Conservation Priorities for Coastal Prairie in Sonoma and Marin Counties

Proceedings of the Sonoma–Marin Coastal Prairie Workshop

November 6, 2006

UC Davis Bodega Marine Laboratory, Bodega Bay, California

A Project of:

the Sonoma–Marin Coastal Grasslands Working Group

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Occidental Arts
and Ecology Center

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Acknowledgements

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Speakers: We sincerely thank our workshop speakers for valuable information on coastal prairie: Peter Alpert – University of Massachusetts; David Amme – East Bay Regional Park District; Peter Connors – UC Davis; John DiGregoria – Point Reyes National Seashore; Sasha Gennet – UC Berkeley; Daniel Gluesenkamp – Audubon Canyon Ranch; Grey Hayes – Elkhorn Slough Coastal Training Program; Phil Northen – Sonoma State University; Brendan O'Neil – California State Parks; Tom Robinson – Sonoma County Agricultural Preservation & Open Space District; Jeanne Wirka – Audubon Canyon Ranch; Todd Keeler-Wolf – California Department of Fish and Game.

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Executive Summary

Coastal prairie communities support the highest plant diversity of all North American grasslands. In Sonoma and Marin counties, observations on the decline of coastal prairie habitats have prompted concern from a broad array of professionals and laypersons.

On November 6, 2006, 69 participants representing 24 agencies, academic institutions, land managers, land planners, conservation organizations, community groups, and private landowners (Appendix B) met at the Sonoma–Marin Coastal Prairie Workshop to identify what would be needed to conserve coastal prairie habitats in our region in the next 10 years. Through presentations, breakout sessions and discussions, they identified 6 priority areas for conservation:

1. Guiding Principals and Approaches for Effective Conservation
2. Conservation Planning: Characterization, Mapping, Risk Assessment, and Prioritization
3. Public Awareness through Outreach and Education (with specific goals for the general public and landowners, such as ranchers, non-ranching "estates" and absentee owners)
4. Policy Changes to Protect Coastal Prairie
5. Sustainable Land Use and Management Practices (with specific goals for site-specific management plans, tools and resources, and the promotion of ranching and grazing practices that sustain coastal prairie)
6. Field Research for Identifying Effective Management and Restoration Techniques

In this document, we provide a description of each conservation challenge and the priority actions that can address these needs. In addition, this document provides a list of workshop participants interested in participating collaboratively in each project. Combined with participant contact information in Appendix B, this document is a valuable tool for all participants interested in developing collaborative efforts.

We recognize that to be successful, conservation efforts must be reiterative as well as collaborative and long-lasting. This document is a first approach at producing a coordinated plan for coastal prairie conservation in Sonoma and Marin counties. It can be used as a starting point for conservation implementation by land managers, landowners and others to assist them in their critical role in sustaining biodiversity and ecosystem processes in prairie habitats. We hope that it will evolve and develop as we move forward in our common goal of thriving coastal prairie communities in Sonoma and Marin counties.

Coastal Prairie — A Unique and Unknown Community

Coastal prairie is arguably one of the least well-known of California's plant communities. Lack of knowledge about this plant community is widespread among all sectors of society, and yet this unassuming, low-growing plant community supports the highest plant diversity of all North American grasslands (Stromberg et al. 2002) — in some places as many as 250 species of wildflowers (http://www.cruzcnps.org/localplants.html).

Coastal prairie is a highly variable mixture of native perennial grasses and forbs, native and non-native annual forbs, and non-native grasses. It extends as a discontinuous ecosystem from Central California into Oregon within the influence of the cool maritime climate and ranges in size from small remnant patches to broad expanses on coastal bluffs or grassy balds on hilltops. It occurs in a complex mosaic of plant communities such as coastal scrub, mixed evergreen forests, redwood forests, and wetlands. Surprisingly, some of the closest affiliations in species composition are with high-altitude grasslands in the Sierra Nevada region (see David Amme, this publication). Many species of insects, as well as numerous birds, reptiles, and mammals (including humans) are dependent on coastal prairie habitat.

Conserving and restoring coastal prairie is a matter of statewide significance. Ninety-nine percent of California's native grasslands have been lost since European settlement (Delfino 1997, Noss and Peters 1995). As a consequence, 90% of California's rare and endangered plant species now live in grassland ecosystems (D'Antonio et al. 2002) and California native grasslands rank as the sixth most endangered ecosystem in North America (Noss and Peters 1995). Grasslands additionally provide important social and economic functions, such as water quality protection, erosion control, carbon sequestration, food production, recreational opportunities and beautiful open vistas.

Remaining coastal prairie in California is threatened by a lack of historic disturbance regimes, exotic species invasions, overgrazing, erosion and conversions to cultivated farmland and housing. Land ownership changes, such as the rapid and continuing shift in the last decade from working ranches to private estates and public lands, can lead to landscape changes that tend toward fragmentation, shrub and tree encroachment and increased invasion by exotics. It is urgent to develop consistent legal protection for this rare community and, where necessary, introduce beneficial land use practices and management techniques that will ensure its continued existence.

Sonoma–Marin Coastal Prairie Workshop — A Strategic Activity for Conservation

In recognition of the ongoing loss and degradation of coastal prairie in Sonoma and Marin counties, a group of like-minded professionals and private landowners formed the Sonoma–Marin Coastal Grasslands Working Group (SMCG Working Group), a collaborative body of land managers, researchers, and landowners dedicated to landscape-level conservation of coastal

grasslands. The Working Group's mission is *"to conserve, protect and restore native coastal grasslands through education, research and effective management."* Aware that a collaborative and inclusive approach will be needed to conserve coastal prairie in the region, the SMCG Working Group's first project was to coordinate the Sonoma–Marin Coastal Prairie Workshop. The goals of the workshop were to create awareness of coastal prairie issues and to begin developing a collaborative and coordinated approach to coastal prairie conservation in our counties.

The Sonoma–Marin Coastal Prairie Workshop was a one-day workshop held November 6, 2006 at the UC Davis Bodega Marine Laboratory. The workshop brought together 69 representatives from 24 agencies, academic institutions, land managers, land planners, conservation organizations, community groups, and private landowners to develop a prioritized list of conservation, management and research priorities for coastal prairie in Sonoma and Marin counties. During morning sessions, workshop participants heard from experienced researchers, managers and educators on coastal prairie management and ecology. In the afternoon, participants broke into small groups guided by facilitators to identify conservation challenges and develop actions that address these needs.

This document is both a summary of the workshop proceedings and working plan for a coordinated approach to coastal prairie conservation in our region. It contains:

- Strategic Activities for Conservation – A working plan of priority conservation areas and activities based upon input of some of the most experienced coastal prairie managers, conservationists, and landowners in our region. A synthesized summary of priority activities is provided in the main text of this document, and the original lists and priority rankings generated at the workshop are included in Appendix C.

- Coastal Prairie Information – The latest information available on coastal prairie conservation, management and research in our region. Transcribed presentations from our speakers are presented in the main text and copies of PowerPoint presentations are provided in Appendix E (a CD enclosed on the back cover of this report).

- Collaboration Resources – A resource for enhancing coordination among persons interested in participating in coastal prairie conservation efforts in our region. Last names of workshop participants interested in each topic or idea that was generated at the workshop are provided in Appendix D. Combined with participant contact information in Appendix B, this becomes a valuable tool for all participants interested in developing collaborative efforts.

We hope it proves a useful resource for achieving a shared goal of a vibrant and healthy coastal prairie ecosystem in Sonoma and Marin counties and beyond.

The California Coastal Prairie: An Overview

Presenter: David Amme – East Bay Regional Park District

Biography: *David Amme earned an M.S. in Range Management from University of California Berkeley in 1981. David is a consummate native plant horticulturist and agrostologist. He is one of the founding members and architect of the California Native Grassland Association (CNGA) and has been absorbed in California grassland ecology as a private Open Space Management consultant, State Park Resource Ecologist, Caltrans Environmental Planner, and certified range manager. During this time David has also been a part-time lecturer and private consultant specializing in native grass horticulture, grassland restoration, stewardship grazing, and integrated roadside vegetation management (IRVM). Currently, David is the Wildland Vegetation Program Manager and Range Manager for the East Bay Regional Park District.*

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

David introduced his talk by pointing out that one of the largest remaining areas of contiguous coastal prairie still managed by grazing is west of Petaluma, leading out toward the coast. He observed that similar grassland once covered much of the area from the Mendocino coast, south through the San Francisco Bay region, and as far south as San Luis Obispo County. The grasslands were grazed by herds of elk, ungulates that grazed in both the forest edges and the grasslands. The morphology of the mouth of elk is similar to that of cattle, and so the grazing of cattle in these remnant grasslands can have a similar effect on the habitat if properly managed.

The California coastal prairie grassland plant community shares many of the same plant species of the mid-elevation slopes of the Sierra Nevada. The same species of grasses, sedges, shrubs and trees found on Tuolumne meadows in Yosemite National Park are found on the coast of Fort Bragg. The prairie grassland and its associated forest, wetland and slack-dune vegetation are representative of the northern Arcto-Tertiary flora. Examples include California oatgrass, tufted hairgrass, red fescue, fir, spruce, lodge pole pine, corn lily, Labrador tea, and manzanita. California oatgrass epitomizes the coastal prairie grassland as far inland as the cool, foggy coastal environment extends 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.

Among factors that must be reviewed in considering the coastal prairie are grazing history, fire history and soil profile, as well as the diversity of many associated scrub and forest communities. “Postage stamp prairies” still exist in our region, islanded by development, but 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 disrupted by expansion or development with only the 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. He ended with the persistent question: the importance of managing this valuable plant community. He cited the alarming loss of diversity in key coastal grasslands that he has observed during his 30-year career.

Throughout his presentation, David showed fine photographs of many of these species as he referred to them:

Key California coastal prairie perennial grass and sedge species:

- *Danthonia californica* (California oatgrass)
- *Deschampsia cespitosa holciformis* (Tufted hairgrass)
- *Deschampsia cespitosa beringensis*
- *Trisetum canescens*
- *Festuca idahoensis roemeri* (Idaho fescue)
- *Festuca rubra*
- *Panicum acuminatum* aka *Panicum pacificum* (Panicgrass)
- *Nassella pulchra* (Purple needlegrass)
- *Phalaris californica*
- *Bromus carinatus maritimus*
- *Hordeum brachyantherum* (Meadow barley)
- *Agrostis pallens* (Thingrass)
- *Koeleria macrantha* (Junegrass)
- *Calamagrostis nutkaensis* (Sand reed grass)
- *Calamagrostis stricta inexpansa* (Thurber's reed grass)
- *Calamagrostis foliosa* (Cape Mendocino reed grass)
- *Alopecurus aequalis* var. *sonomensis*
- *Poa unilateralis*

Typical native grassland forbs:

- *Veratrum fimbriatum*
- *Grindelia stricta platyphylla*
- *Wyethia angustifolia*
- *Iris douglasiana* (Douglas iris)

Naturalized exotic grasses/threats include:

- *Ammophila arenaria*
- *Agrostis capillaris*
- *Anthoxanthum odoratum*
- *Arrhenatherum elatius*
- *Cortaderia jubata*
- *Festuca arundinacea*
- *Holcus lanatus*
- *Lolium perenne*
- *Nassella manicata*

- *Pennisetum clandestinum*
- *Briza maxima*
- *Bromus diandrus*

Impacts of Grazing to California Grasslands: State of the Science

Presenter: Sasha Gennet – University of California, Berkeley

Biography: *Sasha Gennet is currently finishing her Ph.D. at UC Berkeley, where she is looking at the impacts of grazing and environmental factors, like soil chemistry and weather, to the plant and songbird communities of annual grasslands in central California. She has worked in California in natural resource management as a restoration ecologist for the past ten years, primarily focusing on rare and endangered species in coastal ecosystems. She is also interested in the legal, political, and social context of restoration.*

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

Sasha Gennet presented the results of a literature synthesis that she gathered and analyzed for Point Reyes National Seashore (PRNS). Their motivation was to inform the development of their new general management plan for PRNS. The science staff needed a summary of current scientific literature on the impacts of grazing on coastal grasslands, in order to predict how continued grazing, or cessation of grazing, might affect their grassland resources on the Point Reyes Peninsula.

Her methods included querying the databases (Biosis, Web of Life) for articles and studies, and drawing from new book chapters for coming publications (*Terrestrial Vegetation of California, Annual Grasslands*). There exist insufficient studies for quantitative meta-analysis, so her summary is a qualitative analysis. She pointed out that the ecosystem of coastal grasslands is very different from that of inland systems—in fact, opposite responses to an influence may occur—so she included studies from inland systems only when no coastal information was available.

Sasha's results were categorized by resource. Under the category of native grasses, three replicated studies and several long-term, local monitoring studies showed that *Nassella pulchra* (Purple needlegrass) gave an inconsistent response to grazing, but *Danthonia californica* (California oatgrass) had a positive response. Grazing cessation often preceded a succession to low-growing scrub and dominance by other perennial species. Invasive perennial grass species (*e.g.*, *Holcus lanatus*, Common velvet grass) may increase due to grazing. The site's cultivation history and microsite characteristics are key factors in the composition of the grassland. Any cultivation disturbance seems to be a negative influence to the diversity and abundance of native grassland species. Effects vary by site, however.

A lack of grazing is significantly correlated with lower cover of native forbs and wildflowers. The presence of thatch and the increased height of grasses that are left ungrazed, are probably the causes of this effect. Studies show that grazing collectively enhances this guild of species, although individual species should be studied more in regard to this question.

Grazing negatively impacts native shrubs, including *Lupinus* spp. (lupines) and *Baccharis pilularis* (Coyote brush). We know that grazing reduces oak regeneration, but this is a question

that has to be weighed, since shrub and tree encroachment reduces the richness of grass and forb species.

Invasive non-natives show a highly species-specific response to grazing, so that competition between natives and non-natives is best looked at on the species level. Studies show that grazing alone is likely insufficient to permanently restore coastal grasslands to native dominance, but may help "tip the balance" toward the restored natives, or may help maintain native populations.

Studies that have monitored terrestrial vertebrates in coastal grasslands show a lower vertebrate richness in grazed areas. Experimental studies show no difference in abundances for individual species. There is a documented positive interaction between livestock and small mammal grazing (mostly squirrels and voles). Few reptile or amphibian studies have been carried out in grasslands. *Rana aurora draytonii* (California red-legged frog) is positively impacted by grazing in stockponds that are in grasslands, but are negatively impacted in riparian corridors when livestock are present.

The impact of grazing on birds is highly species-specific. Research shows that some grassland-dependent species can be negatively impacted, and that riparian species can be negatively impacted through reduction of habitat by grazing. Livestock-related bird species—such as the brood-parasite *Molothrus ater* (Brown-headed cowbird) or the corvids (*e.g.*, *Corvus corax*, Common raven)—have been observed to prefer to utilize grazed areas at PRNS. These species may be preying on eggs and young of a number of grassland, riparian, and shorebird populations of management concern.

There are too few insect studies related to grazing to adequately characterize its impact, and responses are often species-specific. Some species are negatively impacted by trampling, or by any disturbance. The intermittent die-back of *Lupinus arboreus* (Yellow bush lupine) is negatively related to the abundance of *Hepialus californicus* (Swift or Ghost moth). At PRNS, the endangered Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) may be negatively impacted by heavy grazing, but showed no significant difference in abundance between lightly grazed and ungrazed sites.

This survey of scientific literature highlights the remaining knowledge gaps, which are substantial. Sasha pointed out some of these gaps, citing the lack of replicated studies of impacts of grazing to plant communities, replicated studies of related wildlife, bird species and insects.

Reviewing some of the reasons for these knowledge gaps, she cited ecological reasons:
1) A grassland is a non-equilibrium, non-linear system.
2) There are complex successional pathways in a grassland,
3) There is high species turnover and diversity, so that studies in one coastal site may not be replicable at another site. Species composition depends on soil conditions, weather, micro-topography, geologic factors, grazing and historical factors that are hard to pin down.

Coastal grasslands are temporally and spatially very heterogeneous, non-equilibrium systems, so that when a management action is reversed, that doesn't necessarily mean that it will lead to

reversal of the impacts that the action already had. This makes it difficult to modify strategies and a particular challenge to grassland managers.

Another factor in the knowledge gap dilemma is the communication gap, which she detailed as for managers and scientists: Managers typically do not have access to scientific literature, and find it very hard to translate the results they do get into cohesive management recommendations. Scientists are taught to have fear of interpreting their results too broadly, and may find little support from the academic establishment in helping resources managers. There are many opportunities for more scientific literature surveys, and there are plenty of graduate students who could and would like to do such surveys.

In summarizing her presentation, Sasha offered some suggestions for integrating the science into practice:

1) Syntheses of studies and literature reviews should be freely available online, for integration into management practices.
2) Management priorities should be looked at as the basis for future conservation research priorities.
3) Joint research and monitoring programs should be encouraged.
4) All kinds of knowledge should be respected. Sasha made the point that scientists and grassland managers need to respect and include the body of local knowledge, the experience of grassland managers and ranchers, and the regular observations of those people (in ranching, conservation science, and land management) who are working in the field.

Mapping and Classifying the Vegetation of Coastal Prairies of Marin and Sonoma Counties: Where to Begin (?)

Presenter: Todd Keeler-Wolf – California Department of Fish and Game

Biography: *Dr. Todd Keeler-Wolf is an ecologist who has worked in California for the past 30 years. In this time he has had the pleasure of studying the vegetation and flora of virtually every terrestrial ecosystem in the state. Currently he is the Senior Vegetation Ecologist at the California Department of Fish and Game and leads their Vegetation Classification and Mapping Program. He is co-author with John Sawyer of the* Manual of California Vegetation *and several other books and publications. Todd is actively involved in inventorying and describing all the vegetation of the state using quantitative classification and mapping to focus conservation planning efforts. He lives in Oakland with his wife and three children.*

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

Todd Keeler-Wolf began by stating that the objectives of his talk were to 1) bracket the notion of what a coastal terrace prairie is, 2) offer suggestions, based on the experience of doing vegetation assessments of ecological systems in other parts of California. He consistently uses the term coastal terrace prairie (CTP) for the grassland type of western Marin and Sonoma counties.

He began by defining a grassland as an area that is dominated by grasses or grass-like plants, yet may have substantial forb cover; in which the vegetation averages up to 10% uniform cover of woody plants and at least 10% of grass or grass-like plants; where species may be annual or perennial; and in which vegetation is not permanently wet during the rainy season (therefore not a marsh).

There are four major types of grassland in California. Marin and Sonoma County exhibit two types: North Coastal grassland, moving inland toward Central Valley grassland.

He pointed out that a conventional coastal terrace prairie could be called by other names as well; among these names are fescue-oatgrass, coastal perennial grassland, bald-hills prairie, or a part of North Coastal grassland. There is a strong biogeographical component as well, so that some of the more northern coastal grasslands are like Oregon's coastal prairies, whereas some coastal terrace prairie has affinities to the grasslands of central and eastern Oregon, and to the Palouse Prairie of eastern Washington. Species richness and the amount of cover still provided by native plants are higher along the coast than in the Central Valley. Moisture is of course more significant well into the growing season nearer to the coast, while the climate is more Mediterranean and drier inland. As early as the 1820s, California ranchers recognized that forage productivity was higher year-round in the coastal terrace prairies than in the Central Valley.

To further define a coastal terrace prairie, Todd added these characteristics: 1) it is influenced by cool maritime climate; includes an assortment of grasslands with a number of different combinations of species; CTP plant community patterns are influenced by soil depth, moisture, fertility, and texture, as well as by natural and non-natural historical patterns of disturbance.

Default vegetation is not usually grass in many areas, and stands of CTP are not usually large. For all of these reasons, vegetation mapping of CTP poses a particular challenge.

The effort to clarify what a CTP is and how to best assess the ecology of CTPs, Todd suggests we avoid old paradigms of classification and ask many questions, such as: How do we individuate CTP from other native CA grasslands? How do we individuate it from non-native coastal grassland (annual and perennial)? How do we tease out seral relationships with woody vegetation such as coastal scrub and coniferous forest?

Seral or successional relationships are clearly significant in these very dynamic coastal terrace prairies. Fires, grazing and natural shifts in conditions often lead to grasslands becoming dominated by 1) trees (*e.g.*, Bishop pine, Douglas fir, or Sitka spruce in Mendocino County and northward), 2) scrub (Yellow bush lupine, coyote brush). He suggested that the encroachment of prostrate coyote brush into CTP might be viewed as temporary, and employed to help rid the area of non-native annual grass species, then later the coyote brush could be removed as part of restoration with natives. The yellow bush lupine (*Lupinus arboreus*) populations have been observed to wax and wane, due to natural and disease cycles: 5-6 years of waxing population spread, then a similar period of waning.

It is important to study natural variations at CTP sites, correlating factors in species composition and environment. We can try to determine what is a "natural pattern" in CTP, considering the dynamic balance between stability, disturbance, and succession. We must, he suggests, pay particular attention to how native biodiversity is represented: within grassland stands it may not be high, but the diversity may be high between stands, which should be considered part of the larger CTP mosaic.

The speaker pointed out that small stands of CTP are the norm, rather than the exception. Stands are limited by natural landscape (*e.g.*, terraces, soil lenses, bluffs); narrow strips of grassland are based on sharp gradients (*e.g.*, moisture, salinity); and stands can be based on small patch dynamics (*e.g.*, clearing, fire, browsing/grazing, intensity). Stable "old growth" patches of CTP do exist, he reported, but these are in more inaccessible places that woody plants don't like. Still, in these places, sloughing at steep sites and succession happen too.

We only partially understand the vegetation of the coastal grasslands, he pointed out. No sampling and analysis has been done of natural variation along the coast or middle North Coast Ranges north of Point Reyes. He gave various examples of vegetation-ecology types that blur the definition of CTP. Some contain or are edged by CTP species. In one example, a *Scirpus californicus* marsh is not a CTP, but *Deschampsia cespitosa* can thrive on the edge of such a marsh. There are places where a brackish marsh gives way to a strip of CTP, which borders a coniferous forest. Some bald hills have soil types that resist coastal scrub. Some species thrive in widely divergent soil types (*e.g., Nasella pulchra*, which thrives in Central Valley clay soils, but the species is also a CTP component in shallow, rocky, coastal soils. He referred to *Phalaris aquatica* as a "cancer" of these grasslands.) There are many transitional types of vegetation, but it is not clear that they meet the criteria of being true CTP. The speaker stressed that he is putting out a plea to this group of experts, to quantify and sample these types of vegetation, so that

coastal terrace prairie botanists and managers can learn more about this type, and thereby gain both context and perspective.

Non-native grasslands may be a) perennial (planted for pasture, sustained by higher average moisture than in California's interior, diverse and pugnacious), or b) annual (some species are shared with non-native grasslands in the interior of the state, but some are more directly related to the coastal moist environment). Non-native grasslands vary in their threat to native biodiversity. One of the more negative factors is that they can function as "reservoirs of nativity" for non-native seeds to spread. To address them effectively, we need to understand them better and know their ecologies.

Most of the balance of Todd's presentation was devoted to vegetation mapping issues for coastal terrace prairie. Herbaceous, non-woody vegetation is very hard to map using either traditional or high-tech remote-sensing methods. Difficulties are presented due to small patch size, subtle photo signatures, phenological and inter-annual variability, and a wide variety of types with distinctive species combinations. He states that we can't presume that either the annual or the perennial character of a species is clearly good or bad. All present challenges and some present opportunities.

It is important to map vegetation using the proper parameters. Aerial photographic mapping of small patches can give high-resolution imagery and a small minimal mapping unit, which is more accurate than low-resolution imagery. Superficially similar signatures with fine-scale environmental differences require lots of good supporting GIS information from the field.

Based on years of experience doing vegetation mapping all over California, he offers these general recommendations

- The most efficient approach will be a single integrated sampling and mapping project that has sufficient funding and time to address all of your needs. Consider uses of your data and final mapping products carefully.
- Think broadly about definitions:
    - What was the native grassland historically?
    - Are there non-traditional "grasslands" that you also believe should be addressed?
    - Research the variety of existing grasslands and related types (literature searches).
    - Sample and classify the grassland that is being mapped.
- Mask-out forest, true pasture (planted, highly modified), and other non-related or exogenous types from your mapping parameters.
- Rely heavily on fieldwork. On-the-ground observations by knowledgeable vegetation specialists provide key data to compare to aerial photography.
- Ecologists who actually know the local vegetation should do the mapping.
- Map actual stands as much as possible, not consolidated mapping units.

During the preparation for mapping, the first phase is initial information gathering, when existing classification information and field plot data should be collected, although it will not be enough in itself. This is the phase to develop a sample allocation process, based on the envisioned representation of species and communities that will be identified. Private landowners should be

solicited as much as possible to help with land access, information on historical uses of their land, and to involve them in data collection and attributing.

For the field data phase, the speaker recommends that the field crews should be expert botanists/ecologists. They should use relevés as their method, and sample at peak phenological stages. They should sample the full range of variability of all grassland types and grassland-to-woody transitions within a stand or mosaic of stands. Rigorous geographic information should be collected from the field (*e.g.*, GPS the perimeter of stands that are difficult to interpret from aerial photos). They should collect general information about size and shape of the stand and of adjacent stand types. They should use an array of techniques based on the phase of the project, such as detailed samples, reconnaissance level observations, and accuracy assessment samples.

His mapping recommendations include technical advice as well: Use true color or color infrared high-resolution aerial photography (no smaller than 1:12,000). Choose optimal phenology, or use multiple dates from late spring to mid-summer, if possible. Use photo-interpreters who have a strong background in vegetation mapping, and have been involved with the field data collection and classification of the local grasslands, so they know what they are looking at. And lastly, require as many field-verified samples as possible.

In summary, Todd referred to the coastal terrace prairie as a “flagship” ecosystem, in that it holds a position among a group of similar or related vegetation and ecological types. Use of these prescribed methods could provide us with crucial information to benefit them.

Restoring and Managing Coastal Prairie

Presenter: Jeanne Wirka – Audubon Canyon Ranch

Biography: *Jeanne Wirka is the Resident Biologist at the Bouverie Preserve of Audubon Canyon Ranch (ACR). Prior to ACR, she had been the Project Ecologist for Audubon-California's Landowner Stewardship Program where she designed and implemented habitat restoration projects on private farms and ranches in Yolo and Solano Counties. She was on the Board of Directors of the California Native Grassland Association (CNGA) for 4 years, served as president for 1 year, and continues to teach restoration techniques as part of CNGA's technical training workshops.*

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

This presentation explores *why* we have so many questions about the restoration and management of coastal prairie. One approach to illustrating the complexities of coastal prairie restoration is to contrast it with a relatively simple valley grassland restoration project.

In Yolo and Solano counties, the Landowner Stewardship Program implemented grassland restoration projects on over 1000 acres of privately-owned rangeland. These projects ranged from managing stands with existing natives to restoring over 300 acres of completely non-native areas "from the ground up." The range of projects allowed the program to develop a “recipe” that worked in that particular eco-region. She is hoping that this Coastal Prairie Working Group will be able to develop that kind of recipe for Sonoma and Marin counties.

The speaker first highlighted a couple of biological problems that she feels need to be considered. First, we need to think clearly about the “natural succession” and “encroachment” of coastal shrubs. Deciding what “should” be prairie versus what “should” be coastal scrub in some cases reflects a value judgment that we make in regard to coastal prairies. Secondly, we must consider the loss of native seed sources, recognizing that the local seed supply source is often a problem, due to fragmentation of grasslands.

Restoration practitioners often use a medical model to categorize and treat impacted grasslands. There are the “sick patient” grasslands, which need help to be nursed back to health, and for which a number of kinds of treatments are considered. She defines this as grassland that still has more than ten percent native species. The other kind of patients are “emergency room” grasslands: dominated by weeds, with less than ten percent native cover. The paradox in this model is that the emergency room patient can actually be easier to treat, because various methods completely eradicate non-natives, making it a clean slate on which to add natives, thereby bringing it to where it is merely a sick patient. The same options are not available when trying to preserve remnant stands.

Ms. Wirka used a 30-acre cattle pasture in Yolo County as an example of the hypothetical emergency room patient. In 2000, the site was dominated by medusahead, goatgrass and yellow star-thistle with no native grasses present at all. The pasture was alluvial soil, and had been in cattle ranching for decades. It may have once been oak savannah, but the majority of vegetation

had historically been grassland of some kind. (She contrasted this with coastal prairies, where sometimes we don't know the history, or if land had been shrubland or forest before being grassland.) On this Yolo County site, although there were no natives in the pasture, there were still native species on the surrounding slopes, so the likely original native grass component of the site was known.

Medusahead and other typical annual weeds such as yellow star-thistle, and European forage grasses (wild oats, soft chess, *etc*.) are easier to eradicate than perennials like *Holcus lanatus*. When working with elimination of non-native annuals, a strategy is to take advantage of the difference in phenologies between annual and perennial grasses, both the species you want to keep and the species you want to get rid of. For example, most non-native annual grasses flower earlier in the spring, whereas medusahead and yellow star-thistle flower later. Prescribed fire can be used after non-natives have started to dry out, while medusahead and star-thistle have yet to set seed. A fire during the right window during springtime will steam and kill medusahead seeds before they hit the ground and will girdle star thistle before flowers are even fully formed. Some sites can achieve 100 percent control of medusahead with a single burn.

She learned that relatively low-intensity fire in spring it wouldn't negatively affect the *Nasella pulchra* or any of the loose bunch grasses like *Elymus glaucus* or *Bromus carinatus*. In stands where desirable perennials occur, the dilemma of course is how to promote perennial grasses while not promoting weedy perennials like *Holcus lanatus, Festuca arundinacea, Phalaris aquatica*. The kind of hot, mid-summer burns to control yellow star-thistle can kill perennial grasses, but it will also kill native perennials like *Nasella* and Idaho fescue.

Other research in the Santa Rosa Plateau (SRP) looked at repeat burns in native valley grassland situations, especially at the effect of repeated burning on different species guilds. They found that early spring burning tended to be good for native grasses, but over time, repeated spring burning each year, tended to negatively affect native forbs. The Nature Conservancy, which conducted the Santa Rosa Plateau research, learned to reintroduce some randomness into their treatments; in other words, to set a target goal and methods, then introduce some randomness in timing and intensity of treatments, in order to have various components of the ecosystem respond.

Other components of a hypothetical, best-case scenario for grassland restoration are these: 1) a willing landowner, 2) many years to do pre-project planning, 3) lots of money to work with, 4) several years of pre-project monitoring at adjacent sites not scheduled for treatment, as well as at the site targeted for restoration. Part of what made the previous projects that Jeanne had worked on so ideal, was that all of them were with private landowners—mostly ranchers, some farmers. Therefore they were able to use certain methods, such as the application of herbicides, that are restricted on publicly managed lands.

The ideal method for completely eliminating non-native grass in rangeland was to fallow a pasture for a couple of years before planting natives. She stated that much research shows that, at least in valley grasslands, this is the most effective method for restoring an old field to native grasses: Let the weeds germinate, till, then let the next flush of seeds germinate, then till again, until the weed seed bank is exhausted. Although this method disturbs the soil profile, the soil had

already been very disturbed by tilling, grazing, and long-term, exclusive presence of non-native species.

In this particular project, several other advantages helped create an ideal situation: 1) They had the use of a range drill for native seeding. 2) The project area was near a commercial native grassland seed supplier which had developed ecotypes from the very sites the restorations were occurring, so there was already a collection of locally harvested native seeds. Seeds were all the species that they suspected had once grown there, mixed them, seeded the field, and let the various species sort out by microsite conditions. Finally, 3) The project was on a cattle ranch. A herd of 200 cattle was available in a neighboring pasture so cattle were available to graze the restoration site for a prescribed number of days, to get just the right effect.

Jeanne pointed out that it is important to tailor the grazing to the weed problem. She said that if there is a forb problem on a grassland, using sheep to graze it is preferable to using cattle. At this 30-acre site, she and her team, along with the landowner, experimented with various numbers of cattle for varying amounts of time. In the end, it appeared that for this 30-acre field, 200 cattle for five days did the trick. Since cattle eat from the top of a grass down, you can monitor their progress on a field. On this site, they had already seeded native grasses. They didn't want the cows to eat the native seedlings, so they waited until they had "mowed" the non-natives to an appropriate height and then took the cattle off. The native seedlings were largely untouched.

Some weeds are difficult to control with grazing. Goatgrass, for example, grows low to the ground before it sends up its culms and it flowers much later than the other non-native grasses. To deal with goat grass, the program tried swathing and baling the grass (just like hay) and removing the bales from the field to remove the seed heads. The jury is still out on whether this is an effective long-term method for goatgrass.

Returning to her theme, the speaker asked if we can apply these "recipes" to coastal prairies. Or, she asked, do we even want a "cookbook" for coastal prairie management?

Relevant studies were done by Jeff Corbin and Carla D'Antonio at the Audubon Canyon Ranch property called Tom's Point, near Dillon Beach. The subject of the study was competition between non-native annual grasses and native perennial grasses. The researchers planted out three-month-old native perennial grasses, then added seed of non-native grasses. They concluded that once established in coastal prairie, native grasses are quite stable, less vulnerable to non-native competition than expected; just adding non-native seed was not enough to get the non-natives established. Once natives were established, the study showed that productivity of non-natives went down and native productivity rose. This suggests that seedling survival of natives is very important to success in coastal prairie restoration, since older, larger native grasses may resist invasion.

Another project she cited was Russian Ridge, in the Mid-Peninsula Open Space District. The District had a yellow star-thistle invasion in coastal prairie, and wanted to add native grass and forb seed. Transline worked well to get the yellow star-thistle controlled. However, after the successful experiment was over, a change in personnel meant that attention shifted away from

the site, and it reverted to yellow star-thistle. The lesson is here is that long-term maintenance and monitoring are key.

Fire can be used as a very specific tool in coastal grasslands, but we are not sure if fire has been a major natural influence in the last century. We do know that some drought-influenced burning occurred, and perhaps even at a regular interval. We do know that aboriginal burning occurred for thousands of years. Aboriginal burning most likely kept shrubs out of coastal prairies. We have to be aware that some of the sites we wish to preserve as prairies would in fact have been coastal scrub if native people hadn't managed them as grasslands.

With respect to how and when to burn grasslands, we have to consider the species compositions of the grasslands, objectives of the burn (is it for a specific weed, shrub, or combination?), the phenology of the grasses, and the season of burning.

One way to think of the response of species to different management regimes is to group them into guilds (native grass, non-native grass, native forbs, non-native forbs). If you know what your objectives are, you can tailor your management over time. For example, you may want to focus on getting rid of non-native grasses first, then on managing for native forbs. Another species consideration is that the response of native grasses to management varies by their growth form. For example, fine-leaved, densely-clumped species like Idaho fescue or *Danthonia* may be more susceptible to fire because the fire resides longer and hotter in the crown of the plant. With less dense, loosely clumped grasses such as *Elymus glaucu*s, or rhizomatous grasses like creeping wildrye and saltgrass, fire moves quickly through them and has less time to damage their growing points.

The season of burning is also a very important choice. In valley grasslands, cooler spring burns kill annual grasses. Encroaching shrubs, such as *Baccharis*, need a hot autumn burn to kill them, but that hot burn will kill native grasses, too. Project managers need to decide what their goal is in any given situation.

Shrub encroachment is another concern, as exemplified at Andrew Molera State Park, on Highway One. In an area that is grazed, there are native grasses and some *Baccharis*. In an adjacent area that has been fenced off and left alone, there are now weedy grasses and increasing shrub encroachment. Jeanne requested of the group that there be more research on grazing to control shrubs, and on the most effective concentration of cattle on a site. We need to remember that returning sites to a "natural state" what we think of as "natural" occurs within the context of a historically manipulated landscape. Restoration practitioners need to decide what the contemporary goal is.

In conclusion, she asserted that:

1) Management objectives should be based on contemporary goals. For instance if you have a broom problem, getting rid of it may be more important, for right now, than preserving the *Danthonia* that is there, too. Don't fall into inaction due to indecision; apply treatments for contemporary goals.

2) Respect all kinds of knowledge from published research to landowners' "gut feelings." Try out various combinations of treatments, and on a larger scale. Try to get landowners trying out recipes, with the goal of creating a cookbook of approaches.
3) Research should disaggregate the species guilds. Species will respond differently, so it is not effective to talk broadly about native perennial grasses vs. non-native grasses. Seedling survival should be a goal in prairie replanting projects, in addition to managing competition.

Protecting Coastal Prairies for our Children's Children

Presenter: Grey Hayes – Elkhorn Slough National Estuarine Research Reserve

Biography: *For the past 18 years, Dr. Grey Hayes has focused on agroecology and natural systems ecology of California's Central Coast. His project experience includes work with the Ohlone tiger beetle* (Cicindela ohlone) *and California red-legged frog* (Rana aurora draytonii), *as well as restoration and management of coastal prairie, coastal scrub, riparian, and maritime chaparral ecosystems. He has authored management plans for protected natural areas and published work in scientific and popular journals on land stewardship and restoration. His research experience focuses on restoration ecology of California's coastal prairie, with an emphasis on rare annual wildflowers. Dr. Hayes is currently coordinator of the Coastal Training Program at the Elkhorn Slough National Estuarine Research Reserve. This program focuses on bridging the gaps between regulators, land managers, and researchers by creating educational programs that foster dialogue, help build community, and increase ecological understanding.*

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

Grey Hayes began by recommending two resources that are now available:

1. *Grazing Handbook & Guide for Resource Managers in Coastal California*, produced by the Sotoyome Resource Conservation District and others
2. The website http://www.grazingimpacts.info has information, advice on how to do a grazing plan, and a worksheet for helping weigh factors, goals and animal management

Grey Hayes coordinates the Coastal Training Program (CTP), through the Elkhorn Slough National Estuarine Research Reserve. The CTP focuses on bringing the latest science to land managers and other decision makers so that they are better able to do their jobs conserving natural resources. Conservation of coastal prairie is one of the CTP's many foci. Partners of the CTP include the Elkhorn Slough Foundation, the California Department of Fish and Game, the Coastal Conservancy, and NOAA. The Elkhorn Slough CTP offers workshops, field trips, independent scientific reviews and a website.

Grey Hayes began his presentation with a set of questions, some posed directly to the participants, and other designed to frame and prioritize the challenges to conservation of coastal prairies. Two themes of his presentation were 1) the tension of acting when you are uncertain about outcomes, and 2) the need for diverse audiences to work (and learn) together for conservation success.

As part of the CTP's education and outreach efforts, Grey works with diverse groups of ranchers, educators, conservation land managers, regulators, and land use planners to determine common goals and questions related to preservation and restoration of coastal prairie. He finds that the unifying message, the goal which these diverse audiences can agree upon, is "*To save coastal prairie for future generations, for our children's children.*" Because these diverse audiences have been able to find common ground, they are better able to work together for conservation.

To arrive at this common ground and to work together for conservation requires overcoming prejudice and being honest about what we do not know.

To illustrate this, Grey asked the participants of this workshop who are educators to offer short responses to the following questions, and received these types of answers:

Question: What is overgrazing?

Answer: Not allowing a plant to recover from previous grazing.

Question: What is undergrazing?

Answer: Woody plant invasion; when you remove herbivores and have ecosystem collapse.

Question: Can we reduce weed cover and create a native plant dominated system in coastal prairie? (this is the most common goal that the CTP has discovered through interviews and surveys of conservation land managers)

Answer: The answer to this was uncertain. The speaker observed that we still have a lot of education to do among ourselves, before we can be confident in reaching out to others to tell them what to do.

He then posed this question: What do we mean by "*saving coastal prairie* (from the common goal, stated above)?"

The answer, he said, can only be conservation at a landscape level, because coastal prairie exists as an endangered ecosystem in relatively small patches on the landscape. Conservation at this level means protecting species "from the genetic level to the landscape scale." This includes protecting the rare species, but also the common ones, and not just plant species, but all the other species: insects, birds, snakes, and frogs. It means not just conserving native grass species, but it should also include conservation of the many sub-types of coastal prairie as they are better defined, throughout the cline from the immediate coast to inland: hill slope coastal prairie in the fog belt, grassy balds on the coast, bunchgrass-dominated grasslands, mima mound grasslands, wet meadows, vernal pools, perennial or annual wildflower areas, serpentine grasslands, and many others.

He underscored the point that this kind of conservation requires landscape-level management, with many kinds of people agreeing to a whole range of decisions. Whether you are a rancher or a public land manager, he stated, this process depends on capital, which comes from the world beyond grasslands. Therefore conservation also requires educational outreach to the public taxpayers and their representatives to generate capital for land stewardship. For instance, serpentine grasslands have been considered "the most pristine California grasslands," preserved by their toxic soil that inhibits the competition of non-native plant species against serpentine-specific natives. But now, even these specialized ecosystems are being invaded by non-native species and so require management. Nitrogen deposition, originated from car-exhaust air pollution, fertilizes nitrogen-loving non-native grasses in the previously nitrogen-poor serpentine areas. And so, if even these grasslands now require management, how do we generate the methods and funding to approach managing California's grasslands as a whole? The answer must include public outreach and education.

Grey then asked the group: What do healthy coastal prairies look like? How do we sustain them? He pointed out that these are not just biological questions, but also social, economic, and political—all aspects that need to be looked at.

Grey also asked the group: What are the threats to coastal prairies? He said that the answer depends on whom you ask, but these are people's first responses: overgrazing, housing sprawl, and weeds. Are these the threats we want to educate people about, he asks, or are these too simplistic?

Grey pointed out that the traditional answer to threats to coastal prairie was to buy land for conservation; when it was purchased, most considered it protected. And yet, California has only 5% of its grassland in public ownership, and 95% in private ownership—most is ranched. Even if conservation land protection doubled, still 90% would be in the hands of the ranching community, so we must work with ranchers to build coalitions that agree on priorities and methods of grassland management. Other groups that must be included in these coalitions to conserve coastal prairie include: research scientists, private land managers, conservation land managers, land use planners, advisors, and conservation organizations.

One example of a promising coalition is the Central Coast Rangeland Coalition (CCRC), which has been meeting since 2003. Ranchers formed the foundation of the group, which also includes conservationists and land use advisory agencies. After much deliberation, the CCRC is monitoring a set of proposed indicators of sustainable rangeland stewardship, to help better describe and demonstrate the process of sustaining healthy rangelands.

The CCRC is working with an important emerging conservation concept called "collaborative learning network." These learning networks often involve participatory research and focus on the creation of a formal learning framework. Collaborative learning networks define specific learning questions and collaborate to document, validate, and disseminate their discoveries. Meeting face to face over time is central to this framework. As the CCRC works from these principles it has been exploring regionally relevant sustainability issues related to grassland management and restoration. Thus far, the CCRC has defined these goals: to help the ranchers maintain access to the land; to make it possible for future generations to both have access to land and to manage it in sustainable ways; to facilitate monitoring and management of the land on behalf of human and non-human communities; to educate through demonstration of sustainable grassland management methods.

Together they developed a list of ecological, social, and economic indicators of the sustainability of rangeland management. Ecological indicators stem from three principles outlined by the National Academy of Sciences, with a fourth category added by CCRC:

1. Degree of soil stability and watershed function. Rangelands should not be eroding, and they should capture and retain water rather than shed it as run-off.
2. Integrity of nutrient cycles and energy flows. Rangelands should support plants that capture energy from the sun and cycle nutrients from the soil.

3. Presence of functioning recovery mechanisms. Rangelands should be resistant to extreme disturbances and resilient to change—that is, they should be capable of recovering form more ordinary disturbances.
4. Conservation of species and natural communities. Rangelands should maintain species diversity as well as a wealth of associations of those species.

Once the CCRC members agreed on the importance of these principles, ranchers and conservation lands managers were then asked to list what indicators they observe within each of those categories. (*e.g.*, What do you look for to tell if you have functioning nutrient cycles? How do you gauge grassland resiliency after a drought?)

The list of monitoring variables was distilled to the best few to make a viable monitoring regime and this list was peer reviewed by leading scientists. Through this process, they developed a working list of indicators. Their medium-term goal is to use these indicators to monitor more than twenty ranches within the Central Coast region, testing the system. Then they will demonstrate methods that sustain grassland biodiversity and protect watersheds. After that, they will reach out to educate on a broader scale. The CCRC meets every three months. Participants are excited to bring previously disparate voices together and to be working toward a common goal.

A central tenant to the CCRC is that cattle ranching can be compatible with the conservation of grassland biodiversity. To clarify this presumption, Grey Hayes turned his presentation to his research on cattle grazing impacts on coastal prairie biodiversity. For part of his doctoral research, Grey surveyed grazed versus ungrazed coastal prairie sites from Morro Bay to Fort Bragg during two springs, in 2000 and in 2001. The research originated because experts were concerned that land which was purchased for coastal prairie conservation subsequently had cattle grazing removed, often resulting in the disappearance of rare annual wildflowers (forbs). In addressing this concern, he found that the species richness of annual forbs was higher in grazed sites than in ungrazed sites, and that cover of native annual forbs was much higher in grazed versus ungrazed sites. Grey noted that twenty-five species of rare and endangered annual wildflowers are found only in coastal prairie, and at least sixty native plant species are dependent on coastal prairie habitat. In his estimation, “doing nothing” (removing grazing animals and leaving the land to do as it will) fosters successional pathways that include weed, shrub, or tree invasion, to the detriment of goals which include conserving grassland biodiversity. He is hoping that the Sonoma–Marin Coastal Prairie Working Group will play a leadership role in taking a landscape-scale view, examining the question of how to best maintain grassland biodiversity and where succession to weeds, shrubs, and trees can be abated.

Any leadership for coastal prairie conservation should apply the approach most recently described as *adaptive management*: a process or continuous cycle that moves from learning to doing. The learning phase includes evaluation and planning; the doing phase includes implementation and monitoring. Grey underscored that many conservation land managers facing grassland stewardship issues are increasingly paralyzed in the planning phase, afraid to move forward because there is so much uncertainty with management outcomes. He said that while indeed we have much to learn, we know enough already to implement informed management actions. And so, we can begin now by applying what we already know and adapting as we learn.

Grey ended his talk by stressing that there are many voices with deep and intergenerational experience on grassland management. Those interested in coastal prairie conservation could begin their adaptive management work by working with those with this knowledge to reach sustainable management objectives. And then, we must work together to transfer that knowledge on to the next generation of ranchers, land managers and conservationists. He advised that coastal prairie restoration and management will require long term and dedicated regional leadership to maintain learning networks. Leaders, he said, must be carefully chosen. There must be institutional continuity and commitment to grassland stewardship to make this work. He wished the Sonoma–Marin Coastal Prairie Working Group good luck with this endeavor.

Many managers, researchers, and landowners are unaware of ongoing coastal prairie management projects in the region. In this workshop session, we invited speakers to describe their current projects (Figure 1) and begin the process of enhancing awareness and coordinating conservation efforts for coastal prairie in our region.

Figure 1. Location of coastal prairie management projects discussed by presenters in this session.

Managing Grasslands in the California State Parks, Russian River District

Presenter: Brendan O'Neil – California State Parks

Biography: *Brendan O'Neil has been an Environmental Scientist with California State Parks for the Russian River District since 2001. As natural resource manager for 26,000 acres of State Park property within western Sonoma County, he is regularly humbled by the task of "managing" publicly owned coastline, grasslands, and forests. Prior professional experience includes: California Coastal Commission, paleo-ecological research, environmental consulting (botanical and planning), and various Nature Conservancy positions. He has a M.S. in Forestry and B.S. in Natural Resource Planning, Humboldt State University.*

Map: Salt Point State Park, Bodega Head, Red Hill (Figure 1)

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

Brendan O'Neil began his presentation by stating that he wanted to show how California State Parks, in the North Coast region, manages coastal prairie. He is currently responsible for the Russian River District, within western Sonoma County. He oversees 26,000 acres, in four contiguous park units, which comprise six different parks. As the natural resource manager, he manages approximately 6,400 acres of grassland. He estimates that under 10% of that is dominated by native species, 10–20% is transitional (between native and exotic-dominated), and the rest is primarily non-native perennials, such as *Holcus lanatus.*

He uses a programmatic approach to management, but has to work within the confines of the department operations manual. Between the workload and the regulatory requirements, he must think in big terms and lump projects together.

Iceplant (*Carpobrotus* sp.) is the easiest weed they deal with, he reports. A successful project has been carried out at Bodega Head from the year 2000 to the present. They spray it with 2% glyphosate, which kills the iceplant, leaving mulch behind, followed by a strong recruitment of native species. In larger polygons, a significant percentage of thistle and mustard appears which can be removed by hand or treated with glyphosate the following springtime. There is a plan to seed the larger polygons with natives in 2007, to increase native cover. Aerial photos of Bodega Head showed that after two years of the initial treatments, treated areas of coastal prairie were recovering well, with *Elymus* sp. and *Erigeron glaucus*. Brendan underscored that the treated areas need continual management and long-term commitment. "These projects need to be institutionalized in order to be successful." Triaging weeds is important, he said.

He showed what he calls a "mechanical" project that has been ongoing at Salt Point's Gerstle Cove. Following the 1992 wildfire there, bishop pine seeds germinated and invaded the grasslands. They mechanically removed bishop pines, piled them up, and burned the piles. He acknowledged that this method has stirred some controversy, but says that they were able to return "several tens of acres" to open grassland habitat. They burned six hundred piles of bishop pine.

A similar project dealt with encroachment at Red Hill, red fescue grassland south of the Russian River. Although fire was the desired treatment, burning the many Douglas firs and *Baccharis* there could cause the fire to burn very hot. They don't want a hot fire, because that could kill perennial native grasses, too. So the first step is to remove fir, and the second step is to remove shrubs, which they do using the "lop and scatter" method.

Another photo showed the grazing of cattle, which California State Parks does on about 1,000 acres, less than one-sixth of Russian River District grassland habitat. Some of their grazing projects are historical—remnants from acquisitions; most are not yet integrated with succession or adjacent stands. There is currently much discussion about grazing, which California State Parks has historically felt uncomfortable with, but views may change.

In summary, Brendan reiterated that the big question for State Parks is how to manage—on limited resources—thirty miles of coast that includes grasslands, redwoods, fir, and oak woodlands. A budget of $2.60/acre/year determines that triage is necessary. Groups such as this coastal prairie working group, he says, are essential to protect what we have in Sonoma County, and what is available as public land.

Coastal Prairie Stewardship Study

Presenter: Phil Northen – Sonoma State University

Biography: *Phil Northen is a professor of biology at Sonoma State University, with experience in a variety of local conservation issues. He has worked closely with Kathleen Kraft and Linda Esposito on coastal prairie conservation and restoration at Ocean Song, a private ridge-top preserve in the coastal hills above Bodega Bay.*

Map: Ocean Song Farm and Wilderness Center (Figure 1)

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

The objectives of the Coastal Prairie Stewardship Study, which began in 2002, were to: 1) map coastal grasslands, 2) develop a network of participants, and 3) do research on management options. The site was Ocean Song Farm and Wilderness Center. Other local landowners and agencies cooperated as well, and the U.S. Fish and Wildlife Service and the California Coastal Conservancy funded the study. He credits this project as being the spark that generated the energy and questions that led to this current workshop.

The coastal prairie site is on the western ridge of the Coastal Range in west Sonoma County. Grazing had been going on there for over a century, many non-native species have been introduced over that time, and natural fires have been periodic and infrequent. In recent years, changes in land ownership and use have created certain opportunities: an increase in public ownership of land, and removal of grazing from private lands, along with an increasing interest by private landowners in conservation.

This was not a prairie restoration project *per se*, rather a reference project, which could demonstrate the effects of various treatments. The project participants would like to replicate the study elsewhere, so that useful data can be provided to other grassland managers.

The Finley Preserve study area is a part of Ocean Song, and presents problems, such as the build-up of thatch and the strong presence of non-native grasses and forbs. Questions applied there were: What would happen if we remove or reduce the thatch? Will fire or grazing reduce thatch? Will either treatment alone enhance natives? How does each plant species respond to fire and grazing?

Investigators collected data on the study area for two years before beginning treatments. Pre-treatment species composition included forty percent native grasses, a very low percentage of forbs, (particularly native forbs), and low diversity overall. The site was approximately twenty acres, divided up into five nearby plots, each randomly subdivided into quadrants for treatment: burning, grazing, burning and grazing, or no treatment.

The first burn occurred in November, 2004, with the help of California Department of Forestry. *Danthonia californica* roots survived the fire well, and showed strong post-fire regrowth. In

April–May, 2005, sheep were grazed on the designated plots, moved and controlled with temporary fencing corridors.

Data on the cover of each species in the study area is based on the standard "Daubenmire" procedure, with fifteen frames per plot. Also tracked was how the plants were organized spatially using measures of frequency. The researchers have found ninety-five species in the study area so far. Half of these are present as small individual plots or clumps—45% native—while half are robustly present. These are mostly three species, in decreasing order: California oatgrass (*Danthonia californica)*, purple needlegrass (*Nassella pulchra)*, and blue wild rye (*Elymus glaucus)*.

In 2006, the second year after the burn, data show that burning, grazing, and burning–grazing significantly reduced thatch. In the burned–grazed plots, the percentage of native grass cover increased a little. Opening up the habitat through all three methods did increase the abundance of perennial forbs. These initial treatments dramatically increased the non-native forbs, and only slightly increased the native forbs. By far the main non-native forb that thrived after treatments was *Hypochaeris radicata* (rough cat's ear). Researchers observed that this species mostly came to inhabit the spaces left by the treatments' elimination of non-native grasses, thereby trading one non-native species for another, not further impacting the native species.

Dr. Northen suggests that in the future researchers will be able to consult the ongoing database to answer questions they have about individual species. Their results show that five non-native species were reduced numerically by burning, while four non-native species were enhanced. Burning did not harm any native species.

In summary, Dr. Northen suggests that restoration efforts seek enhancement of native species rather than eradication of non-natives. He hopes that this study area will continue to be a model system where hypotheses are tested and management techniques can be developed. He points out that any disturbance, including these treatments, essentially creates a new set of initial conditions, and that any management strategy must be ongoing in order to be successful.

Sweet Success: Restoring Coastal Prairie on Bodega Head

Presenter: Peter Alpert – University of Massachusetts/Bodega Marine Laboratory

Biography: *Peter Alpert is on the biology faculty at the University of Massachusetts in Amherst and has been a visiting researcher at the Bodega Marine Laboratory since 1996. He started out here working on the wild strawberries that grow both in the grassland and on the dunes, but has turned to the more sobering problem of controlling the introduced grasses. Sugar seems to be an ally, and deer an enemy, and he and Claudia Luke are preparing to carry the good fight across Bodega Bay to Point Reyes this fall.*

Map: Bodega Marine Reserve (Figure 1)

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

Peter Alpert began by explaining that the researchers set out to test this hypothesis: *If natives out-compete introduced species because natives are locally adapted, then any change in selection pressures should increase invasion (Alpert 2006).* The presenter translated this as: *In habitats little altered by humans, anything you do will be bad.*

The silver lining to this is the restoration corollary: *In highly altered habitats, restoring regimes of disturbance and resource availability will promote re-invasion by natives.*

In coastal grassland in Northern California, native plants are still abundant in areas of "mixed grassland," such as exists on parts of Bodega Head. Common native grasses there include *Bromus carinatus, Danthonia californica, Elymus glaucus, Hordeum brachyantherum,* and *Leymus pacificus.* Common native forbs in the area are *Nemophila menziesii* (Baby blue eyes), *Eschscholzia californica* (California poppy), *Iris douglasiana* (Douglas iris), and *Trifolium fucatum* (Bull clover).

Introduced grasses almost completely dominate areas of "invaded grassland," patches of which are common on Bodega Head. The species of introduced grasses there include *Aira caryophyllea, Bromus diandrus, Bromus hordeaceus, Holcus lanatus, Lolium multiflorum,* and *Vulpia bromoides*.

Their experiment was designed to raise and lower two factors: the level of nutrients and the level of disturbance in the form of herbivory by native mammals, including deer and rabbits. They also considered the effect of gopher mounds in their sample plots, by recreating them from typical local soil. Within the fenced plots, clipping was done to mimic the effect of grazing. Altogether, they used four disturbance treatments: ambient grazing, exclusion of grazing, exclusion plus clipping, and exclusion plus mound. These treatments were crossed with three nutrient treatments, added nutrients (NPK), added carbon (white sugar), and no addition. Plots were 1 x 1 meter square.

In invaded grassland, disturbance and nutrient treatments were further crossed with addition of adult native grasses. In each plot with added adults, eight individuals of each of four species

were planted: *Elymus glaucus*, *Hordeum brachyantherum*, *Danthonia californica*, or *Bromus carinatus*. To mitigate seed dispersal as a factor, they added about 100 locally-collected seeds of four native and seven introduced grasses to each plot in both types of grassland.

They had to figure out an experimental method for taking nutrients away from the native and non-native species in the study area, and decided to add common white sugar as a carbon-rich additive. This was based on the knowledge that plants are competing with soil microbes for the same sources of nutrients, so if easy food (sucrose) that can fuel microbes is added, they will proliferate and be starved for nutrients, then take them from the general supply, thereby lowering what is available to the plants.

In mixed grassland, there were fifteen replicate blocks. In invaded grassland, there were ten replicate blocks.

Details of methods include the following: Clipping treatment involved cutting growth to 10 cm above the ground, 3 times per year. Carbon treatment consisted of 0.5 kg sugar/sq. meter, applied twice per year. Added nitrogen treatment consisted of 4-month-release fertilizer (NPK 19-6-12), at 7.3 g N/sq. meter, once per year. Mound treatment meant applying soil from real mounds, 25 cm diameter by 10 cm deep, one time only.

Plant cover measurements were taken in May–June of each year. They measured the cover of every native species in every plot, every year. In the last year of the study, they measured the biomass by clipping and weighing plants in subplots within selected plots.

The study's results showed that the introduced species declined as the nutrients diminished, so low nutrients are bad for the non-native species and good for the native species. Their results showed that when grazing was prevented, it also favored native species. After three years of study, cover of introduced plants was 30% lower if sugared and 15% lower if ungrazed. Cover of natives was 25% higher if sugared and 55% higher if ungrazed. At this point, if grazing was prevented and sugar added, the effect was to flip the grassland species distribution from 80% introduced species to 80% native species. June 2006 results showed that preventing grazing and adding sugar increased the relative biomass of natives from 20% to 60%.

The researchers planted adult native grass species into invaded grassland plots in June 2005. After 18 months, 40% of the planted natives survived, 50% if both sugared and grazed. They reached 15% cover, and 25% if sugared and ungrazed. No natives were established from seed.

In summary, the local adaptation hypothesis was not supported. Instead, invasion in this coastal grassland goes up with nutrients and with disturbance. Results do suggest how to control invasion in the coastal prairie: Where natives remain, add carbon and prevent grazing by deer and rabbits. In invaded grassland, plant adults. Adding carbon and preventing grazing may increase their survival and will increase their cover. Questions being considered for the future include: Will these suggestions work at other sites? Can they be turned into management prescriptions? (A final note was that the next study will use sawdust as a nutrient additive instead of sugar, because it is free and may be effective.)

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Audubon Canyon Ranch

Presenter: Daniel Gluesenkamp – Audubon Canyon Ranch

Biography: *Dan Gluesenkamp directs Habitat Protection and Restoration for Audubon Canyon Ranch (ACR) and leads in the development, implementation, and evaluation of conservation and restoration projects at ACR preserves. Daniel is also president of the California Invasive Plant Council, a statewide organization of more than a thousand professionals and citizens who work to protect California wildlands from invasive plants through restoration, research and education. His work involves experimental evaluation of management techniques, oversight of stewardship activities such as control of invasive alien species, and collaboration with neighboring landowners and agencies to protect ACR lands. Daniel's current research focuses on the factors structuring plant communities, particularly as related to the invasion and spread of introduced plants and animal species, with work in habitats ranging from valley grasslands and vernal pools, to riparian forests and coastal dunes. He earned his Ph.D. at the University of California at Berkeley with research that revealed how populations of native and alien thistles are shaped by plant competition, by insect herbivory, and by effects of habitat productivity on the relative intensity of competition versus herbivory.*

Map: Bouverie Preserve, Tom's Point (Figure 1)

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

Audubon Canyon Ranch Lands: Daniel directs the conservation and restoration efforts of Audubon Canyon Ranch (ACR). Holdings of ACR include twenty-seven properties in Marin and Sonoma counties. These are treated as three campuses: 1) Tomales Bay campus of preserves, mostly along the eastern shore of Tomales Bay, 2) Bolinas Lagoon Reserve, and 3) Sonoma Valley's Bouverie Reserve. Audubon Canyon Ranch manages various restoration and research projects in these places, collaborating with other agencies in some cases.

Audubon Canyon Ranch's Tom's Point sanctuary
Daniel's presentation first highlighted one of ACR's key preserves, which includes a fine example of remnant coastal prairie. The name of the geographic feature and the preserve is Tom's Point, situated near the north end of Tomales Bay. Though small, Tom's Point is fantastically diverse. In addition to north coastal dunes, the site includes significant north coastal strand, ephemeral wetlands, dune slack wetlands, north coastal salt marsh, and a fantastic remnant of the prairie that once was abundant along the California coast. However, there is trouble in paradise, and we need to take action to protect this treasure. So, the Habitat Protection and Restoration program has put together the Tom's Point Natural Resource Management Plan to guide habitat protection and restoration work. He detailed some of the restoration and management challenges that Tom's Point continues to illustrate.

European beachgrass (*Ammophila arenaria*) invasion
Among these problems is the established invasion by the non-native grass *Ammophila arenaria* (European beachgrass), which dominates the sand dunes. A project is underway to restore the dunes to native North Coast dune vegetation, restoring habitat for:

- *Chorizanthe cuspidata* var. *villosa* = San Francisco spineflower
- *Gilia capitata* ssp. *chamissonis* = dune gilia
- *Stellaria littoralis* = shore chickweed

Vegetation mapping

Vegetation mapping has identified a diverse variety of habitat types, with large portions of Tom's Point occupied by coyote brush and non-native grasses, coastal saltmarsh, north coastal strand, iceplant, introduced perennial grasses, beautifully intact California coastal prairie. Some smaller areas are primarily occupied by native species: *Carex* spp., *Juncus* spp., dune lupine, pickleweed or salmonberry. Most of the staff work at Tom's Point is compiling a fine-scale assessment of the native species that are still there, and addressing these questions:

- How to manage those species that are still intact?
- How to manage recovery of those species that are in the "emergency room"?
- How to conceive and carry out full restoration of those species that have been lost?

Important Research

Past and current restoration efforts have been done at Tom's Point by others. Jeff Corbin, Carla D'Antonio, Chris DiVittorioha, Meredith Thomsen, and others looked at the biology of both native and introduced grasses and soil-nitrogen dynamics. Results show that mean productivity and total productivity of three exotic annual grasses (*Avena barbata*, *Bromus diandrus*, *Vulpia myuros*) declined with the addition of native competitors planted at a systematic concentration, whereas productivity of exotics over the same period increased in areas that had not been planted with native competitors. These studies have provided tools that can be assembled into restoration plans.

Another fine example of restored coastal prairie is at Cypress Point, another ACR reserve on Tomales Bay. Years ago, plants of the grasses *Deschampsia cespitosa* and *Elymus glaucus* were planted out there, and effort which has been largely successful. One question there is of increasing interest to restorationists: Whether and how to manage coastal prairie against other natives, especially during the succession of prairie to woody shrubs, specifically *Baccharis pilularis*.

Bolinas Lagoon Reserve is another campus of the ACR system, with a typical North Coast history: It was originally redwood and Douglas fir cut down in the late 1800s; the hardwoods that grew there were cut down for cordwood, replaced by woody scrub; that was cleared and burned for dairy grazing land. Forty years ago, ACR removed the cattle from those hills, so now the question is how best to manage the current reverse succession and maintain diverse coastal prairie.

Bouverie Preserve's Sonoma Valley grasslands

Bouverie Preserve in eastern Sonoma County is where ACR has the most grassland to work with, a combination of coastal and valley prairie habitats and species. Ten years ago, cattle were taken off renowned wildflower sites, and the re-growth of exotic annuals has greatly diminished the wildflowers. Now managed grazing has returned as a method, and oaks are being planted where they once grew, protected by cattle exclosures. Data is being collected to compare which species are encouraged or discouraged by grazing practices.

Nitrogen deposition, which encourages fast-growing European grasses, is the subject of another study. This measures dry nitrogen deposition generated by adjacent automobile traffic, noting effects from a local highway along a gradient up the hill. This work is being done in collaboration with Stuart Weiss and Jeanne Wirka (shown driving t-posts to support a passive nitrogen sampler array). ACR's methods of grassland management include grazing experiments, and using machinery to mow, remove or limit invasive non-natives. His team applies the same strategy as that used for wildfires: with limited resources and personnel, *control the outbreaks first*, before addressing large, established populations. This method is referred to as Early Detection, Rapid Response (EDRR).

A current exciting pilot experiment at Bouverie is monitoring the effects of European slug herbivory on structuring grasslands. The species array includes relatively equal native and non-native perennial grasses, forbs, etc., but abundance is much greater among the European species. Experiments have shown that slug exclusion increases species diversity, decreases the number of grasses overall, increases the number of forbs, and decreases the number of European species. Findings shows that native plant seeds don't do well, whereas established outplantings of native prairie plants do quite well, so the question is: What happens between the seed and seedling stages? Could slugs be playing a significant role here?

Daniel observed that our job is to figure out the tools, and we are close to the answers. He finished up with questions about coastal prairie restoration that he suggests we ask:

- What was growing there before disruption?
- What can be grown there now?
- What is preventing species from recruiting there?
- How to turn answers into tools?
- What do we want for coastal prairie, regardless of what was there originally?

Prairie Community Research at the Bodega Marine Reserve

Presenter: Peter Connors – University of California, Davis – Bodega Marine Laboratory

Biography: *Peter Connors has been at the Bodega Marine Laboratory since 1971, and served as Reserve Manager from 1986 to 2005. He has investigated the role of bush lupine in transforming coastal prairie and has experimented with methods of control of invasives and with revegetation by native plants. In 1993 he rediscovered the "presumed extinct" Showy Indian Clover, and has continued to work with this species in the wild and in a managed population.*

Map: Bodega Marine Reserve (Figure 1)

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

Peter first delineated the five main categories of grassland research that have been done by BML scientists, especially those related to non-native invasive species. BML has produced about 200 publications based on species in the BML grassland.

One category of research at BML has focused on competition, invasion, and water relations (Alpert, Thomsen, Corbin, Muir). A second body of research has looked at questions of herbivory effects on communities (Alpert, Cushman, Maron).

The focal point of a major category of BML's grassland interest is yellow bush lupine (*Lupinus arboreus*) because it is the dominant shrub in and near BML grasslands. Their studies have produced numerous publications on aspects of bush lupine dynamics and conversion from native to invaded prairie (Maron, Connors, Strong and coworkers). Don Strong and his coworkers have investigated the different trophic levels involved in the bush lupine food web, from fungi to nematodes to insect herbivores to lupines. Peter Connors and John Maron looked at effects of bush lupine on coastal grassland, and their results demonstrate that through nitrogen enrichment, bush lupine has converted and continues to convert relatively native coastal prairie into much weedier, non-native plant communities.

Another category of study concerns topics in soil chemistry, and how that relates to species invasion and restoration issues (Maron, Jefferies, Alpert, Bennett).

A final body of research investigates population genetics and its relationship to restoration (Rice, Knapp). One study asks how locally adapted different grasses are, questioning how much a species might lose in fitness if seed is gathered from one area to be planted in another.

Grassland management research projects have also been carried out by the Bodega Marine Reserve management staff. They have done *ad hoc* control of many introduced species, either to control or to eliminate them, along with some revegetation work. They have been able to successfully control iceplant (*Carpobrotus* spp.*)* since 1986, using Roundup. *Lupinus arboreus* (bush lupine) seeds germinate easily in native grassland, eventually fostering the growth of weedy species. Reserve staff pull seedlings that are at the edge of dense bush lupine patches in native grassland, so that the patches do not enlarge.

Holcus lanatus continues to be the species that poses the biggest problem for the grasslands at BML, so most of their management efforts address this species. The Reserve has been mapped to show *Holcus* invasion and research sites, and also to track those native species that have restricted range, in order to focus efforts in those areas. They have experimented with different methods of eliminating a perennial non-native species within perennial native grassland. Areas invaded with *Holcus* have been treated with one of two herbicides: Roundup, or Poast, which is relatively monocot-specific. In 2004, six plots were treated in this experiment. They found that both herbicides were effective in killing *Holcus*, but after 15 months, plots treated with Roundup returned to *Holcus* almost completely, because there were more *Holcus* seeds on the ground than seeds of any other species. Plots treated with Poast showed reduced cover of new *Holcus*, and also showed enhanced cover of a few natives, especially rhizomatous ones such as yarrow. One site differed in its results. Their next experiment will be a more elaborate comparison of both herbicides, applied in different seasons.

Burn trials have also been done on *Holcus lanatus*, with burning done in February and March. The conclusions were that burning can kill *Holcus* if the patch has lots of dead thatch, as in dense older patches, and the weather conditions are dry, to encourage a hotter fire.

Point Reyes National Seashore

Presenter: John DiGregoria – Point Reyes National Seashore

Biography: *John DiGregoria started with the National Park Service in January 2006 as the Point Reyes National Seashore Range Management Specialist. Prior to that, he spent time working in various aspects of ecological restoration. Immediately prior to working at Point Reyes he worked for the U.S. Fish and Wildlife Service in Carlsbad, California.*

Map: Pierce Point, D Ranch (Figure 1)

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

The pastoral zone at Point Reyes National Seashore (PRNS) and the northern portion of Golden Gate National Recreation Area (GGNRA) encompasses 28,000 acres on the Marin coast. The entire pastoral zone is managed by PRNS staff. PRNS lies to the west of the San Andreas Fault and has different geology and climate than GGNRA which lies to the east of the fault.

John describes his current work as "political ecology." "Political Ecology" is the process of working with people to manage natural resources. At PRNS and GGNRA, the beef ranchers and dairies were bought out to create the parks. Currently PRNS staff manage 6,000 animal units on the 28,000, including 25 beef permits and six dairies within the entire pastoral zone.

In the 1970's, a population of tule elk were reintroduced at Pierce Point, at the north end of the peninsula. There is also a smaller population in the area of Drake's Estero. UC Berkeley students are conducting extensive research on the tule elk population at PRNS.

Recently the park collected 15 pounds of California brome seed for seed increase by an independent grower. The park has received 900 pounds of seed from this effort. In the summer of 2006, they collected 25 lbs. of blue wildrye to be grown out in seed increase plots for future use. The park is also buying seed from outside growers for use in the reestablishment of native grasses within the pastoral zone.

Since the land is being grazed by cattle, cattle can be used as a management tool. Park staff are working with the ranchers to modify their management practices to enhance park resources. When attempting to reestablish native grasses into areas that were disturbed by intensive agriculture (tilling for crops) or animal concentration, cattle can be used to reduce seed production and thatch buildup prior to seeding.

Invasive species are problematic in the pastoral zone. A major problem occurring at PRNS is the invasion of velvet grass into upland grasslands. With wet winters and foggy summers, this wetland species is establishing in native coastal prairie. University students are currently conducting research on park lands on velvet grass and wild radish.

Some of the issues that the park has to manage when attempting to protect coastal prairie are the spreading of manure, trailing, access to riparian areas, and animal concentration around gates,

water troughs and feeding areas. Manure spreading is problematic because the manure covers coastal prairie often killing the native grasses. The increased nitrogen in the soil can promote invasion by invasive grasses and forbs. Often poison hemlock and thistles are the first species to colonize heavily manured areas. Trailing is a problem because it opens areas to erosion and invasive species colonization. Cattle can quickly degrade a riparian area by trampling and destabilizing stream banks and removing understory vegetation. Concentrating cattle in areas results in a denuded area subject to erosion.

The park has been attempting to reestablish native grasses on 60 acres of D Ranch in an area dominated by ryegrass. The area is no longer grazed. In an attempt to manage the ryegrass and establish native grasses, the park burned the area one season, then mowed, burned and drill seeded the area with California brome the following year. The timing of the burns and mowing did not reduce cover of ryegrass. Early surveys have not detected establishment of California brome.

A project to reintroduce Showy Indian Clover is underway. This is occurring in an area with intact tufted hairgrass coastal prairie. The majority of this intact coastal prairie has not been invaded by the locally ubiquitous weed species sheep sorrel, buckhorn plaintain, or ryegrass.

John finished his presentation with the quote by James Galvin:
“To be eaten or to be burned — grasses have two fates, both of which it survives.”

The District Approach to Conservation of Coastal Grasslands

Presenter: Tom Robinson – Sonoma County Agricultural Preservation & Open Space District

Biography: *Tom Robinson has been a Conservation GIS Analyst, with Sonoma County Agricultural Preservation and Open Space District for 3.5 years. He recently helped produce* Connecting Communities and the Land: A Long-Range Acquisition Plan, *the District's 10-year guiding document for conserving farmland, scenic and natural areas in Sonoma County. B.S. in Ecology, UC San Diego; Certificate in Geographic Information Science, San Jose State University. Research interests and job duties include landscape- and site-level conservation planning for biodiversity.*

Map: Estero Americano Preserve, Stillwater Cove (Figure 1).

Presentation Summary: (Presentation transcribed by Kathleen Harrison)

Tom Robinson introduced his presentation by explaining that the approach of the Sonoma County Agricultural Preservation and Open Space District (OSD) to coastal prairie conservation is through planned priorities for agricultural conservation easements in highly productive coastal grasslands between Bodega Bay and Petaluma. In addition to those lands, the grasslands and terraces stretching northward from Bodega Bay to the border with Mendocino County are prioritized for outright purchase, to be added to existing state and regional parks and land trust preserves.

The mission of the OSD is to permanently preserve the diverse agricultural, natural resource and scenic open space lands of Sonoma County, for future generations. They accomplish this through permanent conservation of land, clearly identifying the conservation purpose of each acquisition.

The OSD is a special district created by voters in 1990 in response to public concern about loss to urban sprawl of agricultural, scenic and open space lands. The district permanently protects land for benefit of the public. It is funded by a ¼ percent county sales tax that voters have extended to 2031. Their principal conservation tool is permanent conservation easements with willing landowners.

In 1989, public concern about urban sprawl and the loss of agriculture led county officials to place on the county general plan a call for creation of an open space district that would further state policy on open space preservation and implement the county general plan's policy on agriculture and open space.

To date, the OSD has protected 70,000 acres in the county, which includes 142 properties. Local funding has been very important in leveraging state and federal funds.

In June 2006, the previous long-range acquisition plan was updated to increasingly connect communities and the land. Meetings with the public, city and county officials, and local experts in farming and biology led to the inclusion of community concerns. The renewed plan directs the OSD's focus to lands with the greatest conservation values.

The OSD has a framework for selecting conservation potential, which includes four categories: 1) farms and ranches, 2) greenbelt and scenic hillsides, 3) water, wildlife and natural areas, and 4) recreation and stewardship. Projects that satisfy goals from more than one category have enhanced conservation value.

Due to the framework of this acquisition plan, coastal grassland conservation is accomplished through an intersection with the coastal agriculture priorities set forth in the farms and ranches category, and with the park expansion polices in the recreation and stewardship category, since grasslands can fall under one or both of those categories.

Interested landowners sometimes suggest projects, but the OSD also proactively seeks possible acquisitions based on the potential for building a connected block of protected farms, ranches and dairies, or expanding existing parks along the coast. They use staff knowledge and GIS to identify potential project areas, and work closely with partner organizations and agencies to combine efforts and connect the system of recreational lands. Project selection proceeds from identifying opportunities to reviewing suggestions based on selection criteria (*e.g.*, condition of property, health of grassland), then taking into account other natural resource priorities (*e.g.*, sensitive species, water recharge areas), and applying performance measures.

Sonoma County's large "Coastal Agriculture Area" dairy belt was originally mapped as an area of conservation priority due to its value as a critical grazing area for livestock. In the updated plan, an area of inland, smaller agricultural parcels was split off that, and now falls under the conservation category called "Small Farms and Ranches Near Cities."

The partners that work with the Sonoma County OSD make much more conservation possible, since legally, the OSD cannot use sales tax money to operate and maintain lands used for open public access. To date, acquisition partnerships on the coast include: California State Park system (Red Hill, Willow Creek, Carrington Coast Ranch), the regional park system (Stillwater Cove), the Sonoma Land Trust (Estero Americano Preserve), and the California State Coastal Conservancy.

In summarizing, the presenter offered the question: Where are grasslands in relation to OSD priorities? He answered that the OSD has done little grassland management, so far only limited grazing. What this coastal grassland group comes up with as priorities and management strategies should be fed into the Sonoma County OSD decision-making process, for their future consideration.

Strategic Activities for Coastal Prairie Conservation

In this section, we synthesize input from workshop participants (Appendix C) into a summary of strategic actions for the conservation of coastal prairie in Sonoma and Marin counties. Conservation activities are divided into 6 priority areas for conservation:

1. Guiding Principals and Approaches for Effective Conservation
2. Conservation Planning: Characterization, Mapping, Risk Assessment, and Prioritization
3. Public Awareness through Outreach and Education
4. Policy Changes to Protect Coastal Prairie
5. Sustainable Land Use and Management Practices
6. Field Research for Identifying Effective Management and Restoration Techniques

We begin each section with a description of conservation challenges specific to coastal prairie in Sonoma and Marin counties. We then describe priority actions that received high priority ratings by workshop participants (rankings are shown in Appendix C). We urge the reader to further consult Appendix C for levels of detail that are not included in this summary.

1. Guiding Principals and Approaches for Effective Conservation

Conservation Challenges

a. Coastal prairie communities and the processes that sustain them occur on a variety of spatial scales, cross property boundaries, and are supported by processes that expand beyond the life span of humans.

b. Individual local efforts that conserve remnant patches will not be effective for conserving prairie if processes need to be addressed at a regional scale.

c. Lack of communication can create inefficiencies.

   Example from Sonoma and Marin Counties: There was general lack of awareness among workshop participants about each other's activities in coastal prairie management and conservation projects in our area.

d. Short-term efforts, such as single workshops or project meetings, will not be able to sustain and carryout the concerted conservation activities needed to conserve coastal prairie over extended periods of time.

Priority Actions

a. As much as possible, coastal prairie conservation projects, proposals, and activities in Sonoma and Marin counties should be:
   i. Collaborative – Conservation of coastal prairie on a regional scale will not be possible without a highly collaborative effort among a wide variety of agencies, organizations, universities, landowners, and citizens.

ii. Inclusive – Given the diverse and changing land ownership patterns in Sonoma County, a long-term, multi-stakeholder effort is needed. Conservation efforts are more effective if they evolve organically through the combined strengths and needs of all stakeholders.
iii. Communicative – Conservation efforts should set communication among landowners, researchers, managers, policy makers, etc. as a high priority.
iv. Efficient – Given limited resources, it is wasteful to duplicate efforts. For example, we should not create a whole new stand-alone education program when we can partner with existing programs to integrate coastal prairie information into their activities.
v. Long-lasting – Structure conservation efforts and make management changes such that they will be sustainable across generations.

b. Identify a working group that will focus on enhancing communication, collaboration, inclusiveness, and efficiency and can take the lead in maintaining momentum of coastal prairie conservation efforts.

2. Conservation Planning: Characterization, Mapping, Risk Assessment, and Prioritization

Conservation Challenges

a. Because resources for conservation action are limited, it is important to know which projects will be the most effective for the long-term conservation of coastal prairie. This prioritization process requires analysis and integration of key types of information about coastal prairie, including distribution, geographic/genetic variability, biological processes necessary for sustainability, and threats.

Examples from Sonoma and Marin Counties:

i. Little information is available on the distribution of coastal prairie fragments, especially in Sonoma County where detailed county-wide vegetation maps are unavailable.
ii. The diversity of coastal prairie community types has not been fully described. As a consequence, the types of coastal prairie needing separate recognition for conservation action are unknown.
iii. Habitat quality of remaining coastal prairie has not been characterized regionally.
iv. While a number of threats to coastal prairie are identified (e.g., exotic grasses and forbs, invasion by trees or shrubs, inappropriate types or levels of grazing, changes in land use), the location and extent of these threats to coastal prairie habitat is unknown.

b. Land managers and property owners are unaware of the value and role of their properties in the preservation of coastal prairie on a regional scale. Recommendations to landowners might change if regional conservation planning revealed that certain areas were more critical for the preservation of some native grass species.

c. Due to the high costs of restoration and management activities, prioritization for these projects is particularly important. A regional conservation plan would identify key areas where restoration and management are needed if coastal prairie is to be maintained in our region.

Priority Actions

a. A regional coastal prairie conservation planning effort is needed to identify goals for preserving a network of coastal prairie habitats in Sonoma and Marin counties. Key pieces of this plan described by workshop participants included:
   i. A map of coastal prairie in Sonoma and Marin counties showing quality and types of coastal prairie habitat.
   ii. A map in Sonoma and Marin counties showing threats to coastal prairie (e.g., development, land use practices, invasive species, shrub and tree encroachment).
   iii. A map of priority management areas needed to conserve a network of coastal prairie habitat in Sonoma and Marin counties.

3. Public Awareness through Outreach and Education

Conservation Challenges

a. Coastal prairie is largely an unknown plant community. Lack of knowledge about this rare plant community is widespread among all sectors of society, including agencies, government, schools, and conservation groups. This poses a significant barrier to preservation. "In the end, we conserve what we love, we love what we understand, and we understand what we are taught." — *Bab Dioum, African conservationist*

   Examples from Sonoma and Marin Counties:
   i. Lacking awareness of the existence and value of coastal prairie, landowners and land managers plant non-native perennial or annual grasses in coastal prairie to prevent erosion or increase the productivity of rangeland.

   ii. Landowners new to the region and unaware of the value of coastal prairie, allow the property to be completely overgrown with coastal scrub or Douglas firs in the belief that forest is "preferable" to grassland.

b. "Grasslands are not sexy." While redwoods, due to their enormous size and grandeur, can readily capture the imagination of the public, grasses are far more subtle. Transferring enthusiasm for and relaying the importance of native grasslands will take an extra effort.

c. Using a one-size-fits-all approach to teaching a diverse audience (e.g., public, agencies, policy makers, researchers, K-12 students, landowners, ranchers) will not be successful. A clear understanding of the interests and concerns of each group will be needed. For example, the public may value aesthetics and habitat conservation while K-12 students tend to be more interested in the animals that live in coastal prairie habitat. On the other hand, ranchers will need to consider the economic feasibility of managing for native species.

Priority Actions

a. Develop educational materials and programs that bring awareness and appreciation of grasslands to the general public, private landowners, managers, ranchers, planners etc.

b. Create opportunities for on-the-ground experiences, such as demonstrations and tours, since these are often the most inspirational and enhance learning.

4. Policy Changes to Protect Coastal Prairie

Conservation Challenges

a. Despite its rare status, coastal prairie is not adequately protected by state regulations, and counties vary widely in the degree of protection and oversight provided. Lack of consistent and adequate policy also means that many botanists conducting surveys do not recognize, describe and make recommendations for mitigation or management of coastal prairie.

   Example from Sonoma and Marin Counties:
   Workshop participants highlighted policy change needs for Sonoma and Marin County Plans, Farm Bill, and State Parks.

Priority Actions

a. Educate and work with policy makers on the county and state levels to incorporate protection for coastal prairie in regulatory and planning documents.

5. Sustainable Land Use and Management Practices

Conservation Challenges

a. While some information exists on coastal prairie management, best management practices for conserving coastal prairie have not been developed, and recommendations are often ambiguous.

   Examples from Sonoma and Marin Counties:
   i. Many landowners and land managers are willing conservation partners but don't have information about how to manage coastal prairie optimally.
   ii. California State Parks currently do not allow grazing, but might consider changing their policy if there were information that supported such a change. That might also require a change in the common public perception that grazing is "bad".

b. Infrastructure for the management of coastal prairie (e.g., grazing animals, installation and maintenance of fencing, planting, seed sources, herbicide, and equipment) can be cost-prohibitive.

Example from Sonoma and Marin Counties:
On Coleman Valley Ridge there is no longer adequate perimeter fencing to reintroduce grazing animals safely. Infrastructure, such as fencing and water, needed to support grazing is often no longer functional when land use changes from ranching to private estate.

c. Ranching practices have been shown to maintain the diversity of native coastal prairie species in some areas. However, ranching seems to be declining in the region. If changes in ranching practices are needed to sustain coastal prairie, the conservation community needs to understand how these changes will affect the economic viability of ranch operations and collaborate to find solutions.

   Examples from Sonoma and Marin Counties:
   i. In Sonoma County, working ranches are rapidly transitioning to non-ranching private estates or public land. This decline in ranching and associated infrastructure will need to be addressed by the conservation community if grazing is to continue as a management tool for coastal grasslands.

   ii. The economic viability of local ranches is dependent upon a network of local businesses that support them (e.g., slaughter yards, supplemental hay operations, and large animal veterinary practices). Should the number of local ranching operations decline to the point that these services close, the remaining ranches will become even less economical due to the increase in transportation costs.

Priority Actions

a. Provide landowners and managers with guidelines for management that will enhance the diversity of coastal prairie.

b. Develop shared resources, such as materials and funding, for common management needs (grazing, fencing, fire crews, seed banks, volunteer crews, equipment).

c. Work to maintain economically viable ranching operations with their associated infrastructure. These operations may enhance diversity in some coastal grasslands and could provide grazing animals and expertise needed to re-introduce grazing on non-ranching properties.

d. Work with local Resource Conservation Districts and other appropriate agencies to improve conditions for ranching in the region.

e. Increase communication and understanding among stakeholders who share an interest in grassland preservation.

6. Field Research for Identifying Effective Management and Restoration Techniques

Conservation Challenges

a. Critical information needed by managers for effective conservation is not available.

   Examples from Sonoma and Marin Counties:

   i. The recent rapid spread of invasive perennial grasses (notably velvet grass, *Holcus lanatus*), which can form large monocultures, was noted by many workshop participants as an emerging and significant threat to coastal prairie in Sonoma and Marin counties. Effective methods for controlling and eradicating velvet grass have not been developed.

   ii. Field studies in other California grasslands have shown that grazing and/or burning can enhance native species composition of grasslands. However, the efficacy of these techniques in Sonoma and Marin coastal prairie communities has not been well studied. Peter Alpert's study of prairie on coastal bluffs at the Bodega Marine Reserve showed that at this site grazing was detrimental to natives. However, research is needed to develop optimal grazing and burning regimes that can be turned into effective management prescriptions at individual sites.

   iii. A recent and ongoing study by the Coastal Prairie Stewardship Study determined that burning did not harm two common native grasses, purple needlegrass and California oatgrass, and reduced the thatch that impedes growth of forbs. This burning treatment, and to a lesser extent light grazing, also reduced cover of two non-native grasses, ripgut brome and rattlesnake grass. Opening up the habitat, however, encouraged expansion of non-native forbs, not natives, probably because the non-natives were much more common before the burn. More future attention needs to be paid to the non-grass components of the ecosystem if restoration is to be fully successful.

   iv. Lack of species-specific natural history information for native and exotic grasses hampers the ability to develop site-specific management prescriptions. Grassland biologists and managers have long-known that species show different responses to similar environmental conditions (e.g., grazing, burning, rainfall, competition, etc.). Research on species-specific responses to management treatments is needed to develop site-specific management plans.

b. The most pressing management questions are frequently not addressed by researchers. The disconnect between managers' needs and researchers' efforts can be due to lack of communication, differences in objectives, or lack of funding for certain types of questions.

   Examples from Sonoma and Marin Counties:

   i. Managers at the workshop requested new research that produced cost-effective solutions, scalable field management techniques that could be applied on small and large scales, results specific to species and habitats in their area, and tools and techniques in compliance with their land use policies (e.g., some management restrictions include no grazing or no herbicides).

ii. Researchers noted that they could not address these specific issues with funding sources that address other questions. They requested that funds be made available so that these issues could be specifically targeted.
iii. Researchers and managers move in different circles and do not often come into contact with each other. When they do, they sometimes speak different languages or have different interests.

c. Ongoing management activities are underutilized as research opportunities (i.e., adaptive management). As much as possible, management should be designed in collaboration with researchers who can design treatments in a manner that enables a statistical evaluation of the effectiveness of the management effort.

Priority Actions

a. Conduct research that provides critical information needed by managers. Critical information needs highlighted by managers in Sonoma and Marin are:
   i. Control and eradication of velvet grass
   ii. Optimal grazing and burning regimes
   iii. Site- and species-specific variability in response to management treatments

b. Include a research component in ongoing coastal prairie management and restoration projects to increase understanding of the effectiveness of management and restoration actions.

c. Develop research projects collaboratively between researchers and land managers/owners to ensure that the project will address specific needs.

Summary

Coastal prairies in Sonoma and Marin counties are some of our least well-known vegetation community types. The Sonoma–Marin Coastal Prairie Workshop highlighted an urgent need to engage in a variety of conservation efforts to protect and restore these diverse communities. Conservation actions are needed at the most basic levels of planning and action. As an example of this need, workshop participants gave the highest priority ranking to obtaining a map of the location, types and quality of coastal prairie habitats.

The six priority areas for conservation developed at the workshop are a first approach to identifying critical activities needed for coastal prairie communities in Sonoma and Marin counties. We urge the reader to incorporate priorities identified in this document into ongoing and future projects. For example, a management project eradicating invasive species from coastal prairie would also benefit by a collaboration that incorporates research and educational needs described in this document.

We also urge the reader to follow the guidelines for project approaches developed at the workshop. Projects should be inclusive, collaborative, non-redundant, and sustaining. We hope you will participate in the Sonoma–Marin Coastal Grasslands Working Group and seek out like-minded people interested in collaborating on coastal prairie projects (Appendix D).

Successful conservation planning requires an interdisciplinary and reiterative approach among biologists, planners, and private citizens. This document is a first step towards a regional conservation approach that we anticipate will develop, grow and change as participants continue to incorporate new information and expertise. We hope it will be a valuable resource to agencies, organizations, and individuals interested in moving forward to achieve a common vision of thriving and self-sustaining coastal prairie communities in our region.

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Appendices

A. Workshop Agenda
B. Workshop Participant Contact Information
C. Prioritized List of Conservation Activities Generated By Workshop Participants
D. Participants Interested in Collaborations
E. Coastal Prairie Overview and Project PowerPoint Presentations
   (CD enclosed on back cover of this report)

Appendix A: Workshop Agenda

Sonoma–Marin Coastal Prairie Workshop:
Identifying Conservation and Research Priorities for Coastal Prairie in Sonoma and Marin Counties

UC Davis Bodega Marine Laboratory
November 6, 2006

AGENDA

8:30-9:00 Check-in and Arrival
The workshop will be held in the BML Lecture Hall unless otherwise noted below.

9:00-9:10 Welcome & Introductions
Claudia Luke, UC Davis Bodega Marine Laboratory

9:10-11:00 Coastal Prairie Overviews

9:10-9:20	David Amme, East Bay Regional Parks – Coastal prairie overview
9:20-9:30	Sasha Gennet, UC Berkeley – Review of grazing effects
9:30-10:00	Todd Keeler-Wolf, California Department of Fish and Game – Vegetation mapping
10:00-10:30	Jeanne Wirka, Audubon Canyon Ranch – Control and restoration techniques
10:30-11:00	Grey Hayes, Elkhorn Slough Coastal Training Program – Coastal prairie outreach programs

Break (11:00-11:15)

11:15-11:55 Sonoma–Marin Coastal Prairie Projects – Part 1

11:15-11:25	Brendan O'Neil, California State Parks
11:25-11:35	Philip Northen, Sonoma State University
11:35-11:45	Peter Alpert, University of Massachusetts/BML
11:45-11:55	Dan Gluesenkamp, Audubon Canyon Ranch

Lunch (12:00-1:00) in <u>South Lounge</u>

Optional Coastal Prairie Walk (12:30-1:00)

1:00-1:40 Sonoma–Marin Coastal Prairie Projects – Part 2

1:00-1:10	Peter Connors, UC Davis Bodega Marine Laboratory
1:10-1:20	Brock Dolman, Occidental Arts & Ecology Center
1:20-1:30	Jane Rodgers/John DiGregoria, Point Reyes National Seashore
1:30-1:40	Tom Robinson, Sonoma County Agricultural Preservation & Open Space District

1:40-3:15 Coastal Prairie Planning

1:40-2:00 Brock Dolman, Occidental Arts & Ecology Center - Introduction to afternoon activities

Breakout Sessions Held in Work Group Rooms

2:00-3:00 Breakout Group Brainstorming: "What steps do we need to take to maintain viable coastal prairie communities in Marin and Sonoma counties?"

3:00-3:15 Beakout Group Categorization of Ideas: Research, Conservation, Management, Education/Outreach, Organization

Break (3:15-3:30)

3:30-5:00 Planning Prioritization, Collaborations, and Next Steps

3:30-4:30 Reconvene and tabulate ideas

4:30-4:45 Participants prioritize steps and participation interests

4:45-5:00 Summary, next steps, and workshop evaluation

Wine and Cheese Social (5:00-6:30) in South Lounge

No-Host Dinner (6:30-8:00)

Dinner reservations at a nearby restaurant will be made for those participants who would like to continue discussions over dinner.

Appendix B. Workshop Participant Contact Information

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Appendix C. Prioritized List of Conservation Activities Generated By Workshop Participants

Afternoon breakout work groups were asked the same question: "What do we need to do to conserve coastal prairie in Sonoma and Marin counties in the next 10 years?" At the end of the brainstorming session, a facilitator helped them to organize their ideas into conservation, education, management, research, and organization categories. Work groups then reconvened and created a summary list of ideas from all work groups. To quickly reach a consensus of conservation priorities, participants were asked to mark six of the ideas on the summary list that they felt were "the top priority activities needed to conserve coastal prairie in the next 10 years."

The following list contains six priority areas for conservation created by this process. Each need or activity identified by work group participants is listed separately, with the category in parentheses and the number of priority marks following each idea. We provide some organization of the ideas (headings, and in some cases moving ideas from one category to another) to maintain consistency.

1. **ORGANIZATION: Guiding Principals and Approaches for Effective Conservation – 64 total "priority points"**

    1. (Organization) Collaborate on reaching landscape-level goals – 19
    2. (Organization) Best way to share information (including monitoring) between researchers, conservationists, managers, etc – 19
    3. (Outreach) Information needs to get to managers and back to researchers and resource agencies, decision makers – 16
    4. (Organization) Identify and reevaluate regularly clear goals for all categories – 3
    5. (Organization) Good record keeping – 3
    6. (Organization) Set up model for collaborative learning group – use Gold Ridge Estero project as pilot – 2
    7. (Organization) Organizational stability – 2

2. **CONSERVATION: Conservation Planning: Characterization, Mapping, Risk Assessment, and Prioritization – 65 total "priority points"**

    1. (Conservation) Mapping – need more, including threats – 19
    2. (Research) Mapping: remnant patches, threats, special areas, threatened species, ranching infrastructure – 15
    3. (Research) Database of on ground projects with standardized data – 11
    4. (Research) Collect historical land use data – 7
    5. (Conservation) Define what is natural – 4
    6. (Research) Define boundaries of coastal prairie and coastal prairie itself – 3
    7. (Research) Develop assessment tools for conservation – 3
    8. (Conservation) More consistent legal protection for ecosystems à la coastal zone protection – 3
    9. (Conservation) Develop conservation strategy to address configuration of coastal prairie – 0

3. EDUCATION: Public Awareness through Outreach and Education

Educational approaches and techniques for general public – 43 total "priority points"

1. (Organization) Need to make coastal prairie sexy. More information to conservation, protection groups so they can better target, protect land – 12
2. (Outreach) Public land/parks showcase best management practices for grasslands – 8
3. (Outreach) Kiosks, handbooks, education programs for kids – more education curriculum in all state parks – 6
4. (Outreach) Get kids on land – 6
5. (Outreach) Demonstration farms to show Best Management Practices (BMP's) – 5
6. (Outreach) Show people nice grasslands – 3
7. (Outreach) More outreach to public on management tools – 1
8. (Outreach) Outreach through land trusts etc. – 1
9. (Outreach) Continue education at watershed level – 1

Outreach to landowners, ranchers, non-ranching "estates" and absentee owners – 19 total "priority points"

1. (Outreach) Outreach to absentee owners, lessees, urban cowboys, ranchettes, new types of rural landowners – 8
2. (Outreach) Set up effective, efficient meetings with landowners –7
3. (Outreach) Create information to help ranchers recognize and avoid overgrazing and undergrazing – 3
4. (Conservation) Institutionalize good management into agricultural community – 1

4. (NOT ORIGINALLY LISTED AS A SEPARATE CATEGORY): Policy Changes to Protect Coastal Prairie – 0 total "priority points"

1. (Conservation) Better understanding of CEQA, other regulations, policy – 0
2. (Conservation) Recognition of coastal prairie in county general plans – 0

5. MANAGEMENT: Sustainable Land Use and Management Practices

Develop site-specific management plans – 55 total "priority points"

1. (Management) Develop management prescriptions for land managers – 14
2. (Management) Develop landscape level management plans – 11
3. (Management) Long-term monitoring of projects – 13
4. (Management) Get expertise to landowners – tell us what to do – 8
5. (Management) How do we manage succession and encroachment? – 3
6. (Management) How to make decisions with conflicting goals? – 3
7. (Management) Develop decision-making matrix – 3
8. (Management) Develop guidelines for manure management – 0
9. (Management) Livestock public use compatibility? – 0

Develop management tools and resources – 35 total "priority points"

1. (Outreach) Working lands boot camp for land managers – 13
2. (Management) Develop local seed source – 10
3. (Management) Develop infrastructure to rotate animals – 5
4. (Management) Funding for work crews – 4
5. (Management) Local burn team – 2
6. (Management) Make certified rangeland managers available to landowners – 1

Promote ranching and grazing practices that sustain coastal prairie – 51 total "priority points"

1. (Conservation) Promote durable sustainable ranching to provide long-term care of land – 8
2. (Conservation) Bring back elk – 7
3. (Conservation) Provide economic incentives, ensure confidentiality for landowners – 7
4. (Conservation) How do we manage for economic sustainability/gain – 6
5. (Organization) How can we create partnerships that can generate money for private entities? – 6
6. (Organization) Adapt 2007 Farm Bill for California – 6
7. (Organization) Create and maintain economically viable ranching in this area – 5
8. (Organization) Integrate/infiltrate into other working agriculture groups (weed management, wool growers) – 3
9. (Organization) Using farm subsidies to enforce coastal prairie conservation – 1
10. (Management) Exempt restoration projects from prevailing wages – 1
11. (Organization) Using farm subsidies to enforce coastal prairie conservation – 1

6. RESEARCH: Field Research for Identifying Effective Management and Restoration Techniques – 54 total "priority points"

1. (Research) Research burning/grazing regimes – 12
2. (Research) More research related to management prescriptions, include economic analysis – 11
3. (Research) Understand dynamics between plant communities – 6
4. (Conservation) Soil restoration/conservation (see more in outreach) – 6
5. (Outreach) More on soil, below-ground processes – 4
6. (Research) Set goals for research – 3
7. (Research) More autecology information – 3
8. (Research) Predator control studies – 2
9. (Research) Research based comparison of management regimes – 2
10. (Research) Study effects of invasive species – 2
11. (Research) Study below-ground processes – 1
12. (Research) Compare effects of various ungulates – 1
13. (Research) Study native plant forage values – 1
14. (Research) Research on gradients – 0
15. (Research) More literature surveys – 0

Appendix D. Participants Interested in Collaborations

After the afternoon session, each participant was asked to identify activities or projects in which they would like to participate. The following list represents those choices and is included to enable our readers to contact others who share their interests. The last names of participants are shown. Please use the participant contact information (Appendix B) to identify and contact the participant. *(Note: It was often difficult to discern exactly where each mark was placed on the worksheets, so we apologize if anyone finds their name in the wrong category. KK)*

ORGANIZATION/COMMUNICATION ACTIVITIES

- Collaborate on reaching landscape level goals
  DiGregoria, Hickey, Kraft, Esposito, Herrick, Sonoma County OSD, Northen, Luke, Calvi
- Best way to share information (including monitoring) among researchers, conservationists, managers, etc.
  Hayes, Sloop, Wirka, Liu, Northen, Chesnut, Howald, Hirst, Eviner
- Need to make coastal prairie sexy. More information to conservation/protection groups so they can better target/protect land
  Hayes, Wirka, Williams, Cooley, Prunuske, Amme, Annese, Flett, DiGregoria
- How can we create partnerships that can generate money for private entities
  Hirst, Symonds
- Adapt 2007 Farm Bill for California
  None listed
- Create and maintain economically viable ranching in this area
  Harston, Flett, Sonoma County OSD
- Integrate/infiltrate into other working agricultural groups (weed management, wool growers)
  Hickey, Wirka, Sloop, Immel, Williams
- Identify and reevaluate regularly clear goals for all categories
  Keeler-Wolf, Sloop, Williams, Prunuske
- Good record keeping
  Rodgers, Immel
- Set up model for collaborative learning group – use Gold Ridge Estero project as pilot
  Kraft, Hayes, Luke, Hirst
- Organizational stability
  Keeler-Wolf
- Using farm subsidies to enforce coastal prairie conservation
  None listed

CONSERVATION ACTIVITIES

- Mapping – need more, threats (see research needs)
  DiGregoria, Feinberg, Northen, Esposito, Kraft, Williams, Chesnut, Keeler-Wolf, Sonoma County OSD, Amme
- Soil conservation/restoration (see more on education/outreach)
  DiGregoria, Amme, Eviner, Muir, Bennett

- Define what is natural
  Immel
- How do we manage for economic sustainability/gain
  Harston, Hickey
- Institutionalize good management into agricultural community
  Hickey, Scolari
- Better understanding of CEQA, other regulations, policy
  None listed
- Bring back elk
  Kraft, Sliwa, Prunuske, Dolman
- Recognition of coastal prairie in county general plans
  Howald, Keeler-Wolf
- Provide economic incentives and ensure confidentiality for landowners (e.g., use NRCS confidentiality for landowners participating in data collection efforts)
  Wirka, Symonds
- Promote durable sustainable ranching to provide long-term care of land
  Flett, Prunuske, Scolari, Hickey, Eviner
- More consistent legal protection for ecosystems à la coastal zone protection
  None listed
- Develop conservation strategy to address configuration of coastal prairie
  None listed

EDUCATION ACTIVITIES

- Information needs to get to managers and back to researchers and resource agencies, decision makers
  Hayes, Rodgers, Eviner, Luke, Calvi
- Working lands boot camp for land managers
  Mahrt, Wick, DiGregoria, Sliwa, Cooley, Prunuske, Annese
- Public land/parks showcase best management practices for grasslands
  Hayes, Rodgers, Amme
- Outreach to absentee lessee owners, urban cowboys, ranchettes, new types of rural landowners
  Northen, Calvi, Symonds
- Set up effective, efficient meetings with landowners
  Hayes, Feinberg, Scolari, Amme, Symonds
- Kiosks, handbooks, education programs for kids – more education curriculum in all state parks
  Richmond, Flett, Liu
- Get kids on land
  Wirka, Sliwa, Wright, Muir, Sloop, Richmond, Annese, Sonoma County OSD, Flett
- Demonstration farms to show Best Management Practices (BMP's)
  None listed
- More on soil, below-ground processes
  Bennett

- Create information to help ranchers recognize and avoid overgrazing and undergrazing
  Hickey, DiGregoria, Calvi, Northen, Sloop
- Show people nice grasslands
  Hayes, Williams, Annese, Keeler-Wolf, Wirka, Sloop, Howald, Esposito
- More outreach to public on management tools
  None listed
- Outreach through land trusts etc.
  Hayes, Chesnut, Wright, Flett
- Continue education at watershed level
  Liu, Herrick

MANAGEMENT ACTIVITIES

- Develop management prescriptions for land managers
  Wirka, DiGregoria, Sliwa
- Long-term monitoring of projects
  DiGregoria, Liu, Flett, Howald
- Develop landscape level management plans
  Rodgers, Keeler-Wolf, Northen
- Develop local seed source
  Nelson, Richmond, Immel, Gluesenkamp, Amme, Annese, Sliwa, Esposito, Kraft
- Get expertise to landowners – tell us what to do
  Sonoma County OSD
- Develop infrastructure to rotate animals
  Amme, Sliwa, Flett
- Funding for work crews
  Symonds, Flett
- How do we manage succession and encroachment?
  O'Neil, Keeler-Wolf, Immel, Sliwa, Kraft
- How to make decisions with conflicting goals?
  None listed
- Develop decision-making matrix
  Gluesenkamp, Eviner
- Local burn team
  O'Neil, Sliwa, Wirka, Kraft
- Make certified rangeland managers available to landowners
  None listed
- Exempt restoration projects from prevailing wages
  None listed
- Livestock/public use compatibility?
  Eviner
- Develop guidelines for manure management
  None listed

RESEARCH ACTIVITIES

- General interest
  Muir, Bennett, Richmond, Luke
- Study means of controlling perennial invasive grasses
  Gluesenkamp, Kraft, Wirka, DiGregoria, Herrick, Liu, Luke, Amme, Muir
- Mapping: remnant patches, threats, special areas, threatened species, ranging infrastructure
  Kraft, Rodgers, Keeler-Wolf, Richmond, Northen, Muir, Luke, Sonoma County OSD, Hickey, Calvi
- Research burning/grazing regimes
  Alpert, Flett, Northen, Esposito, Sliwa, O'Neil
- More research related to management prescriptions, include economic analysis
  Amme
- Database of on-the-ground projects with standardized data
  Eviner
- Collect historical land use data
  Immel, Calvi, O'Neil
- Understand dynamics between plant communities
  Keeler-Wolf, DiGregoria, Nelson, Richmond
- Set goals for research
  Sloop, Kraft
- Define boundaries of coastal prairie and coastal prairie itself
  Richmond
- Develop assessment tools for conservation
  Keeler-Wolf
- More autecology information
  Richmond
- Predator control studies
  Calvi, Harston
- Research based comparison of management regimes
  Immel, Alpert
- Study effects of invasive species
  Northen, Nelson, Muir, Immel, Bennett
- Study below-ground processes
  Bennett, Muir
- Compare effects of various ungulates
  Sliwa
- Study native plant forage values
  None listed
- More literature surveys
  Sloop