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Habitat Restoration in California's Central Valley

Conference Program

29 April–03 May 2009 at Lake Natoma Inn

Name _____

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Field Trip Leaders

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Matt Gause *Senior Ecologist, Westervelt Ecological Services*

TRIP B

Andrew Fulks *Manager, Putah Creek Riparian Reserve, UC Davis*

TRIP C

Kent Reeves *Natural Resources Division Manager, County of Yolo Parks & Resources Department*

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Note: This Program Book was compiled by Susan Clark Coy, SERCAL Administrative Director, and Julie St. John, SERCAL Publications Director. Minor

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Reclaiming the Sacramento/San Joaquin Delta: Wetland Restoration in the Delta and Bay Region

Chair: **Kevin MacKay** *Senior Restoration Ecologist/Project Director, ICF Jones & Stokes*

Decker Island Habitat Improvement Project: an Overview at Completion.
Chad Aakre, Restoration Resources, 3868 Cincinnati Avenue, Rocklin 95765, c.aakre@restoration-resources.net.

Decker Island Improvement Project consists 5.57 acres of wetland restoration at the northeastern tip of Decker Island, near Rio Vista, California. Habitat design involved concentric planting zones radiating from the inside out within a finger shaped depression created by excavation for levee stabilization. Interior freshwater marsh transitioned to shallow sloped seasonal marsh leading to steeper sloped riparian woodland and grassland. Installation of 1,793 woody species and 3,446 herbaceous plugs occurred during the fall of 2005 and 2006. During the four year establishment period, absolute percent cover of herbaceous species and percent survival of planted woody species was measured to assess the projects progress toward meeting performance criteria. Annual spring and fall monitoring results show that at the conclusion of establishment (December 2008); the habitat improvement project has exceeded performance expectations for woody survivorship and weed control through a well designed and responsive irrigation and plant care strategy, coupled with a variety of manual and chemical weed management techniques. Herbaceous absolute cover of installed plugs within the seasonal marsh habitat zone did not meet performance expectations mainly due to competition with adjacent native and non-native vegetation for sunlight; however, other factors, such as plug installation density and habitat spacing, were also likely significant. Alignment of design specifications and natural ecological processes, such as succession, would likely have improved the chances of meeting performance criteria and resulted in other benefits such as higher habitat value and reduced maintenance cost.

Blacklock Restoration Project: 70 Acres Down…
Terri Gaines[1], Kristin Garrison[2]. [1]California Department of Water Resources, Delta-Suisun Marsh Office, PO Box 942836, Sacramento 94236,* tgaines@water.ca.gov. *[2]California Department of Water Resources, Environmental Information and Planning Branch,* kgarrison@water.ca.gov.

The Department of Water Resources (DWR), in cooperation with the California Department of Fish & Game (DFG), U.S. Bureau of Reclamation (USBR), U.S. Fish & Wildlife Service (FWS), and the Suisun Resource Conservation District (SRCD), has

continued

implemented the Blacklock Restoration Project in Suisun Marsh. Since the property was acquired in December 2003 using CALFED ERP and Suisun Marsh Preservation Agreement funds, these agencies have worked together to develop and implement a plan to restore these 70 acres of diked, managed marsh to tidal wetlands. Tidal restoration is a major component of the *Habitat Management, Preservation, and Restoration Plan for the Suisun Marsh* (Suisun Marsh Plan) currently being developed, In addition, CALFED ERP identified a goal of 5,000–7,000 acres of tidal restoration in Suisun Marsh. This project is the first tidal restoration to be implemented in Suisun. On October 4, 2006, a 61-foot-long breach was constructed in the preferred breach location along Little Honker Bay. In addition to the constructed breach, a natural breach occurred 400 feet to the west in mid-July 2006. The project goals and objectives are to 1) restore the area to a fully functioning, self-sustaining marsh ecosystem created through restoration of natural hydrologic, sedimentation and biological processes; 2) increase the area and contiguity of emergent wetlands providing habitat for tidal marsh species; and 3) assist in the recovery of at-risk species. Knowledge expected to be gained from this restoration includes rates of sedimentation and marsh development, channel network formation and overall geomorphology, hydrology, water quality impacts, and species use. Results can inform scientists and decision makers in long-term land use and restoration planning throughout Suisun Marsh. Current activities include implementation of a 10-year monitoring program and the use of adaptive management to achieve the goals developed for the site.
Details of the project are available online at **www.iep.ca.gov/suisun/restoration/index.html**

Recommended Best Management Practices for Reversing Subsidence on Delta Islands. *Brad Hall*[*1], *Brady McDaniel*[1], *Robert MacArthur*[1], *Keane Sommers*[2], *and Edward Schmidt*[3]. [1]*Northwest Hydraulic Consultants, West Sacramento 95691.* [2]*Nevada Irrigation District, Grass Valley 95945.* [3]*California Department of Water Resources, Sacramento 95814.*

The Sacramento-San Joaquin River Delta serves a variety of functions critical to the everyday life of many Californians. Among other uses, the Delta serves as a water source, an area of agricultural development, a critical habitat for numerous species, a recreational resource, and a home to many Californians. As development in California continues, infrastructure ages, and demands change, the Delta system as it is now exists appears to be unsustainable. Delta levees are at risk of a catastrophic failure. Delta islands have subsided to a depth of 20 feet below sea level in some places. This report examines the subsidence problem and proposes a suite of Management Practices (BMPs) to address the problem. Additionally a site specific plan is offered to address the subsidence problem on Sherman, Jersey, Webb, and Twitchell Islands. The plan presented here is designed to stop and reverse subsidence on Delta Islands while protecting existing uses and critical infrastructure. The approach offers an implementation plan that utilizes BMPs identified in background studies to provide a vision for a subsidence reversal program within the Delta. When possible, the plan is designed to minimize the impact on existing island uses. However, we acknowledge that significant changes to the Delta landscape must be realized in order to meet the needs of a growing state. The U.S. Geological Survey and the Department of Water Resources showed that hydrologic treatments such as managed wetland can reduce gaseous carbon losses from organic soils, thus reducing peat subsidence. The BMPs presented here involve a combination of managed wetlands, sediment enhanced wetlands, modified agricultural practices, and supplemental and enhanced access infrastructure. Island flooding and development of wetlands is a key component of the subsidence reversal program identified in this report. For the purposes of this plan, shallow flooding of the lowest areas with minimal groundwater cycling of the islands is recommended, thus minimizing dissolved organic carbon loading to the adjacent Delta channels. The flooding and wetland implementation should occur immediately after construction of cross and perimeter access roads. As the wetlands in the islands accrete the water level on the islands will be increased, increasing the net wetland area of the islands and increasing the overall rate of island accretion. The construction of subsidence reversal BMPs will occur in three phases of access infrastructure implementation, wetland development and growth, and site accommodation to accreted wetlands. Phases may be completed at the same time on multiple islands. Time periods for project implementation for the four Delta Islands analyzed herein are approximately 5 years, whereas the time period for attaining island accretion back to existing sea level conditions requires time periods on the order over which the island subsidence has occurred.

Design and Establishment of the Liberty Island Conservation Bank. *Carl Jensen, Wildlands, Inc. 3855 Atherton Road, Rocklin 95765,* cjensen@wildlandsinc.com.

The 165-acre Liberty Island Conservation Bank will consist of restored and created aquatic spawning and rearing habitat for special-status fish species, including delta smelt, in the northern Sacramento-San Joaquin Delta. The site is located at the bottom of the Yolo Bypass, necessitating a design that balances habitat restoration goals within the context of one of the most important flood control conveyances in

California. Lessons learned from the documented successes and failures of other fish restoration projects in the Delta were incorporated into the design, along with hydraulic design input by Philip Williams & Associates. Construction is scheduled for the summer of 2009.

Creation and Restoration: Designing Wetlands in a South Bay Valley. *Gale Rankin, Santa Clara Valley Water District, 5750 Almaden Expressway, San Jose 95118,* grankin@valleywater.org.

Two nine-acre freshwater wetland projects were recently constructed in the Santa Clara Valley after several years of planning and development. Few wetlands are present in this intensively used valley today, but historically, over 30,000 acres of freshwater wetlands existed. Our task was to provide one wetland in the northern, more urbanized part of the Valley, and one in the southern, more rural and agricultural area. An early and major challenge was to find feasible sites for situating freshwater wetlands. A geographical search was conducted using successive tiers of criteria to identify potentially suitable sites. The search resulted in the identification of a site suitable for wetland creation in the north and for wetland restoration in the south. The two project designs were then developed to accommodate each project's particular regional setting and site-specific characteristics, while also providing several common features such as adjacency to streams and support of native freshwater wetland vegetation and related wildlife. Two primary differences between the wetlands concern hydrology and mosquitoes. The northern urban wetland's hydrology is managed with water control structures, while the rural wetland relies upon and enhances the naturally-present shallow groundwater. The urban wetland design was greatly influenced by the need to control mosquitoes, while the rural was not. Despite the unique features of the two wetlands, wetland communities establishing at each location are similar.

Additional descriptions of the site designs will be presented with a summary of post construction conditions.

Water Primrose *(Ludwigia hexapetala)* Control for Giant Garter Snake *(Thamnophis gigas)* Habitat Restoration. *Sara Sweet*[*1], *Harry McQuillen*[2], *Eric C. Hansen, Consulting Environmental Biologist*[3], *Larry Rodriguez*[4], *and Jaymee Marty*[5]. [1]*The Nature Conservancy, 13501 Franklin Blvd., Galt 95632,* ssweet@tnc.org. [2]*US Bureau of Land Management, 13501 Franklin Blvd., Galt 95632,* Harry_McQuillen@ca.blm.gov. [3]*2020 U Street, Suite 300, Sacramento 95818,* echansen@sbcglobal.net. [4]*Robertson-Bryan, Inc., 9888 Kent St., Elk Grove 95624,* larry@robertson-bryan.com. [5]*The Nature Conservancy, 2015 J Street, Suite 103, Sacramento 95811,* jmarty@tnc.org.

The giant garter snake (*Thamnophis gigas*) (GGS) is a federally threatened species formerly found throughout a marsh on Badger Creek at the Cosumnes River Preserve (CRP). The Badger Creek population is genetically distinct from all others. Its local range has substantially shrunk over the past several years. Data from the marsh at CRP suggest that one explanation for the range reduction may be the recent expansion of water primrose (*Ludwigia hexapetala*), which has filled in GGS foraging habitat with a dense monoculture and potentially caused premature drying of the habitat during the critical summer active season for GGS. The impact of water primrose on GGS, however, remains debated by experts. In 2008 CRP began a pilot project to test whether restoration of open water results in the return of GGS to previously occupied areas of the marsh. The project also includes hydrologic characterization of the Badger Creek watershed and compilation of existing information about water primrose. Pre-construction surveys found dense concentration of GGS in remnant open-water areas, but essentially no usage by GGS of the primrose-infested restoration site. Hydrologic studies identified irrigated agriculture as the primary source of summer water for the marsh. In September 2008, a one-acre section of the marsh was excavated to create deeper open-water habitat and remove water primrose. During the remainder of the project, CRP plans to test whether GGS recolonizes the excavated area, to complete hydrologic characterization of the watershed, and to develop a management plan for water primrose.

Restoration Opportunities within Working Agricultural & Ranching Landscapes

Chair: **Carol Presley, PE** Pajaro River Regional Programs Manager, Santa Clara Valley Water District

Farmland Habitat Restoration in Yolo County—Results and Vision after 20 Years. *John Anderson, DVM, Hedgerow Farms, 21740 County Rd 88, Winters 95694,* janderson@hedgerowfarms.com.

The landscape of conventional farming in much of California provides numerous potential opportunities to incorporate biodiverse habitat that is compatible with intensive farming. Farmland habitat programs were actively promoted and initiated in Yolo County in the mid 1980s. Programs eventually included the establishment of complexes of native plants in hedgerows, windbreaks, road sides, field boarders, irrigation canals, drainage ditches, sloughs, tail-water ponds, and in non-cropped areas. Numerous plant species, over 60, in many complexes are now being used. Plant selection is based on flowering times for beneficial insects, ability to outcompete weeds once established, erosion control, shade, water requirements, food value for wildlife, structure and cover for wildlife, and potential to support pests. Weed control and irrigation techniques during establishment are important design considerations. Wildlife response to well established corridors has been exceptional. Large populations of winter migratory birds have been observed and there is increased spring and summer nesting of many passerines. Quail populations have grown. Raptors use the tree corridors for nesting and perching. Other vertebrates include deer, raccoons, opossums, skunks, otter, mink, beaver, jack and cottontail rabbits, rodents, shrews, bobcats, snakes, lizards, and tree frogs. Beneficial insect populations, (predators, parasitoids, and pollinators) are very high including many species of native bees. We have seen negligible negative impacts on local crop production (tomatoes, sunflowers, wheat, safflower, alfalfa, walnuts, almonds). Technical assistance and cost share programs will be discussed.

Conservation-Based Agriculture. *Jo Ann Baumgartner, Wild Farm Alliance, PO Box 2570, Watsonville 95077,* wildfarms@earthlink.net.

Farming can benefit from and support many interrelated native species and natural processes. Often though, farmers need a hand with conserving and restoring wild nature. It could be as simple as planting early spring flowering coyote brush, stretches of willows, and clumps of *Ceanothus* that support native pollinators who in turn visit early blooming crops like almonds, making the farm less dependent on imported pollination services. Then again with some assistance, the farmer might make it a priority to plant a native thicket full of shrubs and trees on an eroding ditch bank that will help conserve the land. Creative solutions to once-thought-of problem areas abound. That odd-shaped piece of the farmland unsuitable for cultivation and overrun with weeds could instead be attracting

pest-destroying parasitic wasps, minute pirate bugs and lacewings, when covered with a suite of sequentially flowering natives. Wet areas costing more to farm than they yield, can be restored to wetlands that filter pathogens and other pollutants so prevalent today in our landscapes. Rocky soils restored with native plants provide habitat for wildlife. Similarly, assisting the farmer in learning about and valuing an oak tree–almost an ecosystem by itself–helps to support the wild. Insect-eating bat species roost under loose oak bark, songbirds nest in the canopy, and thousands of species of insects buzz through an oak tree. Increasing farm diversity results in an increase in ecosystem services beneficial to human and wild communities.

Restoring Pollinator Habitat on Agricultural Lands. *Jessa Guisse, California Pollinator Outreach Coordinator, Xerces Society for Invertebrate Conservation (Portland OR), 516 V St., Sacramento 95818,* jessa@xerces.org.

Pollinators are an essential component of all environments, including agricultural systems. Without pollinators, at least 80 percent of our flowering plants could not reproduce. In California, production of several crop species is enhanced by or dependent upon insect pollination. These crops include almond, sunflower, squash, melon, blueberry, plum, apple, strawberry, tomatoes, avocado, and more. Despite their importance pollinators are declining in many areas as their habitat is converted to other land uses. In addition, pesticide use and other practices in agricultural systems also have reduced populations of pollinator insects. In places, however, this is changing. Conservation practices such as hedgerow plantings, integrated pest management, and management of ground cover and field borders are being used to restore nesting and egg-laying sites for bees, butterflies and other insects and preserve the benefits (and services) these insects provide. These efforts are further bolstered by new language in the 2008 Farm Bill that encourages the Natural Resource Conservation Service and the Farm Service Agency to facilitate pollinator conservation practices through the conservation programs they administer. The Xerces Society's Pollinator Conservation Program has been working in California — and across the country — with a wide range of government, agricultural, and non-profit partners to implement pollinator habitat conservation projects on working agricultural lands. In this talk, I will discuss examples of this restoration work and the diverse partnerships formed to make these projects happen.

Treatment Wetlands at the Edge of Vegetable Farms Targeting Nutrients, Pesticides and Sediment. *Bryan Largay, Elkhorn Slough National Estuarine Research Reserve, 1700 Elkhorn Road, Watsonville 95076,* bryan@elkhornslough.org.

Reducing nutrient loads, sedimentation and pesticide related toxicity in receiving waters are goals of growers and resource managers on the California Central Coast. Vegetated treatment systems such as treatment wetlands are a cost effective strategy to advance these goals, but will not be sufficient to reach them. This project established treatment wetlands on the edges of farm fields using design approaches that minimized impacts to the adjacent production agriculture. Existing drainage infrastructure was planted with floating vegetation in addition to grasses, sedges and rushes selected to minimize the risk of pest pressure and concerns about food safety. These systems received irrigation tailwater (runoff) and tile drainage and were designed to address water quality concerns specific to each site. Substantial reductions in turbidity and toxicity were observed. Reductions in nutrient load were inconsistent at the high loading rates these systems were typically subject to. At moderate loading rates, nitrate was substantially reduced. The four demonstration projects improved water quality at each site, but the benefits varied between sites, water quality parameters and evaluation periods. Overcoming this inconsistency would likely require substantially larger projects or lower loading rates achieved by improved nutrient management in the farm fields. The project was lead by the Resource Conservation District of Monterey County (RCDMC) in collaboration with participating growers and landowners, California State University at Monterey Bay, the University of California at Davis, the USDA Natural Resources Conservation Service and Largay Hydrologic Sciences, LLC.

Agricultural Easements Can Raise Interesting Issues Regarding Habitat Restoration. *Tom Scharffenberger, Principal, Scharffenberger Land Planning & Design, 523 17th Avenue, San Francisco 94121, 415.387.3077,* tscharf@pacbell.net.

Conservation easements over agricultural properties are sometimes in conflict with sensitive habitats both within and adjacent to agricultural properties. This seminar will discuss issues that conservation organizations sometime encounter when working with farmers to protect both agricultural and biological resources, and to reserve opportunities for future restoration. Tom Scharffenberger is a conservation planner who has assisted national, state and local conservation organizations, as well as individual landowners, in the negotiation and closing of easement and fee transactions. He has also prepared baseline documentation reports and assisted in the ongoing monitoring of conservation easements.

Watershed Protection, Resource Conservation, and Beyond: Pioneering Sustainable Practices at Fetzer Vineyards. *L. Ann Thrupp, PhD, Manager of Sustainability and Organic Development, Fetzer Vineyards, PO Box 611, Hopland 95449,* Ann_Thrupp@b-f.com.

In recent years, California winegrape growers have become increasingly involved in the implementation of various sustainable practices, including natural resource conservation, water and air quality protection and other environmental stewardship efforts. Fetzer and Bonterra Vineyards are leading pioneers in implementing sustainable and organic methods, and also contribute to education and outreach to others in the industry. In this presentation, I will summarize examples of practices that are being used at Fetzer and Bonterra Vineyards, focusing on methods being

continued

session 2 *continued*

used for watershed restoration and biodiversity conservation. The presentation will include results from a study that was recently undertaken with university researchers to analyze and quantify the impacts of habitat conservation practices on insect populations, and watershed management projects that have been carried out with the Resource Conservation District. I will also summarize other related practices that Fetzer has been using for over 15 years, including organic viticulture, energy, water, and soil conservation practices, wastewater treatment and reuse, renewable energy. Fetzer is also active in collaboration with regional efforts to promote "green" approaches. The presentation will conclude with lessons learned and potential impact on other farming systems.

Seed & Plant Material Techniques for Site Restoration

Chair: **David Amme** Wildland Vegetation Program Manager, East Bay Regional Park District

Sediment Source Control Handbook: An Adaptive Approach to Restoration of Disturbed Areas. *Michael Hogan and Kevin Drake*, Integrated Environmental Restoration Services, Inc., PO Box 7559, Tahoe City 96145,* mhogan@IERStahoe.com, kdrake@IERStahoe.com.

Erosion is one of the most pressing and widespread environmental threats of our time. Much of the available erosion control research is so narrowly focused that results are of little use to practitioners. There is a great need for a more field-based, systematic approach to understanding and controlling sediment at its source, documenting successes and failures, and sharing this information. The California Alpine Resorts Environmental Cooperative (CAREC) formed in 2003 with support from the State and Regional Water Quality Control Boards to address the impacts of recreational development on erosion. CAREC has developed the Sediment Source Control Handbook, a document that lays out an adaptive management process (in the form of Guiding Principles) for planning, implementing, monitoring and continually improving the effectiveness of erosion control and restoration projects. The Handbook includes a toolkit of specific practices to implement the Guiding Principles, which have been developed through six years of applied research and field-testing at six California ski resorts. The Handbook is designed to assist restoration practitioners, project implementers, planners, agency staff, and monitoring personnel to achieve successful projects and to continually improve watershed protection and restoration efforts. Moreover, the Handbook outlines a proactive alternative to the typically reactive permitting process and serves as a springboard for collaboration between project implementers and regulatory personnel. While this Handbook is focused on alpine recreational development, the principles and practices are highly transferable to a wide range of watershed protection and restoration efforts throughout the West.

Native vs. Non-Native Grass Erosion Control Seeding. *Clare Golec, Revegetation Specialist/Botanist, California Department of Transportation, District 1-North Region, PO Box 3700, Eureka 95502-3700,* Clare_Golec@dot.ca.gov.

Grass seeding for erosion control is an extensively applied best management practice to stabilize disturbed soils and reduce water quality degradation through sediment transport. Erosion control seeding is frequently required and consistently applied in construction and land management activities. Native grasses commonly are not utilized due to perceived inferior establishment characteristics and higher cost of seed. Subsequently, non-native grasses with aggressive growth characteristics are selected often at the expense of introducing invasive taxa into natural communities. The non-native annual or "Italian" ryegrass (*Lolium multiflorum*) is still utilized for erosion control seeding despite being well recognized as an invasive grass. In a move away from more aggressive non-native grasses, economical and ephemeral cereal grasses are being used such as barley (*Hordeum vulgare*) and wheat (*Triticum aestivum* and *Triticum aestivum* x *Elytrigia elongata*). However, these non-native grasses can initially compete for space and water with native plants and facilitate invasive plant establishment. Early-successional native grasses can be effective in erosion control seeding, and should be specified for use. Generally the cost of the seed represents a small portion of overall seeding costs (such as application and labor) but increased utilization of native grasses will also influence market supply and demand, and make native grass seed more affordable. Lastly, native grass seed mixes should be used within an ecological context that includes regional/elevation based seed collection zones, site specific habitat assessment, inclusion of other representative seeds of the plant community, and longer-term goals such as establishment of deeper-rooted native shrubs and trees.

Plumas and Sierra Nevada Native Grass Seed Zone Studies: What does it mean and where do we go from here ? *Linnea Hanson*[*1], Jay Kitzmiller[2], and Kevin Rice[3]. [1]Plumas National Forest, Feather River Ranger District, 875 Mitchell Ave, Oroville 95965,* lhanson@fs.fed.us. *[2]5882 Oakmore Dr, Paradise 95969. [3]Department of Plant Sciences, University of California, Davis 95616.*

Preliminary Native Grass Seed Zones have been developed for the Plumas National Forest for *Bromus carinatus, Bromus orcuttianus* and *Elymus glaucus.* These were developed as a result of the data that was analyzed from field plots of grass plugs at 11 different locations around the forest. The analysis data, elevation and vegetation ecotypes were used to develop the preliminary seed zones. Also, preliminary seed zone have been developed for the Sierra Nevada for *Bromus carinatus, Elymus glaucus,* and *Elymus elymoides.* These were developed as a result of data that was analyzed from field plots of grass plugs at 15 different locations throughout the Sierra Nevada. A summary of the work that has been completed to develop these seed zones will be presented. In addition, ideas of how to use these seed zone in the development of native grasses for use in the Sierra Nevada will be discussed.

The Practice of Implementing and Managing California Native Grass Projects. *Chris Rose*[*1], John Anderson[2]. [1]Solano Resource Conservation District,* egustine@gmail.com. *[2]Hedgerow Farms,* Hedgefarm@aol.com.

California native grasses have been utilized throughout the state for the last 20 years and widely used over the past 10 years for ecological restoration, erosion control, and wildlife habitat creation projects. I will discuss various types of projects with a focus on site evaluation, species selection, site design, implementation, and management. The case study projects I will describe have been implemented on sites representing a variety of ecological settings. Variables at each site from different soil type, hydrology, and existing native and non-native vegetation have presented and will continue to present challenges for the establishment of native grasses. I will also discuss the role of "forb play" when designing, implementing and managing native grass implementation and management projects.

Seeding—Some Lessons Learned. *David Steinfeld, Revegetation Specialist, USDA Forest Service, Pacific Northwest Region, 645 Washington St., Ashland, OR 97520,* dsteinfeld@fs.fed.us.

Getting native seeds off to the right start on a restoration project requires assembling appropriate seed mixes, properly applying seeds, and providing a good seed cover. There are many techniques available to the revegetation specialist but for best results, the selection should be based on soils, climate, and species being seeded. Our work revegetating roadsides for the Federal Highway Administration has given us ample opportunity to learn, some times the hard way, how to get the most from our native seeds.

Selected Class California Brome Germplasms from the Lockeford Plant Materials Center. *Derek J. Tilley, Manager, NRCS Lockeford Plant Materials Center, 21001 N. Elliott Rd., Lockeford 95237,* Derek.Tilley@ca.usda.gov.

Twenty-eight accessions of California brome (*Bromus carinatus* Hook. and Arn.) were evaluated in common garden studies at four sites: Los Alamos, Morgan Hill, Penn Valley and Lockeford, CA. Collections were evaluated for various vigor, forage yield and seed production characters from 2006 to 2008. The tested accessions included 'Cucamonga' and a commonly used seed source from Contra Costa County as standards of comparison. From the original 28, five accessions were chosen for selected class germplasm release based on performance and potential adaptation to various eco-regions within the state. Foundation seed is being developed and will be available to commercial entities in 2011.

Incorporating Civil Engineering & Modeling into Habitat Restoration

Chair: **Steve Seville, PE** ICF Jones & Stokes

Green Grass and High Tides: Hydraulic Engineering in Support of Environmental Design on the Sacramento River Bank Protection Project. *Lea Adams, PE, Acting Chief, Hydraulic Design Section, USACE Sacramento District.*

The Sacramento River Bank Protection Project performs supplemental erosion repairs to the Sacramento River Flood Control System levees. USACE is currently operating under a programmatic biological opinion with USFWS and NMFS to perform levee repair work that incorporates environmental features in the designs. The goal is for each erosion repair site to be self-mitigating, based on a standard, mutually agreed-upon methodology. Environmental features such as instream woody material, wetland plantings and riparian vegetation are typically designed to provide resting and rearing habitat for listed salmonids and delta smelt. Hydraulic analyses are performed to establish environmental design water surface elevations, including seasonal mean and two-year peak elevations. This presentation discusses the range of methods used to establish water surface elevations in support of environmental design on the Sacramento River Bank Protection Project.

Protect, Restore or Manage for the New Condition — Degraded River Systems and Development. *Chris Bowles*[*1], PhD, Environmental Hydrologist, and Eric Berntsen[2]. [1]cbec, inc., 2701 Del Paso Road, Suite 130/232, Sacramento 95835,* chrisbowles@mac.com. *[2]State Water Resources Control Board, 1001 I Street, 15th Floor, Sacramento 95814,* eberntsen@waterboards.ca.gov.

In California, frequently regulatory controls prevent modifications to "natural" stream channels during urban development. Invariably, "natural" stream channels have been anthropogenically disturbed to varying degrees due to land management practices, upstream development or flow regulation by dams. The motivation for regulatory prevention of modification is valid; to prevent further degradation of existing streams. However, as a result of urbanization, the resulting conditions can often exacerbate the degradation of the stream channel. Conversion of typically ephemeral channels in the West to perennial channels, combined with the increase in nutrient loading as a result of urbanization, and the lack of invasive vegetation control and prevention, can result in more degraded conditions than prior to development. Protection of stream channels may be appropriate under highly pristine conditions, but under varying degrees of degradation it may be

more appropriate to prepare the channel "for what it is about to receive" through urbanization. With the continuing development of hydromodification planning and development of new standards under stormwater (MS4) permits, the demand to investigate the use of in-stream modification for existing stream channels as a mitigation tool, along with flow duration control and source control (LID), is increasing. Regulatory restrictions are limiting the use of the in-stream modification tool, which limits the ability to protect the existing stream channel. This presentation investigates the problems and potential solutions, and provides an overview of how we could perhaps protect, restore, or manage for stream conditions through urban development.

Noise Considerations for Restoration Construction Projects. *Dave Buehler*[*1], PE, and Joshua Carman*[*2], ICF Jones & Stokes. [1]630 K Street, Suite 400, Sacramento 95814,* dbuehler@jsanet.com. *[2]268 Grand Ave., Oakland 94610,* jcarman@jsanet.com.

This presentation will discuss issues related to noise that should be considered when designing restoration construction projects. An overview of noise fundamentals will be provided which will cover the decibel scale, typical sound levels, sound propagation, and the source-path-receiver concept. Potential noise impacts on humans and wildlife that can arise from the use of heavy equipment will be discussed along with methods that can be employed to evaluate and minimize or avoid impacts. Restoration site selection considerations related to noise will also be discussed.

Erosion Modeling in the Tahoe Basin — Scaling from Plots to Forest Catchments. *Mark E. Grismer, Dept. of LAWR-Hydrology, UC Davis, 1 Shields Ave., Davis 95616,* megrismer@ucdavis.edu.

Land management effects on water quality are of paramount concern in the sub-alpine Tahoe Basin where regulatory agencies work to set Total Maximum Daily Loadings (TMDL) for tributary streams to the Lake. Field runoff and erosion measurements and modeling at the catchment scale are quite difficult, but often the only possibility of generating plausible assessments for subsequent analyses. A distributed hydrologic model with locally–derived sediment-yield equations developed from rainfall simulation (RS) studies at the 1 m^2 scale was employed to evaluate the scaling effects and possible sediment and fines loading reductions from the forested uplands comprising some 80% of the Basin area. The scaling factor, SGF, was found to be independent of sub-basin areas between less than one hectare to hundreds of hectares, but was dependent on sub-basin dominant soil type (granitic or volcanic). The mean area-weighted SGF value for granitic-based sub-basins was ~22, while this value for the mixed volcanic soil type sub-basins was ~2.5. The greatest sediment and fines loading and possible reductions were largely associated with disturbed soils of volcanic origin on the California side of the Lake. Sediment and fines loading of east-side Nevada tributaries was quite small. While some load reduction may be possible from the forested soils, the potential reductions per unit land area are much greater in the more disturbed soils associated with unpaved roads, recreational and ski run areas. The modeling effort provided considerable insight into where the greatest erosion potential may occur, the relative levels of sediment and fines load reduction possible and general corroboration of the applicability of RS research efforts across the Basin.

Biological Engineering & Managed Seasonal Wetland Habitat Designs on a Large Scale. *Chadd Santerre, MS, Wetland Projects Supervisor, California Waterfowl Association, 3170 Hawkins Lane, Biggs 95917,* CSanterre@calwaterfowl.org.

Managed seasonal wetland habitats throughout the Central Valley make up a significant portion of the remaining interior freshwater wetlands within the state of California. Seasonal wetlands supply millions of wintering and breeding waterfowl and shorebirds the resources they require to survive throughout the year. The Yolo Bypass Wildlife Area is one such location, where the efforts of state, federal and non-profit organizations are taking steps to restore habitats that were once abundant. Over the past 8 years, California Waterfowl has been working closely with the Department of Fish and Game to undertake restoration efforts in the Yolo Bypass at a very large scale. In all, we've restored/created 3,726 acres and enhanced 3,352 acres of wetland habitats.

Biologists use information collected from topographic relief and existing infrastructure surveys to create designs that allow for easy and efficient water management and control. Water delivery and drainage are critical to ensuring that water use is not only efficient but effective as well. Improper water management can greatly reduce the production of desired moist soil seed plants which are critical to the survival of wintering and migrating waterbirds. When restoring laser leveled agricultural fields back to a diversified wetland habitat community, construction methods seek to create and maximize topographic diversity. Edge habitat created by the topographic relief provides varying water depths, creating foraging and loafing habitats that benefit a wide variety of wetland dependent species. When working on several thousand acres or more, a cookie cutter restoration plan does not usually apply, but there are several key components that must be considered in any seasonal wetland restoration project; water use efficiency, water control and management, and topographic diversity. We will look at what goes into these projects from start to finish and what are the key components that should be considered.

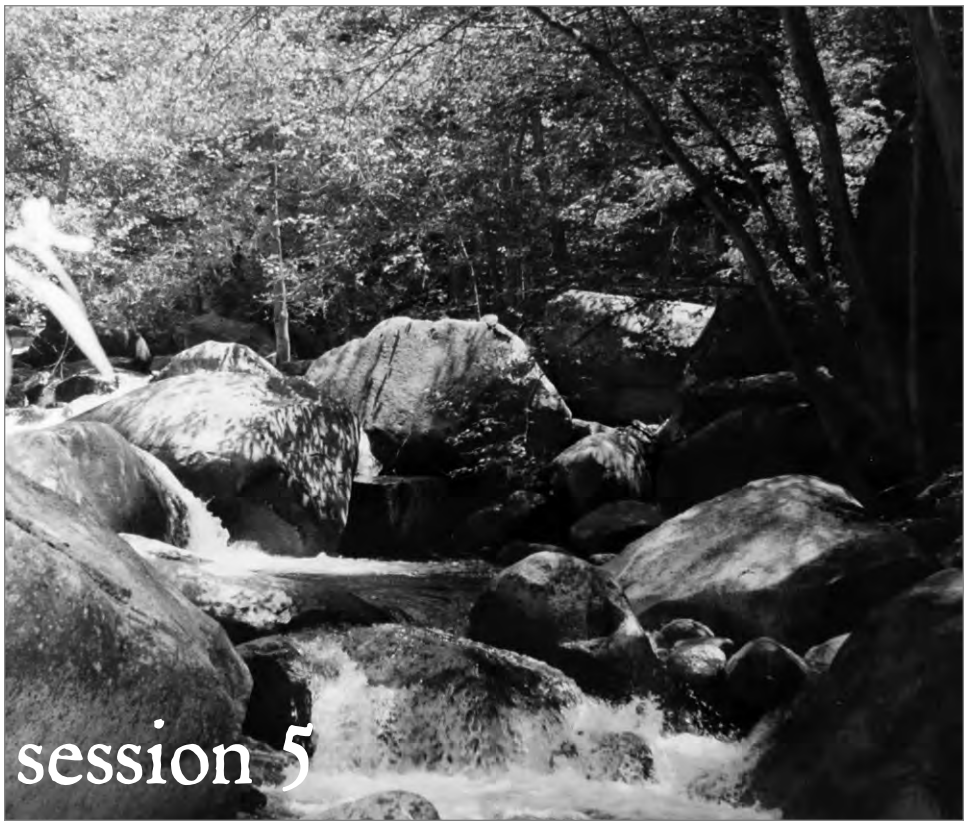
Understanding and Applying Your Survey Data to the Ground and Your Project Site. *Steve Seville, PE, Principal, ICF Jones & Stokes, 10 Lombard Street, Suite 300, San Francisco 94111,* sseville@jsanet.com.

Restoration practitioners rely on a myriad of information to better understand the function and determine the ecologic value of a project site. Conceptual designs addressing the goals and objectives set forth early in the process are eventually transferred to the site topography. It is this topographic information that ties the designer to the environment. Proper

continued

session 4 *continued*

interpretation and understanding of topographic maps, the vertical and horizontal coordinate systems, and the accuracy of the data can be the difference in a project success or failure. This discussion will highlight typical mapping datums encountered, how they relate to one another, and how best to use these data as you move forward with your project.



session 5

Climate Change: Issues, Impacts & Responses

Chair: **Michael Hogan** Soil Scientist, President, Integrated Environmental Restoration Services, Inc.

Potential Impacts of Climate Change on Pacific Salmonids. *Doug Demko* and Michele Palmer. FISHBIO Environmental, 3188 Wood Creek Drive, Chico 95973,* dougdemko@fishbio.com.

Due to large salmon declines along the Pacific Coast, there is growing concern regarding potential climate change effects on fisheries and researchers are exploring ways to predict these impacts to develop better management strategies for salmon stocks. This presentation provides a synthesis of the current knowledge and expert opinions regarding climate change and Pacific salmonid fisheries. We discuss anticipated changes to the physical habitat of Pacific salmonids, including ocean and stream temperatures, timing and magnitude of stream flows, water quality changes (e.g., salinity in estuarine environments), and geomorphologic changes. We also explore the projected impacts on different salmonid species and life stages, and the cumulative impacts to local and regional populations of salmonids and other interconnected species. Last, we present various management action recommendations to deal with climate change issues.

Assessing Potential for Establishing and Restoring California Native Bees to Human-Impacted Landscapes. *Gordon Frankie, PhD*, Jaime Pawelek*, Robbin Thorp and Jennifer Hernandez. Division of Insect Biology, 137 Mulford Hall, University of California, Berkeley 94740,* frankie@nature.berkeley.edu.

Honey bees and native bees are declining globally as human populations continue to increase and impact remaining wildlands. The economic value of the honey bee is indisputable, however, native bees must also be valued for the role they have played in coevolution with angiosperms to produce amazing floras worldwide — and for their potential economic role in the future. In North America, organizations such as the North American Pollinator Protection Campaign (NAPPC) and the Xerces Society have been working vigorously to raise awareness of the need to protect and conserve bee and other pollinator groups. Wildlands are the usual target areas for protecting and conserving native bees, however, urban areas are just beginning to receive attention as sites that are suitable for reproduction and survival of bee populations. University of California researchers have been surveying numerous urban areas in California to assess the diversity and abundance of native bees occupying urban residential gardens, and have found much higher bee diversities than was previously thought. The survey has also produced a wealth of information on how to encourage bees to urban gardens by providing preferred floral host plants and appropriate nesting materials. A restoration strategy is proposed that focuses on providing

resources for bees and reducing negative human impacts in urban landscapes.

Determining the Effects of Floral Diversity and Abundance, Habitat Patch Size and Nesting Site Availability on Bee Communities in the California Central Valley. *Jennifer Hernandez, PhD Candidate, ESPM–Organisms and Environment, 137 Mulford Hall, University of California, Berkeley 94720,* jennhernandez01@gmail.com.

Bees are the most important pollinators of domestic crops worldwide; consequently, concern for bee populations has traditionally focused on honey bees and the apiculture industry. It is now recognized that native bees also provide essential services in wildland and agricultural regions. Native bees pollinate many wild plant species and play an integral role in maintaining ecologically intact ecosystems. Bee communities are being affected by habitat loss and fragmentation; declines in bee populations will likely be exacerbated by climatic changes. Understanding and identifying abiotic and biotic factors affecting bee communities will provide a tool for bee conservation and can be applied to habitat preservation and restoration. The California Central Valley is an ecologically rich region harboring a diverse assemblage of bee species; however, the needs of a growing human population have led to habitat loss, fragmentation and degradation. Bee research in the Central Valley is valuable because it can be applied to restoration project design and used by farmers to create bee friendly habitat in and around crops. I sampled bee communities at 10 study sites in the Central Valley, located along Putah Creek, the Cosumnes River Preserve and the San Joaquin National Wildlife Refuge. The goal of this project was to evaluate three habitat parameters, floral abundance and diversity, habitat patch size and nesting habitat availability, and their effects on the bee communities at each site.

Introduction and Context: Climate Change as Withdrawal, Restoration as Investment. *Michael Hogan, MS Soil Science.*

Climate change is accepted by most credible scientists and informed citizens as a reality. One of the larger questions that remains is how quickly changes will take place. There is widespread understanding that specific input variables such as industrial, residential and vehicle emissions, forest clearing, and even cattle-derived methane all contribute to a generally warming climate worldwide. However, these inputs are seldom considered in the context of withdrawing functional capital from common ecosystem services. This presentation will focus on developing the concept of global climate change as the result of a dysfunctional economic accounting system that has been decoupled from ecosystem capital. We will then discuss the concept of 'slow money' as a foundation of the new restoration economy. We will discuss the critical importance of restoring soil function and fertility as the foundation of the numerous ecosystem functions that are required for our very existence. Current operative economic models notwithstanding, we suggest that a new, tightly coupled ecological-economic system is required if we, as a species, are to move into a livable future. This discussion is intended to present a context for the presentations in this session.

Everyone Can Make a Difference: Reducing Greenhouse Gas Emissions at the Local Level. *John Mott-Smith, Climate Change Advisor, Yolo County,* johnmottsmith@comcast.net.

Although other countries produce more greenhouse gases than the United States, our per capita emissions are much higher than almost every country, creating an opportunity for actions by both individuals and local governments to make a difference in responding to climate change.

Restoration Genetics in the Context of Climate Change. *Deborah L. Rogers. Center for Natural Lands Management, 215 West Ash Street, Fallbrook 92028,* drogers@cnlm.org.

Restoration decisions should be guided by not only by management objectives and species ecology, but the genetic diversity within the species. Risks of inappropriately or insufficiently considering the genetic issues of plant restoration include contributing to genetic erosion, undermining local adaptations, creating opportunities for ill-fated hybridizations, and even reducing diversity in co-adapted species. The spatial scales and contexts for genetic restoration vary in wide measure from small restoration projects of locally restricted species, to large natural areas where assisted regeneration is considered desirable after an extreme event such as a flood or fire, or a long-term use such as grazing or wood harvesting. In California, genetic information has long been considered in revegetation decisions for commercially significant forest tree species (e.g., Douglas-fir, coast redwood, many pine species). Understory species—such as grasses, ferns, herbs, and shrubs—have had much less attention. Genetic considerations are just as important to restoration success with these species as with their commercial counterparts. In the context of climate change, such decisions are more important than ever, and also require revisiting classic restoration genetic principles. The presentation will provide the genetic principles and links to reference materials that can serve as a basis for sound genetic restoration decisions. I will emphasize appropriate use of genetic tools and interpretation of genetic information, how to work with suitable proxies in the absence of genetic information, and consideration of risks. The nexus with climate change—including effects on invasiveness and disruption of daylength-temperature linkages—will be discussed.

Working Grasslands: Managing for Diversity

Chair: **Kent Reeves** Natural Resources Division Manager, County of Yolo Parks & Resources Department

Using Grazing to Maintain Grassland Habitat for Ohlone Tiger Beetle. *Philip Greer*[*1], Richard A. Arnold[2], David Amme[3]. [1]WRA, Inc., 2169 G East Francisco Blvd., San Rafael 94901,* greer@wra-ca.com. *[2]Entomological Consulting Services, Ltd. [3]Wildland Vegetation Program Manager, East Bay Regional Park.*

Horse grazing is used as the primary management tool to maintain the grassland habitat of the federally endangered Ohlone tiger beetle (*Cicindela ohlone*, OTB) at the Glenwood Preserve in Scotts Valley, California. OTB larval burrows occur in an approximately 0.20 acre portion of the 160-acre Preserve that provide suitable soils and patches of bare ground. Prior to 2003, OTB burrows were typically observed along trails and adjoining compacted bare ground. When horses were temporarily removed during installation of pasture infrastructure in 2003, the amount of residual dry matter (RDM) increased while bare ground decreased. During this ungrazed period, trails and compacted areas became vegetated and OTB burrows declined by 38%. During 2005 and 2006, grazing was managed by rotating horses between four pastures. However with horses either excluded or confined to the beetle pasture, horse use of trails and compacted areas within OTB habitat was not reestablished. At the end of 2005, after the first season of managed rotational grazing, RDM was reduced by 50%. This was considerably higher than in 2003 and OTB burrows again declined. In 2006, although burrows increased, however trails were not reestablished and bare ground patches were smaller and more dispersed. In 2007 and 2008, a modified rotation was used allowing horse nearly continuous access to the beetle pasture. RDM was reduced to levels similar to that observed before grazing was removed in 2003, while bare ground and OTB burrows both increased. Management should attempt to maintain both compacted and dispersed bare ground habitat

Native Grassland Species and Livestock Grazing: Does it Really Matter? *Michele Hammond*, Peter Hopkinson, James Bartolome, and Reginald Barrett. Department of Environmental Science, Policy, and Management, 137 Mulford Hall–3114, University of California, Berkeley 94720-3114;* mhammond@nature.berkeley.edu.

For the past six years, we have sampled about 70 grassland plots, some ungrazed, some grazed by cattle or sheep, in East Bay Regional Park District properties, Alameda and Contra Costa counties. We use permanent line-point transects to sample the vegetation, primarily upland Valley grassland, and point count surveys to sample the grassland avifauna. The sampling period includes years of high and average rainfall and drought. We present our findings regarding the effects of livestock grazing on native plants and wildlife. Some apparent trends: grazed sites tend to have greater native plant abundance, although drought may affect this relationship. Nutrient-poor soils appear to harbor a greater abundance of native species. Grazed and ungrazed sites with few native species do not differ much. Some grassland birds are associated with grazed plots. There is much site to site variation.

Vernal Pool Native Species Respond to Climate, Burning and Grazing. *Bobby Kamansky, Kamansky's Ecological Consulting, PO Box 731, Three Rivers, California 93271,* bobinator1@hotmail.com.

Non-native species dominate the increasingly-fragmented vernal pool grassland ecosystems in the Tulare Basin. To examine how native and non-native species respond to climate and disturbances over a three-year period, fire was applied during the first year and grazing applied seasonally each year. Exclosures prevented cattle access to some pools and native species were tracked in treated and untreated areas each year. Vegetative cover, frequency and richness were monitored before and after treatment and compared with reference sites during the experiment. Variations in climate affected native plant richness and cover more than treatment with grazing and fire. Native plant frequency responded to a combination of disturbances more than climate variations. Disturbances and climate interacted to increase or decrease native abundance. Fire alone increased native plant richness, frequency and cover. Grazing alone did not significantly alter native richness, frequency or cover. These results assist landowners, public agencies and non-profits manage natural areas in the Tulare Basin to promote native species.

Restoring Wet Meadows and Wetland Edges on Old Agricultural Fields in the Pajaro Valley. *Jonathan Pilch, Restoration Director, Watsonville Wetlands Watch, PO Box 1239, Freedom 95019,* jonathan@watsonvillewetlandswatch.org.

Historically, wetlands, seeps and springs filled the valley floor of the Pajaro Valley in Watsonville, California. Beginning in the early 1800s and to the present, slough lands were drained and farmed along with the surrounding meadows and prairies. Watsonville Wetlands Watch has been working to restore historic habitat on old fields, with a focus on re-establishing natural diversity and habitat for amphibians and marsh and grassland dependant birds. As more land has become held in public ownership, restoration opportunities and planning for resource support and recovery has become both greater and more dynamic. This effort has led to a comprehensive approach to restore the previously farmed margins of the sloughs, which are now dominated by Poison hemlock, *Conium maculatum* and other exotic species. Mechanical control of this species is proving to be effective, and includes: mowing, roto-tilling any living tap roots, application of an organic mulch and re-vegetation with native plants. Historic habitat types and regional resource needs provide a framework for determining the planting mix, resulting in far greater grassland and meadow diversity along currently mono-cultural and exotic dominant slough edges. This work is being conducted at the Patrick J. Fitz Wetlands Educational Resource Center, and integrates high school students in the process. Many of these students are English language learners whose families are involved in agriculture in Watsonville. When these students go out on a restoration project the result can be a surprisingly positive and confidence-building experience, generating interest in new career opportunities.

Innovative Grazing Management for Diversity and Much More. *John Wick*[1] and Jeffrey A. Creque*[2], Marin Carbon Project. [1]PO Box 597, Nicasio 94946,* johnwick@sonic.net. *[2]908 Western Ave., Petaluma 94952,* oecos@earthlink.net.

The Wick Ranch grazing program draws upon principles from Holistic Resource Management, Short Duration Grazing, Keyline planning and disturbance theory to utilize cattle impacts as a primary tool to enhance native perennial grass cover, reduce cover of Eurasian annuals, increase infiltration, and increase sequestration of atmospheric CO_2 as soil organic matter.

Technology in Habitat Restoration: Recent Advances in Restoring, Monitoring & Managing Landscapes

Chair: **Andrew Fulks** Manager, Putah Creek Riparian Reserve, UC Davis.

LIDAR Applications for Creek Restoration. *Rich Marovich, Streamkeeper, Lower Putah Creek Coordinating Committee, Solano County Water Agency, PO Box 349, Elmira 95625,* RMarovich@scwa2.com.

LIDAR is a remote-sensing technology that is used to develop surface elevation models. In 2005, the Lower Putah Creek Coordinating Committee commissioned a LIDAR survey of Putah Creek from Lake Berryessa to the Yolo Bypass including portions of major tributaries, altogether covering 10,000 acres at a cost of two dollars per acre for one-foot contour resolution. We use the data to generate three dimensional images of channel form, generate flood conveyance (HEC-RAS) models, propose floodplain restoration and bank stabilization projects including cut and fill estimates. We also use the data along with GPS hardware to safely navigate rugged terrain such as dense *Arundo* thickets in an enclosed cab tractor where visibility is limited.

Ecohydrology Modeling of Northern Hardpan Vernal Pool Systems for Restoration. *Niall McCarten, Hydrological Science Program, Department of Land, Air, and Water Resources, University of California, Davis 95616,* nfmccarten@ucdavis.edu.

Ecological and hydrological functioning of existing vernal pools is poorly understood. Our work first focused on how natural hardpan vernal pools function. This was accomplished using five years of field data collection that included surface and hardpan elevation data for the watershed, measurement of saturated and unsaturated soil moisture throughout the watershed including pools depression water depth, soil depth to hardpan, soil texture and other factors relating to water infiltration and subsurface flow. Over the past two years vernal pool plant species have been measured and correlated with pool hydroperiod and soil moisture. The field data were used to create computer models using HYDRUS 2-D & 3-D software that reflect the natural structure of the vernal pool landscape. Rainfall and

evapotranspiration rates reflecting a natural range of dry, average, and wet years were applied and the results compared with the field data. Key findings on vernal pool hydrological functioning include the importance of local watershed area, soil depth to hardpan, continuity of hardpan within the surface watershed, slope of the hardpan, soil heterogeneity, and soil moisture variability from unsaturated to saturated conditions, amount and distribution of rainfall and evapotranspiration. The computer model was then modified to reflect a landscape without vernal pool depressions, with depressions that differ from the natural ones, and by adding depressions to the existing vernal pool landscape. This approach has helped us determine important features such as soils depth, soil heterogeneity, watershed area and slope that determine the potential hydrology of a set of created pool basins.

An Interim Evaluation of Stream Restoration in Blackwood Creek.
Joshua S.E. Meidav[1], Charles R. Goldman[2], and Michael G. Barbour[3]. [1]EDAW Inc., 2099 Mt. Diablo Blvd., Suite 204, Walnut Creek 94596,* josh.meidav@edaw.com. *[2]Department of Environmental Science and Policy, University of California, Davis 95616,* crgoldman@ucdavis.edu. *[3]Department of Plant Sciences, University of California, Davis 95616,* mgbarbour@ucdavis.edu.

Due to a combination of landscape and legacy factors, Blackwood Creek has the highest sediment yield of all 63 streams that enter Lake Tahoe. Blackwood Creek provides a microcosm of Californian montane streams subject to ongoing restoration. Through pre-post and upstream-downstream biogeochemical analyses, this work assesses fish ladder replacement with a step-pool channel. There is a significant trend of decreased total Kjeldahl nitrogen delivery (-1132 kg, -7%) post-restoration. Sediment and nutrient (total suspended sediment, total phosphorus, phosphate, ammonium, nitrate) monthly rank sum values fell post-restoration, though not at statistically significant levels. Post-restoration sediment and phosphorus base loads were lower and peak loads were higher in comparison to pre-restoration values. The post-restoration sum differences for total suspended sediment and phosphorus present cautionary values. Total suspended sediment has a post-restoration sum 60% greater than pre-restoration (+ 2052 tonnes). Total phosphorus (+ 1345 kg) and phosphate (+ 36 kg) demonstrated higher post-restoration delivery, 55% and 23% increases, respectively. A signal of concern for spatial comparisons, with implications for salmonid spawning habitat and lake clarity, was that small particle (0.5 – 11.3m) amounts were higher downstream during both peak and base flows. Stream temperature maxima throughout the watershed were near 20°C, which may be prohibitive for restoring native salmonids. Heeding the Hippocratic Oath, "doing no new harm," remains a challenge for restoration projects and is confined by spatio-temporal limits. Modifying stream restoration design to prioritize and coordinate downstream structures, processes, and actions within an adaptive management and research framework is suggested.

Software Application for Large-scale, Multiple-objective Landscape Restoration. *Julie Rentner*, Chris Stevenson, and Tom Griggs. River Partners, 1301 L Street, Suite 4, Modesto 95354,* jrentner@riverpartners.org.

For over six years, River Partners has been successfully restoring native riparian habitat to former agricultural fields in the San Joaquin River National Wildlife Refuge in Stanislaus County, California. Over 800 acres have already been restored. River Partners designs these restoration projects to be specifically tailored to the subtle soil and hydrology differences across the site, to effectively control invasive weeds, to provide for the habitat requirements of federally endangered species, and to achieve excellent plant survivorship over the life of the project. To effectively accomplish all of these objectives within one large restoration project, the help of a computer is necessary. However large expenditures on sophisticated mapping software are not necessary. River Partners has developed its own user-friendly planting design database which links restoration ecology design principles with efficiency in implementation, monitoring, and reporting. Beginning with investigations of soil, groundwater trends, and flood characteristics, River Partners' design database is used to generate the field layout of native trees and shrubs in rows and fields which best fit the site ecologically and best fit the project's objectives. Adaptive management activities and plant survivorship are tracked in the database. Annual monitoring and reporting are considerably simplified, allowing for lowered costs and increased efficiencies in restoration. The cost savings associated with the design database allow for greater expenditures in initial site investigation, adaptive management, and creative development of restoration solutions for dwindling wildlife habitats along the San Joaquin River.

Optimizing Mesh Networks for Environmental Monitoring at Quail Ridge Reserve. *Shane Waddell, UCNRS, UC Davis Quail Ridge Reserve Steward,* smwaddell@ucdavis.edu.

The Quail Ridge Reserve is part of the UC Natural Reserve System, a 36-reserve network of protected lands in all of the major ecosystems in California managed for habitat protection, scientific research, and university-level instruction. Occupying a 2000-acre peninsula on the Berryessa Reservoir in the Coast Range in Napa County, Quail Ridge features outstanding native grassland and oak woodland habitats. In collaboration with the UC Davis Computer Science Department, it now hosts the world's most extensive wireless mesh network in a wildland setting. Reserve staff are using this communication network to transmit real-time ecological and environmental data from the field to the web. However, taking full advantage of this data-streaming ability for research-driven questions has been challenging. Reserve staff and campus researchers are developing an automated animal telemetry network that will allow real-time animal tracking and monitoring of physiological parameters. This system will allow continuous tracking of animals

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session 7 *continued*

much smaller than those currently tracked by GPS- and Argos-based systems, since the transmitters used in the Quail Ridge system may weigh less than 1 gram. Additionally, staff are setting up long-term acoustic monitoring stations to record frequencies from ultrasonic bat calls and from lower frequency mammal and amphibian calls. These two systems will begin to test the mesh network's ability to work for environmental researchers and foster new additional scientific uses.

Vernal Pool Restoration & Effectiveness Monitoring for Special-Status Species

Chair: **Carl Jensen** Design-Build Director/Landscape Architect, Wildlands, Inc.

Stillwater Plains Mitigation Bank.
Brent Helm, Helm Biological Consulting, 2273 Nolen Drive, Lincoln 95648.

The Stillwater Plains Mitigation Bank (Bank) is located east of the Redding Municipal Airport, Shasta County. The Bank serves the Greater Redding Area and includes five phases of operation in which Phases I, II and III (consisting of a total of 627 acres) are now available for credit sales. A total of 28.16 acres of wetlands (15.18 acres of vernal pool, 5.73 acres of vernal swale, and 7.24 acres of emergent marsh) were delineated in Phase I in 1998. An additional 10.266 acres of wetlands (10.225 acres of vernal pool, 5.658 acres of vernal swale, and 0.042 acre of emergent marsh) were constructed in Phase I during 2001, 2002, and 2003. The term constructed refers to restoration, creation, and enhancement activities. A total of 19.123 acres of wetlands (9.35 acres of vernal pool, 3.798-acres of vernal swale, 2.678-acres of emergent marsh, 3.252-acres of intermittent drainage, and 0.045-acre of ephemeral drainage) were delineated in Phases II and III in 2001. An additional 64.454 acres of wetlands (15.783 acres of clay flat, 10.714 acres of emergent marsh, 5.210 acres of open water, 27.062 acres of vernal pool, and 5.685 acres of vernal swale) were constructed in Phases II and III during 2005 and 2006. Non wetlands habitats occurring within Phases I, II, and III include annual grassland, blue oak woodland, elderberry savanna, and scrubland. Mitigation habitats planned for the future within these three phases include riparian shrub, mixed riparian woodland, blue oak woodland, shrubland, elderberry savanna, and perennial grassland. Short-term monitoring consisted monitoring hydrology, vegetation, and aquatic invertebrates annually in each of the mitigation wetlands for five consecutive years. Hydrology monitoring was only conducted during the initial year following construction of mitigation wetlands. After five years of monitoring roughly 86% (89 of 104) of the constructed habitats within Phase I have met all of their success criteria. Similarly, after three years of monitoring, roughly 77% (111 of 145) of the constructed wetlands in Phases II and III have met their success criteria. This high percent of success is in spite of the below average rainfall at the Bank during the winters of 2006-2007 and 2007-2008. Six special-status species (vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardi*), slender orcutt grass (*Orcuttia tenuis*), legenere (*Legenere limosa*), Boggs Lake hedge hyssop (*Gratiola heterosepala*), Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) and one species of interest, California fairy shrimp (*Linderiella occidentalis*), were known to occur within Phase I prior to construction with a combined total of 68 occurrences. However, after five years of monitoring these seven species now have 253 new occurrences. In addition, two special-status species (western

spadefoot (*Spea* "*Scaphiopus*" *hammondii*) and dwarf downingia (*Downingia pussilla*) now occur in Phase I in six locations and one location, respectively. In contrast to Phase I, Phases II and III supported only four special-status species (legenere, vernal pool fairy shrimp, vernal pool tadpole shrimp and western spadefoot) and one species of interest (California fairy shrimp) prior to construction with a combined total of 18 occurrences. However, after three years of monitoring theses five species now have 94 new occurrences. In addition, Phases II and III now support 33 occurrences of the slender orcutt grass. Overall the constructed wetlands within Phases I, II and III are doing well. However, their continued success, especially in regards to special-status species presence, will need to be determined from the long-term monitoring proposed at the Bank.

The Use of Soil Inoculum in Vernal Pool Restoration: What it Does and Doesn't Do. *Bill Roper, Wildlands, Inc., 3855 Atherton Road, Rocklin 95765.*

The use of soil inoculum is a relatively common practice in vernal pool restoration/creation efforts. Many restoration ecologists and planners view this as having a "magic effect" on the biological development of constructed vernal pools. Others worry about unknown consequences of the transfer of this material from one location to another. While initial results indicate that this material is useful in the establishment vernal pool plants and invertebrates within constructed pools, it is important to understand our objectives for using this material, our expectations, and what the use or nonuse of this material means to future restoration efforts.

Vernal Pool Restoration: Notes for the Future. *Carol Witham, 1141 37th Street, Sacramento 95816.*

The first efforts to create or restore vernal pools were often ineffective. In the intervening fifteen years of regulatory required mitigation, the techniques have improved and many restoration sites have been deemed successful. Unfortunately success is measured in a matter of years and the criteria for determining success are arbitrary. Current restoration techniques involve moving seed bearing soil to the mitigation site, often a substantial distance away and on a different geomorphic surface. While this may serve the regulatory requirement to replace what is being destroyed, it does not necessarily create something that can persist in the new location. Additionally, the practice of translocating seeds and cysts from one vernal pool archipelago to another could have significant genetic consequences. This presentation will explore concepts and techniques that would improve vernal pool restoration efforts beyond the current "cookbook" approach.

Grassland Ecology and Restoration

Chair: **Randi Paris** Forester, Klamath Basin Watershed Team, USDA Natural Resource Conservation Service

California Prairie: Our Unknown Landscape. *Glen Holstein, California Native Plant Society, Sacramento Valley Chapter, 1509 Pacific Drive, Davis 95616,* Holstein@cal.net.

There is now abundant evidence many California herbaceous plant communities were historically dominated by forbs rather than grasses. They often still are. In California such communities have been traditionally but inaccurately called 'grasslands" because of identifiable historical errors. This causes significant environmental damage by emphasizing two kinds of grasses, abundant non-native weeds and frequently scarce to non-existent natives, rather than biologically rich and often still common native forbs. Communities lacking native grasses thus become de facto sacrifice areas for sprawl no matter how rich their forbs, which remain unseen or dismissed as mere "wildflowers." Much money and effort is also wasted "restoring native grasses" in places they never occurred. California's forb-dominated plant communities are unique in producing two or more sequential crops of dominant species as soils progressively dry during a growing season. California's herbaceous communities should be accurately and appropriately called prairies rather grasslands, which is both inaccurate and taxonomically biased.

Grasslands of California State Parks: A Selective Quantitative Survey. *Peter Hopkinson*, Michele Hammond, Sheri Spiegal, and James Bartolome. Department of Environmental Science, Policy, and Management, 137 Mulford Hall–3114, University of California, Berkeley 94720-3114,* phopkin@nature.berkeley.edu.

In Spring 2008, the UC Berkeley Range Lab and the California Department of Parks and Recreation sampled 45 grassland plots in 25 State Parks units, located throughout California and selected for their high degree of native plant cover and richness. Vegetation types surveyed included coastal prairie, Valley grassland (including south coast), montane meadows, and several desert types. We encountered approximately 450 species, about 75% native. Two-thirds of the species were found in only 1 or 2 plots. While non-native species were ubiquitous, areas of high native cover and species richness were distributed throughout the state. Coastal prairie tended to have the greatest abundance of native species.

Grassland Fire Management at the Santa Rosa Plateau. *Zachary Principe, The Nature Conservancy, 402 W. Broadway, Suite 1350, San Diego 92101,* zprincipe@tnc.org.

The fire management program at the Santa Rosa Plateau Ecological Reserve

began in 1988. A total of 7,500 acres have been treated in 13 units, primarily with late spring prescribed fires. Vegetation was monitored from 2001 to 2006 to estimate cover and species richness. Native and non-native forbs behaved similarly, significantly increasing in cover following fire. Native and non-native grasses behaved similarly, significantly decreasing in cover following fire. Native and non-native forb cover was significantly influenced by rainfall, while the cover of native and non-native grasses were not dependent on rainfall. Species richness was not influence by the number of years after fire for any functional group or pooled estimates (total and native species). Pooled, native forb, and non-native forb species richness were significantly influenced by precipitation. Species richness was positively correlated with precipitation below 14 inches, however above this threshold, units responded differently. For units burned during the course of the study, as precipitation increased species richness continued to increase while non-native annual grass (NNAG) cover decreased. For units not burned within two years of the study, species richness decreased as precipitation increased while NNAG cover increased. Herbaceous vegetation is significantly influenced by the presence of Engelmann oaks. Native grasses rarely occur around and under Engelmann oaks. NNAG cover greatly increases around and under Engelmann oaks. Burned sites had significantly lower NNAG cover than unburned sites in grasslands and at the dripline of Engelmann oaks, however, NNAG cover was similar under Engelmann oaks at burned and unburned sites.

Short-term Priority Influences Competitive Ability of Native Perennial Grasses. *Kurt Vaughn, Plant Sciences Department, University of California, Davis 95616,* kjvaughn@ucdavis.edu.

Competition with exotic annuals is one of the greatest limitations to native grassland restoration in California. A previous study found native perennial grasses competed significantly better with a full year's planting advantage (priority) over exotic annuals. Similarly, results from multiple (unreplicated) restoration sites in California grasslands indicate that a single year of weed control can result in far greater establishment success of perennials, even when annuals return to high levels as quickly as a year later. On an even shorter time scale, it has been proposed that the earlier germination and rapid early growth of annuals has lead to the successful supplantation of perennials. I designed an experiment to test whether a two week planting priority would increase the ability of native grasses to compete with annuals. Short term priority did not provide as strong of an advantage as control treatments with no annual competitors. However, at the end of the first growing season I found short term priority had highly significant effects on three distinct measurements of perennial planting success and fitness across all four species. On average I found short-term priority increased cover ten fold, the number of perennial individuals per plot 2.5 times and the number of flower spikes per individual 7.6 times. These findings suggest while the earlier germination of exotic annuals may not fully account for the competitive inhibition of native perennials, it can play an important role in these competitive interactions.

Native Grass/Forb Sod is a Viable Option for Today's Restoration Projects. *Paul Albright* and Bruce Berlin, S & S Seeds, PO Box 1275. Carpinteria 93014-1275,* paulalbright@ssseeds.com, bruceb@ssseeds.com.

Living Channel Liner is an ecologically sound, self-maintaining native plant system that physically secures stream banks, shorelines and watercourses in a "soft armor." It is less expensive and more attractive than the "hard" concrete or riprap storm drain erosion control method. Some of the typical plant establishment difficulties with weed competition, irrigation coverage, and uncooperative weather are not significant factors with this product. We have grown and supplied projects in recent years and seen tremendous potential for its expanded use. This poster will show the evolution of sites using this proven technology.

Wetland Restoration during Early Implementation of the East Contra Costa County HCP/NCCP. *Kevin MacKay*[1], John Kopchik[2], Kate Bode*[1] and Abigail Fateman[2]. [1]ICF Jones & Stokes, 2841 Junction Avenue, Suite 114, San Jose 95134,* kmackay@jsanet.com. *[2]East Contra Costa County Habitat Conservancy, 651 Pine Street, 4th Floor, North Wing, Martinez 94553,* jkopc@cd.cccounty.us.

We are creating and restoring wetlands for the initial stages of implementing the preserve system for the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP). This is the first NCCP operating in northern California. We are completing these projects during the first 2 years of the HCP/NCCP implementation and they are functioning as pilots for a mandatory large-scale wetland restoration program. Challenges of implementing such a large-scale program on deadlines to meet the Stay Ahead provision of the HCP/NCCP are related to the necessary rapid progress on permitting, seasonal survey needs, design plans and specs, and construction bids. Two wetland projects are complete and in the monitoring stage, including a 1.09 acre shallow pond (Vasco Caves site near Byron) and an alkali wetland (Lentzner site near Antioch and adjacent to Black Diamond Mines). A third, larger project is in progress and will be constructed this year at the Souza II site near Byron. This site includes a number of aquatic features, including seasonal wetlands, a pond, and rock weirs in a degraded channel to create in-stream habitat for aquatic species. Initial projects presented here are part of HCP/NCCP conservation strategy to replace and increase regional wetland and waters. Lessons are learned and carried forward on each project. The implementation of this preserve system is a partnership between the East Contra Costa County Habitat Conservancy and the East Bay Regional Park District, which will manage these preserves once they are acquired and restoration construction is complete.

Sundance Properties Grassland and Wetland Vegetation Installation Techniques. *Ian Boyd*, Riley Swift, Ralph Vigil, Chad Aakre, Lucas Piper, Chuck Hatch, Christi Owens. Restoration Resources, 3868 Cincinnati Avenue, Rocklin 95765,* i.boyd@restoration-resources.net.

The Sundance Properties Habitat Restoration Project located near Lincoln, CA, involved the restoration of an inter-related string of habitats including a freshwater wetland complex, riparian floodplain and associated riparian and upland grassland habitats. Installation of native grass and wildflower seed in wetland and upland habitats of the project site was included in the design of restoration to increase the habitat for Swainson's hawk and to provide erosion control for disturbed soils, while wildflowers were introduced to improve the aesthetic value of the property. Native seed pallets were created to develop successive seed generations with reduced competition and protein rich grasslands, desirable for small fossorial mammals. Drill seeding, hand seeding and hydroseeding techniques were utilized in different portions of the site to adaptively

improve the efficiency of the application. The process of de-grassing the project site prior to construction grading revealed compact, clay loam soils which required the creation of a suitable seed bed by repeated ripping and harrowing. In the perennial and seasonal wetlands large flats of tules (*Scirpus* spp.), tall spikerush (*Eleocharis macrostachya*), and Baltic rush (*Juncus balticus*) approximately 2 feet by 3 feet in dimension were installed in order to take advantage of their rhizomatous nature, while other facultative wetland species were planted as smaller individual plugs. The installation of native grasses and facultative wetland species was completed in August of 2008 by Restoration Resources and current conditions of the site demonstrate substantiation of successful installation during the first year of establishment.

Developing Native Revegetation Palettes for Active Ski Slopes. *Jennifer W. Burt*[*1], Shana Gross[2], and Kevin J. Rice[1]. [1]Dept of Plant Sciences, Mail Stop 1, One Shields Ave., University of California, Davis 95616,* jenniferwburt@gmail.com. *[2]Lake Tahoe Basin Management Unit, USDA Forest Service, 35 College Drive, South Lake Tahoe 96150.*

Ski slopes represent large-scale disturbances in high elevation ecosystems, many of which are located on USDA Forest Service lands. Although USDA Forest Service policy mandates the use of native species where possible in revegetation, ski slopes are more often seeded with nonnative erosion control grasses. We are developing native seeding palettes for active ski slope restoration, based on a reference community analysis of plants naturally occurring on ski slopes across the northern Sierra Nevada. Using extensive data on plant community composition of ski slopes from twelve abandoned and seven active ski areas, we identified native, herbaceous or low-growing (i.e. recreation compatible) plants that have naturally colonized ski slopes of this region. We pruned this large plant community dataset further to focus on plants that were found with high frequency and abundance across sites. Here, we present potential plant species for active ski slope revegetation based on these data, with dual emphasis on maximizing native cover and diversity. We are currently developing the experimental design for a USDA Forest Service sponsored project to experimentally test establishment success of many of these identified plant species on ski slopes across six National Forests, with the aim of improving ski slope revegetation practices. A long-term goal of this experimental study is to develop seed bulking sites on ski slopes to generate sources of native-adapted seed for local revegetation projects.

Sediment Source Control Handbook: An Adaptive Approach to Restoration of Disturbed Areas. *Michael Hogan and Kevin Drake*. Integrated Environmental Restoration Services, Inc., PO Box 7559, Tahoe City 96145,* mhogan@IERStahoe.com, kdrake@IERStahoe.com.

Erosion is one of the most pressing and widespread environmental threats of our time. Much of the available erosion control research is so narrowly focused that results are of little use to practitioners. There is a great need for a more field-based, systematic approach to understanding and controlling sediment at its source, documenting successes and failures, and sharing this information. The California Alpine Resorts Environmental Cooperative (CAREC) formed in 2003 with support from the State and Regional Water Quality Control Boards to address the impacts of recreational development on erosion. CAREC has developed the Sediment Source Control Handbook, a document that lays out an adaptive management process (in the form of Guiding Principles) for planning, implementing, monitoring and continually improving the effectiveness of erosion control and restoration projects. The Handbook includes a toolkit of specific practices to implement the Guiding Principles, which have been developed through six years of applied research and field-testing at six California ski resorts. The Handbook is designed to assist restoration practitioners, project implementers, planners, agency staff, and monitoring personnel to achieve successful projects and to continually improve watershed protection and restoration efforts. Moreover, the Handbook outlines a proactive alternative to the typically reactive permitting process and serves as a springboard for collaboration between project implementers and regulatory personnel. While this Handbook is focused on alpine recreational development, the principles and practices are highly transferable to a wide range of watershed protection and restoration efforts throughout the West.

Developing Native Seed Recommendations for Southern California Ecoregions. *Arlee M. Montalvo[1], Jan L. Beyers[2], and Laurel K. Goode*[*3]. [1]Riverside-Corona Resource Conservation District, 4500 Glenwood Drive, Riverside 92501. [2]U.S. Forest Service, Pacific Southwest Research Station, Riverside Fire Lab. [3]Center for Conservation Biology, University of California, Riverside 92521,* lsalz001@ucr.edu.

Seeding of roadcuts, buffers around water quality projects, and other erosive areas can be done with a biodiversity goal using native species, even if the short term goal is rapid growth for erosion control. However, information is scarce on the genetically appropriate use of the native species frequently used in southwestern California ecoregions. Many projects use seeds "off the shelf" from native seed companies on short notice with little consideration about where the seeds were collected or if the seeds were derived from source populations native to the local region. In addition, very few native plant materials have been developed for mass production from southern California populations of plants. For projects with a biodiversity goal, it makes sense to use populations of species that are adapted to the local physical and biological environment rather than using material that is selected for aggressive growth in other regions. As such, we have been working with restoration ecologists, agencies, seed users, and seed producers to develop a list of workhorse species that have potential for commercial development from southern California ecoregions. For each species, we are conducting literature reviews and

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assembling information that will assist in making genetically appropriate choices of seed accessions for seed increase programs as well as information important to agricultural production of seed. Tabulated information will be made available on Resource Conservation District and U.S. Forest Service websites to aid plant development research and to inform choice of species and source populations for direct seeding and seed increase projects.

Diluting the Hybrids: How Much is Too Much? *Ingrid Hogle[1*], Debra Ayres[2], Don Strong,[2] Laura Feinstein[2]. [1]San Francisco Estuary Invasive Spartina Project, 2612A 8th Street, Berkeley 94710,* ibhogle@spartina.org. *[2]University of California–Davis, Department of Evolution and Ecology.*

Since the hybridization between introduced smooth cordgrass (*Spartina alterniflora*) and native Pacific cordgrass (*S. foliosa*) was first documented by Daehler and Strong in the early 1990s, we have witnessed a population explosion in which cordgrass hybrids crossed with other hybrids and backcrossed to the native species to create a genetically variable hybrid swarm. Hybrid cordgrass threatens tidal habitats through ecological engineering and the native species through pollen swamping. The State Coastal Conservancy's San Francisco Estuary Invasive Spartina Project has systematically removed plants with obvious invasive traits, e.g. tall, robust stems; large inflorescences, etc., as they work to eradicate invasive Spartina from the San Francisco Estuary. In the course of monitoring eradication efforts, we used molecular fingerprinting to test hundreds of cordgrass samples each year. The results of these genetic tests show that highly backcrossed hybrid plants, with no obvious morphological characteristics to distinguish them from natives, are "hiding" in the marshes of the Bay. If not identified and removed, these "cryptic hybrids" may further dilute the native genome. But if they look and behave like natives, is it worth the effort to identify and treat these highly backcrossed hybrids? In working to eradicate invasive Spartina, how should the ISP respond to these "cryptic hybrids"?

Seedballs as a Tool for Restoring *Coleogyne rammosisima* Communities. *Joshua D. Hoines[1] and Fred S. Edwards[2]. [1]National Park Service, Lake Mead NRA, Boulder City NV 89005. [2]Bureau of Land Management, Las Vegas Field Office, 4701 N. Torrey Pines Dr., Las Vegas NV 89130.*

Since 2000, thousands of acres of blackbrush (*Coleogyne rammosisima*) have burned in Southern Nevada leaving the newly exposed soils available for colonization by non-native brome grasses and burn scars that may take decades or longer to return blackbrush communities. How long it takes a site to recover after disturbance is largely unknown; however, while documenting the time required for blackbrush community succession, Callison et al. (1985) observed the absence of blackbrush on a 37-year-old burn. One possible explanation for slow recovery is loss of seed dispersal in burns. Seeding disturbed sites in deserts is difficult because most seeds travel from their initial site via ants and rodents or wind and water. Our hypothesis is seedballs allow managers to disperse *Coleogyne* seeds into burned areas, 1) emulating the absent dispersal process, and 2) protecting seeds until environmental conditions are favorable for germination. We used an army of volunteers to make approximately 15,000 seedballs with a predefined mixture of organic soil, sand, clay, coir, and seed. We selected a three-acre demonstration site (100m x 150m) divided it into twenty-four $25m^2$ blocks randomly stratified into two treatments: seedballs or none. Each $25m^2$ block was further divided into m^2 blocks with forty-five randomly selected for long term monitoring. Spring sampling will begin in February 2009. We expect to find blackbrush seedlings at the demonstration site after sufficient winter precipitation. Evidence of blackbrush recruitment this spring would represent an increased regeneration time by several decades or centuries.

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Wildlife-friendly Pond Restoration on Private Grazing lands Benefits the California Red-legged Frog (*Rana draytonii*) and California Tiger Salamander (*Ambystoma californiense*). *Leslie Koenig*[*1], Biologist, and Jackie Charbonneau[2], Ecologist. [1]Alameda County Resource Conservation District,* leslie.koenig@ca.nacdnet.net. *[2]Natural Resources Conservation Service, Livermore Partnership Office; 3585 Greenville Road, Suite 2, Livermore 94550,* jackie.charbonneau@ca.usda.gov.

The Natural Resources Conservation Service (NRCS), Alameda County Resource Conservation District (ACRCD), U.S. Fish and Wildlife Service (USFWS), and Environmental Defense have created a program to benefit the federally threatened California red-legged frog (*Rana draytonii*) and California tiger salamander (*Ambystoma californiense*). Livestock watering ponds provide the majority of remaining aquatic habitat in Alameda County, CA, but most have exceeded their planned lifespan and will be lost if not repaired. Upland habitat surrounding the ponds is being lost to urban and ranchette sprawl. To support ranchers who want to repair, restore, and manage stock ponds and uplands for habitat, we are offering several incentives: (1) 90% cost share that leverages funds from NRCS, USFWS, and other sources; (2) programmatic environmental permitting; (3) Safe Harbor Agreements; and (4) facilitation of conservation and mitigation easement opportunities. With assistance from several species experts, NRCS technical specifications for pond repair were customized to meet the habitat requirements of the two amphibians. Because grazing management to benefit these species suffers from insufficient and often contradictory guidance, we are developing rigorous and practical guidelines. The program provides a much-needed model for using Farm Bill funds to assist species recovery and to help ranchers stay on the land.

Upland Habitat Restoration on Retired Farmlands in the Tulare Basin. *Karl Kraft, Bureau of Land Management, Bakersfield Field Office, Atwell Island Restoration Project, 3801 Pegasus Drive, Bakersfield 93308,* kkraft@ca.blm.gov.

Although anthropogenic habitat conversion has generally been detrimental to most ecosystems, land retirement is beginning to provide opportunities to reverse the trend and to enhance biodiversity. The Atwell Island Restoration Project located in the Tulare Basin is retiring marginal farmlands and restoring them to native uplands habitat. Retired lands provide habitat for wildlife and connectivity with other natural areas. There are however many challenges to restoration such as unknown original habitat conditions, few reference sites, an altered hydrology, only a few native species in the seed bank, large amounts of weed seed in the seed bank, high variation in rainfall, the effects of different soil types, and the effects of past agricultural practices. We have found that soil type generally determines species selection for planting and that a mixture of burning and large-scale horticultural techniques has been very successful in restoring over 2000 acres. Ecosystems however are very complex and it is very difficult to create a single recipe for these habitats because there are just too many variables. We have found out what works best for us through farming experience and lots of trial and error.

Conserving Native Bee Pollinators in Central Valley Rangelands. *Jon O'Brien, Habitat Restorationist, Audubon California Landowner Stewardship Program, Winters 95694,* jobrien@audubon.org.

California's rangeland resources have sometimes been degraded by poor land management practices that have reduced of plant and animal diversity, accelerated erosion, degraded riparian habitats and reduced important ecosystem processes such as migration and pollination. However, many ranchers recognize the economic and environmental value of sustainable range management practices. Given that one half of the estimated three million acres of rangelands in California are privately owned and rangelands can play an important role in providing important forage, nesting sites and sanctuary for native bees, Audubon is working to augment its rangeland work to include native bee conservation. The project is primarily focused on creating habitat for native bees by working with ranchers to install bee blocks, restoration projects featuring a planting palette with year round nectar source, bare ground scrapes and demonstration sites at Audubon Bobcat Ranch and the Farm on Putah Creek, both located in Winters, Ca. The project work features collaboration with the Xerces Society's and Dr. Claire Kremen, University of California, Berkeley. Through the Pollinator Project we have implemented five bee habitat restoration and demonstration projects, created a demonstration project at the Farm on Putah Creek in Winters, California and conducted two workshops with 40 growers and ranchers over the course of two years.

Quartermaster Reach Restoration. *Tania Pollak[1], Natural Resource Planner/ Project Manager and Jeff Peters*[*2], Geomorphologist/Restoration Specialist. [1]Presidio Trust, 34 Graham Street, San Francisco 94129,* tpollak@presidiotrust.gov. *[2]ICF Jones & Stokes, 630 K Street, Suite 400, Sacramento 95814,* jpeters@jsanet.com.

Since the turn of the last century, approximately 42% of tidally-influenced marsh habitat in the San Francisco Bay Area and along the California coastline has been lost to commercial, industrial, and residential development. Of particular significance is the 79% loss of associated brackish marsh habitat, which supports a diverse mixture of flora and fauna and complex ecological processes due to the interchange of freshwater and salt water. This project seeks to restore a functioning

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tidally-influenced marsh with a significant amount of brackish water habitat in between two previously restored water features — Crissy Field Marsh and the upstream riparian corridor called the Thompson Reach, within the Presidio of San Francisco. The objectives of the project are to: a) daylight the stream (currently within a culvert) to create a continuous hydrologic connection between Crissy Marsh and the Thompson Reach, b) create a continuous wildlife corridor between the upper watershed and Crissy Marsh, c) restore a diverse mosaic of coastal wetland and upland habitats to support native wildlife; and d) interpret the cultural history of the site. The highly urbanized setting and the cultural and historic resource values of the Presidio pose several unique challenges to restoration of the Quartermaster Reach. This poster will examine these challenges, illustrate the desired landform components that will be incorporated in the marsh design, and present the current habitat and grading designs. The Quartermaster Restoration project is a collaborative effort between the Presidio Trust and the National Park Service.

The Role of Citizen Scientist in Plant Conservation: The Santa Rosa Plain 'Adopt a Vernal Pool' Endangered Plant Survey Program. *Christina M. Sloop, Laguna de Santa Rosa Foundation, PO Box 7886, Santa Rosa, 95407,* christina@lagunafoundation.org.

The Santa Rosa Plain has lost 85% of its vernal pools due to changes in land use in recent decades, significantly reducing the number of populations of local native endangered vernal pool plants. Many of the remaining populations are presently under unfavorable management regimes, or are slated to enter a new phase of grazing management. Updated baseline information is needed for a comprehensive conservation tactic that takes into consideration the entirety of a given vernal pool endangered species' range, genetic structure, and habitat status and needs. In 2008 we successfully launched a volunteer citizen scientist based project to establish an effective long-term comprehensive standardized assessment of extant populations of three endangered vernal pool plants: Sebastopol meadowfoam (*Limnanthes vinculans*), Sonoma sunshine (*Blennosperma bakeri*), and Burke's goldfields (*Lasthenia burkei*). The program provides resource managers with a current 2008 baseline and continual up-to-date knowledge of population status and habitat conditions across the entire range of the three species, crucial for making appropriate management and conservation decisions to achieve species recovery. We continue to recruit and train citizen scientist volunteers to 'adopt' additional vernal pool sites in support of our data collection work. We ensure quality control of data collection, and manage a comprehensive accessible online database. With increasing demands on our natural resources and scarcity of funds to support professional long-term monitoring programs, we believe that citizen scientists have an important role to play in providing resource managers with the information needed in decision making.

Malibu Lagoon Restoration and Enhancement Project: The Construction Challenges in Restoring Part of Southern California's Historic Tidal Wetlands. *Kristin Teddy*[1] and Kevin MacKay*[2], ICF Jones & Stokes. [1]630 K Street, Suite 400, Sacramento 95814,* kteddy@jsanet.com. *[2]2841 Junction Avenue, Suite 114, San Jose 95134,* kmackay@jsanet.com.

Malibu Lagoon is a 31-acre shallow water embayment located at the terminus of the Malibu Creek Watershed, the second largest watershed draining into Santa Monica Bay. Located adjacent to the famous Surfrider Beach, the site receives approximately 1.5 million visitors every year and is a key component of the California State Park System. Although it is surrounded by urban development, Malibu Lagoon provides a unique opportunity to restore a portion of the state's historic coastal wetland habitat. ICF Jones & Stokes is currently working with the Resource Conservation District of the Santa Monica Mountains, California Coastal Conservancy, and the California Department of Parks and Recreation to prepare detailed plans and specifications to guide restoration of Malibu Lagoon. Construction of the project will be challenging. Various constraints include: cultural resource sensitivity where hand excavation may be the only option, adjacent property owners within 100' in some locations, expensive dewatering of the lagoon to allow for excavation, working around critical times for special status species such as the tidewater goby and southern steelhead trout, and maintaining public access to the famous Surfrider beach through an active construction site.