twenty cows and their calves on a 30-acre allotment at 8,000 feet for 3½ months can significantly impact these wet meadows and the dryer surrounding forest meadows. Salt licks become ground zero. Over time, erosion and gullies begin to form, the meadows begin to dry out, impacting the riparian vegetation, water quality, and the structure of the bogs and fens. This is not good, especially on wilderness areas or sensitive sites that do not have wilderness status.

This type of livestock grazing is taking place on and off wilderness lands where grazing allotments have been grandfathered into the landscape. The Wilderness Act of 1964 states: "A wilderness, in contrast to those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor and does not remain." Unfortunately, this does not apply to man's livestock. —DA

Letter to the CNGA President

Dave,

It occurs to me that a lot of people, such as the woman who quit CNGA over a disagreement on grazing policies (see "From the President's Keyboard," *Grasslands*, summer 2009), don't understand the conditions that typically prevail in what we would call pristine, intact grassland ecosystems: namely, herds of ungulates that stay tightly together, always on the watch for large carnivores, quickly eating much of the forage in a given spot and moving on, only to return after the area recovers from the grazing event.

Stephen W. Edwards has painted an instructive picture of such pristine California grassland conditions in some of his articles, such as "Observations on the Prehistory and Ecology of Grazing in California" (*Fremontia,* Vol. 20, No. 1, January 1992).

California grasslands of the most recent fossil record are comparable in diversity of megafauna with present-day East African grasslands—and, for the vegetation, holistic grazing mimics such "pristine grassland ecosystem conditions." Our early European history shows a diversity of native grazers (pronghorn, elk, deer) in large herds with plenty of grizzlies and mountain lions to keep them alert and on the move. Any California grassland without herds of grazing ungulates is aberrant—an extremely recent "unnatural" phenomenon.

An understanding of healthful grassland dynamics, especially ungulate grazing and browsing impacts, is so important that it might be worth a place of some honor on the CNGA Web site.

This understanding could also be a bridge for relating to people who are not environmentalists. The vision of a bio-diverse world that we can live in and on, with mutual benefits for humankind and animal and plant life, is a hopeful one.

The super-overgrazed hills of Stanford, down to a few tough and utterly depauperate annuals, or the ungrazed long-dead standing annual grass in non-serpentine corners of Jasper Ridge—I find both extremes equally repulsive and dull!

I suppose that nothing would do more for Californian grassland preservation and biodiversity and aesthetic values than simply saner and sounder grazing on agricultural lands and wise management of grazing and browsing on preserves.

It has saddened me to see areas formerly grazed "preserved" without grazing, soon losing some of their native species cohort, which was, naturally, species that did well with grazing (even of the all-too-common poorer sort).

David Theodoropoulos (author of *Invasion Biology: Critique of a Pseudoscience*) points out, in his critique of our criticizing feral wild pig impacts, that the California grizzlies dug up far more extensive areas than the pigs do now—an historic disturbance regime that promoted biological diversity and productivity. We forget about things that are gone—grizzlies and badgers and before them even things like giant ground sloths and mammoths and saber-toothed tigers and camels and horses that went extinct.

Best regards,
Jeffrey Caldwell

Conservation Management of California's Coastal Prairie

Peter Hopkinson, *phopkin@berkeley.edu, and* **James W. Bartolome,** *jwbart@berkeley.edu*
ESPM-Ecosystem Sciences, University of California, Berkeley, 137 Mulford Hall, Berkeley, CA 94720-3114

State of the Coastal Prairie

California's coastal prairie is patchily distributed from Humboldt County in the north to San Luis Obispo County in the south, generally within several kilometers of the coast. Native perennial grasses are often the dominant form of plant life, with forbs making up a significant proportion of the species richness (Hayes and Holl 2003a). Compared to other Californian grassland types, coastal prairie contains more native species and more perennials and should, therefore, exhibit a more predictable response to protection and management under its wetter and more temperate climate (Bartolome et al. 2009). Coastal prairie vegetation needs better descriptions to determine the variations among sites (Ford and Hayes 2007). Until quite recently, the coastal prairie received less basic and applied research attention than California's inland grassland type, Valley grassland.

Like most of California's grasslands, the coastal prairie has been altered through conversion to agriculture, development, invasion by non-native plant species, and human-caused changes in nutrient and hydrological cycles and in disturbance regimes (e.g., fire, soil movement, herbivory). Nonetheless, a comparison of coastal prairie to other grassland types in the western U.S. found that coastal prairie has almost double the number of species of any other type (Stromberg et al. 2001), and generally the coastal prairie's cover of native plants is greater than that of Valley grassland. A 2008 survey of California State Parks grassland properties found that five of seven coastal prairie units had high levels of native cover (>50%) (Hopkinson et al. 2009). In addition, sensitive wildlife species rely on coastal prairie habitat, including several butterfly species (Ford and Hayes 2007). Given its exceptionally high level of biodiversity and the development pressure facing California's coastal region, the coastal prairie deserves protection.

Primary management problems facing the coastal prairie include: (1) invasion by non-native perennial grasses and other weeds, (2) the encroachment of native and non-native trees and shrubs into the grassland (Ford and Hayes 2007), and (3) the disruption of grazing and fire regimes and other ecosystem processes. These problems can result in reduced cover of native grassland plants, local loss of species, altered ecosystem processes, and reduced wildlife habitat values. Several conservation management tools are available to address these problems: livestock grazing, prescribed burning, herbicide application, and mowing and hand or mechanical removal; however, formal tests of their effectiveness in the coastal prairie are few.

Management Tools: Grazing

Grazing is one of several tools that grassland managers can employ to combat weed invasion, encroachment by trees and shrubs, and the disruption of ecosystem processes in the coastal prairie. Grazing has received the greatest research focus, probably because it is the management tool most easily implemented over large areas. In addition, grazing may cost less per unit area to implement than other management techniques.

Grazing by native herbivores is an important and complex coastal prairie ecosystem process with a long evolutionary history (Hayes and Holl 2003a). Although the large native herbivores were extirpated over millennia, culminating with market hunting during the Gold Rush, small native grazers like voles, ground squirrels, and pocket gophers continue to have a strong influence on community structure (Schiffman 2007). The most important large native grazer, tule elk, which has behavior and grazing preferences similar to cattle (Jackson and Bartolome 2007), has been successfully reintroduced to portions of the coastal prairie.

Livestock grazing is a complex ecosystem process for which management involves site-specific control of intensity, timing, and distribution (Jackson and Bartolome 2007). This complexity has reduced the generality of results from grazing experiments. An evaluation of 30 grazing studies in California grasslands showed that results were primarily dependent on soil properties and weather, with variable and probably site-dependent effects of grazing treatments (Huntsinger et al. 2007).

Two recent studies examined the effects of grazing in the coastal prairie. One evaluated cattle grazing in 25 locations along the coast from Mendocino to San Luis Obispo (Hayes and Holl 2003a), the other tule elk grazing at Tomales Point in Marin (Johnson and Cushman 2007). Both studies came to similar conclusions: grazed areas had greater abundance and species richness of native annual forb and non-native annual grass and forb species. Native annual forbs are an important component of the coastal prairie's species richness, and an increasing number of them are considered rare and endangered (Ford and Hayes 2007). The findings fit with theoretical predictions that grazing removes biomass and opens up microsites favorable to annual, short-statured plants.

In contrast to the annual plants, perennial forbs, especially native species, had greater abundance and species richness in ungrazed sites. Hayes and Holl (2003a) note that some of the native perennial forbs in their study were tall species that do not reproduce when clipped.

Both studies found that native perennial grass abundance and species richness did not differ between grazed and ungrazed sites. However, other studies have shown that grazing may have effects on the abundance of specific perennial native grass species. Frustratingly for the development of simple management prescriptions, these

COASTAL PRAIRIE, continued on page 6

COASTAL PRAIRIE, continued from page 5

effects can vary from site to site (Hayes and Holl 2003b).

Nassella pulchra, the most intensively studied native grass species, has shown inconsistent responses to grazing: increasing in abundance in some areas, decreasing in others, or exhibiting no change (D'Antonio et al. 2002). These studies were conducted variously in coastal prairie and Valley grassland. Inconsistent results probably reflect site- or time-specific factors often not evaluated in the studies. D'Antonio et al. (2002) make it clear that carefully controlled, manipulative experiments replicated across the state and over at least several years are necessary to establish the relationship between grazing and *N. pulchra*. And of course, this level of research effort is almost certainly necessary to elucidate the effects of grazing on other native grass and forb species.

In most studies, *Danthonia californica* (California oatgrass), one of the dominant coastal prairie species, has increased in abundance with livestock grazing (Hatch et al. 1999; Hayes and Holl 2003a). In a survey of 17–25 coastal prairie sites, Hayes and Holl (2003a) found that *D. californica* was twice as abundant in grazed sites as ungrazed sites. In a recent update of their experimental work, Hayes (pers. comm., fall 2008) and Holl found that at a site with initial 18 percent relative cover of *D. californica*, the bunchgrass dramatically declined in plots that were released from grazing. After nine years, *D. californica* was reduced to less than 2 percent in undisturbed plots, whereas disturbed plots (mowed or grazed) maintained or increased *D. californica* cover.

Grazing has proven an effective method of reducing cover of invasive weeds and slowing or preventing encroachment of shrubs and trees. Elk grazing greatly reduced the cover of *Holcus lanatus* (velvetgrass), one of the most troublesome perennial grass weeds in the coastal prairie (Johnson and Cushman 2007). The cattle grazing survey also found significantly reduced *H. lanatus* cover on grazed coastal prairie sites (Hayes and Holl 2003a), which confirms findings from Europe and Australia, although there is some evidence from Europe and Canada that low-intensity grazing can encourage the spread of *H. lanatus* (Pitcher and Russo 1988). Livestock trampling also reduces *H. lanatus* cover (Pitcher and Russo 1988). Based on evidence from the United Kingdom, *Anthoxanthum odoratum* (sweet vernalgrass), another non-native perennial grass invading the coastal prairie, may be controlled with grazing before seed development, although the grass is considered poor forage (DiTomaso and Healy 2007).

Grazing can help maintain open grassland, free of shrubs and trees. Coastal prairie intergrades with several shrub and forest community types, all of which tend to encroach upon open grassland in the absence of fire or grazing. The native shrub *Baccharis pilularis* (coyotebrush) is a primary offender in this regard, and grazing animals significantly reduce cover of *B. pilularis* in open grasslands (Johnson and Cushman 2007; Ford and Hayes 2007; McBride 1974).

Point Molate coastal prairie *Photo: David Amme*

Other Management Tools

Little research has been conducted on the efficacy of other management tools that are practical for large-scale application. Prescribed burning can be applied on a large scale, but evidence suggests that burning does not reliably halt shrub encroachment because many shrubs, including *Baccharis pilularis*, are able to resprout following a fire and quickly reestablish pre-burn cover (Ford and Hayes 2007). However, limited evidence suggests that fire in two consecutive years kills *B. pilularis* (Havlik 1984); high shrub mortality would likely inhibit rapid reestablishment of shrub cover. Havlik's (1984) observations need to be confirmed. A University of California, Berkeley–East Bay Regional Park District multiyear study desgined to evaluate the effect of consecutive burns on *B. pilularis* was initiated in spring 2009.

Prescribed burning also does not consistently increase cover of the dominant native perennial bunchgrasses (Bartolome et al. 2004; Hatch et al. 1999). There are conflicting results for the dominant species at different sites (Fehmi and Bartolome

COASTAL PRAIRIE, continued on page 7

COASTAL PRAIRIE, continued from page 6

2003; D'Antonio et al. 2002). For weed control, research from Europe indicates that prescribed burning may control *Holcus lanatus*, especially when combined with grazing (Pitcher and Russo 1988).

Other management tools are also used to control weeds, shrubs, and trees in the coastal prairie. Research conducted in the United Kingdom and New Zealand demonstrates that several herbicides are effective in the control of *Holcus lanatus*. Of course, unless precisely applied, many herbicides will kill non-target species, including native grasses and forbs. Herbicides are commonly used in the control of *Baccharis pilularis*; several State Park units use herbicide as the primary method of shrub control in their coastal prairie (Hopkinson et al. 2009). Mowing and hand-removal (Dremann and Shaw 2002) have also been used to control weeds in the coastal prairie; however, both techniques are labor-intensive and unstudied for long-term effectiveness.

Conclusion

The coastal prairie remaining in California has been significantly altered by human activities and is threatened by development. Maintaining healthy native grasslands requires some degree of management intervention to combat invasions by non-native perennial grasses and other weeds and encroachment by trees and shrubs, and to reduce biomass for the benefit of some native grasses and forbs. Research has shown that grazing and other management practices can be effective but that the effects are likely to be highly site-specific. This means that management for conservation objectives will likely need to be adaptive and developed for specific goals with long-term, rigorous monitoring procedures in place (Bartolome et al. 2009; Reever Morghan et al. 2006).

Acknowledgments

We gratefully acknowledge the Sonoma Land Trust and Anthony Nelson for their support of this review.

References

Bartolome, J.W., J.S. Fehmi, R.D. Jackson, and B. Allen-Diaz. 2004. Response of a native perennial grass stand to disturbance in California's Coast Range grassland. Restoration ecology 12:279–289.

Bartolome, J.W., R.D. Jackson, and B. Allen-Diaz. 2009. Developing data-driven descriptive models for California grassland. Chapter 9 in R.J. Hobbs and K. Suding, eds., New models for ecosystem dynamics and restoration. Island Press, Washington, D.C.

D'Antonio, C., S. Bainbridge, C. Kennedy, J. Bartolome, and S. Reynolds. 2002. Ecology and restoration of California grasslands with special emphasis on the influence of fire and grazing on native grassland species. Unpublished report prepared for the David and Lucille Packard Foundation. University of California, Berkeley.

DiTomaso, J.M., and E.A. Healy. 2007. Weeds of California and other western states. University of California, Division of Agriculture and Natural Resources, Oakland.

Dremann, C.C., and M. Shaw. 2002. Releasing the native seedbank: an innovative approach to restoring a coastal California ecosystem. Ecological restoration 20:103–107.

Fehmi, J.S., and J.W. Bartolome. 2003. Impacts of livestock and burning on spatial patterns of the grass *Nassella pulchra* (Poaceae). Madroño 50:8–14.

Ford, L.D., and G.F. Hayes. 2007. Northern coastal scrub and coastal prairie. Pages 180–207 in M.G. Barbour, T. Keeler-Wolf, and A.A. Schoenherr, eds., Terrestrial vegetation of California. University of California Press, Berkeley.

Hatch, D.A., J.W. Bartolome, J.S. Fehmi, and D.S. Hillyard. 1999. Effects of burning and grazing on a coastal California grassland. Restoration ecology 7:376–381.

Havlik, N.A. 1984. Effects of urban-industrial land use on vegetation and flora in the Potrero Hills, Richmond, California. Ph.D. dissertation, University of California, Berkeley.

Hayes, G.F., and K.D. Holl. 2003a. Cattle grazing impacts on annual forbs and vegetation composition of mesic grasslands in California. Conservation Biology 17:1694–1702.

———. 2003b. Site-specific responses of native and exotic species to disturbances in a mesic grassland community. Applied vegetation science 6:235–244.

Hopkinson, P., M. Hammond, S. Spiegal, and J.W. Bartolome. 2009. Quantitative assessment and characterization of selected State Park grasslands—Final report. Unpublished report. Department of Environmental Science, Policy, and Management, University of California, Berkeley.

Huntsinger, L., J.W. Bartolome, and C.M. D'Antonio. 2007. Grazing management on California's Mediterranean grasslands. Pages 233–253 in M.R. Stromberg, J.D. Corbin, and C.M. D'Antonio, eds., California grasslands: ecology and management. University of California Press, Berkeley.

Jackson, R.D., and J.W. Bartolome. 2007. Grazing ecology of California's grasslands. Pages 197–206 in M.R. Stromberg, J.D. Corbin, and C.M. D'Antonio, eds., California grasslands: ecology and management. University of California Press, Berkeley.

Johnson, B.E., and J.H. Cushman. 2007. Influence of a large herbivore reintroduction on plant invasions and community composition in a California grassland. Conservation Biology 21:515–516.

McBride, J.R. 1974. Plant succession in the Berkeley hills, California. Madroño 2:317–329.

Pitcher, D., and M.J. Russo. 1988. Element stewardship abstract for *Holcus lanatus*. The Nature Conservancy, Arlington, Virginia.

Reever Morghan, K.J., R.L. Sheley, and T.J. Svejcar. 2006. Successful adaptive management—the integration of research and management. Rangeland Ecology and Management 59:126–219.

Schiffman, P.M. 2007. Ecology of native animals in California grasslands. Pages 180–190 in M.R. Stromberg, J.D. Corbin, and C.M. D'Antonio, eds., California grasslands: ecology and management. University of California Press, Berkeley.

Stromberg, M.R., P. Kephart, and V. Yadon. 2001. Composition, invasibility, and diversity in coastal California grasslands. Madroño 48:236–252.

A Wind-blown Garden on a Sea Ranch Bluff

All photos by author

Russell A. Beatty

This article has been excerpted and adapted, with permission, from the July 2009 issue of *Pacific Horticulture.*

The elements of wind, wave, and salt that lash the Sonoma Coast challenge the making of a garden—at least, a garden in the traditional sense. The crashing surf and the incessant winds batter the sea bluffs and everything that grows on them. The property is perched on a bluff above the crashing surf with spectacular views up and down the rugged coast at The Sea Ranch. The property is situated on the north (windward) side of an old, declining hedgerow of Monterey cypress (*Cupressus macrocarpa*)—a Sea Ranch signature. A fenced garden between the original house and the hedgerow was lush with mature specimens of myoporum (*Myoporum laetum*), a beautiful, white-flowering, tree-like ceanothus (*Ceanothus thursiflorus* 'Snow Flurry'), and ferns. A few other plants were sheltered by the house from the strong and incessant winds that sweep down the coast. A few straggly cypresses grew atop the bluff.

The original structure was torn down and replaced with a new house and garage. The new, two-story house was located in roughly the same position as the previous one. To help break the wind, a new garage was sited on the windward side of the front driveway and connected to the house by an arbor-covered walk. The fenced south garden was similar in size and location to the original garden, sitting between the tall house on the windward side and the cypress shelterbelt. As with most new construction, the soil, though naturally friable, was heavily compacted, and existing vegetation had been removed. The soil was rototilled to a depth of about 10 inches throughout the site, then raked smooth after weeds and old roots were removed.

The Conceptual Plan

Working closely with the clients, I prepared a plan for a garden of California native plants that incorporated several outdoor sitting areas: two decks attached to the house and two flagstone terraces, one on the bluff and one in the lee of the existing screen of small cypresses on the west side. The Sea Ranch Association requires that any plants outside fenced areas be native plants that relate to the region's four landscape zones: bluff top, meadow, foothill, and forest. Within courtyards or behind fences, non-native plants that are visually compatible with the landscape character may be planted. Few houses at Sea Ranch have well-defined gardens; landscapes usually comprise volunteer or seeded native grasses, a few scattered, coast-tolerant shrubs, and, where appropriate, a few cypresses or shore pines (*Pinus contorta*).

My clients wanted a natural, yet carefully designed landscape and enclosed garden. Most of the landscape was either within the fenced garden or along the bluff top hidden from public view. Based on clues from the previous garden, the side garden was designed to be a quiet, flower-filled garden with a bench situated out of the wind. Low-growing, colorful perennials would highlight the two sitting areas on the ocean side. Elsewhere, a meadow of suitable native grasses would reflect the native grassland.

A filigree screen of flowering currants lining the walkway under the arbor added depth to the entryway and defined the walk. A dense planting of shade-tolerant herbaceous plants lined the other side of the walk at the base of the house. To reflect the informality of the setting and harmonize with the colors of the house, gray flagstone paved the walkways, sitting areas, and deck aprons; brown crushed rock was used for the casual paths.

The Reality of Ceaseless Wind

After almost four years and a number of refinements, the garden has begun to stabilize. Plants that failed were replaced; in some cases the replacements, though

Front of the house from the cul-de-sac, with an established meadow of California oatgrass (*Danthonia californica*) and Molate fescue (*Festuca rubra* 'Molate Blue'). To the right of the entry is the arbor-covered walkway connecting to the garage.

WIND-BLOWN GARDEN, continued on page 9

WIND-BLOWN GARDEN, continued from page 8

carefully considered, performed poorly and have also been replaced. The coastal winds, for much of the summer, lash the site with incredible force and in unexpected patterns. The house, garage, and fences altered the winds so that they battered areas thought to be sheltered. The considerable pruning of dead wood from the decrepit cypress shelterbelt resulted in an unintentional opening of gaps for the wind to surge through—even though the trees are on the leeward side of the property. In the side garden, the building and fences forced the wind into tunnels or vortexes, severely burning even such tough coastal plants as silk tassel (*Garrya elliptica*) and wax myrtle (*Myrica californica*), and decimating the taller ceanothus, vine maples, and flowering currants.

In front of the house, simple grassy mounds of Molate fescue (*Festuca rubra* 'Molate Blue') with some California oatgrass (*Danthonia californica*) reinforced with silk tassel, toyon (*Heteromeles arbutifolia*), and ceanothus blend the new landscape into the adjacent meadows. All of the shrubs have experienced tip burn but have gradually filled in to create a wind-sheared "critical mass" that has accomplished the intended screening. The fescue has flourished, and although the oatgrass has grown well, the wind shatters its seed heads.

Enclosed side garden with wind-sheared ceanothus behind the bench; flowering currant (*Ribes sanguineum*) against the fence; giant chain fern (*Woodwardia fimbriata*), coffeeberry (*Rhamnus californica* 'Eve Case'), and shore pine (*Pinus contorta*) against the house; groundcover of mown sand-dune sedge (*Carex pansa*) and unmown foothill sedge (*Carex tumulicola*)

Lessons Learned from a Coastal Garden

As with any landscape project, we learn from experience. (That is why it is called landscape architectural *practice*!) Here are some key lessons from this challenging coastal garden project:

- Observe wind patterns carefully after all buildings and other structures have been built, with as many site visits in as many conditions as possible. Annotate a plan, diagramming wind currents using a hand-held anemometer, or simply with flagging tape, to illustrate the patterns.
- Observe plants in similar environmental situations nearby.
- Plant from one-gallon containers (five-gallon containers at the largest). Patience will be rewarded, as the smaller plants will more easily acclimate to the site conditions.
- Plant in fall, if possible, just before the winter rains.
- Reduce summer irrigation after the initial period of establishment (about one year); harden off plants in late summer by reducing irrigation.
- Avoid fertilization that will promote rapid growth.
- When raised in the incubator-like protection of a nursery, even plants known to be tolerant of coastal winds will struggle when first planted; cages of wire fencing and shade cloth may be required for the largest plants.
- If a mature windbreak is present, retain even the old dead branches, which can be nearly as important as live ones in buffering the wind.

The arbor-covered walkway along the house has been a big success. Native ground covers of wild ginger (*Asarum caudatum*) and redwood sorrel (*Oxalis oregona*) have filled the shady strip, complemented by lady fern (*Athyrium felix-femina*), sword fern (*Polystichum munitum*), and maidenhair fern (*Adiantum pedatum* var. *aleuticum*). Flowering currant (*Ribes sanguineum*), underplanted with foothill sedge (*Carex tumulicola*), and Douglas iris, now provide the intended screening between the walk and driveway.

Success on the Bluff Top

On the ocean side of the house, the landscape of meadow and sitting areas has been a great success. The Molate fescue meadow, planted with plugs at eight-inch centers filled in rapidly to form a billowing foreground to the coastal views.

The two flagstone seating areas have become attractive places to relax and enjoy the views. Gracing the edge of the terraces is a thriving mix of tough seaside plants: Douglas iris, seaside daisy, sandhill

WIND-BLOWN GARDEN, continued on page 10

WIND-BLOWN GARDEN, continued from page 9

sage (*Artemisia pycnocephala*), tufted hairgrass (*Deschampsia caespitosa* 'Shell Beach'), and low-growing *Ceanothus gloriosu*s 'Anchor Bay'. The wind-protected north patio contains more color with yarrow (*Achillea millefolium*), sea thrift, Douglas iris, and several grasses, such as tufted hairgrass and Pacific reedgrass (*Calamagrostis nutkaensis)*. The small cypress windbreak has been reinforced with wax myrtle, silk tassel, and *Ceanothus gloriosus* var. *exaltatus*. A broad band of 'Anchor Bay' ceanothus aligns the top of the bluff, linking the two sitting areas.

One problem that baffled me was at the base of the walls of the house, where the meadow grasses (*Festuca rubra* 'Molate Blue') were beaten down in a band extending six to eight feet from the house. As the wind hits the walls it plunges downward, smashing the plants. The grasses here have finally been replaced with a combination of dwarf coyote bush (*Baccharis pilularis* 'Pigeon Point') and sandhill sage.

A garden is never really done. That is why the term *gardening* describes a process, one that is ongoing. In such a harsh environment as California's North Coast, the process can be daunting. With patience and perseverance on the part of the client, the designer, and the maintenance crew, stability was eventually achieved. Nowhere is the phrase "nature abhors a garden" more a reality. Working with nature, however, it is possible to achieve the semblance of "garden" by capturing the essential character and quality of the surrounding natural landscape.

Mature meadow of Molate fescue (*Fescue rubra* 'Molate Blue'). Grasses at the base of the wall continue to be blown down.

A note from the clients says it all:

I wish you could be here to see this gorgeous view; the light is just coming onto the not-so-small grass plugs and the place is literally singing with all the attention. We can't believe our eyes when we look over the beautiful garden you designed for us. It truly surpasses anything we could have envisioned; you have put the wrapping and ribbon on the most beautiful package anyone could have dreamed of…. For two people who don't know one darn grass from another, there was no way we could really envision what you had in mind….

And that is why we make gardens!

Visit HTTP://WWW.PACIFICHORTICULTURE.ORG/ for additional photographs and a complete list of the most successful plants used at this Sea Ranch garden.

Bluff-top terrace edged by silvery sandhill sage (*Artemisia pycnocephala*), with a low ceanothus (*Ceanothus gloriosus* 'Anchor Bay') just beyond; hair grass (*Deschampsia caespitosa* 'Shell Beach') is a star performer in the foreground, at edge of the meadow

FIELD NOTES: Greenhouse Germination of California Oatgrass (*Danthonia californica*) with Potassium Solution

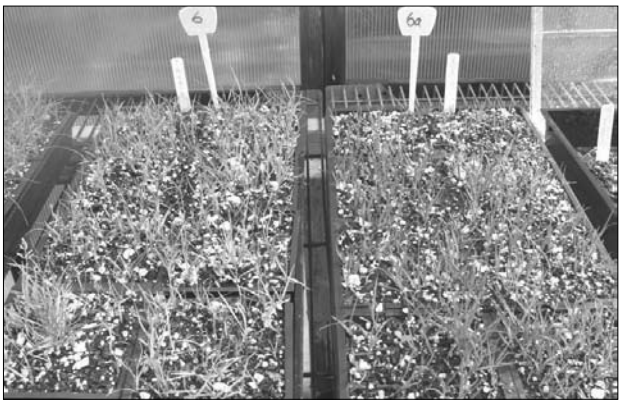
Marsha Sleeth, *Water-Wise Garden Design, Seaside, CA; sleethdesign@att.net*

In preparation for planting 2 dozen 3-×-6-foot research grass plots on the Monterey Peninsula this fall, on June 30 I seeded flats of several native perennial grasses and sedges purchased from Larner Seeds, Hedgerow Farms, and Pacific Coast Seed. The seeded flats were kept in a greenhouse for a month before putting them in an outdoor "baby nursery." The summer weather is temperate, and keeping a close eye on their water needs has been sufficient for most species.

The only one to get my goat was California oatgrass (*Danthonia californica*). I was grateful to learn it is difficult to germinate. I began researching *Danthonia* germination and found in a mid-century botanical journal that using potassium nitrate on *Danthonia spicata* (poverty oatgrass) helped the germination process (Dobrenz and Beetle 1966).

I couldn't find potassium nitrate where I live, so I bought a quart of "natural liquid potassium fertilizer" by Earth Juice, derived from sulfate of potash. The only difference between this and potassium nitrate is that potash is added to calcium nitrate to make potassium nitrate. Potash is the only ingredient that separates potassium nitrate from calcium nitrate, and is also the ingredient from which potassium is derived.

By August 15, the *Danthonia* flats, which were not doing as well as some of the other flats, were moved into a larger greenhouse. I over-seeded the *Danthonia* flats that had not germinated for 6 weeks since they were planted. I soaked flats with water and misted with a mild solution of diluted potassium (½ teaspoon/gallon) on a Saturday. On Monday there were fresh, new shoots ½–1 inch tall; it was like an emerald carpet I could gently run my hand over. Knowing it wasn't possible for the new seeds to have germinated so quickly, I realized the original seeds, planted 2 months previously, must have been in some suspended stage of germination, just waiting to be rescued by this potassium. However, the new seeds began to germinate within 10 days. Considering the amount of new seed I applied, it appears to be a low germination rate so far, but I am continuing to experiment with soaking the seeds and planting them wet, and soaking them and letting them dry as some botanists have been doing with cool-season grasses.



Tray 6 was planted July 1, 2009, and did not germinate for 6 weeks. It was watered with potassium and germinated in 2 days. Soon afterward, the overseeded seed began to germinate. Tray 6a was seeded on August 15 and watered with the same potassium solution, and they germinated within 10 days. The plants in Tray 6a are a darker, brighter green than Tray 6.

All but one species of the other grasses (*Poa secunda secunda*) began to germinate within 3–4 days, and I can't help thinking the mild solution of potassium may have helped them along too.

Reference

Dobrenz, A.K. and A.A. Beetle. 1966. Cleistogenes in *Danthonia.* J. Range Mgmt. 19:292–296.

Comments deadline: Oct. 21

Screening Plant Imports: New USDA Guidelines

Doug Johnson, *Executive Director, California Invasive Plant Council*

Dear California plant conservationists,

We have a great opportunity to make a difference on a critical national policy issue.

USDA has published new guidelines for screening plant imports—a critical aspect of preventing new invasive plant introductions to the country. Under the current system, plants can be imported with virtually no oversight of whether they might be invasive, and as you know, many of the wildland weeds we already have were originally introduced intentionally, often as ornamentals.

We need to make sure USDA hears from all of us working on the ground to control invasive plants that preventing the introduction of invasive plants is important. Comments are being taken until Oct. 21. We've set up a web page at WWW.CAL-IPC.ORG/POLICY/FEDERAL/Q37.PHP with a sample letter, instructions on sending it and submitting a formal comment, and background info.

Please send a letter from your organization, and submit a formal comment! Our campaign to revive California's Weed Management Area funding in 2006 was successful because over 100 organizations sent letters to state decision makers. Let's make sure our federal decision-makers know how important it is to prevent the introduction of more invasive plants. Know of another organization that should voice an opinion? Please send this request to them!

Feel free to contact me at DWJOHNSON@CAL-IPC.ORG with any questions or comments.

Summary Notes on Selected Native Grasses as Reported in the Soil Conservation Service Technical Reports: 1944 To 1960

Cynthia S. Brown, *Dept. of Agronomy and Range Science, U.C. Davis (1992)*

Introduction

Cynthia Brown joined CNGA in its formative early years. She was a Principal Researcher at the Department of Agronomy at the University of California at Davis (UC Davis) between 1993 and 1999. In 1998 she earned her Ph.D. in Plant Restoration Ecology. Between 1992 and 2001 Cynthia completed a variety of native and exotic grass research, collaborating with Kevin Rice, Robert Bugg, John Anderson, and Vic Claassen.

Cynthia is an assistant professor in the Department of Bioagricultural Sciences and Pest Management at Colorado State University, Fort Collins. In 1992 she completed a $3,000 CNGA research contract investigating the SCS Lockeford Plant Materials Center (PMC) archives of native grass development in California: "Summaries of trials with native perennial grasses conducted by Soil Conservation Service Plant Material Centers between 1944 and 1960: Report to the California Native Grass Association." Much of PMC's earliest work took place in the lower Livermore Valley town of Pleasanton and fields in the adjacent hamlet of Sunol in the rich soils of the Alameda Creek floodplain.

Cynthia's brief, concise summaries of the work performed between 1944 and 1960 on California brome, mountain brome, creeping wildrye, blue wildrye, California oatgrass, California melic, and nodding needlegrass follow, more or less verbatim. It is unclear why there is no report on *Nassella pulchra*. UC Davis was deep into *Stipa*/*Nassella pulchra* research in early 1940 (Jones and Love 1944; Love 1944, 1948).

After 1960, the 'Rio' form of *Leymus triticoides* was selected and distributed by the Lockeford PMC. [Zorro fescue (*Vulpia myuros*) was also developed at the Lockeford facility.] An important question is the "what and where" of the mountain bromes. Were they testing perennial forms of *Bromus carinatus*? In the discussion, *B. carinatus* was described as an annual and became the selected 'Cucamonga' brome (Lemmon et al. 1950; Miller 1963). It would be interesting to follow the accession numbers and read the reports where they were collected. The notes in brackets are mine. —David Amme

Jones, B.J., and R.M. Love. 1944. Improving California Ranges. Calif. Agri. Ext. Serv. Circ. 129. 48 pp.

Love, R.M. 1944. Preliminary trials on the effect of management on the establishment of perennial grasses and legumes at Davis, California. J. Amer. Soc. Agron. 36:699–703.

Love, R.M. 1948. Eight new forage plants. Calif. Agricul. 2(1):1–3

Lemmon P.E, A.L. Hafenrichter, and B.A Madson. 1950. Cucamonga brome: a new grass for covercropping. Calif. Agri. Exp. Sta. Circular 401. U.C. Berkeley. 6 pp.

Miller, H.W. 1963. Cucamonga California bromegrass. Crop Science 3(5):462.

California Brome

(*Bromus carinatus*)

General

Though some ecotypes of California brome (*Bromus carinatus*) are biennial or perennial, the accession used most widely by the Soil Conservation Service (SCS), P-1117, was an annual. *Bromus carinatus* was treated as an annual, not a perennial, throughout the SCS Plant Materials Center Technical Reports. [Note: Accession P-1117 was later given the common name Cucamonga Brome.]

Observational Studies and Pure Stand Trials

B. carinatus was considered one of the early-maturing annual grasses of possible value for use as a self-seeding covercrop. *B. carinatus* was expected to be used in deciduous fruit orchards and vineyards. It successfully perpetuated itself under a clipping program, which simulated moderate utilization.

At San Fernando, Los Angeles County, *B. carinatus* was comparable to *B. hordeaceus* (soft chess), though *B. hordeaceus* was thought to be a little better. *B. carinatus* was "a little earlier and more vigorous but spread into adjacent areas was better" for *B. hordeaceus*. *B. carinatus* showed superior growth.

Field Evaluation Plantings (Outlying Nurseries)

In Butte Valley, Siskiyou County, results indicate that grasses should be sown in the fall, not the spring. *Bromus carinatus* was not one of the most promising grasses for this area.

In Temecula, Riverside County, *B. carinatus* performed well. Stands of all species were better on the lower-fertility terrace land than the higher fertility alluvial land. This was thought to be because the competition from introduced annual plants was lower and there was a clay pan which might help conserve water for the summer months on the terrace. *Bromus carinatus* was the most vigorous and rapid developing of the annual grasses tested in 1957. In the second year, *B. hordeaceus* and *Lolium subulatum* stands were better than *B. carinatus*. [Note: *L. subulatum* aka *L. rigidum* is an introduced annual ryegrass.] In 1959, the performance of *B. carinatus* was comparable to *B. hordeaceus* over all three years. *B. carinatus* responded more to fertilization than did *B. hordeaceus*. Both species set heavy seed crops.

Seed Production

The annual *B. carinatus* is a prolific seed producer.

Seed Pellet Trials on Burned Sites

B. carinatus was used in trials using clay seed coatings. The purpose of the clay was to reduce desiccation of the seed in dryland range conditions. Trials were conducted in the greenhouse and on two southern California sites. Results were inconclusive. The greenhouse reached

SCS TECH REPORTS:1944–1960, continued on page 13

SCS TECH REPORTS:1944–1960, continued from page 12

very high temperatures and the field site conditions were unfavorable.

Mountain Brome
(Bromus marginatus)

General

Bromus marginatus is included in the short-lived perennial species group in the Soil Conservation Service (SCS) Plant Materials Center Annual Technical Reports.

When fertilizing, the SCS found it was best to drill the fertilizer below and to the side of the seed. Fertilizer benefited seedling establishment as did reduction of weedy competition.

Seed was planted into flats, then seedlings were transplanted bareroot after six weeks in the greenhouse with very little mortality.

Rust was a common disease problem with mountain brome.

Observational Studies and Pure Stand Trials

B. marginatus is mainly self-pollinated. Many accessions were collected for the Pleasanton, Alameda County, 1945 nursery. P-l0708 emerged as an outstanding accession of *B. marginatus*.

In 1945 when most species were seeded and established, they continued growing throughout the year, one accession of *B. marginatus* went dormant in August and another went semi-dormant in September. Many accessions planted in 1943 died in 1945.

Two main accessions of *B. marginatus* were identified as particularly successful. Accession P-12983 was described as a "very early, vigorous and rapid-developing perennial suited to thin upland soil. Its early, rapid growth will provide better cover and it can be grazed several times during the rainy season due to its strong recovery after cutting. It will maintain its stand well both by survival of mature plants and by reseeding vigorously." *B. marginatus* P-l0385 was described as a "vigorous, high producing strain by reason of its recovery after cutting. A second and third cutting or grazing is possible without irrigation on good soil. It also recovers early in the fall and so provides ample cover for erosion control on sloping fields."

Bromar, P-3368, a certified strain of *B. marginatus* developed in Pullman, Washington, performed best in 1946. Accessions P-5722 and P-l0708 were the next best accessions in 1946. All three strains are rust resistant. There were several good strains of *B. marginatus*, which persisted through the summer drought. Bromar was slow in fall recovery and grew less, later in the winter, than other accessions.

In 1947 six excellent strains of *B. marginatus* had been identified which had different maturity dates. Strains which developed later were more productive than Bromar at Sunol, Alameda County.

At the San Fernando Plant Materials Center, Los Angeles County, production from pure stand trials planted in 1944 were too small by 1947 to be measured. This was generally attributed to competition from annual weeds and drought. In plots seeded in 1946, a very difficult establishment year, only *B. marginatus* and *B. catharticus* (rescue grass) produced satisfactory stands [rescue grass is from Chile].

B. marginatus was successful in spring seedings during the difficult year of 1947–48 and in 1948–49 at San Fernando. The stands were described as "effective" but were not productive enough to have measurable yields in 1947–48. 1948–49 stands were rated excellent.

Perennial grasses planted in San Fernando in 1950 produced less than 760 pounds per acre the first year. The nursery recommended that perennials be protected from grazing the first year when establishment was poor. Of six accessions of *B. marginatus* tested at Sunol in 1952, only three survived.

Creeping Wildrye
(Leymus triticoides)

General

The Soil Conservation Service (SCS) found rust and lack of viable seed were problems in the propagation of *Leymus triticoides*.

Observational Studies and Pure Stand Trials

Accessions of *L. triticoides* were reported to vary in color from blue to green and in height from 24 to 36 inches. Most accessions were affected by leaf and stem rust.

In 1948, at the San Fernando nursery, Los Angeles County, accession P-995l from Kern County, near Gorman, had less rust than other accessions of *L. triticoides* and was described as a "vigorous grower" and "strongly rhizomatous." It is a tall, erect, hay accession but produces little viable seed. SCS growers planned to propagate it by divisions "for use as forage in mountain meadows and for waterway vegetative means." Third year stands of *L. triticoides* were from 70 to 100 percent. All were at least slightly affected by rust. Seed production was from 500 to 2,330 pounds per acre. [Note: in the late 1960s the cutivar 'Rio' was selected by Lockeford PMC from the San Joaquin Valley. 'Rio' produced abundant seed and is now widely sold.]

In 1949 at the San Fernando nursery, *L. triticoides* and *Melica imperfecta* performed nearly as well as native *Stipa* (aka *Nassella*). They were all considered drought resistant and adapted to dryland use. *L. triticoides* P-995l was outstanding in yields, "the only good cool weather growing sod-former." In trials investigating species for stabilization of banks and waterways, *Cynodon dactylon* (Bermuda grass) was judged the best but, because of its poor reputation, *L. triticoides* was suggested as the best substitute. *L. triticoides* plots sown in this year had only 8 percent survival and were not vigorous. *L. triticoides* plots planted in 1948 had survival of only 10 percent and 12 percent in June and July, respectively. In summary, *L. triticoides* is a cool season, sod-forming grass that can be propagated with rhizomes or plant divisions. Propagules should be planted in late fall to late winter. *L. triticoides* will spread

SCS TECH REPORTS:1944–1960, continued on page 14

SCS TECH REPORTS:1944–1960, continued from page 13

rapidly once it is established. Though it performed well at San Fernando in 1949, it did not at Littlerock, in the Mojave Desert region of Los Angeles County.

None of the thirteen accessions planted at Pleasanton in 1958 bore seed. Only P-995l was not affected by rust. All produced strong rhizomes. P-995l continued to perform well at Pleasanton in 1958.

In 1959 in Pleasanton, all accessions produced strong rhizomes and seed heads but very litttle filled seed. Accession P-995l produced the best seed (about 50% glumes filled) and forage (0.5 ton/acre). It had excellent spring recovery and growth. All accessions had 100 percent stands and spread into the alleyway by the end of the season. *Leymus triticoides* is good for stream bank stabilization.

Mixture Trials

In 1946 mixture trials at Sunol, Alameda County, *L. triticoides* failed to become established. *L. triticoides* was described as being of two main types: the lowland type and the inland or continental type. The lowland type is green and occurs in low wet sites and alkaline flood plains and seldom sets good seed. The inland or continental type is bluish-green and occurs at higher elevations on floodplains and hillsides and usually produces good seed crops.

Blue Wildrye

(Elymus glaucus)

General

The main problems with the establishment and growth of *Elymus glaucus* were competition from weeds and rust (for at least some of the accessions).

Observational Studies and Pure Stand Trials

E. glaucus was better than other species at withstanding competition from annuals. The Soil Conservation Service (SCS) found *E. glaucus* to be mainly a self-pollinated species.

Accession P-10128 (from near Sebastopol, Sonoma County) was found to be outstanding in yield and performance. This accession seemed to have a wider range of adaptation. Other accessions were not as successful. [Note: This accession was increased but not released by the SCS under the name tentative name "Lomas grass"].

Three distinct growth forms of *Elymus glaucus* were identified. They were (1) Hay type: erect vigorous, high yielding, (2) Hay and pasture type: intermediate height, vigorous and leafy, (3) Pasture type: dwarf, poor seed production, and very leafy. Early and intermediate maturity accessions of the hay type and early, intermediate, and late maturity accessions of the other two types were identified. Overall, these accessions had good seedling vigor and fall recovery,

Several mixtures were tested for hay production in the fog belt region of California. *E. glaucus* was used in one mixture; which included *Dactylon glomerata* (Orchard grass), *Sanguisorba minor* (burnet), and *Medicago sativa* (alfalfa). The production of this mixture was about 2,000 pounds per acre.

Trials showed that it is best to fallow for 1 year before establishing a dryland pasture mix. It was also found to be best to drill fertilizer below and to the side of the seed.

Many accessions of *E. glaucus* show poor recovery in the fall, which could reflect lack of ability to survive summer drought.

In Southern California, *E. glaucus* did not perform as well as the *Nassellas* and *Bromus carinatus*. *Melica imperfecta* (foothill melic) and *L. triticoides* were also better performers.

E. glaucus was short lived under dryland conditions, though it might be suitable on better sites. Some *Melica* species performed better than *E. glaucus* in years that they were compared at Pleasanton and Sunol, Alameda County. These were rated better than Lomas grass in fall and spring recovery, amount and quality of forage, and seed production.

At Sunol, after 8 years of establishment, stands of *E. glaucus* began to die out.

E. glaucus has potential to be used successfully on range and dryland pasture areas on sites too dry for *Phalaris tuberosa stenoptera* (Harding grass, aka *P. aquatica*). It may not be suitable for sites which are too dry. *Nassellas* can be used in these drier sites.

Cultural Trials

E. glaucus was seeded in alternate rows with a mixture of Harding grass, burnet, and *Trifolium subterraneum* (Subterranean clover). This was not found to be advantageous for establishment of either the mixture or the grass.

Fertilizing with ammonium phosphate did not increase stands of the species.

California Oatgrass

(Danthonia Californica)

Observational Studies and Pure Stand Trials

Accessions of *Danthonia californica* from coastal Oregon and California, the Cascade, Sierra Nevada, and Coast Range Mountains were planted at Corralitos and transplanted to Pleasanton, Alameda County, in 1945. The Soil Conservation Service considered it an important species for revegetation in the "coastal and semi-fog-belt" regions. *D. californica* was described as slow growing and did not produce seed until the second year.

D. californica performed poorly at Sunol, Alameda County, in 1947 having no plants in two of three fertilized plots and two of three unfertilized plots. The stands were not significant in the plots, which had plants.

In 1958 at Sunol, *D. californica* planted in the spring of 1952 had a 70 percent stand, fair fall and spring recovery, and produced 1,679 pounds per acre of forage. *D. californica,* which had been planted in the 1951–52 crop year, persisted in 1960 at Sunol.

Seed Production

Danthonia californica did not produce seed until the second year. In 1946 at Pleasanton accessions produced up to

SCS TECH REPORTS:1944–1960, continued on page 15

SCS TECH REPORTS:1944–1960, continued from page 14

48 pounds of seed per acre, but many produced none at all. These plants had been established during the 1944–45 growing season.

California Melic

(Melica californica)

Observational Studies and Pure Stand Trials

Me1ica ca1ifornica and *M. bulbosa* (oniongrass) were better adapted to domestication and were higher in forage and seed production than other species of *Me1ica* tested. *Me1icas* in general had weak seedling vigor and slow development but were very cold tolerant. All had relatively low forage production and short seasons of use. Fall recovery started after the first winter rains and growth was slow during December, January, and February. The most rapid growth occurred during March, April, and May. For all *Me1ica* species, all accessions averaged about 4 months from time of range readiness until maturity.

Nineteen accessions of *M. californica* were tested in 1951 at Pleasanton, Alameda County. Survival ranged from 35 percent to 100 percent. Flowering occurred from the end of April to the end of May. Most accessions had medium to high forage production. Seed production varied from low to very high. The most outstanding accession was P-11256 from Watsonville. Six others were close seconds so *M. californica* was by far the best of the *Me1ica* genus.

In 1953 at Pleasanton, *M. californica* P-15375 was the best accession. It maintained a satisfactory stand and produced more forage and seed in uniform seed heads than other accessions. The plants were larger and more robust than the others. None of the *Me1icas* performed as well as *Elymus glaucus* but *M. californica* was the best of the *Me1icas*.

In 1959 at Pleasanton, *M. californica*, *M. nitens* (Texas tall melic), and *M. imperfecta* (foothill melic) were the only two *Me1ica* species to survive and were rated as equal. Only Texas tall me1ic and *M. californica* produced a significant amount of seed. *M. californica* had fair spring recovery, maintained a 100 percent stand and produced 1,426 pounds per acre of forage. Other *Melicas* produced more forage.

Seed Production

M. californica was the only native *Me1ica* species which produced reliable amounts of viable seed.

Nodding Needlegrass

(Nassella cernua)

General

In the Soil Conservation Service (SCS) Annual Technical Reports, *Nassella cernua* was included with the drought tolerant, long-lived bunchgrasses. Overall, this species was well adapted to the medium to low rainfall areas in California. It had greater persistence than may other species under range conditions. [Note: before 1947 *N. cernua* was included with *N. pulchra*.]

Observational Studies and Pure Stand Trials

1948 at the San Fernando Plant Materials Center, Los Angeles County, was an extremely dry year; the *Nassellas* performed very well and the growers concluded that "the native *Nassellas* flourish, relatively, in dry years and are partially suppressed or depressed in wet years." This was due to increased competition from volunteer annuals in years with greater precipitation. *Nassellas* were described as the most outstanding in 1949 as well, also a very dry year. They "recovered in the fall and matured in the spring more consistently than the best accessions of any other species." Though *Nassella* yields decreased over these dry years, the stand percentages did not, in contrast to other species. The best *N. cernua* described in 1949 were P-985, high yield, fine leaved, from University of California (Love 43-8), and P-9477, intermediate hay type, early and robust, local accession from San Fernando Valley.

Spring seeding of *N. cernua* during 1949 at San Fernando resulted in a satisfactory stand, which persisted but did not produce seed or grow much vegetatively. In 1949, only one of the *N. cernua* accessions planted in 1945–46, which started out having 100 percent stands was still alive with excellent vigor. *N. cernua* accessions, which survived two seasons to 1949, had poor to fair stands. Spring seeded *N. cernua* stands from the same year had poor to fair stands.

In years when poor stands of perennials were established, growers suggested protecting the plants from grazing until the second season.

In 1958 at Sunol, Alameda County, after 7 years, *N. cernua* had 75 percent stand, fair fall recovery, good spring recovery, and produced 1,679 pounds of forage per acre.

Mixture Trials

1946 Sunol, fertilizing (200 lb per acre) increased annual stands, which led to a decrease in seeded perennials, including *N. cernua*. *N. cernua* stands increased in unfertilized plots only. Growers concluded that "annuals utilized the fertilizer more readily than the slower developing perennials in the establishment year." *N. cernua* is included in the group of grasses that performed very well at Sunol (about 15 inches of annual precipitation, minimum temperature 23°F). In 1947 at Sunol, *N. cernua* had fair stands but plants were small.

Field Evaluation Plantings (Outlying Nurseries)

King City, Monterey County, 1951, *N. cernua* was rated as one of the best perennials but stands were disappointing. 1952 plantings of *N. cernua* resulted in poor stands. *N. cernua* was seeded in 1950 and was one of the few which survived in a year with such low rainfall that annuals in the trials did not produce seed. In a fall seeding in 1956 at King City, *N. cernua* produced a good stand with "slender, vigorous plants."

To find out what's going on at the Lockeford Plant Materials Center today, go to HTTP://PLANT-MATERIALS.NRCS.USDA.GOV/CAPMC/.

CNGA Merchandise Order Form

Phone/Fax: 530-661-2280 **Mail:** P.O. Box 8327, Woodland, CA 95776

Name _____

Mailing address _____

City, State, Zip _____

Day phone _____ **E-mail** _____

Item (All prices include tax. Call for combined shipping.)	**Price**	**S/H**	**Qty**	**Total**
CNGA Logo Items				
SALE! **Sturdy canvas tote,** natural w/green logo, 13x15x7	$15	$4	___	_____
SALE! **Baseball cap,** tan w/black logo, adjustable, was $20	$15	$4	___	_____
SALE! **Crush hat** (aka **bucket hat),** green, S/M only, was $20	$15	$4	___	_____
Tees unisex heather-green, short-sleeve (S/L/XXL/XXXL)	$15	$4	___	_____
NEW! unisex natural, short-sleeve (S/M/L/XL)	$20	$4	___	_____
NEW! women's, army-green, short-sleeve (S/M/L/XL/XXL)	$25	$4	___	_____
Long-sleeve unisex, olive green (S/M/XL/XXL/XXXL)	$25	$4	___	_____
CNGA Workshop Binders				
Restoration and Revegetation	$60	$6	___	_____
Ecology/Management Vernal Pool Grasslands (supply limited)	$35	$5	___	_____
Native Grasses/Graminoids Urban Landscape	$35	$5	___	_____
Grass Identification	$20	$4	___	_____
Posters: Grasses of CA 24x36, laminated	$25	$4	___	_____
(CNPS) set of 4, each different, 24x36, unlaminated	$20	$4	___	_____
SALE! **Notecards:** set of 6, with envelopes, was $10	$8	$2	___	_____
Grasslands				
Complete set of back issues (1991–2009)	$60	$10	___	_____
subtotals			$ ____	$____

Total Enclosed $_____

Make check payable to California Native Grasslands Association (or CNGA) or you may authorize payment by (circle one): Mastercard / Visa / AMEX

Card # _____ **Exp. date** _____

V Code _____ **Billing Street Address** _____

Calendar

Send calendar entries and announcements for the winter '10 issue by Dec. 29, to ADMIN@CNGA.ORG.

October

Wed.–Fri., Oct. 14–16

Developing a Sustainable Grazing Plan to Manage Native Grasslands: *People, Planning, and Profit.* CNGA workshop, Hasting Reserve, Upper Carmel Valley. $245/CNGA member; $285/nonmember. Instructors: ***Richard King,*** Ecologist, USDA/NRCS, and ***Kent Reeves,*** Natural Resources Division Manager, Yolo County Parks & Resources. SRM CEUs approved. Go to WWW.CNGA.ORG for lodging information. Check with Judy at ADMIN@CNGA.ORG for available space.

Thurs.–Fri., Oct. 22–23

Using Grasses and Graminoids in Restoration and Revegetation. A CNGA workshop in Davis. $100/student; $175/CNGA member; $215/nonmember. Proven techniques and strategies using native species; site and species selection, site preparation, planting techniques, weed control, and long-term management. Classroom and field study. Check with Judy at ADMIN@CNGA.ORG for available space.

Fri., Oct. 30

CNGA Board of Directors Meeting. Woodland, CA; 10 a.m.–3 p.m. Interested CNGA members may contact CNGA Administrative Director, Judy G-Scott, at ADMIN@CNGA.ORG.

December

Sun.–Wed., Dec. 13–16

Grazing Lands—A Winning Hand: *4th National Conference on Grazing Lands,* Reno/Sparks, NV. Presented by the Grazing Lands Conservation Initiative. Infor available at WWW.GLCI.ORG, or contact John Peterson, Conf. Manager, at 703-455-4387 or JWPETERSON@COX.NET.

2010 CNGA Workshops and Events

See additional details in upcoming issues of *Grasslands* and at CNGA.ORG.

February

Using Native Grasses and Graminoids in the Water-Conserving Landscape. Santa Rosa, CA. Examine the use of California native grasses and graminoids in a broad range of urban settings. The course will also examine the cultural requirements and adaptability of key native grass and sedge species as they relate to the soil and site parameters in shaping a sustainable, native, drought-tolerant landscape. Date TBD.

Developing a Sustainable Grazing Plan to Manage Native Grasses: *People, Planning, and Profit*. Hollister Ranch, Santa Barbara County. Participants will learn how to develop, plan, write, and implement a successful sustainable grazing program. The workshop will include developing a shared vision that consists of social, economic, and ecological goals for the management of a grassland. Date TBD.

March

Creating a Native Meadow. Santa Rosa, CA. Whether starting from bare ground or replacing maintenance-hungry turf, learn to develop and maintain a native meadow on your own property. Date TBD.

April 16

CNGA Field Day at Hedgerow Farms. Winters, CA. Join us for this third annual opportunity for practical, hands-on, learning about native grasses and grassland restoration.

April 30–May 1

Identifying the Native and Naturalized Grasses of California. Santa Rosa Plateau, Riverside County. Learn about California's grassland ecology, the qualities of specific native grasses for restoration. Become skilled at recognizing the basic groups and common species through work with plant samples in the classroom on April 30, and on May 1 in the field, in one of the best remaining Foothill needlegrass grasslands in the state.

June 3–4

A North Coast Grasslands Symposium—*Humboldt Bay Area.* Come explore native grassland habitats behind the redwood curtain. CNGA presents a two-day symposium with guest speakers on Thursday at the Humboldt Area Foundation and field trips on Friday.

June 5–6

Identifying the Native and Naturalized Grasses of California. Humboldt Bay Area. Learn about California's grassland ecology, the qualities of specific native grasses for restoration. Become skilled at recognizing the basic groups and common species through work with plant samples in the classroom on Saturday and in the field on Sunday.

October release!

"A Real Classic! John Greenlee's Best Yet," says David Amme.

The American Meadow Garden: Creating a Natural Alternative to the Traditional Lawn

The traditional American lawn is a time-consuming, resource-wasting mistake. It's time to replace the lawn and find new ways to create livable outdoor spaces. In *The American Meadow Garden,* John Greenlee offers homeowners a new model—the designed meadow, a vibrant, shimmering mini-ecosystem friendly to kids, pets, and butterflies. Even better, it requires minimal resources and absolutely no mowing. Gorgeous photography by Saxon Holt illustrates the message with stunning examples of meadow gardens from across the country. Hard cover $34.95, 280 pages, full-color throughout. TIMBER PRESS. (Check out the video at http://www.timberpress.com/books/).

CNGA's Bunchgrass Circle

Life Members

Jack Alderson
Jane Anderson
John Anderson
Fred Ballerini
Sheila Barry
Bob Battagin
F. Thomas Biglione
Jack Booth
Janice Bridge
Cindy Burrascano
Sallie J. Calhoun
Sally Casey
Frank Chan
Vic Claassen
Mike Conner
Anne Corey
Duane Cornett
Charlice Danielsen
James Dekloe
Robert Delzell
Rene di Rosa
Jerome Domurat
Bruce Eisenman
John R. Ekhoff
David Gilpin
F. Thomas Griggs
Jim Hanson
Barbara Herren
Lesley Hunt
Richard Ibarra
Ellie Insley
Joni Janecki
David Kaplow
David B. Kelley
Micki Kelly
Paul Kephart
Charlotte Kimball
Lenora Kirby
Ron Lutsko, Jr.
Rod MacDonald
Garry Mahrt
Eugene Majerowicz
Carolyn Malmstrom
Tamia Marg
Rhonda and Bob Mark
Ron Martinolich
Ruth Mazur
Mary Kate McKenna
Richard Nichols
Paul Ostler
Carol Presley
Peggy Rathman
Paul Reeberg
Diane Renshaw
John Roberts
Warren Roberts
Craig S. Rust
Victor Schaff
Robert Schott
Susan Schwartz
Jon Shilling
Jacob Sigg
Diana Steidl
Robert Stephens
Scott Stewart
Lillian Vallee
MaryAnn Warmerdam
John Wick
Margaret Willits
Jeanne Wirka
David Yam

Corporate Members

***Muhlenbergia rigens* level**

Hedgerow Farms

***Nassella pulchra* level**

Delta Bluegrass • Pacific Coast Seed • S&S Seed

***Poa secunda* level**

Elkhorn Native Plant Nursery • Restoration Resources • Shilling Seed

Associate Members

American River Parkway Foundation • Animal Science Department, California Polytechnic State University, San Luis Obispo • Audubon Canyon Ranch
City of Davis • Contra Costa Water District
County of Orange, RDMD/Harbors, Beaches and Parks • Hollister Ranch
Irvine Ranch Conservancy • Livermore Area Recreation and Park District
Los Angeles Chapter, California Native Plant Society
Oak Creek Energy Systems • Orinda Horsemen's Association
Sacramento Regional County Sanitation District
San Luis National Wildlife Refuge • Sonoma County Ag Preservation and Open Space
StopWaste.org • Sun City Lincoln Hills • Thomas Klope Associates
Truax Company, Inc. • Wildlands, Inc.
Yolo County Resource Conservation District • Zentner & Zentner

CNGA Contact List

Board of Directors

Officers

David Amme, President
East Bay Regional Park District
2950 Peralta Oaks Ct., Oakland, CA 94605
510-544-2344; E-mail: seed@tdl.com

Randi Paris, Past President
P.O. Box 1991, Weaverville, CA 96093
E-mail: randiparis@yahoo.com

Wade Belew, President-elect
Cotati Creek Critters; P.O. Box 7511, Cotati, CA 94931
707-694-5086; E-mail: wadekb@sonic.net

Sara Sweet, Secretary
The Nature Conservancy
13501 Franklin Blvd., Galt, CA 95632
916-683-1767; E-mail: ssweet@tnc.org

Jim Hanson, Treasurer
Caltrans: Mitigation and Highway Landscaping
438 49th St., Oakland, CA 94609 (mailing)
510-450-2450 (day)
E-mail: jim_hanson@dot.ca.gov

At-Large Members

Andrew Fulks (2008–2009)
UC Davis Putah Creek Riparian Reserve
2723 Ganges Pl., Davis, CA 95616
530-752-0763; E-mail: amfulks@ucdavis.edu

Clare Golec (2009–2010)
Caltrans, Eureka Office—Distr. 1
P.O. Box 3700; Eureka, CA 95502-3700
707-445-6322; E-mail: clare_golec@dot.ca.gov

Sarah Hoskinson (2009–2010)
Dept. of Plant Sciences, UC Davis
1210 PES, Mail Stop 1, 1 Shields Ave., Davis, CA 95616
530-752-5609; E-mail: sahoskinson@ucdavis.edu

David Kaplow (2009–2010)
P.O. Box 744, Petaluma, CA 94953
707-769-1213
E-mail: dave@pacificopenspace.com

Richard King (2009–2010)
USDA NRCS; 1301 Redwood Way, Suite 215,
Petaluma, CA 94954
707-794-8692 x120; E-mail: richard.king@ca.usda.gov

JP Marié (2008–2009)
UC Davis Office of Resource Management & Planning
376 Mrak Hall, 1 Shields Ave, Davis, CA 95616
530-304-3251; E-mail: jpmarie@ucdavis.edu

Melissa Mooney (2008–2009)
Santa Barbara County Planning and Development
624 W. Foster Rd., Suite C
Santa Maria, CA 93455-6250
805-934-6587; Fax: 805-934-6258
E-mail: mmooney@co.santa-barbara.ca.us

Zachary Principe (2008–2009)
The Nature Conservancy
402 W. Broadway, Suite 1350, San Diego, CA 92101
909-815-2227; E-mail: zprincipe@TNC.org

Kent Reeves (2008–2009)
Yolo County Department of Parks and Natural Resources
120 W. Main St., Suite C, Woodland, CA 95695
530-406-4888; E-mail: kent.reeves@yolocounty.org

Bryan Young (2009–2010)
Sacramento Regional County Sanitation Dist. 8521
Laguna Station Rd., Elk Grove, CA 95758
916-875-9273
E-mail: youngb@sacsewer.com

Judy G-Scott
Administrative Director
P.O. Box 8327, Woodland, CA 95776
Phone/Fax: 530-661-2280 E-mail: admin@CNGA.org

Mary Rodgers
Grasslands Managing Editor
3661 56th St., Sacramento, CA 95820-2342
916-455-0563; E-mail: mrodgers@macnexus.org

Visit CNGA online at:
www.CNGA.org

California Native Grasslands Association

P.O. Box 8327
Woodland, CA 95776
http://www.CNGA.org

Nonprofit Org.
U.S. Postage
PAID
Permit No. 19
Dixon, CA

RECYCLED PAPER

Cover photos: Front: View of coastal t errace prairie at Arroyo de los Chinos, Hearst San Simeon State Park. Grassland dominated by tufted hairgrass (*Deschampsia holciformis*). The mountain in the distance is Bald Top, the south end of the steep Big Sur coast. *Photo: Dave Amme*

Back: *Leymus mollis* ssp. *mollis* foredunes at USFWS Lanphere Dunes, Humboldt Bay. *Photo: Clare Golec*