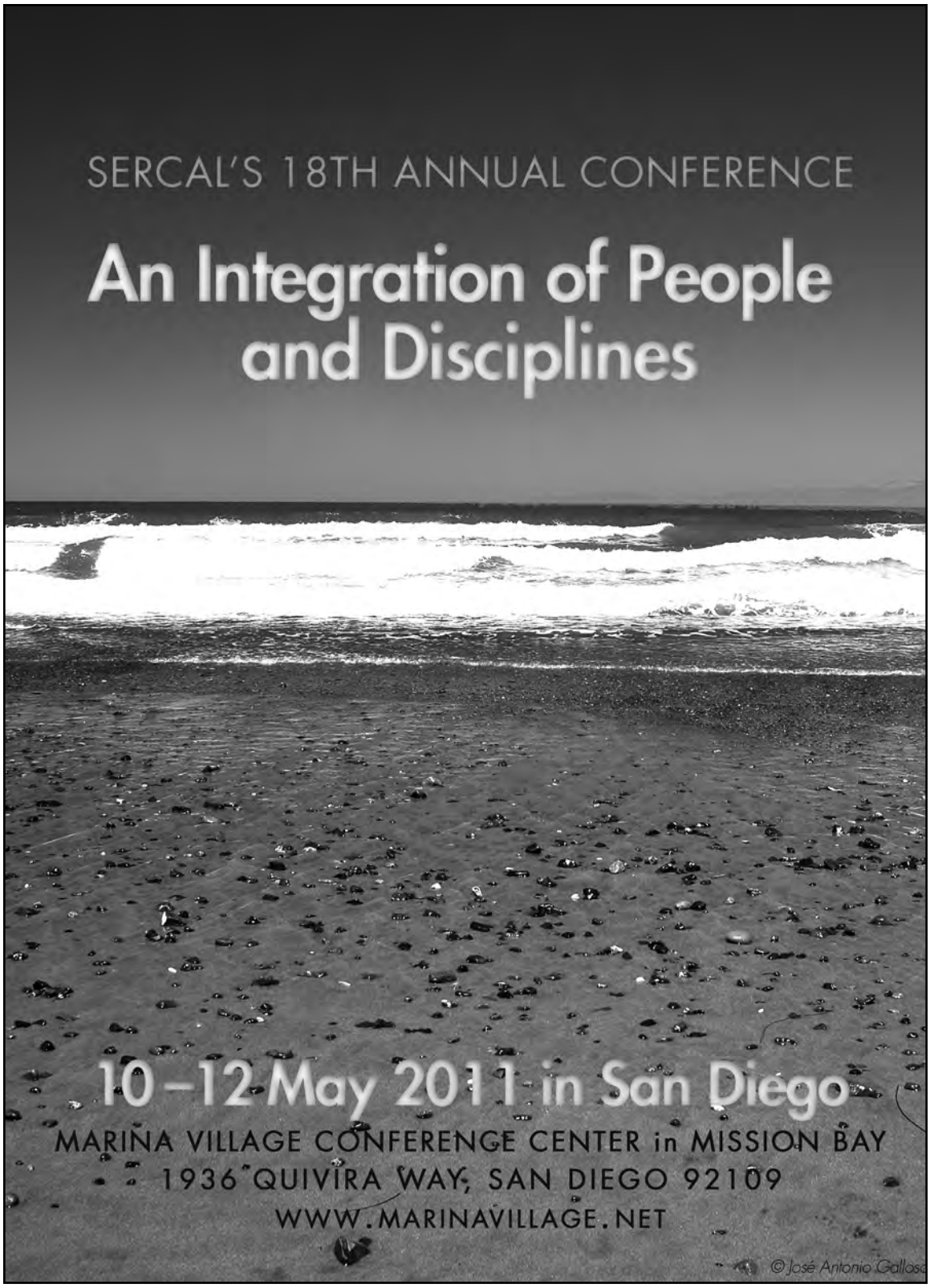

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A male Pipevine Swallowtail *(Battus philenor)*. *©2007 Dennis Walker*

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SESSION 1

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

SESSION 2

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SESSION 3

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SESSION 4

Kathleen Pollett *Biologist, Partners for Fish & Wildlife Program, USFWS*

SESSION 5

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SESSION 6

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SESSION 7

Brian Collins *Wildlife Biologist, San Diego National Wildlife Refuge Complex, USFWS*

SESSION 8

Ross Taylor *Fisheries Biologist, Ross Taylor & Associates*

SESSION 9

Peter Tomsovic *Principal, Restoration Team, RECON Environmental, Inc.*

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Ryan West *Manager, RECON Native Plants Nursery*

Chris Nordby *Nordby Biological Consulting*

And many thanks to our tour fiesta lunch host: ***RECON Environmental & Native Plants Nursery***

Proven and Emerging Technologies

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

Saline Groundwater Mitigation and Reclamation in Riparian Environments: Challenges, Possibilities.

Monisha Banerjee, Matt Grabau, Michael Milczarek, Mark Murphy. GeoSystems Analysis, Inc., 2015 North Forbes Boulevard, Suite 105, Tucson AZ 85745. monisha@gsanalysis.com*

Through the Lower Colorado River (LCR) Multi-Species Conservation Program (MSCP), the US Bureau of Reclamation is revegetating thousands of acres currently farmed or dominated by saltcedar (*Tamarix ramosissima*) with native riparian and upland vegetation. Following decades of Colorado River management for anthropogenic goals, soil and groundwater salinity within some areas of the historic floodplains have increased to levels greater than the tolerance of many native plant species. Since native phreatophytes access both soil water and groundwater, irrigation management must be used to avoid salinizing good quality groundwater. The restoration areas will be irrigated with relatively high-quality water, and effective irrigation management, specifically leaching might mitigate excessive soil salinity. However irrigation leaching could exacerbate already saline groundwater. Where saline groundwater exists, new techniques must be devised to mitigate this problem, since there are no saline groundwater remediation techniques in widespread use. Groundwater freshening, where a freshwater lens is created above an unconfined saline aquifer, is a novel technique that has been implemented to restore riparian areas outside of the U.S. Groundwater freshening, often done in conjunction with groundwater pumping, can be achieved by injecting freshwater, flooding, or inducing river water recharge and could be an effective restoration technique along the LCR and other riparian areas with saline groundwater. For areas with saline groundwater, determining methods to improve the quality of groundwater is imperative if the restoration goal is to revegetate with native phreatophytes.

Building California EDN: Network of Early Detection Networks to Protect California from New Plant Invasions.

Daniel Gluesenkamp, PhD, California Early Detection Networks, 3 Balboa Street, San Francisco 94121. conservation@gluesenkamp.com

In 2006 we began building the Bay Area Early Detection Network (BAEDN), an initiative which coordinates and organizes Early Detection and Rapid Response (EDRR) to plant invasions across the nine counties which contact the San Francisco Bay. BAEDN partners developed an operating framework, obtained grant support, and pulled together critical EDRR infrastructure. BAEDN staff predict which species will be most harmful, coordinate detection of infestations, and prioritize the most harmful outbreaks for eradication. BAEDN then works with agencies and citizens to proactively deal with the highest priority outbreaks before they grow into large and costly threats. This "stitch-in-time" approach minimizes the environmental and economic damage caused by these invaders; educates citizens; and dramatically reduces the need for planning and resources required to control large, established invasive plant populations. In this talk we discuss lessons learned from building the BAEDN. We will also present the infrastructure and systems now available to others building multi-county regional early detection networks, including an integrated mapping platform using mobile phone mapping systems and cloud-based occurrence mapping tools. Finally, we will talk about efforts underway to build California EDN: a coordinated network of networks protecting California from harmful new invasions.

Direct Seeding for Cottonwood and Willow Riparian Re-vegetation.

Matthew R. Grabau, Michael A. Milczarek. GeoSystems Analysis, Inc., 2015 N. Forbes Blvd. #105, Tucson AZ 85745. matt@gsanalysis.com*

In order to mitigate historic destruction of native species habitat, enhance flood control, and increase streambank stability, land managers are actively re-vegetating thousands of hectares of cottonwood (*Populus* spp.) and willow (*Salix* spp.) forests. Salicaceae species are commonly established via vegetative propagation, which typically consists of pole planting, or placement of rooted or bare cuttings. Despite high revegetation success, there are concerns with using vegetative propagation for large-scale revegetation. Stems are taken from a limited number of source trees which reduces genetic diversity, provides homogeneous growth rates, and can result in unfavorable sex ratios. Because Salicaceae species are dioecious, direct seeding ensures that genetic information from many trees is incorporated into restoration sites. Consequently, it has been suggested that sexual propagation should be used whenever possible, and if direct seeding can be implemented for *Salicaceae* species, the costs of large-scale riparian habitat restoration could be dramatically reduced. However, it has been speculated that cottonwood and willow seed cannot be stored for long periods of time while maintaining favorable germination rates, and previous seeding attempts have been largely unsuccessful. During a stepwise feasibility study, we showed that seed viability can be extended to several years by freezing. Additionally, seedling establishment and growth during greenhouse and field study trials following refined seed treatment and seeding methods indicates that direct seeding might result in greater vegetation density and genetic and structural diversity, while reducing costs compared to current vegetative propagation techniques.

Long-term Monitoring of Horticultural and Ecological Performance of Riparian Restoration.

Hammond, J.E.[*1], *F.T. Griggs*[2]. *River Partners* [1] *1301 L St., Suite 4, Modesto 95354;* [2] *580 Vallombrosa Ave., Chico 95926. jhammond@riverpartners.org*

The highly altered and managed ecological conditions present on most rivers in California has resulted in the >95% loss of historic riparian forests throughout the state. This has created the need for active horticultural restoration to re-build riparian habitat that supports obligate wildlife populations. It is generally accepted that riparian restoration is beneficial to wildlife populations, however the horticultural performance and successional trajectory of the vegetative communities at these sites remains largely unknown. This pilot study provides a baseline of data that begins to document the successional vegetative changes that occur through time. Our study focused on 8 and 15 year old restoration sites along the Sacramento River where restoration has been underway for more than 2 decades. We examined plant density, species richness, vegetation structure, and community composition. Our results indicate that while plant density decreases from initial planting for both age categories, species richness does not decrease significantly. Shifts in community composition show mid and late succession species, including cottonwood and valley oak, increase in importance value from 8 to 15 year old sites while early succession species such as coyote brush show a decrease in importance value. Our results indicate successional processes are underway at these restoration sites, although site-specific conditions are undoubtedly contributing to successional pathways. Future work of the Long-term Monitoring Program will focus on ecological and landscape variables that will provide practitioners with the information necessary to target specific vegetative communities and structural features for target wildlife species.

Functional and Condition Based Assessment Methods: A Multipurpose Tool in the Restoration Planning Toolbox.

Lindsay Teunis[*1], *Christopher W. Solek*[2]. [1]*AECOM, Ecological and Environmental Planning Practice, 1420 Kettner Blvd., Suite 500, San Diego 92101;* [2]*Southern California Coastal Water Research Project, 3535 Harbor Blvd., Suite 110, Costa Mesa 92626. lindsay.teunis@aecom.com*

Although functional and/or condition based assessment methods are not novel to the field of restoration planning and design, the range of methods available are diverse and ever evolving. In California, two methods commonly employed to assess wetland condition and/or function are the Hydrogeomorphic Assessment Method (HGM) and the California Rapid Assessment Method for Wetlands (CRAM). HGM has been used for decades as means to assess wetland function. It was developed as a site-specific assessment tool for use in select watersheds within a narrowly defined bioregion. More recently, CRAM was developed as a rapid approach to assess the range of wetland conditions commonly encountered throughout California. CRAM attributes and corresponding metrics can be related to wetland functions, values and beneficial uses, although they are not measured directly by CRAM. Both methods have been used to assess wetlands at a variety of spatial scales, from habitat patches within local restoration projects, to watersheds and regions of various sizes. HGM and CRAM can be used to assess site conditions pre- and post-impact, evaluate site mitigation potential, guide restoration design and adaptive management decisions, and monitor restoration progress. However, the two approaches differ fundamentally in their scope of applicability and the amount of expertise and field effort required. Applications and case studies of these two assessment methods from California will be presented within the context of restoration planning, design, and implementation. In addition the advantages and limitations of each method will be discussed.

Using Resilient Planning Techniques in Mining and Reclamation.

Mignone Wood, AICP, LSA Associates, Inc., 395 Oyster Point Boulevard, Suite 307, South San Francisco 94080. mignone.wood@lsa-assoc.com

Adaptive management is a process used to improve the reclamation process by making adjustments when unforeseeable conditions arise. We will examine the resilient planning techniques used at an aggregate quarry when unexpected challenges are encountered during the reclamation plan creation and implementation. Reclamation of Canal Quarry, located in Richmond California, presented numerous challenges. Mined since 1959, operators used hillside and open pit mining to harvest aggregate. The site is characterized by an excavated 150-foot high slope abutting public parklands and a flat quarry floor. During reclamation, several site conditions were addressed including a severely eroded unstable slope, poor drainage, inadequate revegetation and rock topple. Stormwater runoff was addressed by surface and subsurface drainage systems. Subsurface drains were installed to prevent damage to the earth buttress constructed with a geogrid matrix. Stormwater falling onto the graded slopes were collected in v-ditches lined with turf reinforcing material (TRM). Using the TRM effectively reduced the velocity of stormwater in the ditches, reduced the amount of sediment flowing off-site, allowed percolation into the ground and cost less than a concrete lined ditch. To facilitate revegetation, an area-specific planting program was proposed. The compacted quarry floor soil was evaluated for its ability to support planting. Customized seed mixes were used for hydroseeding and woody plants were hand planted.
Today, Canal Quarry boasts a grassy hillside of native vegetation flourishing on the face of the former quarry. After much anticipation and through all of the site's complexities, Canal Quarry is the successful result of strategic reclamation practices.

session 2 Wednesday 11 May 1:30p — 5:15p *Terrace*

Restoration for Sensitive Species

Chair: **Trish Smith** *The Nature Conservancy*

Restoring Native Vegetation on Santa Cruz Island, CA.

Coleen Cory, The Nature Conservancy, Santa Cruz Island Project, 3639 Harbor Blvd., #201, Ventura 93001. ccory@tnc.org

Santa Cruz Island (SCI), the largest of eight California Channel Islands lying off the coast of Southern California, experienced nearly 150 years of ranching and agriculture. Sheep, cattle, pigs, game birds, honeybees and more than 170 species of non-native plants were all introduced to the island. In 1978, a new era of conservation and restoration began on SCI when The Nature Conservancy initiated management of the western 90% of the island. The eastern 10% of the island became part of the Channel Islands National Park in 1996 allowing the biological diversity of the entire 243 km^2 island to be jointly managed. The initial focus of restoration was on removal of non-native animals that were devastating the vegetation, causing widespread erosion, and indirectly contributing to the plummeting population of the endemic island fox. By 2007, all non-native ungulates were gone from SCI, and the island fox population was rebounding. Management attention then turned to the removal of habitat-modifying weedy plants and restoration of native vegetation. The positive effects of ungulate removal can be seen in the increased numbers of oak and pine seedlings and the recolonization of formerly barren slopes by coastal sage scrub and chaparral. Portions of the island that were intensely farmed and grazed are currently dominated by annual grasses and fennel, and native vegetation recovery is slow in these areas. This has prompted trials of native plant rehabilitation techniques, some of which are showing promise for converting these degraded lands back to habitat dominated by native species and natural processes.

Management Considerations for Protecting and Enhancing Populations of Annual Species: The Southern Tarplant Case Study.

Dave Harris, Lisa Stratton. Cheadle Center for Biodiversity and Ecological Restoration, MC 9615, UC Santa Barbara, 93106. dharris@lifesci.ucsb.edu*

According to the California Native Plant Society nearly 30% of all rare plant species in California are annuals. The majority of these can be characterized as *disturbance followers*, needing specific environmental disturbance regimes for populations to persist. Yet a goal of many restoration projects is to reduce disturbance so as to maintain biotic resistance against invasion by non-native species. The preservation of rare disturbance- dependent annual populations requires adaptive and creative management. Here we report on a restoration project designed to preserve and enhance a population of southern tarplant *(Centromadia parryi* ssp. *australis)* on the UC Santa Barbara campus. Over five years of implementation of the project, multiple changes were made to the original protocols. Our increased knowledge about the ecology of southern tarplant and our understanding of the response of the seedbank and established vegetation to disturbance, led to changes in the methodology of site management, altered propagation protocols, altered approaches to exotic weed control, and detailed performance monitoring. Our adaptive management strategy has been successful for maintaining high densities of the tarplant, and the enhanced monitoring provides more comprehensive insight into the health and ecology of the tarplant population. Here we provide details which we believe are relevant to the broader issue of managing disturbance dependent species within restoration sites.

Direct Seeding of Native Shrubs: Experimental Results from Santa Cruz Island.

David Hubbard[1], Matthew James[1], Coleen Cory[2]. [1]Coastal Restoration Consultants, Inc., 5032 Pacific Village Drive, Carpinteria 93013; [2]The Nature Conservancy, Santa Cruz Island Project, 3639 Harbor Blvd., #201, Ventura 93001. dave@crcsb.com*

Restoration of native habitats on islands is more challenging than in mainland settings due to concerns about maintaining the integrity of island populations and genotypes, including endemics. Incidental introduction of non-native species and genotypes must be strictly avoided. To achieve restoration that meets these high standards for conservation in island ecosystems, seeds must be custom-collected and nursery stock grown on site using sterile soils, supplies and tools, all of which add costs. Minimizing disturbance to existing populations of native and endemic species in the process is paramount. Direct seeding onto undisturbed soils can avoid some risks and pitfalls of more elaborate restoration techniques and soil manipulations and cost less, however responses may be slower than other methods. We experimentally investigated the effectiveness of seeding in restoring coastal sage scrub in post-agricultural non-native annual grasslands on Santa Cruz Island, CA. This replicated experiment ran simultaneously with one using planted nursery stock custom-grown from island-collected seed; neither included irrigation. To evaluate the efficacy of direct seeding in re-establishing native cover, we manipulated thatch, treated weeds and introduced seeds of >20 species of native shrubs and grasses over two rain seasons. Even with intense thatch removal and weed control, direct seeding produced low recruitment, trivial cover and no first-year reproduction of native shrubs in this setting. However, two island endemic buckwheat species performed dramatically better than all other species combined, suggesting that

with some site preparation these species may be viable candidates for direct seeding as a restoration approach on Santa Cruz Island.

Planting Native Shrubs from Small Nursery Stock: An Experiment on Santa Cruz Island.

Matthew James[1], David Hubbard[1], Coleen Cory[2]. [1]Coastal Restoration Consultants, Inc., 5032 Pacific Village Drive, Carpinteria 93013; [2]The Nature Conservancy, Santa Cruz Island Project, 3639 Harbor Blvd., #201, Ventura 93001. matt@crcsb.com*

Restoration of native habitats on islands presents special challenges. The integrity of island populations must be maintained, and introduction of non-native species and genotypes must be avoided. To meet high standards for conservation in island ecosystems, propagules must be collected and grown on-island. Collecting seed from sometimes small, hard-to-access populations may affect the island's natural recovery and is expensive. This makes direct seeding of large areas a challenge. Growing and installing small container plants may be more cost-effective. We experimentally investigated the effectiveness of planting native shrubs and grasses from small plugs without irrigation in restoring coastal sage scrub on post-agricultural lands on Santa Cruz Island, CA. We chose three experimental sites (1.5 acres total) in areas dominated by annual grasses and fennel. To evaluate the most effective method for re-establishing native cover, we treated weeds and introduced over 7,000 plants of >20 species of native shrubs and grasses over two rain seasons. We found that 1) without weed treatment, planted natives had low first-year survival and cover and rarely flowered, 2) with one round of weed treatment, just prior to planting, survival was higher, cover greater and most species flowered and several recruited from seed in the second year, and 3) multiple rounds of weed control over two seasons had minor benefits compared to a single treatment. The techniques we developed and tested in this project have broad applicability on the mainland, especially for projects where commercial seed is not desirable and for projects where irrigation is not feasible.

Efforts to Recover the Ventura Marsh Milkvetch (*Astragalus pycnostachyus* var. *lanossismus*).

Sheri Mayta[1], Mary Meyer[2]. [1]Coastal Restoration Consultants, Inc., 5032 Pacific Village Drive, Carpinteria 93013; [2]California Department of Fish and Game, 4949 Viewridge Avenue, San Diego 92123. smayta@att.net*

Prior to 1997, Ventura marsh milkvetch was considered extinct and known only from old herbarium collections. A population was discovered on imported fill at an oil waste disposal site near Oxnard, California and was listed as endangered in 1999. Efforts to characterize the life history and habitat requirements were undertaken so that experimental introductions could occur, aimed at furthering recovery and reducing extinction risks. Seeds were collected from the wild site, tracked by maternal line and seed bulking was undertaken. Between 2002 and 2004, 472 juvenile nursery raised plants were installed at various sites along the coast in Ventura and southern Santa Barbara counties. Outplanting locations were typically ecotones between coastal wetlands, dunes, and/or uplands. We monitored survival, reproduction and mortality of founders and their natural recruits. Milkvetch performed poorly at sites near high salt marsh, and on drier dune areas. Outstanding vigor and natural recruitment has been documented periodically at some sites. Milkvetch prefer vegetation gaps and low competition growing sites with low levels of thatch and litter. Establishment from seed is favored at locations with a near surface perched water table but dry surface soils. Herbivory by rabbits and meadow voles has been severe at certain locations and minimal at others. Increased vegetative cover and expansion of rhizomatous perennial wetland plants has eliminated suitable growing conditions at some sites. Entrenched weed invasions and non-native snails require ongoing management. Our findings indicate that recovery will be challenging and efforts continue to locate other types of potentially suitable introduction sites.

Balancing Conflicting Needs for Sensitive Species during Habitat Restoration.

Scott McMillan, Lindsey Cavallaro, Cecilia Meyer Lovell. AECOM, 1420 Kettner Blvd., Suite 500, San Diego 92101. Scott.McMillan2@aecom.com.*

The challenges of restoring native habitat in coastal Southern California ecosystems are numerous, but when habitat restoration is intended for sensitive species, balancing conflicting needs for these species compounds the challenge. Appropriate habitat restoration efforts for one sensitive plant or animal species may not always coincide with the habitat restoration needs of another sensitive species. For over 15 years, we have planned and implemented native habitat restoration in Southern California balancing the needs of these unique species. To be successful, this issue must be addressed during planning and permitting stages through the implementation and monitoring stages of a restoration project. Challenges include permitting requirements, seasonal variation and timing, potential reduced mitigation site size, limited inoculum availability or migration sources, specific habitat requirements and habitat use, and conflicting restoration approaches. Our experience includes restoration for almost every habitat type in coastal Southern California. Using case studies from existing vernal pool restoration projects, including Caltrans/Southbay Expressway's State Route 125 South and Caltrans' Dennery Canyon West restoration sites, we will highlight innovative solutions for balancing these needs. Specifically, we will show how to balance the needs of vernal pool species, such as San Diego and Riverside fairy shrimp, San Diego and Otay mesa mint, San Diego button-celery, spreading navarretia, and other vernal pool endemics, with the needs of upland sensitive wildlife species, such as California gnatcatcher, burrowing owl, coastal cactus wren, Quino checkerspot butterfly, and upland sensitive plant species, such as Otay tarplant, variegated dudleya, and barrel cactus, for a successful restoration project.

continued

Matilija Dam Ecosystem Restoration Project.
Steven Reinoehl, Natures Image, Inc., 20361 Hermana Circle, Lake Forest, California, 92630. sreinoehl@naturesimage.net

Matilija Dam was built in 1947 within Ventura County to provide a local water supply and flood control. This dam adversely impacted the ecosystem from the headwaters of Matilija Creek downstream sixteen miles to the Pacific Ocean. It prevented the natural flow of water, sand and sediment from the mountains to the beaches; resulting in significant environmental changes. One year after the completion, massive fish kills due to warming stagnate water were reported in this once viable Steelhead Trout and Salmon habitat. The sedimentation accumulating behind the dam reduced its amount of water capacity eliminating the dams' effectiveness. As a result, invasive species dominate the riparian habitat and have caused a severe decline in wildlife diversity and abundance. Numerous project stakeholders were involved in how best to face the challenges to restore the watershed. One of the first phases to begin the Matilija Dam Ecosystem Restoration Project was to eradicate 1,200 acres of invasive weed species including Arundo, Tamarisk, Castor Bean and Spanish Broom through mechanical and chemical methods. Emphasis was taken to minimize damage to the native vegetation and prevent contamination of ground water resources during the entire removal process. During and after the removal of the invasive species, water testing revealed no groundwater contamination. In addition, the fire hazards that are present in areas dominated by *Arundo donax* were significantly reduced by removing this one invasive species. The successful outcome of this project is just the first step in restoring the vitality to this ecosystem.

session 3 Wednesday 11 May 1:30p — 3:00p *Dockside*

Programmatic Restoration Planning at San Elijo Lagoon

Chair: **Doug Gibson** *Executive Director/Principal Scientist, San Elijo Lagoon Conservancy*

Stakeholder Success: Restoration Planning Progress at San Elijo Lagoon.
Teri Fenner, Cindy Kinkade. AECOM, 1420 Kettner Blvd, Suite 500, San Diego, 92101. teri.fenner@aecom.com*

Development has affected almost every lagoon in southern California, including San Elijo Lagoon. This coastal wetland has gradually been constrained by abutting development and roads/railroads that reduce the tidal prism and lead to a degradation of water quality. If no action is taken to restore the lagoon, on-going change in species will continue to contribute to the transition from a diverse, open water/mudflat lagoon to a primarily salt marsh lagoon. And, in the future condition with sea level rise, ultimately even that more monotypic habitat may be inundated. The San Elijo Lagoon Restoration Project is an effort to restore lagoon functions and values and plan pro-actively for sea level rise. Recent planning efforts have been boosted by the active participation of a committed group of agency stakeholders. Planning efforts had been stalled for 15 years. Now, routine participation of a diverse group of stakeholders has moved the project into engineering modeling and environmental documentation with steady progress for 2+ years. Stakeholders include not only agency staff involved in managing the lagoon and the infrastructure traversing it, but also regulatory staff that would authorize restoration. This presentation will summarize the steps undertaken to establish the stakeholder group, describe how the project team works collaboratively to gather and present information to decision-makers, and how this partnership maintains forward momentum. It will also highlight key steps that have been accomplished as a result of this integrated stakeholder process.

Development and Assessment of Restoration Alternatives — San Elijo Lagoon Restoration Project.
Chris Nordby, Nordby Biological Consulting, 5173 Waring Road #171, San Diego 92120. nordbybio@gmail.com

The San Elijo Lagoon Restoration Project is an ecosystem-wide restoration effort with the overarching goal of improving the physical and biological functions of the lagoon. Development of feasible restoration alternatives that can accomplish this goal presents a challenge to project planners. Many factors must be considered when developing alternatives, including:

- What are the biological and physical restoration objectives and how are they related?
- What are the existing biological resources and how will these be affected?
- To what degree can restoration alternatives accommodate predicted sea level rise?

- How can regional restoration goals be attained?
- What are the maintenance requirements and costs of each alternative?
- Which restoration alternative provides maximum benefit to the lagoon?

The answers to these question are complex and can involve certain trade-offs. For example, designing for maximum tidal prism to ensure an open inlet may reduce the area available for restoration of intertidal wetlands. The San Elijo Lagoon Restoration project alternative development and assessment has involved a diverse group of stakeholders and project consultants. Four restoration alternatives have been developed and analyzed relative to project goals and objectives. This presentation will focus on the process of developing and assessing the alternatives for this regionally important restoration project.

San Elijo Lagoon Restoration Project Planning and Engineering.

Chris Webb[1], Doug Gibson[2], Keith Greer[3], Megan Johnson[4]. [1]Senior Scientist, Moffatt & Nichol, 3780 Kilroy Airport Way, Suite 600, Long Beach 90806; [2]Executive Director, San Elijo Lagoon Conservancy, P.O. Box 230634, Encinitas 92023; [3]Senior Regional Planner, San Diego Association of Governments, 401 B Street, Suite 800, San Diego 92101-4231; [4]Project Manager, California State Coastal Conservancy,1350 Front Street, Suite 3024, San Diego 92101. cwebb@moffattnichol.com*

A large-scale restoration project is currently being planned at San Elijo Lagoon, a coastal lagoon in northern San Diego County. San Elijo Lagoon experienced significant degradation throughout the late 1800s and 1900s after installation of transportation infrastructure across the lagoon, and urbanization of the watershed. As a result, existing hydrologic conditions are modified from a full tidal system leading to degraded habitat, and water quality is impaired. The San Elijo Lagoon Conservancy manages the ocean tidal inlet in an open condition most of the year, but the connection is still constrained. Resource agencies, land and infrastructure owners, and local agencies are working collaboratively together to restore the site to more stable tidal conditions. Technical analyses have been completed as part of restoration planning, and consist of a suite of preliminary engineering and habitat studies. Engineering studies include tide/flood hydrology, inlet stability, water quality, shoaling, tidal muting, and maintenance dredging. Other studies of shoreline morphology and surfing impacts will be initiated in Spring of 2011. Results of preliminary engineering studies will be summarized and presented in context with habitat analyses. Implementation of this project and adaptive management of its future condition will be challenging considering dynamic conditions of sea level rise and future climatic variations.

session 4 Wednesday 11 May 3:30p — 5:15p *Dockside*

Restoration Funding

Chair: **Kathleen Pollett** *Partners for Fish and Wildlife Program, USFWS*

Rare Habitat Restoration on a Nonprofit Budget: Coastal Sage Scrub Restoration at Audubon's Starr Ranch Sanctuary.

Sandra A. DeSimone, Audubon California's Starr Ranch Sanctuary, 100 Bell Canyon Rd., Trabuco Canyon 92679. sdesimone@audubon.org.

At Audubon's 4,000-acre Starr Ranch Sanctuary in southern California, we have taken a non-chemical, research-based approach to coastal sage scrub (CSS) restoration since 2001. Currently we're working on invasive control and restoration in 480 acres of which 154 acres are currently in both passive and active CSS restoration. Many monitored CSS restoration sites have reached a mean of 60% total native cover after 1 to 3 seasons. All work is done by a five person seasonal field crew and two interns who come to live and work at the Ranch each season for 6 to 9 months. Their salaries contribute to the bulk of invasive control and restoration costs. Because Starr Ranch was a former working cattle ranch, historic buildings on site provide housing for seasonal staff so that salary costs are relatively low ($350–450/wk). To calculate per acre costs, staff closely tracks work time: we spend < $400/acre/yr using a rate of $20/hr/person. We fund restoration projects through government and foundation grants and private donations. Partnerships with the USFWS, NRCS, and the Orange County Conservation Corps (OCCC) have played a vital role in making our work possible. Since 2002 funding from USFWS Partners for Fish and Wildlife has helped make our innovative work possible. In 2009, as a result of this partnership, we connected with NRCS and received a WHIPS grant. OCCC crews assist with field work. Additionally, hundreds of volunteer "Weed Warriors," recruited by interns, also help us with non-chemical invasive removal.

Helping People Help the Land: From Land Conservancies to Local Farmers to Tribes.

Shea O'Keefe, USDA-NRCS, 332 South Juniper St., Suite #110, Escondido 92025. shea.okeefe@ca.usda.gov

This presentation will describe the various funding sources available through the Natural Resources Conservation Service (NRCS). Focus will be on the Wildlife Habitat Incentives Program (WHIP), the Environmental Quality Incentives Program (EQIP) and the Wetlands

continued

Reserve Program (WRP). Depending on the program, these funding sources can be administered to agriculture and non-agriculture lands but must address certain natural resource concerns. Several example projects will be highlighted, including individual producers improving pollinator habitat, wetland enhancement projects and watershed-scale restoration projects. Partnerships are often vital to a projects success because of the various ownerships involved in restoring on a watershed-level scale. In my examples, these entities include the city and county of San Diego, but are maintained under operating agreements by several private landowners, a joint powers authority and a land conservancy. These multi-agency ownerships and multi-entity operating agreements provide a need for a coordinated effort. Due to the diligent efforts by all involved parties, approximately 550 acres of the watershed was funded in 2008 under the WHIP program. Under this program platform, funding and leadership were provided for restoring the ecologically important valley of San Pasqual, as well as decrease the susceptibility for continued wildfires. This coordination also led to other funding opportunities with US Fish and Wildlife Service and the San Diego Association of Governments (SANDAG). As of January of 2011, 370 acres has been treated for arundo and tamarisk and 20 acres have been revegetated. By January 2012, another 180 acres will be treated completing this phase of funded restoration.

NOAA Funding Opportunities for Community-based Marine and Coastal Habitat Restoration.

Milena Viljoen Gavala, NOAA Restoration Center / I.M. Systems Group, 6010 Hidden Valley Rd. Suite 101, Carlsbad 92011. milena.viljoen@noaa.gov

The NOAA Restoration Center is devoted to restoring the nation's coastal ecosystems and preserving diverse and abundant marine life. By promoting partnerships and local stewardship, our programs inform and inspire people to act on behalf of a healthier coastal environment. Within the NOAA Restoration Center, the Community-based Restoration Program applies a grassroots approach to restoration and is designed to actively engage communities in on-the-ground restoration of local habitats. NOAA Restoration Center funding and technical assistance support a wide variety of efforts including projects to benefit marine and estuarine habitats and support anadromous fisheries. This talk will focus on the various national and regional NOAA Restoration Center grant funding opportunities available to restoration projects in Southern California.

session 5 Thursday 12 May 8:30a — 3:00p *Dockside*

Urban Restoration

Chair: **Arlene Hopkins** *Architect and Educator, Arlene Hopkins & Associates*

Enhancing Habitat by Redirecting Runoff: Opportunities in Restoration.

Rachel Alford, Lisa Stratton, Dave Harris. Cheadle Center for Biodiversity and Ecological Restoration, MC 9615, UC Santa Barbara 93106. rachel.alford@lifesci.ucsb.edu*

Many restoration projects now take place within urban settings where run-off from hardscaping can present management challenges. The Cheadle Center for Biodiversity and Ecological Restoration (CCBER) at the University of California, Santa Barbara works to use run-off creatively in our restoration projects thereby increasing habitat values, biofiltration, and aesthetics. In addition, the University setting offers a unique opportunity for building ecological knowledge in the outdoor classroom. In this talk we will present examples of several successful ecologically based adaptations of engineering solutions involving run-off from buildings, landscaped areas and parking lots with the goal of encouraging the better integration of engineering challenges with ecological process and possibilities. These project adaptations include re-grading 'detention' basins, low flow diversions to freshwater marshes, and energy dissipation boxes to reduce scouring in wetlands. In addition, we provide supporting data on the use of wetlands to reduce nutrient loads associated with reclaimed water and first flush storm events which benefit downstream wetlands.

Lessons Learned: San Pablo Creek Emergency Bank Stabilization Project.

Jason Drew CPESC[1], Ryan Shaffer PE[2], Karineh Samkian[3]. [1]Nichols Consulting Engineers, P.O. Box 1760 Zephyr Cove, NV, 89449; [2]Nichols Consulting Engineers (NCE), 501 Canal Blvd, Suite I, Point Richmond 94804; [3]City of San Pablo, 13831 San Pablo Avenue, Building 3, San Pablo 94530. jdrew@nce.reno.nv.us*

The San Pablo Creek Emergency Bank Stabilization Project is an excellent example of a public private partnership to protect an urban creek and private infrastructure as well as an example of the future of Urban Creek Restoration. Lower San Pablo Creek is a highly urbanized reach located primarily within the City's of San Pablo and Richmond CA. The Creek has been severely altered by grazing, railroad infrastructure, development and flood control projects over the past 100 years. In several locations residential and commercial development has encroached significantly on creek banks and in some cases into the stream channel. During the winter of 2005 several large rain events caused widescale flooding in the

watershed and destabilized the streambank along several properties on Brookeside Drive in the City of San Pablo. One property owner lost an entire backyard and was in danger of losing the foundation of the house. The City of San Pablo and NCE assisted the homeowner with design, permitting and construction management of a bioengineered bank stabilization project. The design included footing stones, geo-cell bank, willow posts and poles and soil lifts made of biodegradable erosion control blankets. The site had numerous constraints including limited site access, unique soil conditions, perennial flow in the stream and adjacent properties also impacted by the bank instability but not participating in the project. Resources for project design were provided by the homeowner, City of San Pablo and NCE and the construction was funded by the Natural Resources Conservation Service.

Flood Channel Restoration and Urban Sustainability: The Potential and Promise for the Return of Ecological Riparian Function in Urban Los Angeles.

Jessica Hall, Restoration Design Group, 618 Vincent Park, Redondo Beach 90277. jessica@rdgmail.com

With 90% of Los Angeles area streams managed as concrete flood control channels or underground culverts, options for restoring riparian habitat are severely limited. Local entities such as The Los Angeles and San Gabriel Rivers Watershed Council and The Santa Monica Bay Restoration Commission have commissioned studies to explore opportunities for creating connectivity, access and habitat within the Compton Creek, Ballona Creek and Adams Flood Control Channels. Naturalized cross-sections were proposed with consideration of bankfull channel conditions and geomorphic floodplains within constrained flood control rights-of-way. Preliminary hydraulic flood modeling using HEC-RAS evaluated water surface elevations for various design storms, including the One Hundred Year and Los Angeles Capital Storms. The results suggest that partial naturalizations of these flood control channels can be designed to maintain existing levels of flood protection while reestablishing riparian habitat. While these findings are hopeful, projected uncertainties of imported water sources, urban densification, peak oil and other factors suggest a need for larger-scale sustainability planning that could incorporate a higher level of channel dynamics and habitat into urban areas.

An Introduction to the Challenges of Urban Ecological Restoration Illustrated by Emerging Urban Strategies and Solutions.

Arlene Hopkins, Architect and Educator, Arlene Hopkins & Associates, Santa Monica 90405. Arlene.Hopkins@gmail.com

Urban Habitat Restoration in East Coast Cities: Lessons for California.

Mark S. Laska, PhD, Great Ecology & Environments, Inc., 1020 Prospect Street, Suite 402, San Diego 92037. mlaska@geeinc.net

Urban habitat restoration has many challenges including planning for and designing systems likely to succeed in an urban context, creating an experience humans can relate to and learn from, setting appropriate target ecosystem functions that will thrive and developing key metrics to measure success. Moreover, habitat restoration ecologists can often be constrained by drivers of a project — is it for regulatory release of compliance and/or liability, or for public access and recreational utilization. Nonetheless, there are many opportunities to enhance, restore, and create natural systems in an urban context. This presentation will explore these issues using several case studies of ongoing and built restoration projects — newly constructed and designed Brooklyn Bridge Park and Fort Totten Park in New York City, the Croton Water Treatment Plant in New York City, a brownfield site in Woodbridge NJ, Don River Park in Toronto and Union Pier in Charleston, SC. For instance, created salt marshes at Brooklyn Bridge Park had to be designed to be protected from extreme wave action from boats, while the protected marshes at Union Pier had to be designed to withstand significant freshwater storm water runoff. Don River and Woodbridge were systems built on formerly contaminated habitats. Lessons will be drawn and applied to California urban centers that share common challenges to habitat restoration practitioners.

Reclaiming the Bay's Historic Natural Resources: An Overview of Restoration in San Francisco Bay.

Kevin MacKay, ICF International, 75 East Santa Clara Street, Suite 300, San Jose 94113. kmackay@icfi.com

Beginning in the mid-1800s, large areas of San Francisco Bay's wetlands, streams, and rivers were filled, leveed, or drained to create farmland, construct evaporation ponds for salt production, and/or provide land for industrial and residential development. These historic changes in land use and management in the Bay and its tributary watersheds have greatly modified the natural physical and ecological processes, and substantially reduced the amount of available habitat for many dependent fish and wildlife species. In an effort to offset this historic loss of habitat, a number of restoration and/or mitigation projects have been planned and implemented in the Bay over the past 30 years. This presentation will provide an overview of several of the more prominent projects including restoration of tidal wetlands and enhancement of open water habitat in the South Bay and at the mouth of the Napa River, restoration of shaded riverine aquatic and instream habitat to benefit salmonids on the Napa and Guadalupe Rivers, creating habitat to support listed wildlife species as part of Habitat Conservation Plans, and daylighting a culverted creek on the Presidio of San Francisco. The presentation will also discuss the "lessons learned" from a riparian restoration project that was implemented in 2001.

Implementation of Ecologically Resilient Urban Restoration Projects on Dysfunctional Floodplains.

Michael Rogner, River Partners, 580 Vallombrosa Ave, Chico 95926. mrogner@riverpartners.org

In 2004, C.S. Holling described ecological resilience as "the capacity of a system to

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absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks." 95% of riparian habitat in California has been converted to other uses. The ecological resilience of the remaining riparian habitat is compromised by the frequency and severity of anthropogenic disturbances. Consequently, the vast majority of floodplain habitat cannot be restored passively. River Partners has actively restored more than 7,000 acres of riparian habitat in California. Our older restoration projects have experienced severe and diverse disturbances, including fire, unnatural flooding, and weed invasions, though they continue to thrive despite these perturbations, demonstrating that active restoration design and management actions can create resilient, functioning habitat for riparian wildlife. The lessons learned from these projects will be discussed as they relate to a new, 65-acre restoration project located at the mouth of the Otay River on the South Bay Unit of the San Diego Bay National Wildlife Refuge. Project challenges include upstream dams which rarely release water, a hydrograph driven by urban runoff, and dense invasive weeds. We will also present our regional objectives, which include several other funded projects, as well as outreach and enhanced recreational opportunities in underserved communities.

Laguna Niguel's Journey to Revitalizing a Southern California Urban Creek (Sulphur Creek).

Lindsay Teunis, AECOM, Ecological and Environmental Planning Practice, 1420 Kettner Blvd., Suite 500, San Diego 92101. lindsay.teunis@aecom.com*

Restoration of channelized streams is critical to the long-term revitalization of any urban watershed and provides an opportunity for urbanized communities to enjoy and respect the functional benefits of the natural environment. In 2002, the City of Laguna Niguel (City) embarked on a journey to address ongoing degradation of the City's surface water quality through restoration of a degraded urbanized stream to native wetland, riparian, and upland habitats. To date, the City has successfully planned and installed more than 2.5 miles of restoration along a semi-contiguous portion of Sulphur Creek located in the Aliso Creek Watershed. Specific restoration goals identified during the planning process are (1) restoring hydrologic processes (water storage, stream stability, and energy dissipation), (2) restoring biogeochemical functions (nutrient cycling, nutrient availability, and sediment deposition), and (3) restoring biologic functions (native habitat and improved flora and faunal movement, dispersal, and diversity). Using a robust annual monitoring program that included vegetation transects, functional assessments (Hydrogeomorphic Functional Assessment [HGM] and California Rapid Assessment Method [CRAM]), and qualitative surveys, AECOM tracked the ongoing improvement to the creek system. In addition to increased native vegetation cover and complexity, increased species richness, and native recruitment, on-site hydrological processes have improved. The restoration has contributed to a significant decrease in fecal indicator bacteria levels, which is often a difficult water quality variable to address. This project is a clear example of the role that urban restoration can play in the larger context of restoring and conserving valuable habitat and improving functions within a watershed.

session 6 Thursday 12 May 8:30a — 12:00p *Starboard*

Coastal Restoration

Chair: **Nick Garrity** *PE, ESA PWA*

Lessons in Grassland Restoration: Succession, Controlling Natives, and the Chumash.

Wayne Chapman, Lisa Stratton. Cheadle Center for Biodiversity and Ecological Restoration, Harder Stadium South, MC 9615, UC Santa Barbara, 93106. w_chapma@lifesci.ucsb.edu*

Restoration projects don't always turn out as planned. Inadequate funding, unrealistic goals or persistent weed invasions make the establishment of native California grasslands challenging. Additionally, ecological succession may result in unexpected trajectories even after the desired community has been successfully established. When the native plant community follows natural shifts or is swamped by native species not originally part of the restoration plan, decisions must be made as to what future goals are both ecologically realistic and affordable. In this talk, we highlight several projects implemented by The Cheadle Center for Biodiversity and Ecological Restoration (CCBER) on the UCSB campus where we have had to make decisions regarding how to maintain the original desired grassland communities in the face of seemingly 'natural' succession. The primary native 'invaders' in these systems have been the perennials *Baccharis pilularis* and *Isocoma menziesii*, and the annual tarweed *Deinandra fasciculata*. We discuss lessons learned and several parameters used to guide decision making based on the successional species' life spans, soil preferences, role in harboring herbivores, and project mitigation requirements. We also address the historic evidence that coastal grasslands in our region were encouraged and maintained by Chumash Indians and compare this to anthropogenic maintenance of grasslands today. Over the course of 12 years and several different projects CCBER has

found that the native grassland is an elusive restoration goal for this coastal region.

Los Peñasquitos Lagoon: A Watershed Approach to Lagoon Restoration.

Nick Garrity, PE[1], Andy Collison, PhD[2], Brian Haines[2], Steve Gruber[3], Ruth Kolb[4]. ESA PWA, [1]Los Angeles and [2]San Francisco; [3]Weston Solutions, Inc., Carlsbad; [4]City of San Diego Storm Water Department, San Diego. ngarrity@esassoc.com*

Los Peñasquitos Lagoon is experiencing rapid sedimentation that threatens its functions and values as tidal wetland habitat. Sedimentation in Los Peñasquitos Lagoon is a natural process that has been accelerated by urban development (and hydromodification) in the watershed and modifications to the lagoon. The San Diego Regional Water Quality Control Board has established a Total Daily Maximum Load (TMDL) to address the impairment of the lagoon by sedimentation. The goal of the TMDL is to reduce sediment loading to the lagoon by 70%, to 1970s levels, and restore portions of the lagoon that have been degraded by sedimentation. The TMDL provides a regulatory framework for a holistic watershed-scale approach for lagoon restoration. A watershed approach, including consideration of coastal processes and lagoon inlet dynamics, is necessary to restore the underlying physical processes and ensure successful lagoon habitat restoration. Suspended sediment monitoring data collected throughout the lagoon's watershed suggest that one of the lagoon's three main tributaries, Carroll Canyon, is the main source of sediment to the lagoon. ESA PWA performed a geomorphic assessment to identify the main sources of sediment from the watershed to the Lagoon. We conducted a qualitative geomorphic field assessment to identify sediment sources and sediment abundance in the creek channels, and used a semi-quantitative method of assessing sediment availability to Los Peñasquitos Lagoon. We mapped sediment sources from Carroll Canyon using a two-fold classification system to describe each segment in terms of sediment production and delivery. We then performed hydraulic and sediment transport analyses to estimate relative sediment loading from tributaries to Carroll Canyon. ESA PWA also identified and evaluated potential actions to reduce the rate of sediment loading into Los Peñasquitos Lagoon and inform TMDL implementation and Lagoon restoration efforts. These actions include: 1) Source control of increased urban stormwater runoff, 2) Stabilization of eroding channel banks, 3) Floodplain restoration in the upper tributaries to trap sediment and provide habitat benefits, and 4) Sediment detention basins and channel management to capture and remove sediment before it reaches the Lagoon.

Los Peñasquitos Lagoon: Regulatory Drivers for Restoration Alternatives.

Steve Gruber[1], Andrew Kleis[2], Mike Hastings[3]. [1]Weston Solutions, Inc., 2433 Impala Dr., Carlsbad 92010; [2]City of San Diego Storm Water Department, San Diego; [3]Peñasquitos Lagoon Foundation, Cardiff by the Sea. steve.gruber@westonsolutions.com*

Los Peñasquitos Lagoon is a coastal estuary in San Diego County, California. The lagoon and surrounding watersheds provide numerous ecosystem services and societal benefits, including flood control, recreation, aesthetics, wildlife habitat, and endangered species protection. Over the past 40 years, development of the coastal zone in southern California has increased rapidly, leading to a variety of anthropogenic stressors on the coastal environment. During that timeframe, the lagoon has experienced a dramatic increase in the amount of sediment that it receives from three upstream drainages. The increased sediment load has impaired the lagoon, particularly in the upper portions of the estuary, where increased siltation has converted productive, diverse saltwater habitat to less desirable freshwater marsh habitat. Due to the impairment and associated loss of services provided by the coastal estuary, regional regulators have issued a Total Maximum Daily Load (TMDL) for siltation in Los Peñasquitos Lagoon. The Implementation Plan for the TMDL requires a diverse stakeholder group to reduce sediment loads to the lagoon by nearly 70% in the next ten years to achieve the desired waste load allocations. Restoration of the lagoon to pre-impact conditions is also required by the TMDL. Monitoring required to produce the sediment loading model in the TMDL is also being used by stakeholders to facilitate selection of cost effective sediment reduction options that achieve both TMDL and ecosystem restoration goals. Assessing the effectiveness of existing sediment reduction best management practices in the watershed will assist stakeholders in selecting restoration projects that meet the regulatory requirements of the TMDL, enhance existing ecosystem services provided by the lagoon, and restore services that were present prior to anthropogenic impact.

Ballona Wetlands Restoration: Recreating Estuarine Habitats in Los Angeles.

Diana Hurlbert[1], Nick Garrity*[2], Mary Small[3], Sean Bergquist[1], Jeremy Lowe[4], Jeff Haltiner[4]. [1]Santa Monica Bay Restoration Commission, Los Angeles; ESA PWA, [2]Los Angeles and [4]San Francisco; [3]California State Coastal Conservancy, Oakland. dhurlbert@santamonicabay.org, ngarrity@esassoc.com*

In 2004, the State of California took title to 600 acres of the remaining Ballona Wetlands in Los Angeles. The property is owned by two state agencies, the Department of Fish and Game and the State Lands Commission. The Coastal Conservancy is funding the restoration planning. Together, the three agencies are working with stakeholders and other agencies to develop a plan for restoration of this extraordinary resource in the middle of Los Angeles.

The agencies and stakeholders have established restoration goals, which include: 1) Restore and enhance salt-water influenced wetland habitats to benefit Endangered and Threatened species, migratory shorebirds, waterfowl, seabirds, and coastal fish and aquatic species. Restoration of seasonal ponds, riparian and freshwater wetlands, and upland habitats will be considered where

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beneficial to other project goals or biological and habitat diversity; 2) Provide for wildlife-dependent public access and recreation opportunities compatible with the habitats, fish and wildlife conservation; and 3) Identify and implement a cost-effective, ecologically beneficial, and sustainable (low maintenance) habitat restoration alternative. Five preliminary alternatives which meet these objectives were developed and refined by the Project Management Team and a consultant team led by ESA PWA in a Feasibility Report, with the advice of stakeholders and agencies. Preferred restoration alternatives were selected based on the results of the Feasibility Report. The preferred alternatives include full tidal wetland restoration to support a range of functional estuarine habitats. Currently, the preferred alternatives are undergoing further refinement to include the desired mix of estuarine and upland habitats, consider adaptation strategies to accommodate sea level rise in the next 50 to 100 years, improve cost effectiveness, and address flood management and other regulatory permit approval processes. The Ballona Wetlands Restoration planning process and supporting technical studies will be presented as a case study of tidal wetland restoration in a highly-urbanized environment with accelerated future sea-level rise.

Regional Eradication of an Invasive Plant as a First Step to Tidal Marsh Restoration.

Peggy R. Olofson, Olofson Environmental, Inc., San Francisco Estuary Invasive Spartina Project, 2612-A 8th St., Berkeley 94710. prolofson@spartina.org.

Restoration of former tidal marshes, lost for a century to salt production, agriculture, and development, became a top priority for state and federal agencies and others in the San Francisco Estuary in the 1990s. The agencies invested many millions of dollars to purchase lands and begin reestablishing tidal connections, only to discover that the first plant to establish in the new marshes was an extremely invasive introduced cordgrass (*Spartina alterniflora*), or its even more aggressive hybrids (*S. alterniflora* x *foliosa*). Recognizing that restoration objectives would be unattainable if the invasive plants became dominant in the ecosystem, the agencies quickly established and funded a major program to a address the invasion regionally, literally clearing the way for the tidal marsh restoration. It took four years for the program to finish environmental compliance documentation and permitting, establish critical partnerships, and develop effective treatment methods, during which time the plant spread from 200 net acres to cover more than 1,000 net acres — including many newly-restored marshes. However, between 2005 and 2010, the project succeeded in reducing the total cover by more than 90%, and regional eradication is in sight. Now the project is dealing with complexities related to hybridization of the introduced and native species, and with the more typical challenges of tracking down and killing remaining individual plants within a vast and complex geographic area.

'Henne's' Coronis Fritillary (*Speyeria coronis hennei*), Mt. Piños.
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Assessing Restoration Success: Measuring Bird Abundance and Species Richness at the San Dieguito Wetland Restoration and Reference Wetlands.

Steve Schroeter[1], Mark Page[1], Paul Lehman[2], Dave Hubbard[3]. [1]Marine Science Institute, UC Santa Barbara, 93106; [2]11192 Portobelo Drive, San Diego 92124, [3]Coastal Restoration Consultants, Inc., 808 California St., Santa Barbara 93103. stephen.schroeter@lifesci.ucsb.edu*

The San Dieguito Wetland Restoration in Del Mar, California is a project designed as partial mitigation for the impacts of the San Onofre Nuclear Generation Stations (SONGS) on the marine environment. The restoration entails the creation of about 165 acres of tidal habitat from ruderal uplands surrounding the San Dieguito River. This project is unique in requiring the independent assessment of some 15 performance standards annually for the forty plus years of the operating life of the power plant. One of these standards requires that the density and species richness of birds in the restored wetland be similar to that in reference wetlands. We present the details of the monitoring design and protocols, and some preliminary results which show that, although construction is not yet complete, the wetland is providing resource value to wetland birds. Unique aspects of the project include contemporaneous assessments in multiple wetlands and the use of sampling rather than census to assess abundance. Fortuitously, both samples and censuses are being conducted at the restoration site, making it possible to compare the two methods. In addition to presenting results used to assess the performance of the restoration, we present information on regionally rare and threatened or endangered species occurring at the restoration site.

Restoration as Land Management on Public Lands

Chair: **Brian Collins** *Wildlife Biologist, San Diego NWR Complex, USFWS*

Soil and Groundwater Salinity and Management: Implications for Riparian Revegetation.

Matthew R. Grabau[1], Michael A. Milczarek[1], Monisha Banerjee[1], Ashlee Rudolph[2]. [1]GeoSystems Analysis, Inc., 2015 N. Forbes Blvd. #105, Tucson AZ 85745; [2]Lower Colorado Regional Office, Bureau of Reclamation, 500 Fir St., Boulder City NV 89006. matt@gsanalysis.com*

Agencies along the lower Colorado River (LCR) plan to re-vegetate thousands of hectares in the USA and Mexico with native vegetation to provide habitat for native fauna. Due to diversion practices for anthropogenic goals, soil and groundwater salinity within many areas of the historic floodplain have increased to phytotoxic levels for salt-intolerant native tree species. A study is currently being implemented to better understand salinity management needs at three riparian restoration sites along the LCR and during 2010, a soil and groundwater monitoring network was developed for these sites. Soil salinity results to date indicate correlation between soil salinity and soil texture, distance from irrigation culverts, irrigation frequency, and re-vegetation success. At Beal Lake Restoration Site, which has very shallow (less than five feet below ground surface) groundwater, coarse-textured soil likely prevents extensive capillary rise and soil salinity levels for regularly-irrigated plots are generally less than 5 dS/m. At Palo Verde Ecological Reserve, characterized as a mix of fine and coarse-grained soil textures, depth to groundwater is too great to result in surface evapo-concentration and all soil salinity levels are less than 5 dS/m. At Cibola National Wildlife Refuge, a combination of fine-grained soils and shallow to intermediate depths to groundwater likely promotes capillary rise, soil clogging and extensive salt accumulation. Future work on the project will include determination of aquifer transmissivity and modeling of long-term salinity budgets. Alternative irrigation management strategies will be developed as necessary to minimize probability of salt accumulation in restoration sites.

Promoting Coastal Sage Scrub Vegetation after Invasive Grass Removal.

Alice E. Levine, Carla D'Antonio. Department of Ecology, Evolution, and Marine Biology, UC Santa Barbara, 93106. alevine@lifesci.ucsb.edu*

California's coastal sage scrub (CSS) habitats are among the most threatened habitats in the state's Mediterranean regions, due to invasion by exotic annual vegetation in concert with anthropogenic disturbance. *Bromus* species are among the most abundant invasive annual grasses, and they appear to be able to dominate for long periods of time, interfering with CSS establishment. Restoring CSS involves both control of exotic annuals, and reintroduction of natives. We evaluated methods for reintroducing CSS species to a site dominated by *B. diandrus* (ripgut bromegrass) for over 60 years, following prescribed burning or tillage (hereafter, management treatments). We compared CSS establishment between seeded, transplanted and no-revegetation (control) plots, crossed with hand-weeding of *B. diandrus* across management treatments. CSS species had low seedbank representation, thus fewer species established in control compared to seeded and planted plots. However, control plots in managed treatments had greater recovery than in an unmanaged treatment. In each management treatment the addition of planted seedlings led to immediate increases in native richness, while in seeded plots richness increased slowly over two growing seasons. Richness across management treatments declined after several more growing seasons due to competition between establishing natives. Native percent cover increased significantly and equally between planted and seeded areas over time. Hand-weeding significantly increased richness and cover across management treatments over time, but in few of these treatments individually. The timing of revegetation after *Bromus* management was critical: recovery was significantly less if revegetation was delayed beyond the first post-burn growing season.

Dredging, Filling, and Breaching Solar Salt Ponds to Restore Tidal Salt Marsh in San Diego Bay.

Chris Nordby, Nordby Biological Consulting, 5173 Waring Road, # 171, San Diego 92120. nordbybio@gmail.com

Through a partnership of federal, state and local agencies, and non-profits we are restoring tidal influence to three active solar salt ponds at the San Diego Bay National Wildlife Refuge. By restoring tidal influence and tidal marsh elevations, we will restore approximately 214 acres of tidal flats, salt marsh, and subtidal habitat that once existed before the salt ponds were built. Approximately 151,500 cubic yards of material will be dredged and redistributed among the ponds to achieve appropriate elevations for tidally-influenced habitats. A network of tidal creeks will be restored that will provide a variety of micro-habitats to ensure a habitat complexity that favors species richness. Following the completion of the dredging operation, the outer levees will be breached to provide tidal circulation to this site for the first time in 50 years. The portions of the levees not affected by breaching will be retained to provide roosting habitat for various avian species. Project construction began in February 2011 and is expected to end in June 2011.

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32nd Street Canyon and Community Inspired Management on Public Land.
Jim Prine, AECOM, Ecological and Environmental Planning Practice, 1420 Kettner Blvd., Suite 500, San Diego 92101. james.prine@aecom.com

An increasing number of open space areas on public lands are being formally preserved and managed under the direction of management plans and funds set aside for this purpose. The 32nd Street Canyon in San Diego, California is not protected by the City's Multiple Species Conservation Program (MSCP) and was significantly degraded and close to being developed and forgotten. However, as a result of motivated citizens supported by technical specialists, the canyon has experienced significant positive changes over the last eight years. In 2000, over 75 percent of the 10-acre coastal canyon was badly infested with invasive exotic plant species (e.g., *Arundo donax*, *Acacia* sp., etc.). In addition, illegal dumping, homeless encampments, and illegal activities made the canyon unsafe and fire prone. When the State of California planned to fill the canyon in order to build a school, the neighborhood galvanized and ultimately prevailed in relocating the school to an adjacent site. Since 2003, the 32nd Street Canyon Task Force has raised more than $550,000 for restoration and outdoor education activities. Neighborhood activists, public volunteers, and contractors/ consultants have worked together progressively to remove nonnatives and plant native species (over 6,000 by neighbors and children). The resulting benefits include restored habitats in progress, improved water quality and wildlife habitat, public education opportunities, and an increased appreciation of the canyon within the neighborhood and City. The dedicated activities of the now-educated citizenry, particularly in the political outreach to decisionmakers, fill an important role in the understanding, management and future of the canyon.

Using Active Restoration as a Management Tool in the Mojave National Preserve.
Mari Quillman, ECORP Consulting, Inc., 1801 Park Court Place, Building B, Suite 103, Santa Ana 92701. mquillman@ecorpconsulting.com.

Preserving and restoring the visual landscape and wilderness experience is one of the primary mandates of the National Park Service (NPS). Land managers who are faced with land management mandates and public pressure frequently find that natural recovery processes are too slow. Funding availability, political priorities, and scientific knowledge are frequently the most important considerations in deciding when and how to implement active restoration efforts. In the Mojave Desert, historical human disturbances related to mining and prospecting have left long-term scars and safety hazards on the desert landscape. Approximately 67% of the abandoned mines in California are located on Federal lands (Bureau of Land Management, NPS, and U.S. Forest Service). Restoring the many abandoned mine land features, both for their cultural and natural values, is a daunting challenge in the Mojave National Preserve (MNP) in California. Active habitat restoration has successfully been implemented at a number of disturbed sites in the MNP, including the Morning Star Mine. This historic gold mining operation left a visual scar in an otherwise pristine area of the MNP. The remoteness of the site, the high degree of disturbance, and the harsh desert environment presented unusual challenges in the planning and implementation of Phase 1 of the habitat restoration. Higher than normal precipitation in the two years following planting has contributed to very encouraging results in the success of the restoration site.

The Quino Checkerspot (*Euphydryas editha quino*) — on its host plant, dwarf plantain (*Plantago erecta*) — is on the Endangered Species list and is a very rare sighting. It currently flies on a fraction of the open land it once did thanks to ever-increasing development in Southern California, and many of its known haunts are closed to the public. *©2010 Dennis Walker*

Southern Steelhead Management and Restoration

Chair: **Ross Taylor** *Fisheries Biologist, Ross Taylor and Associates*

Recovering Southern California Steelhead under the ESA.

Mark H. Capelli, South-Central/Southern California Steelhead Recovery Coordinator, National Marine Fisheries Service, 735 State Street, Suite 617, Santa Barbara 93010. Mark.Capelli@NOAA.gov

In 1997 the National Marine Fisheries Services (NMFS) listed two distinct sub-populations (DPS) of steelhead (*Onchorhynchus mykiss*) within the southern half of coastal California: a threatened sub-population along the south-central coast and an endangered sub-population along the south coast; the range of the southern sub-population was extended to the US–Mexico border in 2002. NMFS Technical Recovery Team has divided the Southern California Steelhead DPS into five Biogeographic Regions, characterized by a distinguishing suite of physical, climatic and hydrologic feature. Recovery of the Southern California DPS will require the restoration of a minimum number of populations within each of the five Biogeographic Regions to ensure long term persistence of the species. Steelhead at the southern end of their range have persisted in watersheds that have exhibited a wide range of habitat conditions over the past 20,000 years, and have evolved a wide variety of life-history strategies (and other adaptations) for coping with sometimes hostile environmental conditions. These life-history strategies have pre-adapted this species to erratic and unstable habitat conditions, including some of those which climate change models predict. Other anthropogenic changes to the coastal watersheds which southern and south-central California steelhead use for spawning and rearing would compound the environmental stresses which currently threaten these two species. The Recovery Plan for the Southern California DPS identifies a series of recovery actions intended to address the threats currently facing the species, as well as future threats posed by climate changes. Additionally, a long-term research and monitoring program is proposed to address a number of key issues and refine population and DPS-wide viability criteria developed by the TRT. Recovery will require re-integrating the listed sub-populations back into habitats in a manner which allows the co-occupancy of watersheds.

Numbers + Charts x Graphs ÷ Y = Saving our Fisheries.

Nica Katherine Knite, Southern California Regional Manager, California Trout, 4592 Santa Monica Avenue, San Diego 92107. nknite@caltrout.org

Countless hours spent in labs. Innumerable days spent behind desks. And endless weeks spent in the field — gathering and analyzing data. To what end? Y (why) do research? How is it used? Here are two real life examples. The Santa Clara and Ventura Rivers are among the few remaining natural systems along California's South Coast, yet the areas Southern California steelhead face an array of significant challenges. Multiple hydropower projects, an overwrought agricultural basin, groundwater depletion, impassable barriers, low or eliminated flows, and the removal of riparian habitat have all pushed steelhead to the breaking point. During four years a "perfect storm" of opportunities arose on the Santa Clara: Biological Consultations; ESA Take Lawsuits; FERC Licenses; hidden Federal Legislation riders; Clean Water Permits. And a decades long process is underway at Matilija Dam on the Ventura. Each process used, and some misused, science and research. The timing and casts of related players have allowed fairly coordinated, strategic watershed and steelhead restoration plans to take hold. By applying sound science throughout, essential building blocks have been laid. Regulatory protections and collaborative solutions are taking shape, providing guidance and requirements for decades to come. The plans, outcomes, and solutions are not perfect, but the experience demonstrates the value of research & science, and the critical aspect of information that is "most up-to-date." Hear about successes and lessons learned in these microcosms for the application of data and research — Science + Regulation = Fisheries Restored

Lower Santa Ynez River Southern Steelhead Restoration and Population Trends.

Timothy H. Robinson, Scott Volan, Scott Engblom. Cachuma Operation and Maintenance Board, Fisheries Division, 3301 Laurel Canyon Road, Santa Barbara 93105. trobinson@cachuma-board.org*

Fisheries monitoring and habitat restoration efforts by the Cachuma Water Agencies on the Lower Santa Ynez River (LSYR) in Santa Barbara County have shown a modest increase over the past decade in smolt production and returning adult southern steelhead (*Oncorhynchus mykiss*). Ten habitat enhancement projects have been completed within the LSYR and its tributaries that have culminated in this overall increase in the steelhead/rainbow trout population. Projects include passage barrier fixes, stream bank stabilization, and supplemental watering systems. Migrant trapping, snorkel surveys, and redd surveys are used to assess the transient and over-summering population of fish within the LSYR basin. These data are further used as performance metrics for completed habitat restoration projects. The general environmental condition and specific stream ecology affect growth rates and

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population trends that are seen when integrating migrant capture, genetics and scale analysis data. Salsipuedes Creek (closest to the ocean) and Hilton Creek (furthest from the ocean) are routine monitoring locations that show different population trends based on their hydrology, proximity to the ocean, habitat and water quality, and gene pool. Data on smolt production and returning adults will be presented in context of environmental variables that influence life history strategies within these two LSYR tributaries. Late arriving adults and spring smolt runs suggest the importance of spring rains and storm runoff to assure migration opportunities to the ocean, which is particularly importance for Hilton Creek due to the distance to the ocean and Salsipuedes Creek due to its dependence on natural flows.

Disturbance-based Ecosystem Approach for Maintaining and Restoring Southern Steelhead Habitat.

Matthew Sloat[1,2], Ann-Marie Osterback[1,3], William Sears[1,4]. [1]Stillwater Sciences 2855 Telegraph Avenue, Suite 400, Berkeley 94705; [2]Department of Fisheries and Wildlife Management, Corvallis OR 97331; [3]Department of Ecology and Evolutionary Biology, UC Santa Cruz, 95060. [4]San Francisco Public Utilities Commission, San Francisco 94103. matthew.sloat@oregonstate.edu*

Perspectives from the Pacific Northwest regarding the role of disturbance regimes in maintaining a mosaic of critical aquatic habitats have improved management and conservation of anadromous salmonids. Here, we offer a complimentary case study from the southern margins of salmonid anadromy. In southern California, El Niño climate events drive large flood disturbances with a periodicity of about 5 to 8 years. In some drainages, these floods completely remove riparian trees. Immediately after flood disturbance, the loss of riparian vegetation increases stream insolation, causing stream temperatures to heat quickly and constraining the distribution of thermally sensitive species such as steelhead trout. In Santa Paula Creek, a tributary to the Santa Clara River, riparian vegetation recovered quickly following complete removal during the 2005 flood disturbance. Maximum summer stream temperatures cooled by an average of 3°C between 2 and 4 years after flood disturbance. Steelhead persisted in stream habitats where summer temperatures did not exceed 30°C, but their probability of persistence declined precipitously at higher temperatures. Because the threshold for thermally suitable and unsuitable habitat was very steep, small decreases in stream temperature result in large changes in the extent of available summer rearing habitat. The 3°C cooling of stream temperatures in 2009 resulted in a 43% increase in the length of stream suitable for steelhead. These results suggest that the extent of suitable steelhead rearing habitat expands and contracts cyclically in response to the effects of El Niño-driven flood disturbance on riparian vegetation. Characterizing natural disturbance regimes that affect the quantity and quality of critical aquatic habitat is an important first step for steelhead management and recovery planning.

Restoration Field Guide: A User-Friendly Guide for Restoration Techniques in Riparian Habitats.

Brian B. Stark[1], Kaila Dettman[2]. [1]Conservation Operations Director, Ojai Valley Land Conservancy, P.O. Box 1092, Ojai 93024; [2]Deputy Director, Land Conservancy of San Luis Obispo County. brian@ovlc.org*

This presentation outlines the contents of a newly published field guide for habitat restoration in riparian habitats. The field guide, published July 2010, is an outgrowth of habitat restoration projects funded by the Avila Beach Trustee Council, a partnership between the California Department of Fish and Game (CDFG) Office of Spill Prevention and Response (OSPR) and the U.S. Fish and Wildlife Service (USFWS). The Trustee Council retained the Guide's authors through the Land Conservancy of San Luis Obispo County to assist in the planning and implementation of projects designed to restore or replace resources damaged by the spill. Between 1999 and 2008, multiple projects were completed that addressed migration barriers for steelhead, stream bank stabilization and revegetation, in-stream habitat for steelhead, invasive species removal, and water quality enhancement. Throughout the restoration projects, the authors relied heavily on published guides to develop implementation strategies. These published resources provided extensive information regarding how projects should look when constructed. However, these resources contained very little information of a practical nature relating to "how" the projects should be built and what potential problems could arise during construction. Project delays caused by accidents, unforeseen problems, and insufficient materials on site make projects more costly and complicated than necessary. These delays may also result in damage to habitats and injury to people. It was only through the experience gained in the field, or communicated by other experienced restoration managers, that methods were developed to address common problems associated with various project types. Case studies will highlight some of the challenges and potential mistakes encountered when implementing restoration projects.

Southern Steelhead Restoration Success Stories and Future Ecosystem Restoration Needs.

Matt Stoecker, Stoecker Ecological and Southern California Steelhead Watershed Research Center, UC Santa Barbara. matt@stoeckerecological.com

Restoring wild, self-sustainable steelhead populations in southern California requires a broad reaching ecosystem and watershed restoration effort. To successfully accomplish this goal, watershed-specific assessments need to determine steelhead habitat conditions and population dynamics, identify factors limiting steelhead, prioritize restoration actions, and implement effective

restoration projects that restore the critical function of steelhead swimming ocean nutrients into our watersheds and feeding entire ecosystems. In Santa Barbara and Ventura Counties we have studied and prioritized restoration actions for almost every steelhead watershed and have successfully implemented dozens of restoration projects. The primary focus of these efforts, and top priority in most southern California watersheds, is to remove migration barriers and restore access between the ocean and headwater streams. The presentation will provide examples on assessing and prioritize steelhead restoration actions on a watershed and regional scale, implementing effective and long-term restoration projects and avoiding the quick "band-aid" projects, and efforts underway to address complex issues such as large dams, our future water supply systems, and how to ensure a reliable water supply for humans, while restoring steelhead and ecosystem function. Come swim beneath the surface with southern steelhead, see before and after images of barriers removed, and watch a dam blow up.

session 9 Thursday 12 May 1:30p — 5:00p *Terrace*

Restoration from the Landscape Contractor's Point of View

Chair: **Peter Tomsovic** *Principal, Restoration Team, RECON Environmental, Inc.*

The Realities of Constructing a Successful Upland Habitat.

Justin Fischbeck, Shelby Howard, Sally Trnka. HELIX Environmental Planning, 7578 El Cajon Blvd., Suite 200, La Mesa 91942. JustinF@helixepi.com*

It seems simple, after all native plants should be able to grow with little or no help at all… right? The reality is that upland habitat restoration can be very challenging. Often, the best laid plans require significant "adaptive management" even before the installation is complete. We will evaluate two successful upland restoration projects and compare, from the point of view of those charged with taking the project from concept to implementation, the differences between the two successful methods. The two projects were implemented within one year, and within 2 miles of each other in the City of Carlsbad. The first project was installed in 2005 and involved restoration of 21 acres of non-native grassland to coastal sage scrub using primarily duff reapplication (no container stock or irrigation was used). The second project was installed in 2006 and involved restoration of 11 acres of manufactured slopes to coastal sage scrub using container stock, seed, and irrigation. Weeding strategies were similar over the 5 year maintenance and monitoring period of each project, but the resulting habitat that developed on each project was different.

Landscape Contractor's Approach to Restoration Utilizing Local Floral Resources.

Matt Kedziora, AECOM, 1420 Kettner Blvd. Suite 500, San Diego 92001. matthew.kedziora@aecom.com

The Dennery Canyon West restoration site is located within the 90-acre Dennery Canyon West Parcel located in Otay Mesa, and is owned by California Department of Transportation. The parcel supports both vernal pools and potential habitat for the Quino checkerspot butterfly, as well as coastal sage scrub, maritime succulent scrub, and grasslands. Mitigation for impacts from the SR 905 Extension Project includes the preservation, enhancement, and restoration of a 9-acre segment of the Dennery Canyon West parcel of existing vernal pool habitat. The Habitat Restoration Plan was developed by AECOM to comply with the conservation measures, as outlined in the issued Biological Opinion. AECOM's approach to restoration efforts aim to document floristic diversity and preserve local genetic integrity. AECOM conducts maintenance activities for the mitigation parcel, which includes scouting, vouchering, collection, and dispersal of native plant and seed resources, propagation of plants, and weed management. These methods aim to gradually reduce the nonnative seed bank and establish stable native plant communities. Floral resources identified for on-site use were identified with voucher specimens, providing documentation of the genetic source population. Voucher specimens were submitted to the San Diego Natural History Museum Plant Atlas project. All plant and seed resources were drawn from the Dennery Canyon West restoration site or local vicinity. Installed plant resources enhanced both upland and vernal pool habitats. Desirable plants included native vernal pool indicators, upland watershed species and sensitive species. These efforts were completed within the contractor's daily activities, and provide a template for future restoration efforts.

Certification for Ecological Restoration Practitioners.

John Rieger, Society for Ecological Restoration Ad-hoc Committee on Certification; John Rieger & Associates, 3802 Rosecrans St. #373, San Diego 92110. jprwood@cox.net

The Society for Ecological Restoration (SER) has been in the process of creating

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a certification program for ecological restoration practitioners. The current program is undergoing review by consultants. This program, the SER Practitioners Certification Program (PCP), will be administered by a new corporation, SER Practitioners Institute (SERPI). The results of a "Standards of Practice Survey" conducted in the spring of 2009 are being used to guide the design of the certification program. The SER PCP will certify practitioners based on their overall professional competence and takes into consideration their education, training, experience, and professional involvement. Specific requirements for certification vary depending on the level of certification. Three levels of certification will be offered: Certified Ecological Restoration Practitioner In-Training (CERPIT), Certified Ecological Restoration Practitioner (CERP), and Certified Senior Ecological Restoration Practitioner (CSERP). SER PCP goals are to: 1) Provide practitioners of ecological restoration with the credentials needed to improve consumer confidence in the profession; 2) Improve the quality of ecological restoration projects worldwide; 3) Foster the incorporation of the principles of ecological restoration, as embodied in SER foundation documents, into the decision-making process of ecological restoration practitioners; 4) Develop a community of practitioners who are actively engaged in the continued improvement of their individual abilities and of their profession; 5) Create standards for practitioners of ecological restoration; and 6) Stimulate growth of the profession of ecological restoration. SERPI will begin accepting applications for certification in early 2012.

Considerations when Teaming with a Native Plant Nursery to Ensure Appropriate Plant Material on your Restoration Project.

Ryan West, RECON Native Plants, Inc., 1755 Saturn Blvd., San Diego 92154. rwest@recon-us.com

Successful habitat restoration projects require a myriad of considerations such as selecting an appropriate restoration site, hiring an implementation contractor, developing irrigation options, identifying weed abatement strategies, bonding, and many others. All too often securing the source of seed and plant material is a last minute task. When agencies use plantcover as a primary criteria for project sign-off and the establishment of genetically appropriate plants is one of the primary criteria for determining success in habitat function, it stands to reason that securing a nursery to provide the site appropriate material in a timely manner be carefully considered at the beginning of the planning process and handled as a priority in order to allow ample time to collect seed and grow the material. Restoration biologists who understand the importance of source identified seed and plant materials for their projects must incorporate adequate measures in their restoration plan to account for: time to collect seeds and cuttings, time to grow container plants of desired size, acquiring permission from property owners for site access, salvage and use of native soil as a planting medium, and seed material requirements for cleaning, testing, and storage. Restoration biologists who are proactive and involved with the nursery throughout the growing process will reap the rewards with a successful restoration effort and a satisfied client.

Wednesday 11 May 10:00a — Thursday 12 May 5:00p *Baja*

Poster Session

Reception: **Wednesday 11 May 5:30 — 7:00p**

Automated Vernal Pool Hydrological Monitoring for Efficient Data Collection.

Matt Kedziora, AECOM,1420 Kettner Blvd. Suite 500, San Diego 92101. matthew.kedziora@aecom.com

The State Route (SR) 125 South vernal pool and Quino checkerspot butterfly (Quino) habitat restoration site is located in San Diego County on Otay Mesa. The 52-acre site is mitigation for SR 125 South, a highway and toll road developed through a joint partnership project between South Bay Expressway, L.P. and the California Department of Transportation. Regulatory authorizations were issued for the project to impact vernal pools and the federally endangered Quino. AECOM provided oversight and preparation of the site restoration plans, as well as implementation of restoration activities and 5 years of maintenance and monitoring. Project activities included integrated restoration of Quino upland habitat and vernal pool watershed areas. Hydrological monitoring of vernal pools was completed to document vernal pool ponding and drying during the span of the project. The unique hydrological process is associated with the timing of numerous floral and faunal surveys. During the final year of the 5-year maintenance and monitoring period, a vernal pool hydrological monitoring device (KEDZIG) was installed. The device was constructed using a differential pressure sensor enclosed in a watertight, submersible unit constructed with PVC piping and custom plastic housing. The device captured automated hydrological data throughout the rainy season. The development and use of automated data collectors is an example of innovative natural resource management. The manual hydrological monitoring results are compared with the data from the

device. A discussion of the benefits and limitations of the monitoring technology is provided.

Santa Barbara Airport Tidal Restoration.

Johanna Kisner, Julie Love. URS Corporation, 130 Robin Hill Road, Suite 100, Goleta, CA 93117. johanna_kisner@urscorp.com*

Restoration of a 2.5-acre experimental tidal basin on Santa Barbara Airport property was designed and implemented by URS and the Airport to reduce bird strike hazards. The project restored tidal influence to a freshwater basin near the main runway. This basin had been tidally influenced prior to the filling and berming of the Goleta Slough associated with the original construction of the runway. A tidal restoration feasibility study indicated that the project could be implemented without increasing bird strike hazards because tidal areas would attract shorebirds that are less of a hazard than the larger, flocking waterfowl that occupy the freshwater basins. The study determined that the experimental basin and a nearby control basin should be monitored for a minimum of two years. The tidal basin was created in 2005 by installing a culvert with a tide gate under the berm between the freshwater basin and the tidally influenced Tecolotito Creek. Pickleweed (*Salicornia virginica*) sprigs and topsoil were tilled into the basin. A berm was created in the center of the freshwater basin to provide a freshwater control basin. URS monitored the project for three years to examine the effects of the reintroduction of tidal flow on the vegetation, bird community and bird strike hazards, benthic macroinvertebrates, tidewater goby (*Eucyclogobius newberryi*), and water quality. The monitoring data suggests that introduction of tides has reduced bird-strike hazards; therefore, the tidal basin will be applied towards wetland mitigation requirements and an additional 10 acres of tidal wetlands were restored in 2010.

Restoring California's Habitat with Small Spill Settlement Funds.

Vicki Lake, California Department of Fish and Game, Office of Spill Prevention and Response, 1700 K Street, Ste. 250, Sacramento 95811. vlake@ospr.dfg.ca.gov.

The California Department of Fish and Game (DFG), Office of Spill Prevention and Response (OSPR) conducts natural resource damage assessments on many small pollution events. DFG is typically the only natural resource trustee agency involved in these spills. DFG's wardens and environmental scientists respond to the pollution events. Following a spill, DFG-OSPR resource economists, environmental scientists, and attorneys work to assess damages, determine the value of compensatory restoration, and reach settlement with the responsible party. Unless otherwise specified, the settlement funds from small spills are deposited into trust sub-accounts held by the National Fish and Wildlife Foundation. Most of these settlements are deposited into "habitat-specific" sub-accounts. Each settlement is deposited into the account that is most appropriate for the resource injuries caused by the spill. It is the responsibility of OSPR to see that these funds are used in a timely fashion for the designated types of habitat restoration. It is also a goal of OSPR to conduct restoration in a way that is coordinated with the needs and priorities of the DFG Regions. Consideration is given to projects that restore habitats designated by the small spill case settlement funds available at any given time. Priority is given to projects that have the commitment of other project partners, that have completed the environmental review and approval process, and that are considered to be high priority by DFG's regional biologists.

Arroyo Burro Estuary Restoration Project.

Johanna Kisner, Julie Love. URS Corporation, 130 Robin Hill Road, Suite 100, Santa Barbara 93117. Julie_Love@urscorp.com*

In 2004, the City of Santa Barbara Creeks Division undertook major habitat restoration actions along Arroyo Burro Estuary in Santa Barbara, California to enhance water quality and expand habitat function. URS Corporation prepared a comprehensive estuary restoration and park enhancement plan which included: modifying a concrete apron on Arroyo Burro Creek to facilitate fish passage, potentially encouraging natural re-population of the federally endangered southern steelhead; expanding the estuary to enhance habitat for the federally endangered tidewater goby and other estuarine species; replacing the 300-foot culvert along Mesa Creek with an open natural riparian stream channel; stabilizing and revegetating the banks of Arroyo Burro estuary and the newly created banks of Mesa Creek with genetically local riparian and wetland vegetation; creating trails and interpretive signs; and installing a footbridge across Mesa Creek to allow pedestrian access to the adjacent Douglas Family Preserve. In 2006, URS provided guidance during the implementation process. Successful pre-construction relocation of tidewater gobies was completed with assistance from ECORP Consulting, Inc. Habitat restoration implementation was initiated along with a 5 year maintenance and monitoring period. In 2009, 3 years after implementation, success of the project was demonstrated with substantial native plant cover in the restoration areas at 91 percent, over 43 established native plant species, low non-native cover in the restoration areas at less than 1 percent, and the presence of tidewater goby after construction completion at levels similar to those seen prior to construction. The project was awarded the Santa Barbara Beautiful Award in 2008.

Restoration of Vernal Pools on San Diego National Wildlife Refuge.

John Martin, USFWS, San Diego National Wildlife Refuge, PO Box 746, 14715 Highway 94, Jamul 91935. John_A_Martin@fws.gov

San Diego National Wildlife Refuge is restoring 30 acres of vernal pool habitat, including the surrounding matrix of coastal sage scrub/foothill needlegrass grassland ecotone. The site had been degraded by agriculture, grazing, and exotic plant invasion. Weed control began

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in April 2007 and has continued site-wide through the present. Thirty-three basins were re-contoured in 2007, and an additional 30 created in 2009. Planting of native shrubs and perennial grasses began in January 2011. Soil inoculum from contiguous vernal pool habitat was spread in selected basins in November 2008. Seed of native vernal pool plants was broadcast into selected basins in December 2009 and November 2010. Vegetation change has been monitored annually using permanent transects and species inventory in vernal pool basins. The site currently supports 4 federally listed species, 9 vernal pool obligates, and six additional regionally sensitive species. Qualitative and quantitative monitoring show that native species richness and cover are increasing throughout the site. We anticipate the need for continued weed control to maintain populations of listed and sensitive native flora and fauna. The site is contiguous with another vernal pool restoration project being conducted by Sweetwater Authority, which enhances the effectiveness of both projects in conserving vernal pool species and ecological function.

Wetland Monitoring for Identifying Adaptive Management Opportunities and Evaluating Long-term Success: A Case Study with San Dieguito Lagoon.

Mark Page, Steve Schroeter, Jennifer Wolf. Marine Science Institute, UC Santa Barbara, 93106. page@lifesci.ucsb.edu.*

The San Dieguito Lagoon Restoration Project, a mitigation project required of Southern California Edison (SCE) by the California Coastal Commission (CCC), involves excavation and grading of degraded upland to create subtidal, intertidal mudflat, and vegetated salt marsh habitats. Following construction, independent monitoring will be conducted to measure the success of the restored wetland in achieving performance standards outlined in the Coastal Development Permit. Most of the excavation and grading to create wetland habitat was completed over two years ago. Final inlet dredging and project completion is scheduled for the middle of next year. We are monitoring the wetland during construction to identify opportunities for adaptive management. Although construction is not yet finished, much of the constructed habitat is currently providing biological resources (invertebrates, fish, birds). However, the vegetation in some areas graded to a high elevation (~6.4 to 7.1' Mean Lower Low Water) with little topographic relief and high soil salinity has performed poorly. Based on our data collected during the past two years, SCE has re-graded and expanded the tidal creek networks in these problematic areas to improve tidal inundation and the likelihood of successful plant establishment. The San Dieguito Lagoon Restoration project illustrates the value of monitoring during construction to identify trends in the development of wetland resources and to inform adaptive management that may improve the success of the restoration project.

Southern Steelhead Restoration Success Stories and Future Ecosystem Restoration Needs.

Matt Stoecker, Stoecker Ecological and Southern California Steelhead Watershed Research Center, UC Santa Barbara. matt@stoeckereclogical.com

Restoring wild, self-sustainable steelhead populations in southern California requires a broad reaching ecosystem and watershed restoration effort. To successfully accomplish this goal, watershed-specific assessments need to determine steelhead habitat conditions and population dynamics, identify factors limiting steelhead, prioritize restoration actions, and implement effective restoration projects that restore the critical function of steelhead swimming ocean nutrients into our watersheds and feeding entire ecosystems. In Santa Barbara and Ventura Counties we have studied and prioritized restoration actions for almost every steelhead watershed and have successfully implemented dozens of restoration projects. The primary focus of these efforts, and top priority in most southern California watersheds, is to remove migration barriers and restore access between the ocean and headwater streams. The presentation will provide examples on assessing and prioritize steelhead restoration actions on a watershed and regional scale, implementing effective and long-term restoration projects and avoiding the quick "band-aid" projects, and efforts underway to address complex issues such as large dams, our future water supply systems, and how to ensure a reliable water supply for humans, while restoring steelhead and ecosystem function. Come swim beneath the surface with southern steelhead, see before and after images of barriers removed, and watch a dam blow up.

It's the Little Things that Count: A Review of Tidal Datum and the Possible Implications of Error on Coastal Restoration.

Lindsay Teunis[1], Yvana Kuhn[1], Darryl Hatheway[2]. AECOM, [1]Ecological and Environmental Planning Practice, [2]Water, 1420 Kettner Blvd., Suite 500, San Diego 92101. lindsay.teunis@aecom.com*

Perhaps one of the most critical elements of any successful functioning wetland restoration project is hydrology, whether considering riverine, vernal pool, or coastal salt marsh habitats. However, as coastal zone hydrology is driven solely or partially by tidal action, the added complexity of vertical tidal datum in relation to the topographic elevation datum increases the potential for tidal inundation projection errors that can lead to a project's ultimate failure if handled incorrectly. In addition, it is not uncommon for a restoration plan to go through numerous revisions over the years and pass through multiple restoration specialists. Through this planning process, it is critical to maintain quality control over the topographic elevation survey data. Using hypothetical scenarios, we will illustrate how applying various elevation datums could result in drastically different restoration results. For example, the difference (conversion)

between Mean Sea Level (MSL) and Mean Lower Low Water (MLLW) is 2.733 feet. This is more than two times greater than the habitat elevation ranges for various salt marsh habitats (i.e., mudflat, low-marsh, and mid-marsh), which have distinct habitat transitions occurring every 1 to 2 feet of elevation change. If this datum difference and tidal inundation range is not accounted for prior to grading, target salt marsh habitats could be planted significantly lower or higher than their natural range. The vertical datum factors associated with coastal hydrology analyses have numerous implications for successful restoration planning and implementation, including cost (grading and material disposal), proper tidal inundation periods, and a properly functioning ecosystem.

Can Carbon Addition Be Used to Reverse the Effects of Atmospheric Nitrogen Deposition?

Donald E. Thomas, San Francisco Public Utilities Commission, Division of Natural Resources and Land Management. DEThomas@sfwater.org

Soil deposition of air-borne nitrogen originating from automobile exhaust has a detrimental effect on serpentine grassland because it stimulates the growth of non-native annual grasses, to the competitive disadvantage of native plants. The addition to the soil of a labile form of organic carbon, such as sucrose, has been shown to reduce plant-available nitrogen and inhibit the growth of these grasses more than that of native perennial bunchgrasses. I conducted an experiment to test the effect of carbon addition on the growth of annual grasses in test plots to which nitrogen fertilizer was applied to simulate atmospheric nitrogen deposition. The test was carried out in serpentine grassland in the Peninsula Watershed of the San Francisco Public Utilities Commission. There were four treatments: control (no sucrose and no nitrogen), addition only of sucrose, addition only of nitrogen and addition of both sucrose and nitrogen. I found that addition of carbon to unfertilized test plots significantly reduced mean dry weight (at the 0.05 level), indicating the efficacy of applying labile carbon amendments. This effect was also found for test plots that were fertilized with nitrogen. However, because there was no significant difference in dry weight between the control treatment and the treatment of only adding nitrogen, it was not possible to demonstrate that carbon addition reversed a stimulatory effect of increased nitrogen. Though these results were inconclusive, this method should be further explored to evaluate its utility in the restoration of serpentine grassland habitat degraded by atmospheric nitrogen deposition.

Saving Time, Money and the Bay: How *Save The Bay* Successfully Manages a Community-based Wetland Restoration Program.

Laura Wainer, Save The Bay, 350 Frank Ogawa Plaza, Suite 900, Oakland 94612. lwainer@savesfbay.org

Ecological restoration by volunteers is often associated with inefficiencies and inefficacies. Contrary to this stereotype, for over ten years Save The Bay, San Francisco has used over 50,000 community volunteers to successfully restore transition zone salt marsh habitat throughout the San Francisco Bay Estuary. We present here ten years of tidal salt marsh enhancement data to indicate the success of Save The Bay's Community-based Restoration program. Lessons learned from analysis of this data have been used to adaptively manage our restoration efforts, increase productivity associated with utilizing volunteers, and to project a timeframe for meeting our goals. We assess our restoration efforts by measuring non-native plant reduction, native plant coverage, non-native to native plant ratio, habitat use by sensitive species, acreage, and maintenance. We depict quantitative data that indicate the financial, organizational and volunteer resources necessary for successful habitat enhancement. We conclude with recommendations for other community-based restoration programs.

Using Resilient Planning Techniques in Mining and Reclamation.

Mignone Wood, AICP, LSA Associates, Inc., 395 Oyster Point Boulevard, Suite 307, South San Francisco 94080. mignone.wood@lsa-assoc.com

Adaptive management is a process used to improve the reclamation process by making adjustments when unforeseeable conditions arise. We will examine the resilient planning techniques used at an aggregate quarry when unexpected challenges are encountered during the reclamation plan creation and implementation. Reclamation of Canal Quarry, located in Richmond California, presented numerous challenges. Mined since 1959, operators used hillside and open pit mining to harvest aggregate. The site is characterized by an excavated 150-foot high slope abutting public parklands and a flat quarry floor. During reclamation, several site conditions were addressed including a severely eroded unstable slope, poor drainage, inadequate revegetation and rock topple. Stormwater runoff was addressed by surface and subsurface drainage systems. Subsurface drains were installed to prevent damage to the earth buttress constructed with a geogrid matrix. Stormwater falling onto the graded slopes were collected in v-ditches lined with turf reinforcing material (TRM). Using the TRM effectively reduced the velocity of stormwater in the ditches, reduced the amount of sediment flowing off-site, allowed percolation into the ground and cost less than a concrete lined ditch. To facilitate revegetation, an area-specific planting program was proposed. The compacted quarry floor soil was evaluated for its ability to support planting. Customized seed mixes were used for hydroseeding and woody plants were hand planted.

Today, Canal Quarry boasts a grassy hillside of native vegetation flourishing on the face of the former quarry. After much anticipation and through all of the site's complexities, Canal Quarry is the successful result of strategic reclamation practices.