sercal 2017

Looking Back… *Leaping Forward*

The 24th Annual Conference of the California Society for Ecological Restoration

10–11 May 2017 **UC Davis Conference Center** *Davis*

12 May 2017 **Post-Conference Fieldtrips**

INSIDE

Looking Back… Leaping Forward: SERCAL 2017 in Davis

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CONFERENCE LOGISTICS **Julie St. John** *SERCAL Admin Director* | **Carol Presley** *Raffle* | **Will Spangler** *Career Panel*

SESSION CHAIRS **Thor Anderson** *Burleson Consulting* | **Gavin Archbald** *H.T. Harvey & Associates*
Allegra Bukojemsky *Landscape Architect* | **Kevin Ghalambor** *Burleson Consulting* | **Glen Kinoshita** *ICF* | **Kevin MacKay** *ICF*
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FIELDTRIP LEADERS **Peter Buck** *SAFCA* | **Andrew Fulks** *UC Davis Arboretum* | **Matt Gause** *Westervelt Ecological Services*
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Gerrit Platenkamp *ESA* | **Chris Rose** *Solano RCD* | **Amanda Seidel** *Wildlands* | **Nina Suzuki** *UC Davis Arboretum* |

Wednesday, May 10 Day One: Conference

7:30–9am **Registration Check-in** | **Sponsor & Poster Set-up** | **Hosted Continental Breakfast**

9–10am **Welcome** *SERCAL President & Conference Chair Harry Oakes, ICF*
Plenary Session *Erik Loboschefsky, Program Manager, CA DWR EcoRestore Program*

10–10:30am **Hosted Coffee Break**

10:30–Noon **Concurrent Technical Sessions**
Native Plant & Seed Sources | Technology & Innovations | Tidal Habitat

Noon–1:30pm **Hosted Buffet Lunch**

1:30–3pm **Concurrent Technical Sessions** **these sessions run 1:15–3:15pm*
Native Plant & Seed Sources | Technology & Innovations* | Tidal Habitat*

3–3:30pm **Hosted Coffee Break**

3:30–5pm **Concurrent Technical Sessions**
Stream & Riparian | Technology & Innovations | Tidal Habitat

5–7pm **Poster Reception** | **Hosted Appetizers** | **Craft Brews** | **Music by the Simpler Tones**

Sponsor Booths Open

Posters on Display

Raffle Items on Display *Proceeds benefit Student Scholarship fund.*

Thursday, May 11 Day Two: Conference

7:30–8:30am **Hosted Continental Breakfast**

8:30–10:30am **Concurrent Mini Fieldtrips**

Special Session: Career Panel

10:30–11am **Hosted Coffee Break**

11–12:30pm **Concurrent Technical Sessions**
Stream & Riparian | Looking Back at Early Restoration Projects | Adapting to Climate Change

12:30–2pm **Hosted Buffet Lunch** | **SERCAL Member Announcements** | **Raffle Drawing**

2–3:30pm **Concurrent Technical Sessions**
Stream & Riparian | Looking Back at Early Restoration Projects | Adapting to Climate Change

3:30–4pm **Hosted Coffee Break**

4–5:30pm **Concurrent Technical Sessions**
Stream & Riparian | Looking Back at Early Restoration Projects | Adapting to Climate Change

Raffle Items on Display *Drawing at Lunch*

Sponsor Booths Open

Posters on Display

Friday, May 12 Day Three: Post-Conference Fieldtrips *Pre-registration required*

North Bay Tidal Marsh Restoration | Sacramento River Ranch
Cosumnes Floodplain Mitigation Bank After the Flood | Sacramento River and American River

Wednesday, May 10 Day One: Conference

9–10am **Welcome from Harry Oakes followed by our Plenary Speaker, Erik Loboschefsky**

Erik Loboschefsky is an Environmental Engineer and Program Manager for DWR's EcoRestore Program within DWR's Executive Program Office. In this position, Erik provides leadership and technical environmental engineering support for projects and efforts associated with the DWR EcoRestore. Additionally, Erik works across numerous DWR divisions and external agencies on habitat restoration design and implementation, landscape datasets and data management architecture, GIS and mapping, and physical and biological modeling in support of the Department's mission. Erik joined DWR's Division of Environmental Service's (DES) Suisun Marsh Program in the summer of 2012 as a water resources engineer. At DES, Erik worked on a variety of projects including operations of several DWR facilities in Suisun Marsh, water quality monitoring projects, biological studies/surveys, as well as the planning and implementation of several tidal wetland restoration projects in both Suisun Marsh and the Delta.

Erik is a Central Valley transplant from Park City, Utah, and has lived in the Sacramento/Davis region since the fall of 2000 when he started attending UC Davis. At UC Davis, he majored in Civil and Environmental Engineering and minored in Atmospheric Science. During his undergraduate career, he was a member of the UC Davis men's rowing team and on a near daily basis practiced in the Sacramento Deep Water Ship Channel. Upon finishing his undergraduate studies, Erik entered into the Civil and Environmental Engineering graduate program at UC Davis to pursue a PhD; there he had the opportunity to work on a variety of different projects. For one project, he worked with out-migrant juvenile salmon in the Columbia River; not a typical engineering task to say the least. The bulk of his dissertation research was focused upon building and implementing an individual-based life-cycle model for striped bass and longfin smelt in the Bay Delta region as a tool in assessing their population dynamics.

In Erik's presentation, he will give an overview of several DWR-led restoration projects that have been "in the ground" for numerous years, discussing the status of those projects and lessons learned. During the course of his talk, he will discuss EcoRestore's goals and current status, some of the key challenges for restoration implementation coupled with methods/mechanisms that have been found to alleviate some aspects of these challenges, and how adaptive management is an integral part of each restoration site.

5–7pm **Poster Reception and Student Poster* Contest**

This year's Poster Session features both professional and student presentations. Volunteer judges will score student posters Wednesday evening on clarity of content, ease of legibility, and style. A first and second place will be awarded that evening, decorated with an award ribbon, and featured on the SERCAL website following the conference. Any presenter may request constructive feedback from poster judges when they sign in at the conference.

BRUSATI E | CDFW's Invasive Species Program Contributes to Ecological Restoration

CHRISTMAN M | The Interagency Development of an EcoRestore Adaptive Management Program

DANIELCZYK M | Enhancing the Wildlife Value of Farms in the Central Valley: A team effort

FETTKE K | Bonus Points: Unrecognized supplemental benefits of mitigation and conservation banks

FREESE R | Soil Salvage as a Technique for Coastal Sage Scrub Restoration

GROEBNER J | A Study of Long-term Restoration Success from Southern California

KLEINER E | Success with the National Seed Strategy: Restoration projects using local source seed

*LANE B | Flow, Form, and Function: Integrating hydrologic and geomorphic considerations reveals opportunities and tradeoffs for river restoration

MAJOR M | Testing Methods to Restore Diverse Perennial Grasslands in Southern California

MALIK A | Revisiting Common Planning Approaches to *Arundo* Removal to Increase Resiliency within Riparian Ecosystems

*MAROWITZ M | Using Restoration to Change Our Culture for a Sustainable Future

*MASJUAN V | Fairview Park Case Study: Citizen scientists' role in seed collection

MCDERMOTT E | Successful Restoration of Riparian Habitat from a Himalayan Blackberry Thicket

PETERS J | Comparison of Stream Simulation to Hydraulic Design Approaches for Constructing Fish Passage Channel Segments in Central California Coastal Streams: Challenges, opportunities, and lots of large rocks

*SHAW J | Strip-seeding, a Novel Grassland Restoration Strategy

*SOLINS J | Effects of European Beachgrass Removal on Native Dune Vegetation

*TADDEO S | Leveraging Public Aerial Image Datasets to Evaluate Wetland Restoration Progress

Wednesday, May 10 Day One: Conference

10:30–Noon **Concurrent Technical Sessions**

Ballroom A

Native Plant & Seed Sources Thor Anderson & Kevin Ghalambor *Chairs*

10:30 GILPIN D | Looking Back at Butte Fire Seeding: Stepping ahead with the National Seed Strategy

11:00 KLEINER E | Searching for Climax

11:30 DELFINO S | Breeding Systems and Hybridization Potential of Native Grassland Species

Ballroom B

Technology & Innovations
Allegra Bukojemsky *Chair*

10:30 DRONOVA I | The Promise of High-resolution Remote Sensing for Cost-effective and Coherent Wetland Restoration Monitoring Programs

11:00 GILLESPIE S | Tracking Alluvial Floodplain Restoration Using UAV-derived Digital Surface Models and Imagery

11:30 O'CONNELL G | Intertidal Eelgrass Mapping in Humboldt Bay: Ultra-High resolution UAV imagery and GIS spectral classification

Ballroom C

Tidal Habitat Restoration
Gerrit Platenkamp *Chair*

10:30 SUTTER G | Conservation, Restoration and 'Reconciliation': Site selection principles that don't let the perfect get in the way of the good

11:00 FINNEMORE P | Tidal Restoration in the Suisun Marsh, Amidst Conflicting Regulatory Requirements and Permits

11:30 HOLLAND C | Design and Implementation of Tule Red Tidal Restoration Project in Suisun Marsh

1:30–3pm **Concurrent Technical Sessions** **these sessions run 1:15–3:15pm*

Native Plant & Seed Sources Thor Anderson & Kevin Ghalambor *Chairs*

1:30 PIEHEL E | Adaptive Methods of Seed Collection for Special-status Plant Restoration

2:00 ROBB L & L CAVALLARO | Special-Status Plant Propagation: Mojave and Colorado Desert species

2:30 MARCELLUS J | Greenheart Farms: Utilizing agricultural practices to make history in restoration

Technology & Innovations*
Allegra Bukojemsky *Chair*

1:15 CURD E | Monitoring California's Biodiversity through Environmental DNA

1:45 POWELL C | Two New Calflora Tools

2:15 MERRILL A | A Habitat Quantification Tool: Case study and empirical ground truthing

2:45 ANDERSON E | Measuring Milkweed: Quantifying restoration outcomes for the monarch butterfly

Tidal Habitat Restoration*
Gerrit Platenkamp *Chair*

1:15 BORGONOVO A | 40+ Years of Wetland Restoration in San Francisco Bay: Lessons learned and emerging trends

1:45 HANSEN D | The Balancing Act: Tidal restoration benefiting landowners and fish

2:15 PERUZZI M | Bringing a Community Together While Restoring Habitats

2:45 ARCHBALD G | Designing High Tide Refuge Islands for the California Ridgway's Rail

3:30–5pm **Concurrent Technical Sessions**

Stream & Riparian Restoration
Kevin MacKay *Chair*

3:30 SINGH J | Developing a Multi-Objective Restoration Strategy for the Coon Creek Watershed

4:00 WHITE J | Incorporating Geomorphic Processes into Stream Restoration Design

Technology & Innovations
Allegra Bukojemsky *Chair*

3:30 LINK E & K LANTZ | Transforming Vegetation Data Collection & Analysis Through the Use of Digital Collection Methods

4:00 STRATTEN D | 3D Drafting for Design of Naturalistic Restoration Projects

4:30 LEONARD D | Photorealistic Geodesign

Tidal Habitat Restoration
Gerrit Platenkamp *Chair*

3:30 HARTMAN R | Laying Down a Framework for Standardized Monitoring — and Starting to Fill It In!

4:00 BERGMAN P | Measuring Fish Response as a Primary Performance Metric for Tidal Marsh Restoration Implementation

4:30 FETTKE K | Restoration of Historical Tidal Wetlands for Compensatory Mitigation: Quantifying ecological lift

Thursday, May 11 Day Two: Conference

8:30–10:30m **Choice of 3 Mini Fieldtrips**

Registration for these three fieldtrips will be available after the plenary session on Wednesday morning. Sign up is first come, first served. All fieldtrips will depart from the Conference Center and directions, signup sheets for carpools, etc., will be available at the registration desk.

Please join us for a hosted continental breakfast (7:30–8:30am) before you head out for your fieldtrip! Two fieldtrips involve carpools and one is a walking tour from the Conference Center.

Tour of Hedgerow Farms — *Leader: Chris Rose, Solano Resource Conservation District*

Hedgerow Farms, Inc., is a seed production farm of California native species with over 400 acres in seed production. They have over 100 species of origin-known California native grasses, forbs and sedges available and some species are available from multiple sources. Starting in the 1980s John Anderson, founder of Hedgerow Farms, began incorporating native revegetation and restoration practices into the working farm landscape. Chris Rose, executive director of Solano RCD, will show some of the examples of mature hedgerows, roadside, field side, and canal plantings on the farm. The tour will include discussion of these native plantings and their importance in erosion control, riparian health, wildlife habitat, pollinator forage, water and soil quality, and weed control. Rachael Long, Yolo County Farm Advisor, will also talk specifically on hedgerow plantings and the value they add to the landscape.

Visitors should be aware this is a working farm and should bring sunscreen, bug spray, water, hats, sturdy shoes, and a camera. There will be some easy walking involved. There is only one bathroom on the farm so taking care of personal needs before leaving for the tour is appreciated. Carpooling is also appreciated.

Tour limit: 30 people

Tour of Putah Creek Riparian Reserve at Russell Ranch — *Leader: Andrew Fulks, UC Davis Arboretum*

Russell Ranch is about a 15-minute drive away from the Conference Center. Once there, we'll walk around the grassland areas, looking at the species mixes as well as some of the challenges we've had with weeds. Bring hat, sunglasses, water, and sturdy shoes. We'll be walking over uneven terrain.

Visitors to Russell Ranch will see a 300-acre native grassland restoration. Learn about the use of managed grazing to reduce thatch and optimize hawk foraging habitat. The wildflowers are blooming, and visitors will discover the best techniques for installation and establishment of native forbs into a restored grassland ecosystem. The ranch also features a 70-acre valley oak forest that has been self-regenerating over the last 40 years.

Tour limit: 5 cars (approx 25 people)

Walking Tour of UC Davis Arboretum — *Leaders: Anna Haven Kiers, Stacey Parker, and Nina Suzuki*

This tour will focus on the east end of the Arboretum, specifically the Mary Wattis Brown native plant garden, the Redwood Grove, and the recently installed Arboretum GATEway Garden. As a bonus, we will update participants on the latest developments with the Arboretum Waterway and the construction that's currently going on.

Bring sunscreen and/or a wide brimmed hat and good walking shoes. Davis can be hot this time of year, so a water bottle is also recommended.

Tour limit: 25 people

8:30–10:30m **Student Career Panel**

SERCAL Board member, Will Spangler has been working with academic advisors and invited a wide variety of professionals to provide both graduate and undergraduate students with tips and resources for moving into a career in the far-ranging field of ecological restoration.

Current UC Davis students in departments such as Plant Biology and Evolution & Ecology have been invited to attend and all conference goers are encouraged to attend this panel as well. Bring your questions and learn more — *and ask more* — about how to find internships, does it "pay" to volunteer, what should you expect to learn from your first job experience.

We hope to see you there!

Thursday, May 11 Day Two: Conference

11:00–12:30 **Concurrent Technical Sessions**

Ballroom A

Stream & Riparian Restoration
Kevin MacKay *Chair*

11:00 SHAW D | Middle Martis Alluvial Fan Restoration, Part 1: Design diversification in a dynamic setting

11:30 CHRISTMAN B | Middle Martis Restoration, Part 2: Moving from design to implementation

12:00 HOLMES K | Riparian Restoration in Urban Settings

Ballroom B

Looking Back at Early Restoration Projects Ross Taylor *Chair*

11:00 HOWARD S | Challenges of an Urban Restoration Site: Cannon Road West wetland mitigation

11:30 DAPRATO M | Establishing Wildlife Habitat Across the Sacramento Valley's Agricultural Landscape: Lessons learned from Yolo, Colusa, and Solano County Projects

12:00 HARTMAN B | Long-term Monitoring of Ecosystem Restoration on Santa Rosa Island, California

Ballroom C

Adapting to Climate Change Glen Kinoshita & Christina Schaefer *Chairs*

11:00 SIEGEL S | Climate Change: Policy challenges for restoration (nature-based infrastructure solutions)

11:30 GARDALI T | A Framework for Making Restoration Climate-smart

12:00 SPENCER W | The Sierra Nevada Forest Resilience Initiative

2:00–3:30 **Concurrent Technical Sessions**

Stream & Riparian Restoration
Kevin MacKay *Chair*

2:00 YOUNG M | Salmonid Habitat Restoration and Conservation Along the Sacramento River: A case study

2:30 PETERS J & L FEENY | SFPUC Bioregional Habitat Restoration at Sheep Camp Creek, Sunol CA

3:00 CLARK C | Monitoring Wetland Restoration and Validating the California Rapid Assessment Method for Depressional Wetlands

Looking Back at Early Restoration Projects Ross Taylor *Chair*

2:00 TAYLOR R | Morrison Gulch Culvert Replacement: Sixteen years of post-project monitoring

2:30 PINNELL C | Looking Back: 35 years of restoration in the Mattole Watershed

3:00 SWENSON R | The Cosumnes River Preserve: 30 years of floodplain and riparian restoration

Adapting to Climate Change Glen Kinoshita & Christina Schaefer *Chairs*

2:00 HUNING B | Using Structured Decision-making for Climate Adaptation Planning

2:30 SMICK G | Tidal Marsh Plain Restoration: Technological advances for planning and monitoring

3:00 PRANGE R | Adaptive Management of Pond Hydroperiod in the Face of Drought

4:00–5:30 **Concurrent Technical Sessions**

Stream & Riparian Restoration
Kevin MacKay *Chair*

4:00 AIROLA D | Non-Native Himalayan Blackberry as Essential Nesting Habitat for the Tricolored Blackbird: Will our xenophobia contribute to extinction?

4:30 ZEFFERMAN E | Restoring the Salinas River through Large-scale *Arundo* Control

Looking Back at Early Restoration Projects Ross Taylor *Chair*

4:00 RIGNEY J | Seascape Uplands HCP: Two decades later

4:30 STAFFORD C | Urban Development Shapes One of Orange County's Most Endangered Species

5:00 YAKICH J | Long-term Success of Restored Vernal Pools Along the Fringe of San Francisco Bay

Adapting to Climate Change Glen Kinoshita & Christina Schaefer *Chairs*

4:00 PHANEUF R | Examining the Influence of Aspect on *Eriogonum* species in an Alpine Plant Community

4:30 SINDHAR S | Challenges in Riparian Restoration and Adaptive Management Strategies

5:00 VILLANUEVA B | Assessing Community Response to 'Front-yard' Coastal Dune Species Conservation & Restoration

Native Plant & Seed Sources: *Challenges and Solutions in Plant Propagation and Seed Collection*

Chairs: Thor Anderson and Kevin Ghalambor, Burleson Consulting

Wednesday 10 May — 10:30–12:00 and 1:30–3:00 — *Ballroom A*

Abstracts listed alphabetically by presenter (*)

Breeding Systems and Hybridization Potential of Native Grassland Species

Sylvia Delfino

sdelfino@hedgerowfarms.com

Maintaining the genetic identity of a given population in restoration is a key issue restoration practitioners face. Ecological restoration in California is still a young field both in terms of theory and practical application. The definition of ecological restoration is "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" as defined by the Society for Ecological Restoration. Implementation methods and strategies are still being tested and ecologists strive to rehabilitate California's ecosystems using materials that do not adversely alter the genetic structure of a site's existing or historical plant populations. Materials for projects in California often come from native seed producers within the state. Producers strive to provide materials that are genetically true to a species and to the geographic distribution in which it was collected (i.e., ecotype). Producers take precautions to reduce the chances of hybridization between species and cross-pollination between ecotypes, while also maximizing genetic diversity of seeds during the harvest and cleaning processes (e.g., making sure to harvest both early- and late-setting seeds for a particular species). This review focused on two questions: First, what are the breeding systems of the species grown in large-scale production? Second, with which other species and/or genera does the species hybridize?

Looking Back at Butte Fire Seeding: Stepping ahead with the National Seed Strategy

David Gilpin*[1], Vanessa Stephens[2], Chris Swann[3], Bill Agnew[4], and David Lightle[5]

[1]General Manager, Pacific Coast Seed; [2]Resources Analysts; [3]Watershed Ranger Supervisor; [4]Agnew Environmental Consulting; [5]Erosion Model Consultant

In the aftermath of the 70,000 acre Butte Fire (2015) East Bay MUD elected to provide native seeding and erosion control treatments to 20 acres on the crest of the Mokelumne River Watershed that drains to Pardee Reservoir. Researchers utilized this natural laboratory to establish and measure treated plots for cover % for native seed, other vegetation, bare ground, litter, and more. Seeding results are presented from select treatments measured over two seasons. Revised Universal Soil Loss Equation (RUSLE2) calculations were formulated to measure soil erosion reduction from seeded areas compared to areas with no treatments. Additionally, RUSLE2 estimates future benefits from such treatments and projects the results of increased cover over time. Finally, this and other research and outreach should be advantageous to California by realizing the value of expanding appropriate native restoration seed sources across a large array of agencies, practitioners and the public-at-large through the National Seed Strategy.

Searching for Climax

Ed Kleiner

Comstock Seed LLC, 917 Hwy 88, Gardnerville, NV 89460, 775.720.3681, **ed@comstockseed.com**

The recently published National Native Seed Strategy is promoting the use of locally sourced seed through the expansion of farm cultivation and native acquisitions. This strategy is influencing specifications in the private sector which is now requiring local seed for large rural projects such as utility corridors, highways, and mines, as well as projects at the urban interface. This presentation will review several historic projects in the western U.S. that included local seed acquisitions and present a photographic timeline of restoration progress. Common themes in the design and implementation of these projects, emphasizing the use of locally sourced seed, provide insight for a functional path for future projects and support the National Native Seed Strategy.

Greenheart Farms: Utilizing agricultural practices to make history in restoration

Jordan Marcellus*[1] and Andrea Finnegan[2]

[1]Greenheart Farms, Inc., 902 Zenon Way, Arroyo Grande 93420, **JMarcellus@greenheartfarms.com**; [2]US Bureau of Reclamation, **Afinnegan@usbr.gov**

For several years, Greenheart Farms has been propagating and transplanting native restoration species for the Lower Colorado River Multi-Species Conservation Program along the border of California and Arizona. As one of the largest restoration project in US history (50 years, 8,100 acres), novel solutions to plant propagation

and transplanting were critical for long-term success and viability. Greenheart Farms' decades of experience in vegetable-transplant production has helped make this program not only extremely successful but also cost-effective by utilizing agricultural principles and automation in many aspects of propagation and transplanting. To date, over 10 million native trees, shrubs, and grass plugs have been planted across over 4,600 acres, creating vital habitat for at least 18 LCR MSCP cover species of fauna, most of which are state or federally listed as sensitive, threatened, or endangered.

Adaptive Methods of Seed Collection for Special-status Plant Restoration

Eric Piehel* and Cecilia Meyer Lovell

AECOM, 401 West A Street, Suite 1200, San Diego 92101, **eric.piehel@aecom.com**

Restoring special-status plants requires constant adaptive management and innovation due to their rarity and often specific habitat requirements. Seed collection is the first crucial step in the seemingly species specific process of rare plant restoration. It is understood that each rare plant has its own set of habitat and soil preferences; phenology; and reproductive, dispersal, and germination strategies. Observing and knowing each of these factors and the relation of them for your specific target species is the key to developing successful special-status plant seed collections. There is no simple formula for successful special-status plant seed collection, but by deconstructing and analyzing species-specific methods and processes, common patterns and factors emerge. Lessons learned, including successes and failures of seed collection from several special-status plant species of San Diego County will be shared with the idea that these lessons can be applied to other regions with their own unique special-status plants.

Special-Status Plant Propagation: Mojave and Colorado Desert species

Linda Robb*[1], Lindsey Cavallaro*[1], Scott McMillan[1], Bruce Hanson[1], Cecilia Meyer Lovell[1], Setal Prabhu[2], and Sean Bergquist[2]

[1]AECOM, 401 West A Street, Suite 1200, San Diego 92101, 714.478.0755, **Linda.Robb@aecom.com**; [2]Southern California Edison, 6090 N. Irwindale Avenue, Irwindale 91702

Propagation of special-status plants poses many challenges, especially for species that have specific microhabitat requirements and have not been successfully propagated in a nursery setting. Understanding how phenology and microhabitat conditions factor into a plant's rarity is key to successfully propagating rare plant species. Southern California Edison (SCE) worked with AECOM to propagate a number of sensitive desert plants species in an effort to reestablish plants that could not be avoided during construction of SCE transmission line projects. White-margined beardtongue (*Penstemon albomarginatus*), rosy two-toned beardtongue (*Penstemon bicolor* ssp. *roseus*), and nine-awned pappus grass (*Enneapogon desvauxii*) are species from the Mojave Desert near Las Vegas, Nevada, that are currently being propagated by AECOM for SCE mitigation. Rosy two-toned beardtongue and nine-awned pappus grass have been successfully propagated and outplanted, as well as used for seed bulking and seed dispersal in appropriate habitat. White-margined beardtongue has unique habitat requirements, and several attempts have been made to propagate this species utilizing native soil and germination throughout different times of the year, with mixed results. Coachella Valley milk-vetch, a Colorado Desert species, was propagated by the Rancho Santa Ana Botanic Garden for SCE utilizing knowledge of key habitat requirements and collaborative input from restoration experts at SCE and AECOM. Coachella Valley milk-vetch was ultimately most successful when propagated with native soil and from seed dispersed back into its native habitat. We will share the methods and results of the special-status plant species propagation efforts and identify valuable lessons learned for each species.

Technology and Innovations: *Data Collection, Analysis, & Reporting*

Chair: Allegra Bukojemsky

Wednesday 10 May — 10:30–12:00, 1:15–3:15, & 3:30–5:00 — Ballroom B

Abstracts listed alphabetically by presenter (*)

Measuring Milkweed: Quantifying restoration outcomes for the monarch butterfly

Erik Anderson

Environmental Incentives, LLC, 3351 Lake Tahoe Blvd, Suite 2, South Lake Tahoe, **eanderson@enviroincentives.com**

Well-designed environmental metrics provide science-based, objective, and transparent assessments of ecological function. They allow for regulators, regulated entities, restoration designers, and landowners to understand a problem in the same way, communicate with a shared language, and work towards a common goal. Using these tools, the contribution of every action can be understood in a quantified way, fostering innovation and creativity to achieve habitat outcomes efficiently and with limited resources. This presentation will provide an example, using the recently-developed Monarch Butterfly Habitat Quantification Tool (HQT), of how environmental metrics and associated tools can be designed to meet the needs of the diverse stakeholders who use them. This design approach ensures that the HQT will: • Meet the requirements of pertinent regulatory authorities; • Provide precise estimates of habitat function or ecosystem service outputs in order to guide resource allocation decisions and incentivize desired behaviors; • Be applied in a reasonable amount of time; and • Generate consistent, repeatable results. Preservation of the monarch butterfly's annual migration will require multi-national collaboration at an almost unprecedented scale. Well-designed environmental metrics can serve as the backbone of this collective effort, and can support restoration and recovery efforts for other imperiled resources and species as well.

Monitoring California's Biodiversity through Environmental DNA

Emily Curd*[1], Rachel Meyer[2], Robert Wayne[3]

University of California Conservation Genomics Consortium, University of California, Los Angeles 90095: [1]4153 Terasaki Life Science Building, **eecurd@g.ucla.edu**; [2]4153 Terasaki Life Science Building, **rsmeyer@g.ucla.edu**; [3]4162 Terasaki Life Science Building, **rwayne@ucla.edu**

A major challenge in conservation and restoration biology is effectively monitoring species distributions and establishing reliable baselines of a region's biodiversity. This is particularly true for rare, cryptic, or hard-to-observe species (e.g. microorganisms) which may play critical roles in community stability. We introduce the CALeDNA citizen science-supported program by the University of California Conservation Genomics Consortium, which tackles biodiversity monitoring by sequencing DNA shed into the environment. As organisms live and die, they lose DNA to soils and sediments. We can collect these materials, and use metagenomic sequencing to reconstruct the biodiversity of a location. This initiative will generate a state-wide biodiversity baseline by recruiting 1,000 citizens to collect a total of 18,000 samples. These samples and sequencing data can be analyzed in multiple ways for basic and applied purposes. The kinks in metagenomics are far from worked out, and there are technical and theoretical challenges to doing such work, as well as challenges on the program operational front. However, this approach holds promise to identify entire communities from microbes to mammals, providing a community-oriented toolkit for managers. Our program demonstrates this value through additional targeted biodiversity projects aimed for conservation and restoration (e.g. pacific pocket mouse reintroduction, crayfish removal and restoration monitoring). We present the multiple angles of the CALeDNA approach to monitoring biodiversity, including technology developed to support citizen science, laboratory methods to generate data, accessibility of data and soil samples, and ways to involve conservation and restoration managers in our project.

The Promise of High-resolution Remote Sensing for Cost-effective and Coherent Wetland Restoration Monitoring Programs

Iryna Dronova* and Sophie Taddeo

202 Wurster Hall #2000, Department of Landscape Architecture & Environmental Planning, UC Berkeley, Berkeley 94720, **idronova@berkeley.edu**, **sophie.taddeo@berkeley.edu**

Wetlands are important targets in ecological restoration due to their multiple ecosystem services — protection against coastal flooding, sequestration of greenhouse gases, pollution remediation, supporting biological diversity and various aesthetic and recreational qualities. However, measuring these benefits is difficult — wetland environments are often spatially complex, difficult to navigate, and often inhabited by sensitive plant and animal species easily disturbed by human presence. Very high-resolution remote sensing offers outstanding novel opportunities to monitor restored wetlands at spatial detail appropriate for small patches and microhabitats and at broad site extents where comprehensive field work may be logistically prohibitive and ecologically disruptive. Our study demonstrates the potential of such approaches across a chronosequence of 4 different-aged restored freshwater marshes in the Sacramento-San Joaquin Delta, where wetlands are actively explored as a target for carbon markets and emerging cap-and-trade programs. We discuss how remotely sensed information assists in detecting changes in ecosystem composition and structure and their sensitivity to site designs and how these outcomes may be used to assess whether restored sites follow their intended trajectories and with that to inform adaptive strategies to manage existing sites and design the future ones both in California and other similar regions.

Tracking Alluvial Floodplain Restoration Using UAV-derived Digital Surface Models and Imagery

Sundaran Gillespie

GISP, FAA Section 107 Pilot, **gillespie@wra-ca.com**, 415.524.7274

Munz Canyon is an alluvial fan restoration project within the boundaries of both the proposed San Andreas Rift Zone Significant Ecological Area and the Desert Renewable Energy Conservation Plan Area. The site is a component of the larger Petersen Ranch Wetland Mitigation Bank, the largest wetland bank in the state. Munz Canyon is topographically and biologically diverse with dominant vegetative communities including seasonal wetlands, ephemeral and desert washes, and alluvial floodplains. The project goal is to lower an existing dam and restore a large alluvial fan with re-introduced sediment deposition. As a pioneer in the field of restoration, WRA constantly employs new technologies. In order to save field-related costs and having a need for high accuracy data, WRA utilized an unmanned aerial vehicle (UAV) for analysis. WRA conducted several flights of the site at key points of interest to track change during restoration. Flights were performed prior to construction, directly after completion, and after all major rain events. With the 2016/17 rain season being one of the wettest in the last several years, it provides the perfect opportunity to track change. Aerial imagery from each flight was then processed into high resolution (2cm) orthomosaic imagery and a digital surface model. Utilizing both data products, change detection was performed through remote sensing, flow analysis, volumetric calculations, and visual interpretation comparing all of the datasets from each date. Success criteria are then addressed to confirm project goals are being met. The Petersen Ranch restoration project is ongoing for the next several years.

Photorealistic Geodesign

David Leonard

AICP, ASLA, GISP, LEED Green Associate, Senior Project Manager, Infrastructure and Planning Sector, PARSONS, 525 B Street, Suite 1600, San Diego 92101, 619.515.5153 office, 619.200.7309 cell, **david.leonard@parsons.com, www.parsons.com**

Accurate photorealistic depictions of habitats have not been feasible until now. In this presentation, we will explore software that provides the realism of Hollywood with GIS and CAD accuracy. We will demonstrate the workflow from concept to visualization rendering. This session will demonstrate how easy it is to depict habitats of all kinds, tidal inundations, sea level rise, and habitat migration. 3D visualization capability allows us to better explore our own designs, engage our clients and stakeholders, expedite decision-making, and view the site from many vantage points. The use of procedural vegetation increases the integrity of the renderings by not having repeating objects (all are unique). We will also explore how to generate custom plants for unique habitats to increase the accuracy of the site visualization.

Transforming Vegetation Data Collection & Analysis Through the Use of Digital Collection Methods

Eric Link* and Kristin Lantz*

ICF, Sacramento, **eric.link@icf.com**, **Kristin.lantz@icf.com**

Botanical surveys incorporate many different methods to survey plant communities and habitat restoration areas for plant survival, percent cover and species composition and other metrics. These surveys typically include an on-the-ground assessment and "getting eyes" on your project site. These tried and true methods continue to be the best way to assess site conditions and progress toward meeting and achieving success criteria. However, the game is changing as it relates to data collection, management, and analysis. Recording field data has traditionally relied on the paper form followed by hours of data entry, but technological innovations are allowing us an opportunity to "upgrade our systems". Incorporating digital data collection, storage, and transfer methods can improve the efficiency of data collection, management and analysis. We will discuss some of the options available for streamlining data collection, setting up project-specific electronic data collection forms, data transfer and management, and efficiencies in data analysis. We will provide some project-specific examples, as well as some lessons learned we have experienced.

A Habitat Quantification Tool: Case study and empirical ground truthing

Amy Merrill*[1], Daniel Kaiser[2], John Cain[3], Nat Seavy[4], Rene Henery[5], and Scott Sellers[2]

[1]Stillwater Sciences, Berkeley, **amy@stillwatersci.com**; [2]Environmental Defense Fund, San Francisco, dkaiser@edf.org, ssellers@edf.org; [3]American Rivers, Berkeley, **jcain@americanrivers.org**; [4]Point Blue Conservation Science, Petaluma, **nseavy@pointblue.org**; [5]Trout Unlimited, Berkeley, **rhenery@tu.org**

Land use conversion, drought, and climate change are conspiring against many native species once abundant in the Central Valley. Restoring and protecting habitat is critical for their recovery, and private lands, which make up over 80% of the Central Valley, are a necessary part of the solution. How do we engage private land owners in this effort to effectively address multiple species needs? As part of the Central Valley Habitat Exchange (CVHE), we developed and piloted a scientifically based and accessible "Multispecies Habitat Quantification Tool" (mHQT), to assess habitat quality and quantity, and to track conservation or mitigation outcomes for multiple native species in the Central Valley. To date, these species include riparian associated or dependent species: Swainson's hawk, riparian landbirds, Chinook salmon, and giant garter snake. The mHQT incorporates information from the landscape and site-specific scales for site scoring, program tracking, and prioritization. The mHQT provides clear and concrete guidelines with response scores that private landowners can use to guide land management planning, implement conservation and mitigation projects, and demonstrate good

stewardship. We present a case study for application of this tool to guide and initiate tracking restoration outcomes. We also present results from a ground-truthing study in which we compared tool scores against species occurrence data at 12 locations in the Delta and Central Valley using simple correlation analysis. Study results indicate the mHQT does reflect species use (R2=0.72) while sources of variation suggest the mHQT could be improved by addressing meso-scale site characteristics.

Intertidal Eelgrass Mapping in Humboldt Bay: Ultra-high resolution UAV imagery and GIS spectral classification

Greg O'Connell

SHN Engineers and Geologists, Inc., 812 W Wabash Ave, Eureka 95501, 707.441.8855, **goconnell@shn-engr.com**

Eelgrass (*Zostera marina* L.) is a native, perennial seagrass in the Zosteraceae family. Its rhizomatous growth pattern allows eelgrass to form dense, habitat-rich meadows in low-intertidal and shallow-subtidal portions of soft-bottomed estuaries and marine embayments. Accurate mapping of eelgrass has historically been challenging due to its patchy distribution in very soft substrates and access limited by infrequent negative tides during its growth period. Recent advancements in remote sensing technology allow for very precise mapping of intertidal eelgrass distribution when using ultra-high resolution imagery and spectral classification tools. In Humboldt Bay, we've used Unmanned Aerial Vehicles (UAVs; aka "drones") to collect transects of ultra-high resolution aerial images (~3mm pixels). Individual photos were incorporated into large-scale mosaic images that are georeferenced and orthorectified. Supervised geographic information system (GIS)-based spectral classification of pixel color was used to create raster layers indicating presence/absence of eelgrass within each pixel. The classification output from mosaic images have resulted in reliable eelgrass classifications with accuracy assessments over 85%. Eelgrass classification is most accurate when eelgrass is above the tide line, lacks heavy epiphyte loads, occurs in dense clumps, and is not interspersed with algal macrophytes (e.g. *Ulva* spp.). In most instances, UAV-based imagery collection can map intertidal eelgrass faster, and more precisely than traditional ground-based global positioning system (GPS) surveys. Lastly, mosaic images serve as preserved "snapshots in time", allowing future comparisons within the same spatial area. The high accuracy of mosaic image eelgrass spectral classification is a perfect match with ongoing developments in UAV technology.

Two New Calflora Tools

Cynthia Powell* and John Malpas

cpowell@calflora.org; **jhmalpas@calflora.org**

Calflora is a plant database containing over 2 million plant observations for over 10,000 species in California. We have two new features available: our planting guide and the ability to create history stacks to monitor and report on population changes over time. Use the Calflora Planting Guide for suggestions on which California native plants will likely grow well at a particular location. These suggestions are based on climate and soil suitability for that location, its elevation, as well as what other plants grow in that area. The occurrence data is only as good as what Calflora users submit, so we encourage all botanists to submit their wild plant data using a smart phone, spreadsheet, shapefile, or asking us for help. Many Calflora users need to monitor population changes over time, which can now be done within Calflora. This functionality might be used at a restoration site or within an invasive plant polygon over the course of several years. The ability to track and report on change over time, and create a so-called "history stack" allows effectiveness of restoration or treatment to be quantified. Using our free phone apps (on android or iOS), the blue GPS tracking dot can help data contributors find and visit previous Calflora plant assessments from past days, months, or years, which can be loaded on the phone to show on the maps. Then the new assessment may be added to the "root record," thus creating a history stack.

3D Drafting for Design of Naturalistic Restoration Projects

Daniel Stratten*[1] and Nic Truscott, EIT[2]

ICF: [1]danny.stratten@icf.com, 360.255.2522; [2]1108 11th Street, Bellingham, WA 98225, **nic.truscott@icf.com**, 360.255.2307

Stream, floodplain, and wetland restoration projects require reliable prediction of the site's hydraulic response to the proposed project. Having a reliable prediction allows designers and reviewers to have confidence the constructed project will function as intended. Modern computers and software allow restoration designers to more accurately develop and analyze complex design elements, which in turn leads to more informed design revisions, and ultimately better functioning projects. This presentation illustrates the application of 3-dimensional drafting and design using AutoCAD Civil 3D to design fish-passable roughened rock channels and complex large wood material habitat structures. We will illustrate methodology to simulate complex boulder/cobble/gravel streambeds, combining 3D objects with modelled channel corridors and topographic survey to develop a representative digital terrain model (DTM). The resultant DTM defines the streambed geometry for a 2D hydraulic model with much greater detail than a DTM from just channel breakline definitions and topo survey. The roughened channel bed definition leads to more detailed results from the hydraulic model to better inform design decisions. We will also demonstrate how 3D drafting can be used for the design of complex large wood material (LWM) habitat structures. Some projects include LWM structures created from dozens of individual logs. 3D drafting provides a better visualization of the LWM structures, and ensures the proposed design can be assembled using the specified materials, while providing means for more precise analysis to ensure long-term success.

Tidal Habitat Restoration: *Practitioners' Perspectives*

Chair: Gerrit Platenkamp, ESA

Wednesday 10 May — 10:30–12:00, 1:15–3:15, & 3:30–5:00 — Ballroom C

Abstracts listed alphabetically by presenter (*)

Designing High Tide Refuge Islands for the California Ridgway's Rail

Gavin Archbald*[1], Max Busnardo[1], and Marilyn Latta[2]

[1]H. T. Harvey & Associates, 983 University Avenue Building D, Los Gatos 95032, **gavinarchbald@harveyecology.com**; [2]California State Coastal Conservancy, 1330 Broadway 13th Floor, Oakland 94612

Recovery of the endangered California Ridgway's rail (*Rallus obsoletus obsoletus*) is threatened by a lack of high tide refuge habitat in San Francisco Estuary marshes. To decrease predation on Ridgway's rail, the California Coastal Conservancy constructed 63 earthen, high tide refuge islands during winters from 2013-2016, strategically located in 13 tidal marshes lacking refuge habitat. We designed the islands to mimic natural gumplant (*Grindelia sticta*) dominated slough channel berms, then annually monitored the islands for four years to iteratively modify the design and to evaluate habitat establishment. Our key findings are: (1) gumplant canopy established most rapidly when islands were built near the upper end of gumplant's elevational range, and (2) island soil derived from marsh sediments remained horticulturally suitable, however, gumplant canopy was enhanced by use of terrestrial soil around plantings to reduce transplant shock. Moreover, in 2016, islands built to elevations of 1.0 foot (ft) and 1.3 ft above MHHW (Year 1 and 2 islands) were providing on average about 1 vertical ft of gumplant canopy above the highest predicted tides, the minimal cover needed to hide rails from predation during most extreme high tides. By contrast, islands built to 1.7 ft above MHHW (Year 3 and 4 islands) had gumplant canopy on average 3 ft above the highest predicted tides and provided high-quality refuge habitat. Gumplant survival averaged 73% across islands. The project demonstrates a feasible and cost-effective method to rapidly provide high tide refuge habitat in tidal marshes.

Measuring Fish Response as a Primary Performance Metric for Tidal Marsh Restoration Implementation

Christopher Fitzer, Garrett Leidy, and Paul Bergman*

Environmental Science Associates, 2600 Capitol Avenue, Suite 200, Sacramento 95816, **cfitzer@esassoc.com**

Substantial investments are being made in large-scale restoration of tidal wetland habitats in the Bay-Delta to restore ecological processes and aid in the recovery of native fish. Understanding species response to restoration is critical in determining whether or not goals and objectives are being met and also to provide lessons to inform the design of future projects. The Hamilton Wetland Restoration Project, located in Marin County, California, restores a former Army airfield (648 acres) to a mix of tidal and seasonal wetland, transitional ecotone and upland habitats. The project is being implemented by the USACE, in partnership with the Coastal Conservancy. The site was constructed and opened to tidal inundation in the spring of 2014. Fish species assemblages were surveyed in the springs of 2015, 2016, and 2017 utilizing a combination of techniques at multiple sample sites to assess the distribution and relative abundance of juvenile and adult fish species in the restored marshes, mudflats, and associated shallow water areas. The encouraging results document initial fish response to the very young restoration site and they show that properly designed restoration projects can achieve immediate results. Using these monitoring results along with results from other sites as case studies, we hypothesize whether all sites can be measured equally in terms of performance. Specifically, we evaluate and consider how fish response expectations (and performance criteria) should be developed and applied to new sites based on their location in the Bay-Delta ecosystem and the associated fish community inhabiting surrounding waterways.

40+ Years of Wetland Restoration in San Francisco Bay: Lessons learned and emerging trends

Michelle Orr, PE[1], Stephen Crook, PhD[2], Mark Lindley, PE[1], and Ann Borgonovo*[1]

[1]Environmental Science Associates, 550 Kearny Street, Suite 800, San Francisco 94108, 415.262.2310, **morr@esassoc.com**; Sylvestrum Climate Associates

In San Francisco Bay, more than 90% of historic tidal wetlands have been lost or disturbed by human intervention. Public concern for the Bay's health began to grow in the 1950s, and reached a tipping point in 1965, when a successful citizen movement resulted in passage of the McAteer-Petris Act—the first wetlands protection in the United States— preventing further filling of wetlands in San Francisco Bay and promoting restoration. Initial attempts at restoration in the Bay were primarily driven by compensatory mitigation requirements. The general approach involved setting the right elevations, planting native vegetation and then breaching levees to flood the restored area. These restorations were successful in creating a vegetated tidal marsh, however, they typically lacked physical and biological complexity. In the 1990s, projects began to incorporate design approaches that rely on the power of natural processes acting over time to create desired wetland features. As restoration practice has evolved, approaches have expanded. Current Bay restoration issues, as documented in the Goals Project Science Update 2015, include accelerated sea-level rise, a shortage of estuarine sediments, more extreme weather events, and invasive species. Projects now cover a broader range of tidal and associated habitats, ranging from oyster and eelgrass areas to upland ecotone slopes that add ecological diversity and climate resiliency. This talk will discuss lessons learned from 40+ years of project implementation and explore emerging trends that look towards restoration's future.

Restoration of Historical Tidal Wetlands for Compensatory Mitigation: Quantifying ecological lift

Kim Fettke

Wildlands, 3855 Atherton Rd, Rocklin 95765, 916.435.3555, **kfettke@wildlandsinc.com**

Wildlands has been working to restore the 59-acre proposed Newark Slough Wetland Mitigation and Species Conservation Bank (Bank) site as compensatory mitigation for impacts to aquatic resources, saltmarsh harvest mouse, and Ridgeway's rail. Historically, the Bank site was tidal marsh, but it was isolated from tidal flows and used for salt production in the 1950s. Most of it now consists of salt flats that often pond rainwater during the winter. This degraded but jurisdictional habitat would be restored to tidal marsh habitat of higher value. Many in the regulatory community would like to quantify and regulate aquatic resources based on their functions and services, rather than just area, in hopes of more successfully reversing dramatic losses of these aquatic resources. A quantitative functional analysis has not been developed or adopted in California for this regulatory purpose. However, the California Rapid Assessment Method (CRAM), a measure of wetland condition, is becoming more widely used, and some hope to adapt this method for regulatory purposes. In order to determine the value of the ecological lift generated by the restoration of this jurisdictional habitat, the U.S. Army Corps of Engineers San Francisco District requested that Wildlands propose a CRAM-based quantitative crediting approach. The proposed crediting approach quantifies the anticipated ecological lift using an assessment of ecological condition, and it could be adapted for universal regulatory use.

Tidal Restoration in the Suisun Marsh, Amidst Conflicting Regulatory Requirements and Permits

Robert Capriola[1] and Priya Finnemore*[2]

[1]Westervelt Ecological Services, 916.646.3644, **rcapriola@westervelt.com**; [2]Environmental Science Associates (ESA), 415.896.5900, **pfinnemore@esassoc.com**

A large number of regulatory agency approvals are needed for tidal restoration projects in the Suisun Marsh, and each agency has legal and policy requirements that often put those requirements in conflict with other agencies. Resolving these often unanticipated conflicts adds time to project approval and takes careful negotiation. Resulting long timelines for permit approval of tidal restoration projects increases cost and uncertainty when initiating projects for development. The Tule Red Tidal Restoration Project began planning and design in 2012, and involved a suite of resource agencies. Careful study of existing permits and approvals for other relevant projects provided a baseline of potential permit conditions, relevant interdependencies of other approvals, and approximate approval timelines. However, once environmental documents and permit applications were submitted in the spring of 2015, several conflicting agency requirements became apparent, making the process challenging, uncertain, time consuming, and ultimately costly. Based on our team's experiences through the negotiation of final permits and project groundbreaking in the fall of 2016, we conclude that — within the Suisun Marsh, elsewhere in the Delta, and beyond — tidal restoration projects would benefit from programmatic solutions to policy and resource conflicts like the ones experienced in development of the Tule Red project.

The Balancing Act: Tidal restoration benefiting landowners and fish

Doreen Hansen

Humboldt County Resource Conservation District, 5630 South Broadway, Eureka 95503, 707.498.1072, **dhhcrcd@gmail.com**

One of the West Coast's largest coastal stream and estuary restoration projects is currently being implemented in northern California. The Salt River Ecosystem Restoration Project is a private-public effort that consists of "reclaiming" 330 acres of tidal estuary from a former organic dairy ranch, and excavating and restoring 7 miles of river channel in the Eel River Delta. This project combines flood alleviation on agricultural lands with fish and wildlife benefits across much of the Delta. This presentation will provide a description of the overall project and progress made to date, but will focus on the tidal estuary restoration implemented in 2013. Learn about the tidal restoration construction elements that return hydrologic function and biological habitat fundamentals back to the system. Find out how the restoration is performing after three years through the successful, and not so successful, geomorphic, vegetative, and aquatic biological response thus far.

Laying Down a Framework for Standardized Monitoring — and Starting to Fill it In!

Rosemary Hartman*, Stacy Sherman, and Dave Contreras

Fish Restoration Monitoring Program, California Department of Fish and Wildlife, 2109 Arch Airport Road, Suite 100, Stockton 95206, **Rosemary.Hartman@wildlife.ca.gov**

The Interagency Ecological Program's Tidal Wetland Monitoring Project Work Team has developed the "Tidal Wetland Monitoring Framework for the Upper San Francisco Estuary." The Framework is a tool and resource to guide the development of hypothesis-based monitoring plans of the effectiveness of tidal wetland restoration for the benefit of listed fish species. The goal is to encourage scientifically sound monitoring that will result in data that are comparable across multiple restoration projects, while leaving room for learning and adaptation. Use of the Framework by multiple monitoring groups should facilitate a clearer understanding of landscape-level effects of tidal wetland restoration. Version 1.0 of the Framework will be posted online, and we welcome suggestions and feedback from users for future improvements to the

document. We have been rigorously evaluating the methods we recommend to others, while at the same time collecting pre-project baseline data around restoration sites. We found broad differences in diversity of fish food resources across habitat types and across regions in the Delta. These results provide support for the hypotheses outlined in the Framework, but these are the first drops in the bucket of data necessary to show the benefit of wetland restoration for native fishes.

Design and Implementation of Tule Red Tidal Restoration Project in Suisun Marsh

Brian Wardman, PE[1] and Chris Holland*[2]

[1]Northwest Hydraulics Consultants, 2600 Capital Avenue, Suite 140, Sacramento 95816, 916.371.7400, **bwardman@nhcweb.com**; [2]Chris Holland*, Restoration Designer, Westervelt Ecological Services, 600 North Market Blvd., Suite 3, Sacramento 95834, 916.646.3644, **cholland@westervelt.com**

Tidal exchange is the driving process that creates and sustains tidal wetlands. The tidal exchange process delivers sediment, maintains channels, imports and exports nutrients, and promotes the growth of marsh vegetation allowing food web and natural ecological processes to occur. Tidal restoration designs should be processed-based designs focused on reestablishing these key processes. Design elements will vary based on site-specific conditions such as existing elevations, sediment size and availability, proximity of neighboring infrastructure, as well as regulatory and constructability constraints. These constraints must be understood within the framework of the processed-based design and addressed during the plan development. Functional design components required to satisfy species-specific project objectives or regulatory requirements can then be incorporated around the process-based design components. This presentation provides a case study discussing the design and implementation process of the Tule Red Tidal Restoration Site in Grizzly Bay. The approximate 400-acre managed-marsh is composed of recently deposited sediments covered with dense stands of low marsh vegetation. The project includes a breach of the existing marsh ridge and the excavation of over 7.5 miles of new marsh channels reconnecting the marsh to Grizzly Bay and enhancing marsh connectivity and geomorphic progression. Functional design concepts address objectives in the Suisun Marsh Plan, provide transitional upland habitat to accommodate projected sea level rise, and increase residence time within the site to enhance zooplankton growth.

Bringing a Community Together While Restoring Habitats

Michelle Peruzzi*[1] and Matt Yurko[2]

[1]8 Conch Reef, Aliso Viejo 92656, **michelleperuzzi@yahoo.com**; [2]California Coastal Commission's Community-Based Restoration and Education Program, Back Bay Science Center, 600C Shellmaker Rd., Newport Beach 92660, **myurko@coastal.ca.gov**

The Community-Based Restoration and Education Program, located at the Upper Newport Bay in Newport Beach, has brought the local community together to turn a very disturbed area into a wonderful native habitat for the endangered *Polioptila californica* and other native species. The volunteers helping to restore this area include environmentally conscious student interns, who, as project leaders, are passionate about helping revive the habitat to its most natural state. Through on-site training in ecological restoration and environmental education, the students also learn the importance of restoring the environment and sharing these lessons with other volunteers. Volunteers have removed much of the invasive habitat that was previously growing there and replaced it with many native plants, which are now flourishing. This leader training program has been very successful with spreading the word about the importance of a healthy habitat. In this presentation, we will share the experiences of a student leader as well as the lessons learned in working with students as leaders to help restore their local environment.

Conservation, Restoration and 'Reconciliation': Site selection principles that don't let the perfect get in the way of the good

Gregory Sutter

Westervelt Ecological Services, 600 North Market Blvd., Suite 3, Sacramento 95834, 916.646.3644, **gsutter@westervelt.com**

Site selection for the purpose of conservation has traditionally focused on identifying and setting aside pristine pieces of land for the purpose of maintaining landscape-scale biodiversity. Site selection for the purpose of restoration emphases the same conservation principles, but concentrates more on returning historically perfect sites, that have been impacted by humans, to their historically natural state for the same purpose. Some ecologists argue that there isn't enough ideal or historically perfect land available to maintain biodiversity. They are encouraging restoration 'reconciliation'. This approach focuses on 'good' restoration sites, that historically may fall short of being 'perfect', but due to the conservation landscape should get a second glance. This presentation focuses on the multi-disciplinary approach to site selection for the purpose of tidal marsh habitat restoration in the Delta. This process utilizes many different types of tools, but the principles of site selection are the same — focus on a landscape scale and watershed conservation approach, consult the experts and do your research. The presentation looks at four Delta projects; Tule Red Tidal Restoration Project, Potrero, Grizzly King, and Cosumnes Floodplain Mitigation Bank. Each was selected using the same site selection principles, but offer a look at conservation, restoration and reconciliation.

Stream and Riparian Restoration

Chair: Kevin MacKay, ICF

Wednesday 10 May — 3:30–5:00 and Thursday 11 May — 11:00–12:30, 2:00–3:30, & 4:00–5:30 — Ballroom A

Abstracts listed alphabetically by presenter (*)

Non-Native Himalayan Blackberry as Essential Nesting Habitat for the Tricolored Blackbird: Will our xenophobia contribute to extinction?

Daniel A. Airola

Northwest Hydraulic Consultants, 2600 Capitol Ave, Suite 140, Sacramento 95816, 916.494.1283, **dairola@nhcweb.com**

The Tricolored Blackbird is in population decline and being considered for listing under the federal and state ESAs. Historic population losses resulted from wetland habitat decline, but recent causes are colony destruction in agricultural crops and habitat loss to development and orchard and vineyard conversion. Recent studies show much of the remaining breeding population nests in open grasslands in the Sierra foothills. The blackbird nests there primarily in the non-native Himalayan blackberry, which is a superior nesting substrate. The blackberry, however, is designated as an invader that disrupts natural habitats. Blackberry is confined to wet soils in the arid foothills, so most patches used by Tricolored Blackbirds grow in intensively used pastures, ditches, and ponds. These areas are dominated by non-native plants. Major opportunities exist to increase the Tricolored Blackbird population by establishing new nesting habitat. Federal and state habitat managers are reluctant to manage for non-native blackberry and have proposed use of native species. Evaluation of native alternatives, based on their prevalence, growth form, physical characteristics, and blackbird use shows they are inferior to Himalayan blackberry as a nesting substrate. Detrimental ecosystem impacts from focused management of Himalayan blackberry for the blackbird are limited and can be further minimized through management. The blackbird's native ecosystem, and potential to restore it, is mostly gone. We need to face reality and model restoration on the non-pristine conditions to which the blackbird has adapted. Managers and environmentalists needed to adopt greater flexibility and proceed with a key recovery action for this species.

Middle Martis Restoration, Part 2: Moving from design to implementation

Beth Christman*[1] and David Shaw[2]

[1]Truckee River Watershed Council, P.O. Box 8568, Truckee 96162, 530.550.8760 x1, **bchristman@truckeeriverwc.org**; [2]Balance Hydrologics, P.O. Box 1077, Truckee 96160, 530.550.9776, **dshaw@balancehydro.com**

Once you have identified a problem and devised a technical solution, then what? My presentation will focus on how to move a complex meadow restoration project from design to implementation to post-project monitoring. I will address stakeholder coordination, environmental compliance, construction, project monitoring, and preliminary restoration results. The Middle Martis Creek Wetlands project is a fantastic case study of challenges encountered during restoration implementation. The project included multiple landowners including a State Agency, a Federal Agency, private landowners, and two special districts. Environmental compliance was extremely complex due to abundant cultural resources on the project site, special status species, and the usual concerns about working within wetlands. The project was funded through multiple sources, so identifying, securing, and managing the funds was a challenge. And finally, construction itself was not easy due to site access concerns, including having a State Highway running through the middle of the project site. Despite all that, TRWC was able to bring everyone together, assemble an effective restoration team, and restore 40 acres of meadows and a mile of intermittent stream channels.

Monitoring Wetland Restoration and Validating the California Rapid Assessment Method for Depressional Wetlands

Cara Clark

Central Coast Wetlands Group at Moss Landing Marine Laboratories, 8272 Moss Landing Rd., Moss Landing 95039, 831.771.4428, **cclark@mlml.calstate.edu**

Depressional wetland restoration improves habitat and water quality. Depressional wetlands are the most abundant wetland class in California, and support many endangered species. However, they are subject to ongoing impacts and are seldom monitored consistently. We developed tools to assess the overall condition of depressional wetlands, consistent with the State's Wetland and Riparian Area Monitoring Plan, which calls for map-based landscape inventories, rapid field assessment, and intensive quantitative field measures. The California Rapid Assessment Method (CRAM) is a field-based, cost-effective, and scientifically defensible tool for monitoring wetlands. We validated depressional CRAM by examining correlations between CRAM data and intensive field measures, including macroinvertebrate and algae indices of biotic integrity (IBIs), and water quality. We leveraged data collected in Southern California and the Bay Area (15 sites each), and also collected new data with consistent methods at 15 sites in Northern California. CRAM data was significantly correlated with the macroinvertebrate IBI ($\rho = 0.42$, $p = 0.0036$) and the algae IBI ($\rho = 0.49$, $p = 0.0005$). Results indicate that CRAM is sensitive to some of the same factors that affect macroinvertebrate and algae communities, which validates its effectiveness. Depressional CRAM is a powerful tool for assessing the success of wetland restoration projects. It has been used at multiple projects to track change in condition through the restoration

trajectory. Initially, the overall condition may decrease after grading and the disturbance it causes. Over time, as the project matures and native plantings become established, the condition improves with maintenance and adaptive management.

Riparian Restoration in Urban Settings

Katherine Holmes

Solano Resource Conservation District, 1170 North Lincoln Street #110, Dixon 95620, 707.301.5779, **katherine.holmes@solanorcd.org**

Over the past ten years, Solano RCD has implemented numerous riparian restoration projects on farm edges and in wildland parks. Recently, however, we have increasingly worked in urban settings along creeks in Vacaville, Fairfield, and Vallejo. Although we have found that many of the restoration techniques and practices developed for rural settings are transferable to urban ones, important differences must be addressed to ensure project success. Restoration site design in urban areas must take into account diverse issues such as fire suppression (there is an inherent conflict between native grasses and aggressive mowing requirements), compacted soils (use of a variety of augers is key), and large homeless populations (dense pods of shrubs can be a problem). Restoration implementation techniques must also be modified. The high numbers of people present in urban areas require restoration practitioners to make adjustments to equipment type and operation as well as to herbicide spraying techniques. Vandalism problems can be ameliorated with subsurface drip systems and inexpensive plant protection materials. In addition to its challenges, urban restoration offers unparalleled opportunities to educate, involve, and motivate the public. Community-based planting events, demonstration gardens, informational signs, and the adoption of sites by school groups can all be easily incorporated into urban restoration projects. Community involvement not only provides direct value to a restoration project via free labor and guardianship, but it also expands the reach of the project by teaching participants to value wildlife habitat and incorporate conservation and restoration practices into their own yards and lives.

SFPUC Bioregional Habitat Restoration at Sheep Camp Creek, Sunol CA

Jeff Peters*[1], Leanne Feely*[2], and Scott Chenue[3]

[1]ICF, **jeff.peters@icf.com**; [2]Avila and Associates, **lfeely@avilaassociates.com**; [3]Scott Chenue, San Francisco Public Utilities Commission, **schenue@sfwater.org**

ICF and Avila and Associates support the San Francisco Public Utilities Commission on restoration of Sheep Camp Creek Mitigation Area, a Bioregional Habitat Restoration site in the Alameda watershed. In 2014, Avila developed and implemented a strategy to install and irrigate 21,000 plantings of 40 native species across the 430-acre site via direct seeding and rhizome-division propagation. Vegetation surveys and habitat assessments began in 2015, collecting a broad suite of data to monitor germination, survivorship and recruitment rates, as well as absolute coverage of native and non-native species. Despite severe drought conditions in 2014 and 2015, the site is now transforming from heavily degraded non-native grassland into a matrix comprising oak, sycamore and willow riparian and seasonal wetland habitats. High rainfall in 2016 and 2017 continue to bolster the preliminary success of these re-vegetation efforts. In 2014, ICF conducted a baseline erosion inventory of all erosion features within the Site. The baseline hydrogeomorphic surveys identified such features as eroding banks, headcuts, canyon wall slumps, and other "legacy erosional features" from years of sheep and cattle grazing. To protect and support extensive habitat restoration efforts, remedial actions have been taken to address bank erosion, headcuts, and other erosional features on site. Recent monitoring by ICF has shown significant increase in vegetation establishment and reduced bank erosion. This exciting project will continue until Year 10, and Avila & Associates and ICF will to continue identify areas of erosion severity for future restoration potential.

Middle Martis Alluvial Fan Restoration, Part 1: Design diversification in a dynamic setting

David Shaw*[1] and Beth Christman[2]

[1]Balance Hydrologics, P.O. Box 1077, Truckee 96160, 530.550.9776, **dshaw@balancehydro.com**; [2]Beth Christman, Truckee River Watershed Council, P.O. Box 8568, Truckee 96162. **bchristman@truckeeriverwc.org**, 530.550.8760 x1

Restoration of channel processes on alluvial fans is a challenge, especially where infrastructure limits the feasibility of widespread sediment deposition and channel dynamics. In many locations, alluvial fan restoration must be limited to "dynamic corridors," with appropriate confinement to protect infrastructure from erosion and channel shifting. In other areas, where space is available, it is possible to restore channel and fluvial dynamics to significant portions of the alluvial fan. The recently-constructed Middle Martis Alluvial Fan Restoration Project includes both dynamic corridors as well as elements to restore widespread channel evolution across the fan. A comprehensive landscape and site assessment was critical in identifying where to design flow controls and infrastructure protection and where to encourage less-predictable widespread channel migration. This multi-faceted approach also required a wide a wide range of project features, ranging from engineered bank protection and constructed channels to flow dispersal logs with no constructed channels.

Developing a Multi-Objective Restoration Strategy for the Coon Creek Watershed

Jai Singh*[1], Chris Bowles[1], and Matt Wacker[2]

[1]cbec eco engineering, 916.231.6025, **j.singh@cbecoeng.com**; [2]H. T. Harvey & Associates

Coon Creek drains a 101-square mile watershed that originates in the Sierra foothills near Auburn and extends to the floor of the Central Valley approximately 20 miles north of Sacramento. Since the late 1800s, numerous disturbances have

affected the watershed including agricultural encroachment, grazing, channel realignment, berm and levee construction, flow management, urbanization and water quality effects. As a result, physical processes have been inhibited, aquatic and riparian habitat has been degraded and the anadromous salmonid population has declined. Nonetheless, the catchment remains one of the least developed foothill watersheds in the area and is prioritized for conservation and restoration strategies as part of the Placer County Conservation Plan. We leveraged a fluvial audit methodology to establish an understanding of the system's geomorphic processes and controls. Combining this work with anadromous fish habitat assessments and targeted juvenile fish surveys, riparian habitat assessments, water quality monitoring, and hydrologic analysis facilitated an integrated understanding of physical and ecological functions. This interdisciplinary approach enabled us to identify controlling factors for declines in watershed health and to develop a multi-objective, process-based restoration strategy. We present a prioritized portfolio of rehabilitation projects and management efforts that can improve the health and resilience of the watershed's riverine ecosystems while also maintaining other land use objectives.

Incorporating Geomorphic Processes into Stream Restoration Design

Jason Q. White*, Aaron A. Fulton, Jorgen A. Blomberg, and Ann E. Borgonovo

Environmental Science Associates, 1425 N. McDowell, Suite 200, Petaluma 94954, 707.509.9487 mobile, **jwhite@esassoc.com**

Geomorphic processes are responsible for the formation and maintenance of natural stream habitat; however, few restoration designs explicitly include geomorphic process-driven approaches to restoring habitat complexity. Environmental Science Associates (ESA) has developed a geomorphic approach to stream restoration design that accelerates stream evolution to improve geomorphic and ecological function. ESA recently applied this geomorphic approach on two projects in Northern California. For the Sonoma County Water Agency's Dry Creek Habitat Enhancement Project, ESA designed a perennial secondary channel to provide summer rearing habitat for coho and steelhead in the Russian River basin. The secondary channel was designed to utilize geomorphic processes at various scales to create self-maintaining riffle-pool units under dynamic conditions. For Napa County's Napa River Restoration Project, ESA designed large benches and flow expansions within the incised corridor to create winter refugia and enhance riffles for chinook and steelhead in the Napa River basin. The benches were designed to widen the incised corridor, and initiate gravel deposition and maintenance of constructed riffles during high flows. Overall, ESA's design approach for the Dry Creek and Napa River Projects focuses on utilizing geomorphic processes to create natural self-maintaining complex stream habitat.

Salmonid Habitat Restoration and Conservation Along the Sacramento River: A case study

Mark Young

Restoration Designer and Manager, Westervelt Ecological Services, 600 North Market Blvd., Suite 3, Sacramento 95834, 916.646.3644, **myoung@westervelt.com**

Conservation banking for salmon and steelhead began in the last century and has continued to evolve as laws and policies are refined. This presentation reviews a salmonid conservation bank in the Central Valley, located directly on the Sacramento River, the Bullock Bend Mitigation Bank. The preserve addresses the need for off-river floodplain habitat mitigation for salmonids during period of moderate to high flows during out-migration. Restoration of the site focused on providing the necessary ecological processes along a critical reach of the Sacramento River that fulfill the habitat requirements for listed juvenile salmonids including: 1) inundation timing, adequate water depth, dissolved oxygen, and temperature; 2) freshwater corridors to access off-channel rearing habitat; and 3) woody and herbaceous riparian vegetation for both terrestrial and aquatic food web support, escape cover, and foraging habitat during out-migration for salmonids. The presentation will give an overview of site selection, design, permitting, implementation, and management of the bank; it will also review the ecological results to date of the project.

Restoring the Salinas River through Large-scale *Arundo* Control

Emily Zefferman*[1] and Paul Robins[2]

Resource Conservation District of Monterey County, 744 La Guardia St., Building A, Salinas 93908: [1]831.424.1036 x129, **emily.zefferman@rcdmonterey.org**; [2]831.424.1036 x124 **paul.robins@rcdmonterey.org**

The Salinas River has the second-worst *Arundo donax* (giant cane) infestation in the state of California. Dense, impenetrable stands of *Arundo*, covering almost 1,500 total acres, increase the risk of flooding in the watershed, consume huge amounts of water, and degrade habitat for fish and wildlife. In 2014, the Resource Conservation District of Monterey County began the Salinas River *Arundo* Control Program with a goal of eradicating *Arundo* in the watershed to restore more natural fluvial processes and vegetation communities. With funding from the Wildlife Conservation Board, the Monterey County Agricultural Commissioner, and private landowners, the RCD has treated over 250 acres of *Arundo* in three years through a combination of mowing, hand-cutting, and herbicide application. Here we present some of the challenges in developing and conducting this large-scale program along over 90 river miles of privately-owned land, our approach and methods, results of work to-date, and lessons learned that can be applied to this and other riparian restoration projects throughout the state.

Looking Back at Early Restoration Projects:
How have they fared the test of time?

Chair: Ross Taylor, Ross Taylor & Associates

Thursday 11 May — 11:00–12:30, 2:00–3:30, & 4:00–5:30 — Ballroom B

Abstracts listed alphabetically by presenter (*)

Establishing Wildlife Habitat Across the Sacramento Valley's Agricultural Landscape: Lessons learned from Yolo, Colusa, and Solano County projects

Miles DaPrato

Habitat Restoration Project Manager, Solano Resource Conservation District, 1170 N. Lincoln Street, Suite #110, Dixon, 95620, **miles.daprato@solanorcd.org**, 707.474.2248 cell

Integrating functional habitat into the working agricultural landscape has been a 13-year journey that has taken me through multiple counties within the Sacramento valley watershed. Working with over 100 conservation-minded farmers and ranchers over the years has continued to inspire me and shape the design of the habitat projects I have worked on. I will discuss some of those lessons learned about working on private lands, and the evolution of the techniques and designs that have led to the current habitat "recipes" that I follow in my current work in Solano County. Project types discussed will include oak woodland, native perennial grassland, riparian, and on farm habitat features such as tail water ponds, vegetated ditches, and native plant hedgerows.

Long-term Monitoring of Ecosystem Restoration on Santa Rosa Island, California

Brett D. Hartman*[1] and Cause Hanna[2]

[1]Environmental Science and Resource Management Program, CSU Channel Islands, Camarillo 93012, **brett.hartman@csuci.edu**; [2]Santa Rosa Island Research Station, CSU Channel Islands, Camarillo 93012

Santa Rosa Island, the second largest island (215.3 km^2) in the Channel Islands National Park, offers a unique opportunity for large-scale ecosystem restoration. The island has a history of intensive ranching dating back to 1843. Grazing pressure led to a shift from scrub, island chaparral, and woodland vegetation types to European annual grassland and bare ground, widespread gully erosion and landslides, and a progressive loss of pine and oak stands on ridges. The first phase of ecosystem restoration consisted of passive restoration following non-native grazer removal. Sheep had been removed by the early 1900s, feral pigs were removed by 1992, cattle were removed by 1998, and introduced mule deer and Roosevelt elk were removed by 2010. Based on a time series of classified Landsat TM5 satellite images, from 1989 to 2011 scrub cover increased 39%, island chaparral increased 46%, and woodland cover increased 160%. In contrast, valley and foothill grassland cover decreased by 38% and bare ground by 57%. Analysis of historical photographs dating back to 1929 and field sampling of stand demography indicates that rare, endemic and ecologically important species such as *Quercus tomentella* (island oak) and *Pinus torreyana* ssp. *insularis* (Torrey pine) are recovering. Historic aerial photographs are also being used to evaluate potential soil stabilization and vegetation recovery on highland ridges. Finally, long-term vegetation monitoring data reveal community level changes such as increased cover of native grasses and forbs in grassland transects. Restoration efforts are now transitioning to more active restoration on denuded ridges, including establishing check dams, wattles, and leaf litter traps to build soil resources, installing fog capture fences to increase water inputs, and active planting. These research results can help guide restoration efforts into the future.

Challenges of an Urban Restoration Site: Cannon Road West wetland mitigation

Sherri Howard

Associate Engineer, City of Carlsbad Public Works Department, 1635 Faraday Avenue, Carlsbad 92008, 760.602.2756, **Sherri.Howard@carlsbadca.gov**

The Cannon Road West project restored or created 8.4 acres of wetland habitat. This was accomplished over four creation sites and through restoration of the impact area below a set of bridges. The 1.75-acre restoration site below two 454-foot bridges, proved challenging and therefore the most interesting of the five sites. In development for nearly fifteen years, the Cannon Road West project constructed two miles of new roadway. Construction was initiated in 1997 and completed in 2000. Restoration of the temporary impact area was completed in 2001 by a landscape subcontractor to the roadway/bridge contractor. The landscape contractor had little experience with native habitats at that time. Significant oversight by the Landscape Architect and City Inspector was required. City staff, the maintenance contractor and monitoring biologist sought creative techniques for dealing with impacts from human, pest and non-native plant impacts throughout the 8.4-acre, we encountered the majority of the challenges in the 1.75-acre restoration site. Impacts were rapidly addressed, often during the bird-breeding season. Human-related challenges included controlling/eliminating bicycle and motorcycle use, homeless encampments, graffiti, general vandalism, and trash dumping including dropping safes off the bridge onto the site. Pest management had to contend with rodents, oyster-shell scale, molds, powdery mildew and non-native weed populations including pampas grass, tamarix, wild fennel, bristly ox-tongue and perennial pepperweed. Efforts to control human, pest, and non-native weed

populations have been successful. Today the site supports coastal native plant, bird and animal populations.

Looking Back: 35 Years of restoration in the Mattole Watershed

Cassie Pinnell

Mattole Restoration Council, **cassie@mattole.org**

The Mattole River watershed, located along California's northern Lost Coast, is the home of one of the earliest, grassroots watershed restoration efforts. Over the last 35 years, what started as a handful of visionaries and community volunteers has grown into a strategic, highly organized approach that involves multiple non-profits, technical advisory committees, scientists, and community members. This collaborative effort now secures $2-3 million annually, implements coordinated restoration projects throughout the watershed, and has built a restoration economy that employs nearly 100 residents in some capacity each year. Over this time, we have experienced many challenges including effective collaboration between local groups, prioritizing projects and target areas, and our ability to retain a qualified workforce. Also, we have faced difficulties organizing decades of data and results into a usable format that allows us to assess effectiveness of restoration efforts, and apply an adaptive management strategy to projects. Throughout this talk, I will look back at some of the most important challenges in our local restoration history, and share the lessons learned and strategies that we've used to address these challenges.

The Cosumnes River Preserve: 30 years of floodplain and riparian restoration

Ramona Swenson*[1], Sara Sweet[2], and Jaymee Marty[3]

Environmental Science Associates, 2600 Capital Ave, Suite 100, Sacramento 95816, **rswenson@esassoc.com**; [2]The Nature Conservancy, Cosumnes River Preserve, 13501 Franklin Blvd., Galt CA, 95632. **ssweet@tnc.org**; [3]Marty Ecological Consulting, Sacramento CA, **martyjt@yahoo.com**

The Cosumnes River Preserve (established 1987) protects over 50,000 acres of habitat and agricultural lands through a cooperative partnership of agencies and nonprofits. Since 1990, the Preserve partners have restored farmlands to riparian forest. Early efforts focused on hand-planting valley oak and willows, with varying success. Historical analysis inspired a shift to process-based restoration. The Cosumnes River has a fairly natural flow regime because it lacks major dams. In 1995, The Nature Conservancy breached a levee to restore flooding to 130 acres. In 1997, another 96 acres was flooded by storms. Large floods transported and scoured sediment, creating complex topography and stimulating plant recruitment. Smaller floods transported nutrients, stimulated pulses in aquatic productivity, and provided connectivity to the floodplain for fish such as juvenile salmon. Plant monitoring since 2000 has tracked recruitment and succession. Over 100 plant species (64 native, 42 non-native) have colonized the floodplain as of 2010. Natural recruitment of valley oak was slow. The plant community was more complex than on planted sites, due to topographic heterogeneity. The restored floodplain is a diverse mosaic of early successional forest, herbaceous vegetation, and seasonal marsh. While process-based restoration worked well here, successful application elsewhere depends on local site characteristics (elevation, soils), hydrology (magnitude and timing of flooding, groundwater), and climate (precipitation). We discuss vegetation patterns and trends at planted and natural-process restoration sites, challenges with invasive species, lessons learned for land managers, and next phases of restoration on the lower Cosumnes River.

Seascape Uplands HCP: Two decades later

Joe Rigney

Ecological Concerns Incorporated, 309 Seabright Ave, Santa Cruz 95062, **jrigney@ecologicalconcerns.com**, 831.325.5754

In 1997, the USFWS issued an incidental take permit for the federally endangered Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*). This was one of the first such permits issued in California. The associated Habitat Conservation Plan (HCP) included several elements designed to benefit the species, including road underpasses, native shrub planting to create movement corridors, and the building of additional breeding ponds on the project site. We look at the successes and failures of this HCP, both in terms of the stated goals of the plan, and as an overall project. Population data for the species is presented, and the current status of landscape features created for this project are discussed. Recommendations for the success of this and future projects are provided.

Urban Development Shapes One of Orange County's Most Endangered Species

Corey Stafford

Dana Point Nature Interpretive Center, 34558 Scenic Dr., Dana Point 92629, **DPNaturalResources@danapoint.org**, 949.939.1004

Orange County, California, has been a prized location for coastal development over the last 50 years. However, the presence of North America's smallest rodent resulted in a tiny gem hidden amongst urban development in Dana Point, CA, at the Headlands Conservation Area (HCA). At the HCA, active monitoring of the Pacific pocket mouse (*Perognathus longimembris pacificus*, PPM), and educational opportunities for

the community has created a place where both the public and our natural inhabitants coexist. The HCA is jointly managed by the City of Dana Point (City) and the Center for Natural Lands Management (CNLM). These entities work together to preserve and maintain the land for not only recreation, but the important flora and fauna that live among the 60 acres of environmentally sensitive habitat. The HCA was acquired to protect Orange County's endangered species: the PPM, the Coastal California gnatcatcher (*Polioptila californica californica*), and at least 15 rare plants that have been documented onsite. PPM were thought to be extinct for more than 20 years, until they were rediscovered and emergency-listed as endangered in 1994 on what is now the CNLM Preserve. Nearly 25 years after their rediscovery, CNLM and the City are studying PPM by using track tube monitoring, as well as live trapping on the CNLM Preserve to better understand their distribution and abundance. Furthermore, the City is promoting volunteer and community-based restoration programs to increase the public's knowledge on the importance of open space and how this species is shaped by urban development.

Morrison Gulch Culvert Replacement: Sixteen years of post-project monitoring

Ross N. Taylor, M.S

Ross Taylor and Associates, McKinleyville, **rossntaylor@sbcglobal.net**, 707.839.5022

Morrison Gulch is a small tributary of Jacoby Creek that flows into Humboldt Bay. Near the mouth of Morrison Gulch, the Quarry Road culvert was surveyed in 1998 during a fish passage inventory of county-maintained stream crossings. The five-foot diameter culvert was assessed as a complete barrier to all age classes of salmonids, due to the five-foot drop at the culvert outlet, which completely blocked access to 3,400 feet of spawning and rearing habitat. Numerous observations of failed leap attempts by migrating coho salmon were made at the culvert outlet during three consecutive winters between 1998 and 2001. The site was initially ranked #11 in the Humboldt County inventory, but was raised to the top-priority treatment site based on the assumption that immediate recolonization would occur due to the consistent presence of fish attempting to migrate upstream. Humboldt County Public Works replaced the culvert during the summer of 2001. The new crossing consisted of a 10-foot diameter culvert with 6" x 2" corrugations set at a zero-percent slope with a series of six boulder weirs — three downstream weirs to raise the water surface elevation to promote swim-through conditions, and three upstream weirs to provide grade-control to minimize channel incision. Post-project monitoring has included resurveying channel longitudinal profiles, assessing passage conditions through the new culvert with FishXing, and conducting annual spawner surveys. Elevations of the downstream weirs were also resurveyed to assess long-term stability. Annual surveys have confirmed coho salmon successfully spawning upstream of Quarry Road for 16 consecutive winters, with a long-term average of 60 adult coho salmon and 33 redds.

Long-term Success of Restored Vernal Pools Along the Fringe of San Francisco Bay

Jason D. Yakich*[1], Philip Greer[1], and Ivette Loredo[2]

[1]WRA, Inc. ,San Rafael, **yakich@wra-ca.com**, **greer@wra-ca.com**; [2]U.S. Fish and Wildlife Service. Fremont, **ivette_loredo@fws.gov**

Vernal pool habitat around the fringe of San Francisco Bay is a unique and imperiled habitat type. The Pacific Commons Preserve is a 444-acre vernal pool and grassland preserve created as mitigation for a nearby development in Fremont, California. The construction of vernal pools and other wetlands within the Preserve was initiated in 1998, and continued in phases through 2002 (173 features in total). The Preserve was incorporated into the Warm Springs Unit of Don Edwards National Wildlife Refuge in 2012 and has been subsequently managed by the USFWS. Created pools were inoculated with site-collected cysts of the federally listed vernal pool tadpole shrimp (*Lepidurus packardi*) following construction, and continue to support a robust population of shrimp that substantially exceeds the original mitigation requirements. The monitoring of randomly-selected pools in 2008 found shrimp present in 96% of pools designed for shrimp occupancy, as well as in 56% of other pools not constructed for this purpose. Vegetation monitoring of created pools from 2012 to 2016 indicates that absolute cover of both native and vernal pool obligate plant species increased by factors of approximately 2.4 and 3.1, respectively. Additionally, the average number of native species in the created pools increased from 8 to 17 species. Grazing is the primary site management technique, and weed control was also important during the performance monitoring period. Overall, the case study of the Pacific Commons Preserve demonstrates the success of large scale, onsite, and in-kind mitigation in an urban area.

Restore, monitor, mitigate… Repeat?
Adapting Habitat Restoration Projects for Climate Change

Chairs: Christina Schaefer, Schaefer Ecological Solutions, and Glen Kinoshita, ICF

Thursday 11 May — 11:00–12:30, 2:00–3:30, & 4:00–5:30 — Ballroom C

Abstracts listed alphabetically by presenter (*)

A Framework for Making Restoration Climate Smart

Thomas Gardali*, Brent R. Campos, Kristen E. Dybala, Alicia D. Herrera, John J. Parodi, Nathaniel E. Seavy, Isaiah Thalmayer, Leia Giambastiani, and Pete Warzybok

Point Blue Conservation Science, **tgardali@pointblue.org**

The science and practice of ecological restoration must address climate change. Despite increasing research on modifying restoration goals away from historic baselines and toward dynamic systems, restoration still lacks a clear framework for incorporating the impacts of climate change in restoration plans. To meet this need, we defined climate-smart ecological restoration and identified seven principles: (1) show your work, (2) look forward but do not ignore the past, (3) consider the broader ecological context, (4) build in ecological insurance, (5) build evolutionary resilience, (6) include the human community, and (7) monitor and experiment. We propose that with the current state of scientific knowledge and the guidance provided by our framework, ecological restoration can be modified by on-the-ground practitioners to prepare ecosystems for the consequences of climate change.

Using Structured Decision-making for Climate Adaptation Planning

Beth Huning

Coordinator, San Francisco Bay Joint Venture, 735 B Center Blvd, Fairfax 94930, 415.259.0334 office, 415.518.8568 cell, **bhuning@sfbayjv.org**

The San Francisco Bay Joint Venture is a partnership of NGOs, resource and regulatory agencies, landowners, and the business community working collaboratively to protect, restore, and enhance all types of wetlands in San Francisco Bay and along the California Coast. In 2011 the question arose as to whether the partnership should continue on the trajectory of tidal wetlands restoration for the endangered Ridgway's Rail, given climate change and sea level projection. Using the SDM process, different objectives, trade-offs, and conservation options were analyzed and provided a well-vetted, robust set of conservation recommendations. It resulted in the larger question of balancing tidal marshes and Ridgway's Rail strategies with those of other habitats and species, which led to a year-long process in 2014-15, the Climate Adaptation Decision Support (CADS) process. This presentation will use the CADS process to introduce effective decision-making and the Structured Decision Making (SDM) process to answer complicated conservation questions that will enable the decision-maker to be confident that the decision will lead to desired ecological outcomes. It will show how CADS addressed uncertainly, risk tolerance, and linked decisions about allocating resources to address climate change in multiple geographic regions and across multiple habitats and species, both short and long term. The presentation will focus on the challenges and successes of embarking on a complex decision analysis, the tools and models that were developed, and how they are now being utilized in resource management and climate change planning and habitat delivery in the region.

Examining the Influence of Aspect on *Eriogonum* Species in an Alpine Plant Community

Ryan Phaneuf

Saddleback College, **rphaneuf2@saddleback.edu**

At least five different species from the genus *Eriogonum* exist in the alpine Baldy Notch region of the San Gabriel Mountains northeast of Los Angeles. In addition, a large variation in topography exists throughout the area, with north- and south-facing slopes forming an integral part of the interaction between topography and the alpine plant community. Transects were surveyed on two sets of north- and south-facing slopes at Baldy Notch estimating densities of *Eriogonum* species, and densities compared between the two aspects. The density of plants within the genus *Eriogonum* varied considerably, with south-facing slopes displaying a greater density of *Eriogonum* than the opposite north-facing slopes. North-facing slopes surveyed contained very few plants from genus *Eriogonum*, while their south-facing neighbors contained over three hundred specimens respectively. The surprising diversity within genus *Eriogonum* was well-represented even in a small area, given to the harsh temperatures and rocky conditions of the alpine fellfields at Baldy Notch. While genus *Eriogonum* can adapt to diverse environmental conditions, the findings of this study suggest that species within this genus are still limited by factors as commonplace as the topography of their habitat. The limitation of suitable habitat for plants within this important genus may hold key insights for the planning and execution of habitat restoration projects in alpine environments, especially with the shifting temperatures likely to accompany climate change.

Adaptive Management of Pond Hydroperiod in the Face of Drought

Russell Prange

WRA, Inc., 2169-G E. Francisco Blvd., San Rafael 94901, **prange@wra-ca.com**, 415.524.7270

As drought conditions become more frequent in the face of climate change, breeding ponds for aquatic species are drying out sooner. Restoration specialists need tools to better understand pond hydrology in order to ensure these habitats support the necessary hydroperiods for the species of concern that utilize them. This study presents a model for analyzing pond hydrology by examining an existing California red-legged frog (CRLF) breeding pond and developing a daily water budget model. A CRLF pond at a private ranch near Vallejo was identified that did not have an appropriate hydroperiod through the drought to support CRLF breeding. A water level logger was installed to measure daily changes in water level over the course of a year. Using a laser level and GPS, pond bathymetric and surrounding topography were then measured. Next, a water budget model was created that measured daily pond depth based on the NRCS TR-55 method of measuring runoff. Using the level logger results, the model was calibrated to reflect real world conditions. The model was then further refined with 3D modeling created from topography data. Once complete, the model allowed designers to easily change pond depth, surface area, soil infiltration rate and watershed size to quickly understand the resulting effect on ponding duration and depth for any given year. With this tool, a deeper pond was designed and then modeled for the previous 20 years. Results showed that a deeper pond would more reliably provide the ponding duration needing for CRLF breeding habitat.

Climate Change: Policy challenges for restoration (nature based infrastructure solutions)

Stuart W. Siegel, PhD, PWS

Coastal Resilience Specialist, San Francisco Bay National Estuarine Research Reserve, 3152 Tiburon Blvd, Tiburon 94920, **siegel@sfsu.edu**

Gaps and obstacles of our current policy framework in the face of climate change pressures impedes planning, implementation, and achieving outcomes of ecosystem restoration (aka "Nature Based Infrastructure Solutions"). Our guiding laws — Endangered Species Acts, Clean Water Act, McAteer-Petris Act, CEQA, NEPA, and many more — responded to pressures of their day. Climate change exerts pressures that bridge across these vital yet often insular policy mandates. Our challenge, then, is to protect their underlying intents while evolving them to be responsive to climate change's multi-faceted ramifications: •Allowing boldness in action plus time for results, where outcomes certainty is not high. •Allowing some impacts now from actions intended to give us "resiliency". •Preserving landscapes that later will be essential to continued ecological functions and ecosystem services. •Choosing between investments in "holding the line" vs. "managed retreat" in shorelines, levees, flood management, and more. •Treating sediment as the critical commodity that it is. •Accommodating seemingly "novel" approaches. •Supporting durable analytics essential for informed decision-making in the face of political and economic pressures. •Permitting projects expeditiously and minimizing tangential requirements, to shave off years and costs of taking action. •Acting now when it's less costly for the same results. •Rolling with new climate change projections. •Supporting landscape-scale adaptive management. And all the while, human society will be exerting a wide range of other pressures, natural disasters may well reorder our natural and human systems, species invasions will continue, and our knowledge and skills will continue to grow. Inaction will not preserve the status quo.

Challenges in Riparian Restoration and Adaptive Management Strategies

Saudamini Sindhar*[1] and Logan Elms[2]

[1]Senior Botanist/Restoration Ecologist, Stantec, 290 Conejo Ridge Avenue, Thousand Oaks 91361-4971, 805.358.9023 cell, **saudamini.sindhar@stantec.com**; [2]661.754.0385, **Logan.elms@stantec.com**

Restoration in most riparian ecosystems in Southern California is typically conducted in response to fulfillment of conditions specified in permits issued by regulatory agencies. Many individual small-scale restoration projects are being conducted in the Santa Clara River ecosystem, which is one of the last few wild and scenic river systems left in California. The focus of this discussion is to use examples of innovative restoration practices going on in the Santa Clara River; discuss benefits of the use of an ecosystem-level approach in restoration planning, given the changing hydrology of the river, from one year to another; and innovative ways to successfully combat ongoing vandalism on plants by 'homeless living in the river'. We will conclude with applications of restoration strategies that have been successful in the Santa Clara river to other large river systems in Southern California.

Tidal Marsh Plain Restoration: Technological advances for planning and monitoring

Geoff Smick

WRA, Inc., 2169-G E. Francisco Blvd., San Rafael, 94901, **smick@wra-ca.com**, 415.306.4003

East Bay Regional Park District's Breuner Marsh in Richmond is one of the Bay Area's first tidal marsh restoration projects constructed to accommodate sea level rise. The main marsh plain is a high marsh designed to support a pickleweed-dominated community. The surrounding upland areas were constructed at an elevation where the tidal marsh can migrate inland and upwards in elevation with rising sea levels. The elevations of the restored marsh plain and surrounding transitional habitats that will convert to

tidal marsh were developed using a combination of field studies and 3-dimensional GIS modeling. 3-D modeling provides a simple but powerful tool for planning and communicating project designs. The restored tidal marsh was designed to re-vegetate passively. By grading the marsh plain to the appropriate tidal elevations and returning tidal flows to these areas, the tidal marsh will receive plant propagules via the tides. While this is not an uncommon practice, the results of the first two years of post-construction monitoring indicate that some areas self-regenerate much more quickly than others. The restored tidal marsh is being monitored using drone aerial photos in combination with remote sensing software and GIS. Given the relatively large (20+ acres) area and difficult access, traditional mapping techniques are time consuming. In addition, we've found that these new techniques are actually more accurate and comparable from year to year than hand mapping the vegetation. The design process and preliminary results for this project may be applicable to other tidal marsh projects to increase efficiency and success.

The Sierra Nevada Forest Resilience Initiative

Wayne Spencer

Conservation Biology Institute, 815 Madison Ave., San Diego 92116, **wdspencer@consbio.org**

Conifer forests in the Sierra Nevada have been greatly altered by human influences, including logging, tree planting, fire suppression, and climate change. There is general scientific consensus that these altered conditions are not sustainable, as evinced by recent increases in the size of severe fires and unprecedented tree mortality due to drought and associated bark beetle outbreaks. However, it is unclear whether "restoring" historic conditions is possible, or even desirable, given our changing climate; and some imperiled species, like the Pacific fisher and spotted owl, strongly select for the densest available forest conditions—or those considered "least resilient." Numerous scientists have been studying various aspects of these issues, but there has been little effort to integrate the results into a more comprehensive understanding of how topography, climate, vegetation composition and structure, and other factors interact to affect habitat resilience as well as habitat quality for forest wildlife. The Sierra Nevada Forest Resilience Initiative is bringing together diverse researchers, managers, and ecological modelers to develop scientifically sound metrics of resilience that can be mapped, projected into the future under alternative scenarios, and used to track progress towards resilience objectives. The ultimate goal is a comprehensive, integrated, and scientifically sound decision-support system to help forest managers prioritize actions to sustain forests that are both resilient to fires, drought, pests, and climate change, while also offering high quality habitat conditions for dense-forest wildlife.

Assessing Community Response to 'Front-yard' Coastal Dune Species Conservation & Restoration

B.B. Villanueva

Natural Resources Coordinator, City of Newport Beach, Office of Natural Resources. 100 Civic Center Dr. E Bay, Newport Beach 92660, 949.644.3037, **bvillanueva@newportbeachca.gov**

The City of Newport Beach has undertaken a conservation and restoration project in Newport Beach, CA, along the Balboa Peninsula within US Fish & Wildlife Service designated critical habitat of coastal dune areas. These areas lie within 20-30 meters of beachfront residential properties, are within line sight of ocean view, and are surrounded by open access symbolic fencing to prevent disturbances. The local community has varied responses to the conservation and restoration efforts. Communication strategies for the public focus on increasing knowledge base of conservation and restoration, explanation of city, state, and federal regulations, interpretation of charismatic species, and outlining benefits of natural coastal dune habitat as buffers against climate change and sea level rise. Community responses, both adverse and supportive, are taken into consideration and affect adaptive management decisions towards restoration. Volunteers for restoration and monitoring are drawn from supportive community members. Training on communication practices for field working staff and volunteers is required as confrontation by inquisitive or combative members of the public have become apparent. Increased involvement within public outreach and local community groups prove to be drivers in adapting the project to serve both the environment and its human audience.

Poster Session & Student Poster Competition

Chair: Gavin Archbald, H. T. Harvey & Associates

Reception: Wednesday 10 May — 5–7pm

Abstracts listed alphabetically by presenter (*)

CDFW's Invasive Species Program Contributes to Ecological Restoration

Elizabeth Brusati

Invasive Species Program, California Dept. of Fish and Wildlife, Sacramento, **Elizabeth.brusati@wildlife.ca.gov**

The mission of the California Department of Fish and Wildlife's Invasive Species Program is to reduce the negative effects of non-native invasive species on the wildlands and waterways of California. We are involved in efforts to prevent the introduction of these species into the state, detect and respond to introductions when they occur, and prevent the spread of invasive species that have become established. Our primary focus is aquatic species. We also work to address the ways by which species are introduced, typically inadvertently, by human activities. This poster will highlight current projects in the Invasive Species Program that contribute to ecological restoration. First, CDFW conducts weed risk assessments for State Parks' Division of Boating and Waterways (DBW). These assessments are required for DBW to add invasive plants to its control program and improve Delta habitat for both native species and navigation. Second, CDFW has implemented an eradication project for watersnakes (*Nerodia* spp.) near Sacramento. These invasive snakes are probably abandoned pets that prey on native fish, amphibians, and snakes. Third, CDFW is coordinating the update to the California Aquatic Invasive Species Management Plan, which will include actions on prevention, control, and outreach. Finally, California Invasive Species Action Week is June 3-11! See our website for a list of events and add yours.

The Interagency Development of an EcoRestore Adaptive Management Program

Maggie Christman*[1], Karen Kayfetz[2], Martina Koller[3], Tricia Lee[4], and Lauren Hastings[5]

Delta Stewardship Council, 980 Ninth Street Suite 1500, Sacramento 95814: [1]**maggie.christman@deltacouncil.ca.gov**, 916.445.0464; [2]**karen.kayfetz@deltacouncil.ca.gov**, 916.445.5694; [3]**martina.koller@deltacouncil.ca.gov**, 916.445.5838; [4]**tricia.lee@deltacouncil.ca.gov,** 916.445.5336; [5]**lauren.hastings@deltacouncil.ca.gov**, 916.445.5026

The California EcoRestore initiative calls for the restoration and enhancement of 30,000 acres of habitat, primarily floodplain and tidal marsh, in the Delta and Suisun Marsh by 2020. As part of this initiative, the Interagency Adaptive Management Integration Team (IAMIT), comprising agency and stakeholder scientists and technical management staff, was charged with developing a white paper describing existing adaptive management resources, how those resources link together, and what resources are currently lacking. The white paper was developed in 2016-2017 and concludes with a series of recommendations for developing a complete, integrated, and financially supported adaptive management program for EcoRestore. We present here the recommendations of the white paper, which integrate existing efforts to enhance coordination, synthesis and evaluation, information sharing, and communication. The desired outcome of implementing these recommendations is a program that 1) supports individual restoration projects, 2) considers local and system-scale effects, 3) sets a stage to evaluate impacts of restoration actions at multiple time and spatial scales, and 4) has an organization structure wherein acquired knowledge is effectively communicated and used for development of subsequent goals, objectives and management actions. While the scope of the program is initially limited to integration of current EcoRestore projects, implementation of the recommendations will provide a strong foundation for a robust, long-term habitat restoration adaptive management program based on scientifically rigorous modeling, monitoring, research and assessment methods.

Enhancing the Wildlife Value of Farms in the Central Valley: A team effort

Matthew Danielczyk*[1], Reyn Akiona[2], and Cindy Lashbrook[3]

[1]Audubon California, 400 Capitol Mall, Suite 1535, Sacramento, **mdanielczyk@audubon.org**; [2]USFWS, 7376 S. Wolfsen Rd., Los Banos 93635; [3]Riverdance Farms, Livingston

We bring together farmers, government agencies, other NGOs, students, and other volunteers to establish woody vegetation on farms, simulating riparian forest to benefit migrating riparian songbirds and other wildlife. Most farms have a small percentage of unused or marginal land that could be put to use as wildlife habitat, which could partially ameliorate the effects of the decline of riparian habitat in California's Central Valley, including the impact on listed species. These restoration projects also provide opportunities to engage the community in conservation. We typically work with five to ten different organizations, each lending a particular expertise to the overall effort. This cross-fertilization has led not only to successful restoration projects, but also to strategic collaboration beyond the scope of the projects.

Bonus Points: Unrecognized supplemental benefits of mitigation and conservation banks

Kim Fettke

Wildlands, 3855 Atherton Rd., Rocklin, **kfettke@wildlandsinc.com**, 916.435.3555

The purchase, restoration, and protection of natural lands for mitigation banks (e.g., wetland banks) and conservation banks (i.e., species banks,) generates credits to sell as mitigation for impacts to specific species

or wetland resources that benefit from the bank (e.g., kit fox credits, seasonal wetland credits). However, banks benefit many additional species and habitats, even though these benefits may not be recognized via the generation of mitigation credits. Ecosystem bonus! Four Wildlands banks provide examples of these unrecognized benefits. **Fremont Landing Conservation Bank** — 100-acre bank in Yolo County at the confluence of the Sacramento and Feather Rivers, entitled for the sale of riparian floodplain and shaded riverine aquatic (SRA) habitat credits as salmonid mitigation. This species bank also provides habitat benefits for the state-listed Swainson's Hawk documented onsite. **San Luis Rey Mitigation Bank** — 56.5-acre bank in San Diego County, entitled for the sale of riparian wetlands and waters credits. This wetland bank also provides valuable benefits to the state- and federally-listed Least Bell's vireo documented onsite. **Ridge Cut Giant Garter Snake Conservation Bank** — 186-acre bank in Yolo County, entitled for the sale of Giant Garter Snake credits. This species bank also provides over 100 acres of freshwater marsh benefits. **Pajaro River Mitigation Bank** — 273-acre bank in San Benito County along the Pajaro River in Santa Clara Valley, entitled for the sale of freshwater marsh credits. This wetland bank also provides valuable year-round (wintering and breeding) habitat benefits for the western burrowing owl, a CA species of special concern.

Soil Salvage as a Technique for Coastal Sage Scrub Restoration

Robert Freese*[1], Matthew Major[1], Sarah Kimball[2], Riley Pratt[1], Megan Lulow[3], Constantin Raether[1], Paige Lowry Austin[2], and Jutta Burger[1,2]

[1]Irvine Ranch Conservancy, 4727 Portola Parkway, Irvine 92620, **rfreese@irconservancy.org**; [2]Center for Environmental Biology, Francisco J. Ayala School of Biological Science, University of California – Irvine, Irvine 92697-1450; [2]UCI Reserve System, University of California – Irvine, Irvine 92697-1450

Good quality native habitats have surface soil that contains a native seedbank, various propagules, and a complex microbial community. These resources are important components needed for successful ecological restoration. Surface soil can be harvested from sites slated for development and transported to nearby sites of degraded habitat as a means to restore them. However, the salvage process also poses several challenges that need to be considered. We explore management issues at three restoration sites in Irvine, California, which received surface soil from a common donor site in December 2015. Placement of transported soil can alter soil physical properties as evidenced by soil compaction, crusting, erosion, and mixing with underlying soil materials. It also creates a highly disturbed environment open to weed invasion. However, data from six and sixteen months after soil transfer show that vegetation at these sites can progress rapidly toward success under optimum environmental conditions. Despite a common donor source, the three recipient sites appear to be developing vegetation communities with distinctly different components of shrubs and forbs.

A Study of Long-term Restoration Success from Southern California

Julia Groebner

Restoration Ecologist, AECOM, 401 West A Street, Suite 1200, San Diego 92101, 619.610.7590, **julia.groebner@aecom.com**

Despite many advances in the field of restoration ecology, little is known about the long-term effectiveness of restoration efforts. It is often assumed that restored habitats follow a reliable trajectory towards the desired ecological state, but very few studies have addressed this topic. This study examines the long-term effectiveness of upland and wetland habitat restoration efforts in San Diego County, California. I evaluated the current ecological conditions (vegetation community composition, diversity, and structure, and quality of surrounding habitat) of 25 restoration sites that had not been actively managed for at least 5 years. I compared the sites' current conditions to their conditions at the conclusion of active restoration and analyzed whether current vegetation conditions are related to historic site conditions or surrounding habitat quality. I found significant differences between upland and wetland restoration sites. Upland restoration sites were more variable in condition and less successful long-term, particularly if they were of lower habitat quality at the end of active restoration. Wetland restoration sites were less variable in condition and more successful long-term, as long as the proper wetland hydrology was established. However, both upland and wetland restoration sites may be declining in habitat quality with time elapsed since the end of active restoration. The study provides several ways in which planning and implementation of upland and wetland restoration projects could be improved to better promote long-term restoration success. It also serves as a valuable baseline for future studies of restoration success in San Diego County.

Success with the National Seed Strategy: Restoration projects using local source seed

Ed Kleiner

Comstock Seed LLC, 917 Hwy 88, Gardnerville, NV 89460, 775.720.3681, **ed@comstockseed.com**

The National Native Seed Strategy is challenging the seed industry by encouraging the use of local seed sources. The strategy is influencing specifications in the private sector which is now requiring local seed for large rural projects such as utility corridors, highways, and mines, as well as projects at the urban interface. Common themes in the design and implementation of successfully completed projects, as well as failure points in others, provide insight for a functional path for future projects. Indeed, all projects provide unique circumstances; experience gained adds to the functional path.

Flow, Form, and Function: Integrating hydrologic and geomorphic considerations reveals opportunities and tradeoffs for river restoration

Belize Lane*, Gregory Pasternack, and Samuel Sandoval-Solis

Department of Land, Air and Water Resources, University of California Davis, One Shields Ave., Davis 95616, **baalane@ucdavis.edu**

The extent and timing of river ecosystem functions is largely controlled by the interplay of hydrologic dynamics (i.e., flow) and the shape and structure of the river corridor (i.e., form). However, most river restoration studies address either flow or form without regard for their dynamic interactions. This study represents a first attempt to apply synthetic hydrologic and geomorphic archetypes to the evaluation of river flow-form-function linkages to inform effective watershed- and regional-scale river restoration efforts with limited resource requirements. In an application to California's Mediterranean-montane streams, we evaluated the interacting roles of channel morphology, water-year type, and hydrologic impairment in river ecosystem response. The pool-riffle archetype supported flow convergence routing and promoted high hydraulic diversity and riparian recruitment, while the plane-bed archetype facilitated sediment transport and provided habitats of reduced stress for salmonid redds during dry years. Only wet years supported riparian recruitment, high performance of salmonid bed preparation, and a shear stress reversal, while dry years significantly increased spatiotemporal hydraulic diversity in the river corridor and availability of spawning habitat. Hydropower-driven hydrologic impairment caused redd dewatering risk and altered salmonid bed occupation and preparation functions. This study highlights critical tradeoffs in ecosystem function performance and emphasizes the significance of spatiotemporal diversity of flow and form at multiple scales for maintaining river ecosystem integrity.

Testing Methods to Restore Diverse Perennial Grasslands in Southern California

Matthew Major*[1], Robert Freese[1], Sarah Kimball[2], Nicole Tamura[1], Paige Lowry Austin[2], and Jutta Burger[1,2]

[1]Irvine Ranch Conservancy, 4727 Portola Parkway, Irvine 92620, **mmajor@irconservancy.org**; [2]Center for Environmental Biology, Francisco J. Ayala School of Biological Science, University of California – Irvine, Irvine 92697-1450

Valley needlegrass grasslands are highly invasible and their restoration and persistence is challenged by propagule pressure and competition from non-native species. Diverse grasslands are also difficult to restore because their two major components — native grasses and broad-leaf forbs — compete with one another during initial establishment. Here, we investigate different methods to successfully restore forb diversity into native grassland across two parallel planting trials within the Irvine Ranch Natural Landmarks in Orange County, CA. In the first trial, a palette of 15 forbs was seeded either (A) early or (B) later after seeding purple needlegrass (*Stipa pulchra*) within the same season. In the second trial, forbs were seeded in an established monoculture of purple needlegrass, either (1) directly, (2) after mowing and de-thatching, or (3) after mowing, de-thatching, and treatment with low-dose glyphosate. When forbs were seeded soon after grasses but prior to the application of selective herbicide, a different suite of forb species emerged than when they were seeded later. When forbs were seeded into established grassland, mowing and dethatching improved forb establishment and low-dose glyphosate treatment further promoted establishment relative to controls. Based on results, we conclude that forbs and needlegrass can be seeded in close succession under low ambient weed seed load or when selective herbicides are used aggressively early after seeding. Staggered seeding over multiple seasons works only with aggressive management to temporarily stunt needlegrass, increase seed-soil contact, and reduce weed cover. Many site-specific factors play a role in establishment, such as erosion, existing grass density, and the non-native seed bank.

Revisiting Common Planning Approaches to *Arundo* Removal to Increase Resiliency within Riparian Ecosystems

Anisha Malik

5 Hutton Centre Drive, Suite 500, Santa Ana 92707, 949.855.3674, **anisha.malik@mbakerintl.com**

Southern California watersheds have been impaired by the introduction of *Arundo donax*, a moderately invasive species that successfully outcompetes the native habitats for resources. Riparian restoration projects have been underway the past few decades, with each project learning more about the resilience of the species and improved methods of removal. On one such project within Arroyo Trabuco Creek, the *Arundo* grew over 15-20 feet before bending over due to its weight. Once this happened, new sprouts entangled themselves in the existing shoots, causing a thick wall to be formed. This decreased provided ecosystem services due to alteration of the channel morphology, displacement of riparian habitat, reduction in food supply, and corridor capabilities for local wildlife, and an increase in bank erosion caused by diversions of water flow. The complete removal of *Arundo* rhizomes at this project site has allowed for the channel to correct itself following significant precipitation events in January of this year. Although the site is improving with the installation of native plantings, changes continue to occur within the system as new variables are introduced. The new variables emphasized the importance of baseline studies and adaptive management to better understand the external drivers for the site. Species complexity was focused on as a means of deterring future invasion. With the introduction of polyphagous shot hole borer to the area as well as other stressors, what are the most effective methods for planning restoration of these riparian ecosystems to increase resiliency against emerging threats?

Using Restoration to Change Our Culture for a Sustainable Future

Matthew Marowitz

Saddleback College, 24821 Pointe Stanhope #E, Dana Point 92629, **mattmarowitz@gmail.com**

People from industrial nations tend to appraise the natural world by the dollar value it can be assigned in terms of natural resources. Such a view about exploiting nature is not sustainable. If we continue our culture of overconsumption, the planet will not be able to keep up. We need innovations in how restoration interacts with the public so we can shape our culture to be sustainable. Having more opportunities in community-based restoration is an effective way to persuade more people. By spreading community-based restoration across a region, we can build strong environmental values that will root themselves into our society. The environment is something more people are becoming concerned about. Community-based restoration programs allow people to express their concerns, promoting stewardship over the environment by educating volunteers and making them part of the solution. This creates a sense of ownership within volunteers, urging them to think about environmental issues in a new way and hopefully causing them to change their habits to be less impactful. We must use restoration as an opportunity to teach people about ecosystem services and the impacts humans have on nature. Consistent pressure, through repeated conversations by many people is needed to shape the mindset of society. Eventually our culture will no longer reflect overconsumption as the norm. We will seek to conserve our natural resources rather than exploit. First, however, we must use restoration as a platform to help change the environmental values within our culture so we can sustainably move into the future.

Fairview Park Case Study: Citizen scientists' role in seed collection

Victoria Masjuan

Saddleback College Ecological Restoration Program, 28000 Marguerite Pkwy, Mission Viejo 92692, **victoriamasjuan@gmail.com**

In a unique pilot program offered by the City of Costa Mesa's Department of Parks and Recreation, led by staff and trained interns with the Institute for Conservation Research and Education, ecologically-minded residents come together to take part in the "Fairview Environmental Workshop". Over the course of four consecutive Saturdays, locals learn the history of restoration at Fairview Park, take part in weeding activities, and also learn about and participate in native seed collection. Volunteer citizen scientists enrolled in the summer 2016 workshop collected dozens of paper bags filled with fascicled tarplant (*Deinandra fasciculata*) and bush sunflower (*Encelia californica*) seeds, which were then propagated at the Banning Ranch Land Trust nursery and are ready to be used in future restoration activities at Fairview Park and the surrounding areas. If we as restoration practitioners uphold the traditional logic dictating that the more locally sourced the seeds, the better, then the example set by the Fairview Environmental Workshop shows us one pathway to truly local, cost-effective native seed sourcing, with the added bonuses of community involvement and drumming up local support for restoration projects in the area.

Successful Restoration of Riparian Habitat from a Himalayan Blackberry Thicket

Erin McDermott*[1] and Sue Wickham[2]

[1]Nomad Ecology LLC, 822 Main St., Martinez 94553, **emcdermott@nomadecology.com**; [2]Solano Land Trust, 700 Main Street, Suite 210, Suisun City 94585, **sue@solanolandtrust.org**

Solano Land Trust in partnership with Nomad Ecology implemented the Old Homestead Wetland and Riparian Enhancement Project located at Lynch Canyon Open Space in Solano County in 2012. The 9-acre restoration site includes 1,600 linear feet of creek, 1.4 acres of wetlands and waters, a spring, riparian vegetation, and cultural resources. Prior to project implementation, the site contained over an acre of dense Himalayan blackberry in wetland and riparian habitat. The challenging goals of the project included removing Himalayan blackberry in sensitive riparian habitat, long-term control of this aggressively rhizomatous species, and replacing it with locally sourced native vegetation that would provide habitat for wildlife. The project provided many opportunities such as engaging volunteers in the restoration effort, amplifying local seed material, using an onsite spring to naturally provide water to the wetland plantings, and employing cattle as a vegetation management tool. This enhancement project implemented a multistage approach of mechanical and chemical Himalayan blackberry control, seed collection and amplification, tree and shrub planting, and grazing management. Five years after the enhancement project was initiated, the site is meeting objectives: cover of Himalayan blackberry is extremely low, the creek channel is dominated by native vegetation, the wetlands where blackberry was removed are dominated by herbaceous wetland vegetation, native tree and shrub cover has increased onsite, and the site provides habitat for wildlife.

Comparison of Stream Simulation to Hydraulic Design Approaches for Constructing Fish Passage Channel Segments in Central California Coastal Streams: Challenges, opportunities, and lots of large rocks

Jeff Peters*[1], Jeff Kozlowski[2], Brendan Belby[3], Danny Stratten[4], and Martin Fisher[5]

ICF, 630 K Street, Suite 400, Sacramento 95814, 916.737.000: [1]Geomorphologist and Restoration Specialist, 916.231.9603 direct, 916.752.984 mobile, **Jeff.Peters@icf.com**; [2]Fish Biologist; [3]Hydrologist; [4]Restoration Specialist; [5]Civil Engineer

This poster compares different fish passage restoration design approaches for two separate bridge replacement projects

located on two central California coastal streams in Santa Barbara County: Arroyo Parida Creek and Salsipuedes Creek. Arroyo Parida Creek is located near the town of Carpinteria, and is crossed by State Route 192. Salsipuedes Creek is located near the town of Lompoc and is crossed by State Route 1. Both creeks are designated as critical habitat for federally endangered Southern California Coast steelhead. Two design options are presented herein — a hybrid roughened channel/step-pool complex design with a 4.7% slope on Arroyo Parida Creek, and a rock ramp / roughened channel design with a 2.0% slope on Salsipuedes Creek. The design approach for Arroyo Parida Creek centers on creating a channel that best simulates the conditions found elsewhere in the creek (i.e., the reference reaches) using the stream simulation methodology. The primary goal of the stream simulation design is to provide for a high degree of channel stability by simulating the geomorphic conditions observed elsewhere—a continuous streambed that simulates natural channel width, depth, and slope. For Salsipuedes Creek, site conditions and other constraints necessitate that a hydraulic design approach be undertaken. Unlike the stream simulation design approach, the hydraulic design approach involves designing a structure for passage of targeted fish species and life stages by establishing a stable channel that is compatible with the swimming and leaping abilities of fish over a specified range of flows. For both projects, we estimated changes in hydraulic variables—such as depths, velocities, shear stress values, and energy dissipation factors —that would result from implementation of the design options and to assess whether these changes would affect fish passage conditions, stream morphological characteristics, or the quality of habitat for fish and other aquatic organisms in channel reaches upstream and downstream of the proposed design reaches. Changes were assessed for a range of flow conditions from base flow to higher magnitude, less frequently occurring events. Each project presents a unique situation to provide fish passage at a range of flows, with associated opportunities and constraints. For Arroyo Parida Creek, a buried water main pipeline and a relatively narrow riparian corridor serve as the primary design constraints, while the presence of relatively pristine upstream reference reaches aided in the design approach. For Salsipuedes Creek, which occurs at a geologic transition within the watershed, no appropriate reference reaches were available. As such, with the aide of 2-dimensional hydraulic modeling, we designed a rock ramp that would create sufficient flow depth and velocity, as well as habitat diversity, to ensure that fish passage and 100-year channel stability needs would be met. Both projects involve the use of very large boulders (D84 = 4.5 feet!), are in the latter stages of design, and are expected to be constructed within the next few years.

Strip-seeding, a Novel Grassland Restoration Strategy

Julea A. Shaw*[1], Leslie M. Roche[1], Travis Bean[2], Emilio A. Laca[1], Andrew P. Rayburn[3], and Elise S. Gornish[1]

[1]Department of Plant Sciences, University of California–Davis, **jashaw@ucdavis.edu**; [2]Botany & Plant Sciences, University of California, Riverside; [3]River Partners, Modesto

The prevalence of invasive annual grasses and the difficulty of establishing native perennials makes restoration of California grasslands challenging. Recently, strip-seeding has been proposed as a novel, cost-effective strategy to address these persistent challenges to restoration success. Strip-seeding is a spatially-patterned seeding method that involves seeding in linear patches across a site. The method is expected to reduce cost of seed, increase native establishment, and reduce invasive species cover within seeded areas. However, strip-seeding has never been formally tested in western grassland systems, and it is unclear how initial configuration may alter the plant community and dispersal of desirable species to unseeded areas. We examined the utility of strip-seeding by seeding native perennial bunchgrass mixes in different strip width configurations (seeding coverage from 0% - 100%) in fall 2012 in Davis, CA. In spring 2016, we measured the community diversity and abundance across transects in seeded strips and in unseeded between-strip areas. There were no significant differences in plant communities among strip-seeded treatments, but there were differences between plant communities in strip-seeded treatments and controls. Native grasses successfully established in all seeded strips with cover similar to those in the 100% seeded treatment (~31%). Average native cover in unseeded areas was only slightly lower than in seeded areas (~27%), however non-native cover was higher in unseeded areas than in seeded areas (~60% vs ~31%). Therefore, strip-seeding is an effective method for establishing native species, but control of non-natives in unseeded areas will require further management.

Effects of European Beachgrass Removal on Native Dune Vegetation

Joanna Solins*[1] and Lewis Reed[2]

[1]UC Davis Graduate Group in Ecology, **jsolins@ucdavis.edu**; [2]Bodega Marine Reserve, **lkreed@ucdavis.edu**

European beachgrass (*Ammophila arenaria*) is an invasive perennial grass that has significantly modified coastal dune ecosystems on the Pacific coast of the United States. Removal of European beachgrass is challenging and costly, and thus prioritization of management efforts is important to maximize the benefits of limited intervention opportunities. This study examines the impacts over time of manually removing European beachgrass at different densities of invasion in Bodega Bay, California. We compared plant communities in removal test plots to those in control plots, as well as those in a nearby uninvaded area. Cover of European beachgrass decreased and stabilized one year after removal for all levels of invasion density, but there was no increase in native species cover or species richness compared to pre-removal or control plots. Native cover, species richness, and Shannon diversity were greatest in the uninvaded area, but diversity and native cover were

also high in areas of low European beachgrass density. Results of this study suggest that management of European beachgrass by manual removal should target areas of low-density invasion to preserve the native plant community found there and prevent spread into nearby uninvaded areas.

Leveraging Public Aerial Image Datasets to Evaluate Wetland Restoration Progress

Sophie Taddeo*[1] and Iryna Dronova[2]

Department of Landscape Architecture and Environmental Planning, University of California at Berkeley: [1]202 Wurster Hall #2000, Berkeley 94720-2000. **sophie.taddeo@berkeley.edu**; [2]304 Wurster Hall, Berkeley 94720, **idronova@berkeley.edu**

The continued monitoring of ecological properties is critical to advancing our understanding of post-restoration dynamics and factors constraining site recovery. However, limited budgets restrict the consistent monitoring of wetland ecosystems at a spatio-temporal scale relevant to ecosystem processes of interest. The heterogeneous and dynamic nature of wetlands calls for repeated and long-term measurements which can inflate monitoring cost. Public aerial images and remote sensing datasets could help circumvent these challenges yet remain under-utilized in wetland monitoring and restoration ecology. To address this gap, we use a restored freshwater wetland of the Sacramento-San Joaquin Delta as a case study to demonstrate how aerial images from USDA's National Agriculture Imagery Program (NAIP) can be leveraged to monitor vegetation dynamics. Using a time series spanning 11 years, we measure changes in the extent, distribution, and structure of vegetated patches in the study site. Our study reveals a significant relationship between patch size and patch growth, with smaller patches showing a faster growth than larger ones. We observe a continual increase in the heterogeneity and structural complexity of patches as well as a significant relationship between initial patch distribution and species dispersal. The continued monitoring of lateral vegetation growth patterns reveals a site's capacity to maintain critical functions including soil built-up, carbon sequestration, and habitat provision. Our study shows how easily implementable analyses based on free datasets can offer a rapid site-scale screening of vegetation properties in wetlands.

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Contact: Ramona Robison, **rrobison@cal-ipc.org**

California Native Grasslands Association

www.cnga.org

Statewide non-profit working to promote understanding, protection, restoration, and management of California's grasslands and native grasses.

Contact: Diana Jeffery, Administrative Director, **admin@cnga.org**

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Contact: Scott Herbert, Mapping & GIS Sales, 916.344.0232 x149
scotth@csdsinc.com

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Cardno

www.cardno.com

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno provides expertise in both water resources engineering and natural system management. We develop sustainable solutions that protect sensitive resouces and infrastructure including aquatic and riparian habitat, rivers and streams, recreational facilities, roads, and pipelines. Our experience spans the full spectrum of project development, from concept and design, to construction supervision and post-project monitoring. We can lead all facets of large-scale restoration programs or provide expertise related to individual technical study components such as hydrologic and hydraulic modeling, in-stream flow assessment, geomorphic studies, or aquatic habitat inventories.

Contact: Mitchell Katzel, Senior Geomorphologist
mitchell.katzel@cardno.com

cbec, Inc.

www.cbecoeng.com

cbec is a certified small business that provides innovative and sustainable solutions to meet a variety of client needs involving water resources. We focus on floodplain and channel management, fluvial and tidal wetland rehabilitation, and green urban stormwater. The diverse academic training and professional experience of our staff provide cbec with a unique set of qualifications to facilitate problem-solving. This broad skill set is especially useful where complicated multi-discipline solutions are required, such as integrating goals and objectives for flood-risk reduction into ecosystem restoration projects, while balancing the requirements of other land uses, like agriculture and urban development.

Contact: Christopher Bowles, President, 916.231.6052
c.bowles@cbecoeng.com

Cornflower Farms, Inc.

www.cornflowerfarms.com

California Native Plant Nursery

Contact: Kristi Burrus, Project Manager, 916.689.1015
kristi@cornflowerfarms.com

9811 Sheldon Road, Elk Grove 95624
Mailing: PO Box 896, Elk Grove 95759

Dudek

www.dudek.com

Environmental Consulting, Habitat Restoration Design, Design-Build Engineering, Hydrology and Construction Management.

Contact: John Zanzi, RLA Habitat Restoration Specialist, 916.438.5313 **jzanzi@dudek.com**

1102 R Street, Sacramento 95811

Ecological Concerns

www.ecologicalconcerns.com

Established in 1992, ECI is an ecological consulting firm, habitat restoration contractor, and California native plant nursery. ECI has been providing sustainable land management for over a quarter century. ECI specializes in consulting, designing, and implementing land management projects with a focus on ecological design, rare and sensitive species surveys, permitting, habitat restoration, and vegetation management.

Contact: Josh Fodor, President, 831.459.0656
jtfodor@ecologicalconcerns.com

ESA

www.esassoc.com

ESA is a 100% employee-owned environmental consulting firm specializing in restoration, ecology and biology, water resources planning, and environmental compliance for coastal, fluvial, and estuarine environments. ESA provides clients with multidisciplinary services from 13 offices throughout the West Coast. The firm includes more than 475 professionals who develop innovative and workable solutions based on sound science, policy, and planning. ESA is a recognized leader in providing expertise related to restoration, shoreline management, climate change adaptation, and sea level rise impacts, including the climate change vulnerability assessment and coastal hazards analysis. With multiple offices nationwide and an array of technical specialties, ESA is large enough to offer a full range of services but small enough to provide the kind of personal service and attention clients expect and consider integral to project success. Clients look to ESA as a single source for well-reasoned, timely, and effective solutions for their premier project and planning needs.

Contact: Gerrit Platenkamp, Northern California Biological Resources Director, 916.231.1208 **gplatenkamp@esassoc.com**

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Booths located in the Lobby, Meeting Rooms, and Breakout Rooms

Eureka Water Probes

www.waterprobes.com

Eureka Water Probes manufactures multiparameter water quality sondes for surface and ground water monitoring. Manta Plus Probes may be used for spot-checking with hand-held displays, as self-powered loggers, or for remote continuous real-time monitoring with telemetry stations. Manta sondes are easy to use, reliable, and operate in the toughest field conditions!

Contact: Joanna Howerton, 512.302.4333 x1 or fax 512.251.6842
sales@waterprobes.com

2113 Wells Branch Pkwy., Ste 4400, Austin, TX 78728

GEI Consultants

www.geiconsultants.com

GEI Consultants, Inc. is a privately owned multidisciplinary engineering and environmental firm established in 1970, with 37 offices nationwide and 5 offices located in California. GEI offers extensive experience in ecological consulting, including biological resources, natural resources management, and planning and design. GEI's ecological services team provides riverine, wetland, riparian, and upland habitat restoration planning and design; compensatory mitigation planning; restoration construction documents preparation and construction oversight; natural resources and land management planning; conservation planning; aquatic and terrestrial resources surveys and monitoring; habitat mapping; soils analysis; special-status species surveys; and more. In addition to ecological services, GEI offers environmental planning, regulatory permitting, water resources, flood management, geotechnical, engineering, and cultural resources.

Contact: Vance Howard, Senior Restoration Ecologist and Ecological Services Team Leader, 916.912.4933
vhoward@geiconsultants.com

Greenheart Farms Inc.

www.greenheartfarms.com

Wholesale propagation nursery and transplant services specializing in Western native species from local sources.

Contact: Jordan Marcellus, Director of Specialty Crops,
JMarcellus@greenheartfarms.com

H. T. Harvey & Associates, Ecological Consultants

www.harveyecology.com

Since 1970, the highly trained ecologists and professionals at H.T. Harvey & Associates have delivered exceptional consulting services to public agencies, private entities, and nonprofit organizations. We apply our expertise in wildlife ecology, restoration ecology, plant ecology, fish and aquatic ecology, and landscape architecture in pursuit of our mission to create ecologically sound solutions to our clients' complex natural resource challenges. Areas of service are: Restoration design, Environmental analysis, Permitting, Landscape architecture and planning, Compliance support, and Conservation planning.

Contact: Max Busnardo, Principal
mbusnardo@harveyecology.com

Habitat Restoration Sciences

www.HRSRestoration.com

Habitat Mitigation & Restoration, Design-Build, Streambed Restoration, Weed Management, and Preserve Management.

Contact: Mark Girard, HRS President, 760.479.4210
mgirard@hrs.dudek.com

1217 Distribution Way, Vista 92081; 3888 Cincinnati Ave, Rocklin 95765

Hedgerow Farms

www.hedgerowfarms.com

Hedgerow Farms specializes in producing high-quality seed of origin-known, wildland-collected California native grasses, forbs, sedges, and rushes. We offer seeds in single species or custom seed mixes, plug transplants, and native grass straw. Our seed and plants are used in wildlife habitat restoration projects, agricultural revegetation projects, for erosion control, and urban and rural landscaping.

Contact: Patrick H. Reynolds, General Manager, 530.662.6847
preynolds@hedgerowfarms.com

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ICF

www.icfi.com

Environmental planning, natural resource management, habitat restoration.

Contact: Harry Oakes, Restoration Ecologist, 916.231.9600
Harry. Oakes@icfi.com

630 K Street, Suite 400, Sacramento 95814

Marin Municipal Water District

www.marinwater.org

We manage our natural resources in a sustainable manner and provide our customers with reliable, high quality water at a reasonable price.

Contact: Greg Andrew, Fishery Program Manager
gandrew@marinwater.org

Mattole Restoration Council–Native Plant Nursery

www.mattole.org/resources/native-plants

The MRC Native Plant Nursery is a non-profit program focused on providing native plants and seed for northern California restoration projects and habitat enhancement. Our seed is sourced locally, and plants are cultivated at two native grass farms and our 1-acre nursery in Petrolia, CA.

Contact: Veronica Yates, Nursery Manager, 707.629.3514
veronica@mattole.org

Northwest Hydraulic Consultants

www.nhcweb.com

Northwest Hydraulic Consultants (NHC) provides hydrologic, geomorphic, hydraulic, and sediment transport analyses and design services to support restoration of rivers, creeks, lakes, wetlands, and estuaries. Our expertise includes field surveying, hydrologic and hydraulic modeling, hydrotechnical design, and development of engineering construction documents on numerous fish passage, riparian, wetland, and aquatic restoration projects throughout California and western North America.

Contact: Brent Wolfe, 916.371.7400 **bwolfe@nhcweb.com**

Pacific Coast Seed

www.pcseed.com

California Native grasses, wildflower and forbs; Site-specific seed collection.

Contact: David Gilpin, General Manager, 925.373.4417
info@pcseed.com

533 Hawthorne Place, Livermore 94550

Putah Creek Council

www.putahcreekcouncil.org

Putah Creek Council protects and enhances Putah Creek, its watershed, and tributaries through advocacy, education, and community-based stewardship.

Contact: Kent Anderson, Executive Director, 530.795.3006
kent@putahcreekcouncil.org

Rocky Mountain Bio Products

www.RockyMtnBioproducts.com

Supplier of organic fertilizers and soil amendments.

Contact: Tom Bowman Division President, 303.696.8964
Tom@bowmanconstructionsupply.com

10801 E. 54th Avenue, Denver, CO 80239

S&S Seeds, Inc.

www.ssseeds.com

S&S Seeds, Inc., is a full-service provider of seeds for reclamation and revegetation projects. We also offer site collection, cleaning, conditioning, and increase-growing services to ensure the availability of the right seed from the right source at the right time.

Contact: Jody Miller, 805.684.0436 **info@ssseeds.com**

SERCAL 2017 Sponsor Exhibitors

Booths located in the Lobby, Meeting Rooms, and Breakout Rooms

The Watershed Nursery

www.thewatershednursery.com

A restoration nursery specializing in California native plants for revegetation.

Contact: Diana Benner, Principal
Diana@thewatershednursery.com

Westervelt Ecological Services

Wesmitigation.com

Westervelt Ecological Services specializes in creating mitigation and conservation projects and provides environmental mitigation and habitat planning services to landowners, businesses, and government agencies. Through their work, Westervelt has restored over 8,000 acres of wetland and endangered species habitat on over 18,000 acres of preserved properties nationwide.

Contact: Travis Hemmen, Vice President, 916.646.3644
themmen@westervelt.com

Wildlands

www.wildlandsinc.com

Wildlands is a national leader in establishing wetland mitigation banks, special-status species conservation banks, and project-specific habitat mitigation preserves that protect wetlands and wildlife habitat in perpetuity. Dedicated to the restoration and preservation of wetlands and special-status species habitats, Wildlands focuses on procurement, habitat development, and long-term management of projects throughout the western United States, providing robust mitigation solutions. Wildlands is based in Rocklin, California, and has regional offices in Oregon and Washington.

Contact: Julie Maddow, Inside Sales Manager, 916.435.3555
jmaddox@wildlandsinc.com

3855 Atherton Road, Rocklin 95765

WRA, Inc.

www.wra-ca.com

WRA, Inc., provides professional consulting services in plant, wildlife, and wetland ecology, regulatory compliance, mitigation banking, environmental planning, GIS, and landscape architecture. Operating from offices in California and Colorado, WRA has 75 professionals who have completed over 3,000 projects for public agencies, non-profit, and private organizations. WRA is a leader in the restoration and enhancement of California's natural ecosystems including diverse tidal, riparian, and aquatic habitats, critical to many endangered and threatened plant and wildlife species endemic to each region. For over 35 years, WRA's multidisciplinary staff has successfully managed complex projects from initial feasibility and planning stages through project implementation and long-term monitoring. WRA is also a leader in design and implementation of wetland and species conservation banks throughout the state.

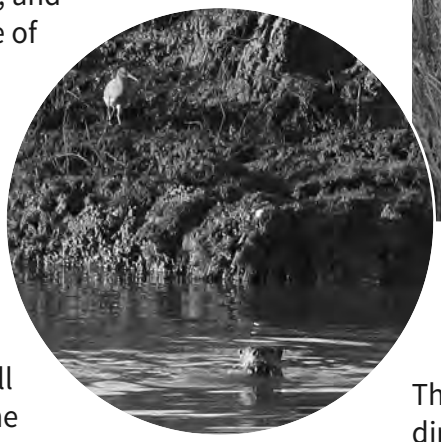
Contact: Liz Agraz, Marketing Director, 415.524.7245
agraz@wra-ca.com

Post Conference Fieldtrip: North Bay Tidal Marsh

North Bay Tidal Marsh Restoration: Lessons Learned and Emerging Trends

A full-day fieldtrip led by Gerrit Platenkamp and Mark Lindley, ESA

Wetland restoration has been in progress in San Francisco Bay since the 1970s. Restoration practices have evolved as lessons have been learned from each successive wave of restoration projects. Early restorations were largely unplanned and resulted in habitats of widely varying quality. As the understanding of the relationships between tidal processes, sedimentation, and marsh ecology improved, a second wave of restoration projects were designed and implemented in the 1980s and 1990s. These projects provided consistently higher quality wetlands habitats while offering new lessons to further refine the restoration practice. Now a third wave of projects has been constructed that incorporate science-led design and adaptive management. This field trip will visit a number of tidal wetlands along the northern shores of San Francisco Bay to highlight current design practices based on the lessons learned from earlier projects and to explore new questions for future projects.



Photos courtesy ESA.

This is a full-day fieldtrip. A map, directions, and (if needed) signup sheet for carpooling will be provided at the conference.

Maximum number of people: 25

What to bring and be prepared for: Bring lunch and water, sunscreen/hat. Wear good walking shoes and dress in layers.

Post Conference Fieldtrip: Sacramento River Ranch

Photos courtesy Wildlands.

Sacramento River Ranch: Conservation and Mitigation Banking on a Working Agricultural Landscape *A half-day fieldtrip led by Wildlands staff*

This is a unique opportunity to visit a U.S. Army Corps of Engineers 404 wetland mitigation bank, a U.S. Fish and Wildlife Service species conservation bank, a National Marine Fisheries Service approved salmon conservation bank, and California Department of Fish and Wildlife approved farm-friendly raptor preserves at the Wildlands River Ranch Mitigation Complex. River Ranch is located approximately 40 minutes from UC Davis and will give visitors a comprehensive look at mitigation and conservation banking in Northern California. The tour will include three separate site visits; first of the wetland mitigation bank, then on to the National Oceanic and Atmospheric Administration salmon bank and USFWS conservation bank at the northern portion of the Ranch. Attendees will take a hay ride from site to site, and Wildlands staff will be stationed at each bank to answer questions and provide insight into banking on the ground in the Sacramento Valley.

Maximum number of people: 30

What to bring and be prepared for: Please wear shoes acceptable for wet/muddy terrain. This tour is completely outdoors with little shade on much of the tour. Please wear appropriate layers for the day's forecast, and hats are be suggested. Water will be provided onsite.

The fieldtrip begins at 8:30am. Depending on weather & ground conditions, the tour will extend no later than 11:30am.

Parking is limited; a signup sheet for carpooling will be available at the conference. Vehicles should park at the north end of the Ranch — a map and directions will be provided at the conference.

Please note that it has been a season of heavy rain and tour details, such as the hay ride, are subject to ground conditions.

Post Conference Fieldtrip: Cosumnes Floodplain After the Flood

Cosumnes Floodplain Mitigation Bank After the Flood: A Review of 7 years of Natural Process and Horticultural Restoration *A half-day fieldtrip led by Westervelt staff*

As of mid-April, Lake Comanche is at 69% capacity and releasing 3900 cfs. Part of the Mokelumne River is still flowing across New Hope Road (our access road) and through our front gate. This condition will remain unchanged until Comanche reservoir stops releasing water to make room for snow melt. We can still get onto the Cosumnes Bank but it does mean driving through 8 inches of water to get to our gate on Grizzly Slough. We will have to play it by ear, but it is a really good lesson in restoration planning in the floodplain because our project was designed to accommodate an upstream breach just like what happened.

Tour begins at the south end of the property with an overview of the project and its history that lasts about 30 min w/Q&A. Then we will load into vehicles or a hay ride and do a driving tour along the Mokelumne River, stopping at several sites to look at preserved valley oak forest, planted native grass and woody riparian restoration sites, natural process restoration sites, then out to our levee breach.

Maximum number of people: 15

What to bring and be prepared for: Sturdy shoes, hat, long-sleeve shirt and pants (mosquitoes), mosquito repellent (we will also supply some for everyone's use). Bring binoculars if you are interested in doing some birding.

Photos of site in its current state courtesy Westervelt.

The fieldtrip begins at 8:00am on the south end of the property. Depending on weather & ground conditions, the tour will extend no later than 11:00am.

Parking is limited; a signup sheet for carpooling will be available at the conference. A map and directions will be provided at the conference.

Please note that it has been a season of heavy rain and tour details, such as the hay ride, are subject to ground conditions.

Post Conference Fieldtrip: Sacramento & American River Projects

Sacramento River and American River: Large-scale Mitigation and Floodplain Restoration Projects *A half-day fieldtrip led by Peter Buck, SAFCA, and Vance Howard and Steve Chainey, GEI Consultants, Inc.*

This field tour will consist of several stops to visit restoration and mitigation projects associated with flood control projects implemented by the US Army Corps of Engineers and the Sacramento Area Flood Control Agency (SAFCA). The tour will begin with two stops in the Natomas Basin, where participants will visit riparian woodland, native grassland, and managed freshwater marsh habitats that were planted 5+ years ago. Participants will learn about SAFCA's comprehensive approach to on-site project mitigation, as well as important lessons about successful design, construction, planting, and maintenance of large-scale mitigation sites. The tour will then travel to the banks of the Sacramento River to visit a well established erosion repair project site where participants will see first-hand the successful features of the project, as well as the challenges of human use at the site. The final stop will be on the American River to visit an aquatic and riparian habitat restoration project currently under construction, which involves laying back an eroding bank to restore floodplain habitat.

Maximum number of people: 40

What to bring and be prepared for: Water, sack lunch, hat, sunscreen, and sturdy shoes. Bring binoculars if you are interested in doing some birding.

Photos courtesy Vance Howard.

Participants will meet at 8:00am at the Archery Range in Discovery Park in Sacramento. Carpooling will be an option from this location, with departure time at 8:15 a.m. We will return to Discovery Park, which is the final tour stop, by noon. For those who have time, we will walk over and visit the American River restoration site until 1:00pm. Participants will be welcome to eat their lunch on the banks of the American River at the restoration site.

A map and directions will be provided at the conference.

The Working Group for Phytophthoras in Native Habitats (**www.calphytos.org**) was unable to present this year as they did in our special session at last year's conference. They did, however, share the BMPs they are currently using when they plant a site — this is an internal document and written as such. If you need further information, please visit their website or participate in their meeting May 18 in San Jose.

SANITATION KIT INSTRUCTIONS

PREVENT THE SPREAD: ARRIVE CLEAN, LEAVE CLEAN.

Sanitation Kit Contents:

2 Tarps
Boot brush & scraper
2 Spray bottles of 70% isopropyl alcohol
2 Long handled brushes
2 Paint scrapers
Kit Instructions
*On Muddy Days: also bring a basin & 2 jugs water

Help prevent the spread of soil *Phytophthora* (fie-TOF-thora) and other plant diseases by cleaning and sanitizing footwear and tools before and after field use. If plants, soil or water contaminated with *Phytophthora,* a water mold, are accidentally introduced to natural areas, the infection can spread, kill additional plants, and infect the soil. The best way to prevent the spread of these diseases is to not move soil from one location to another. This kit will be used at planting events, contaminated sites, and when otherwise recommended by staff.

1. ARRIVE CLEAN

Phytophthora may be present in agriculture, plant nurseries, landscaped areas, and native plant restoration sites. Prevent further spread by arriving at a site with clean tools and footwear, most importantly they must be free of soil and plant material. At sensitive sites, you may be asked to clean and sanitize your footwear and tools again at the site entrance (see Sanitize directions in section below). On muddy days, avoid or limit access to sensitive or contaminated sites.

2. BEFORE LEAVING A SITE: LEAVE CLEAN

Remove Debris

Standing on the first tarp, use the boot scraper, paint scraper and a stiff brush to remove any soil and plant material on both the top and bottom of footwear and from tools including the digging ends and handles. Make sure to clean out crevices. On muddy days, fill the basin with water to assist in rinsing off excess soil once the majority of debris has been removed.

Sanitize

Standing on the second tarp, spray cleaned footwear and tools with 70% isopropyl alcohol, thoroughly wetting the surface and allowing it to dry (approx. 1 min). If the surface of your footwear or tools is already wet, spray extra alcohol to displace the water and allow the alcohol to soak the surface.

3. Sanitation Kit Maintenance: Keep Clean

Before leaving the site, shake soil off the scrapers, brushes and tarp. At the field office, thoroughly clean the kit by washing out, spraying with alcohol and drying the container and all contents before storage. The Sanitation Kit must be clean before moving to a new site.

Comments or Questions can directed to Resource Management Specialist Amanda Mills at 650-691-1200.
For more information on *Phytophthora* and sanitary practices visit CalPhytos.org.

The 25th Annual Conference of the
California Society for Ecological Restoration

Join us as we look back at the past 25 years of restoration efforts in California — planning, implementing, maintaining, monitoring, and more — and lay the groundwork for addressing the impacts of climate change in the future:

Adaptive Management ❊ Fire & Urban Forestry
Wetland & Riparian Areas ❊ BMPs ❊ And more!

Get involved, take a role: sercal.org