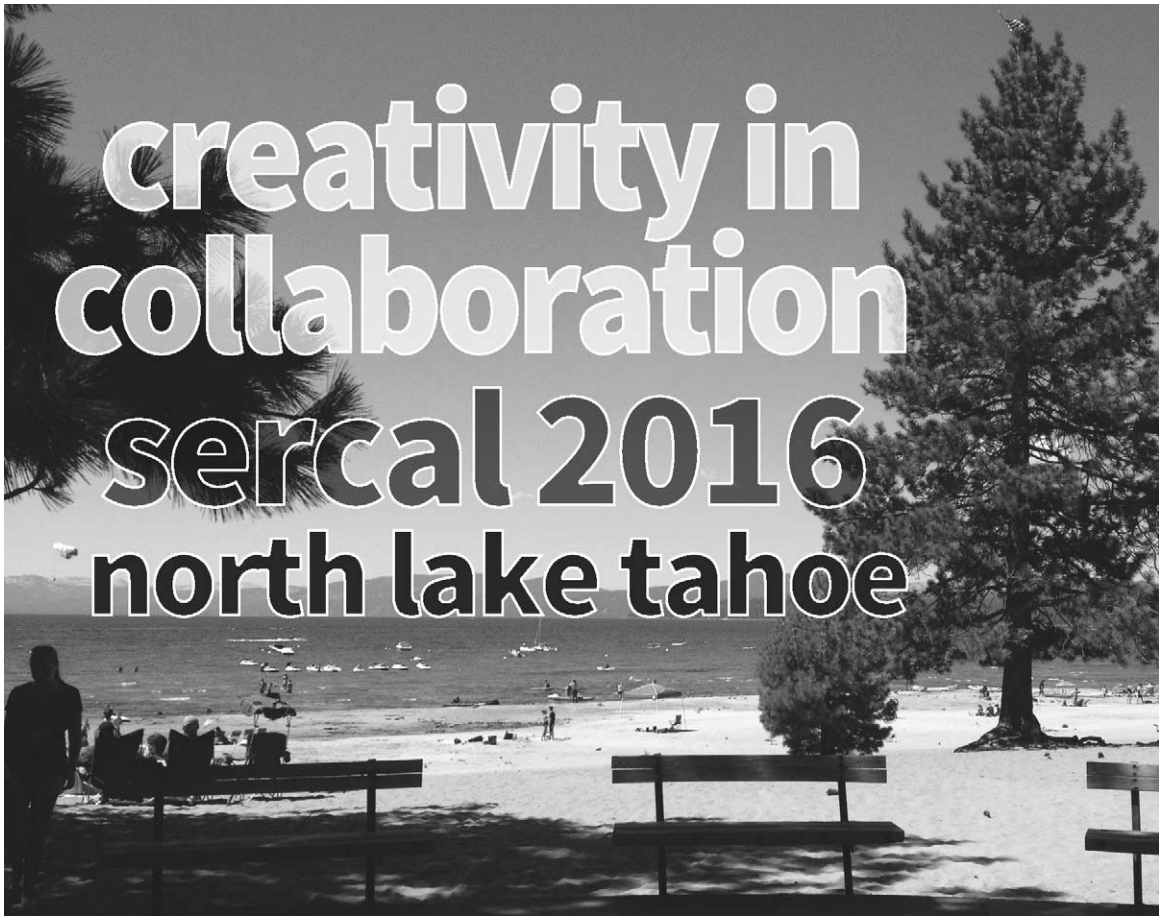
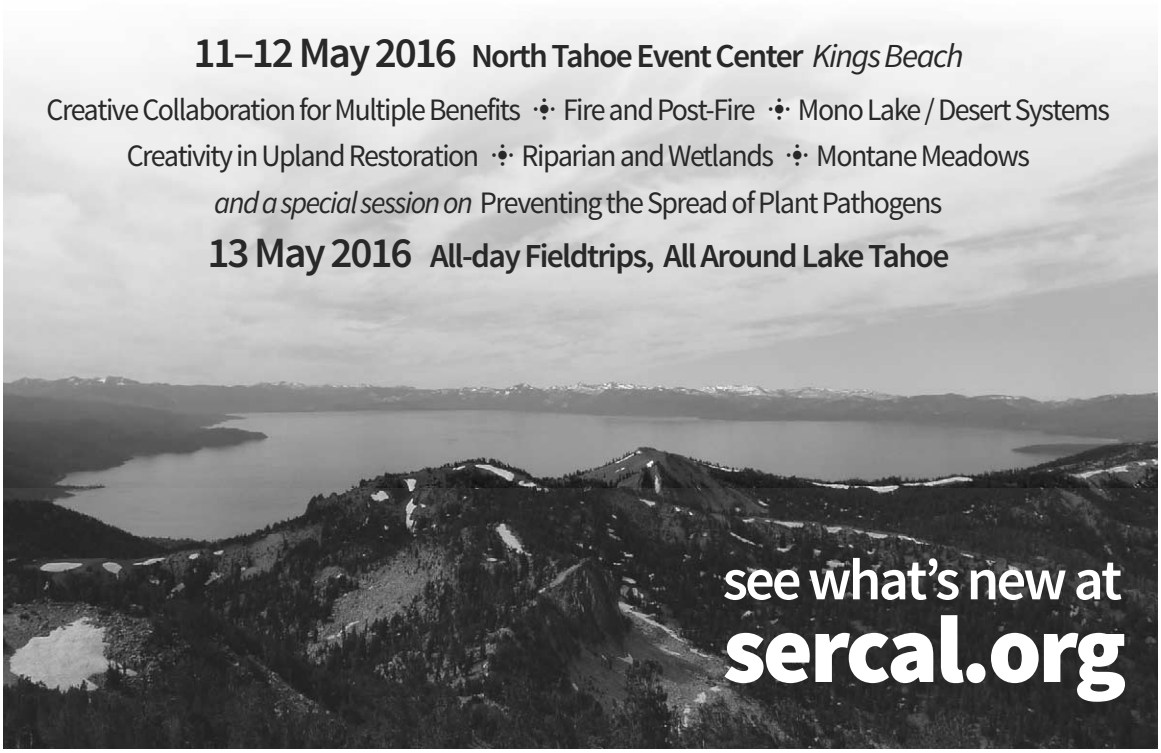


The 23rd Annual Conference of the California Society for Ecological Restoration



INSIDE

SCHEDULES

ABSTRACTS

Creativity in Collaboration:

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Wednesday, May 11 Day One: Conference

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

9–10am **Welcome** *SERCAL President & Conference Chair David Shaw, Balance Hydrologics*
Plenary *Lisa Wallace, Truckee River Watershed Council, with Kathleen Eagan & Joanne Roubique*

10–10:30am **Hosted Coffee Break**

10:30–Noon **Concurrent Technical Sessions**
Creative Collaboration for Multiple Benefits | Fire & Post-Fire | Mono Lake / Desert Systems

Noon–1:30pm **Hosted Buffet Lunch**

1:30–3pm **Concurrent Technical Sessions**
Creative Collaboration for Multiple Benefits | Fire & Post-Fire | Riparian & Wetland

3–3:30pm **Hosted Coffee Break**

3:30–5pm **Concurrent Technical Sessions**
Creative Collaboration for Multiple Benefits | Creativity in Upland Restoration | Riparian & Wetland

5–7pm **Poster Reception** | **Hosted Appetizers** | **Music by the Simpletones**
and **Craft Brews from SERCAL's favorite brewmaster at Alibi Aleworks**

Sponsor Booths Open

Posters on Display

Raffle Items on Display
Proceeds benefit Student Scholarship fund.

SERCAL 2016 in Tahoe

Deep appreciation to the dedication of our conference team:

CONFERENCE PROGRAM CHAIR **Dave Shaw** *SERCAL President, Balance Hydrologics*

CONFERENCE LOGISTICS **Julie St. John** *SERCAL Admin Director* | **Will Spangler** *Fieldtrip Chair*

SESSION CHAIRS **Gavin Archbald** *H.T. Harvey & Associates* | **Carol Presley** *Carol Presley Consultants*
Andrew Rayburn *California Native Grasslands Association* | **Will Spangler** *H.T. Harvey & Associates*
Ross Taylor *Ross Taylor & Associates* | **Ralph Vigil** *Habitat Restoration Sciences* | **Mark Young** *Westervelt Ecological Services*

FIELDTRIP LEADERS **Beth Christman** *Truckee River Watershed Council* | **Jason Drew** *NCE*
Julie Etra *Western Botanical Services* | **Michael Hogan** *Integrated Environmental Restoration Services*
Virginia Mahacek *Cardno* | **Michele Prestowitz** *Truckee River Watershed Council* | **Will Spangler** *H.T. Harvey & Associates*
John Svahn *Truckee Donner Land Trust* | **John Zanzi** *HRS Dudek*

Thursday, May 12 Day Two: Conference

8:30–10:30am **Concurrent Mini Fieldtrips**
Kings Beach | Rosewood Creek | Martis Creek

Special Session on Emerging Issue
Preventing the Spread of Plant Pathogens

10:30–11am **Hosted Coffee Break**

11–12:30pm **Concurrent Technical Sessions**
Creativity in Upland Restoration | Montane Meadows | Mono Lake / Desert Systems

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

2–3:30pm **Concurrent Technical Sessions**
Creativity in Upland Restoration | Montane Meadows | Riparian & Wetland

3:30–4pm **Hosted Coffee Break**

4–5:30pm **Concurrent Technical Sessions**
Creativity in Upland Restoration | Montane Meadows | Riparian & Wetland

Raffle Items on Display
Drawing at Lunch

Sponsor Booths Open

Posters on Display

Friday, May 13 Day Three: All-day Fieldtrips, All Around Lake Tahoe

Adaptive Management: North & West Shores | Stream and Wetland Restoration: East & South Shores
Truckee River Watershed | Donner Summit and Van Norden Meadow

Wednesday, May 11 Day One: Conference

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

Room 1

Creative Collaboration for Multiple Benefits Will Spangler *Chair*

SINGH J | Donner Basin Assessment: Approaching Watershed Restoration Across Disciplines and Missions

KULCHAWIK P | Beyond Zone A: Hydraulic Models to Evaluate Multiple Restoration Objectives

GREEN S | Collaboration for Ecosystem and Community Benefits on Markleeville Creek, CA

Room 2

Fire and Post-Fire Carol Presley *Chair*

MARTY J | The Importance of Fire in Grassland Restoration

WINKEL V | Response of Vegetation after Wildfire on the Warm Springs Natural Area in Moapa, Nevada

ENGLEBERG K | Fire Mid-restoration Planning Process: An Extra Check on Design

Room 3

Mono Lake / Desert Systems Ross Taylor *Chair*

PARMENTER S | Discoveries in the Control of Emergent Plants in Great Basin Springs and Ponds

DIGGORY Z | Planning, Permitting, and Restoring Endangered Species Habitat and Resiliency on a Southwest River

MCQUILKIN G | Stream Restoration Agreement Charts New Cutting-edge Path for Habitat Recovery

1:30–3pm **Concurrent Technical Sessions**

Creative Collaboration for Multiple Benefits Will Spangler *Chair*

LULOW M | Collaborative Partnerships Create Opportunities for Restoration Using Salvaged Soil and Specimen Plants

DREW J | What Happens When Private Redevelopment Spurs Watershed Scale Restoration in Tahoe

THOMAS T | The Restoration of an Urban Creek: Long-term Success through Collaboration

Fire and Post-Fire Carol Presley *Chair*

GILPIN D | How Could California Benefit from the Newly Enacted "National Seed Strategy for Rehabilitation and Restoration"

SWANN C | Restoration-Express — Creative, Effective, and Timely Restoration Efforts following California's Butte Fire

PRESLEY C | Revisiting Burned Chaparral Landscape 15 Years Post Fire

Riparian & Wetland: Water Quality and Restoration Mark Young *Chair*

RAYBURN A | 20 Years of Collaborative Conservation after Curtailment of In-channel Mining on Lower Cache Creek

LINCOLN A | The Role of Local Adaptation in Heavy Metal Tolerance and Phytoextraction Capacity

GRUBER S | Integrating Water Quality Improvements into Coastal Restoration

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

Creative Collaboration for Multiple Benefits Will Spangler *Chair*

SMICK G | Creek Restoration Benefits of Local Ecology and School Curriculum

SCHAEFER C | Chollas Creek Watershed Benefits: Collaborative Creek Restoration and Mosquito Abatement

FARRELL S | Tamalpais Lands Collaborative — One Mountain, One Vision

SCHMIDT E | Improved Permitting (and Funding) for Voluntary Restoration Projects — Know the Opportunities

Creativity in Upland Restoration Andrew Rayburn *Chair*

BURKE T | Successful Desert Scrub Reclamation at Boron Open Pit Mine

SCHWAN J | Revegetating Rock: Restoration of Sites with Disturbed or Limited Soil

ANDERSON T | A Monumental Task: Restoring Maritime Chaparral Habitat on Fort Ord National Monument

Riparian & Wetlands: Restoring Bay Wetlands Mark Young *Chair*

ZUMWALT C | Comparative Spatial Analysis for SF Bay Restoration Monitoring

MEISLER J | Tides not Casinos: Restoring 1,000 Acres of Tidal Wetlands at Sears Point

SWENSON R | Predicting Functions of Restored Tidal Wetland Habitats

Wednesday, May 11 Day One: Evening

5:00–7:00 **Poster Reception and Student Poster Contest* with Hosted Appetizers, Craft Brews from Alibi Aleworks, and Music by the Simpletones**

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.

CHRISTIANSON K | Coastal Dune Mining Site Revegetation and Stabilization Methods

CUTTING L | Lee Vining Rockfall Safety Project Provides Unique Restoration Opportunity

GOMEZ M | Community-supported Steelhead Recovery Efforts in Santa Barbara and Ventura Counties

HALDEMAN K | Accelerate Your Restoration Project Using Programmatic Permits!

MALIK A | Laguna Canyon Road: Impacts of a Changing Climate on Wetland and Riparian Creation

MICHAELS J* | Livestock Grazing for Landscape Diversity in California Vernal Pools

MORAWITZ D | Eradicating Weeds in Sierra Meadows for Climate Change Resilience

OYERVIDES P* | Effects of Temperature on Soil Erosion Rates in the Lake Tahoe Basin

ROONEY L* | Fuels Treatment Effectiveness Project in Woods Creek, Lake Tahoe Basin

SMICK G | Breuner Marsh, Resilient Restoration Design in the Face of Sea Level Rise

STRNAD G | Riparian Habitat Restoration on Rock Stabilized Levee Repair Sites

Thursday, May 12 Day Two: Morning

8:30–10:30 **Your Choice of 3 Mini-fieldtrips or Special Session on Emerging Issue in Room 2**

Mini fieldtrips will be available on a first come, first served basis.

Sign-up sheets will be available at the registration desk after the plenary.

KINGS BEACH Community Core Improvements Project Julie Etra *Leader*

Meet at 8:30 at the Event Center and walk to site.

ROSEWOOD CREEK Restoration Virginia Mahacek *Leader*

Meet at 8:30 at Incline Village site, location TBA at conference

Mainstem MARTIS CREEK: Restoration Opportunities and Constraints Michele Prestowitz *Leader*

Meet at 8:30 at site, location TBA at conference

Preventing the Spread of Plant Pathogens Carol Presley *Chair*

Over the past several years, numerous species of the pathogen Phytophthora *(pronounced Fie-TOF-ther-uh) have been detected in California native plant nurseries and restoration sites. Preliminary investigations have identified more than 20* Phytophthora *species in northern and southern California native plant nurseries and restoration sites.*

Efforts are underway to prevent pathogen introduction and spread by implementing Best Management Practices for native plant nurseries and restoration projects. Additionally, the Working Group for Phytophthoras *in Native Plant Habitats is bringing all aspects of the problem together to coordinate a comprehensive, unified program of management, monitoring, research, education and policy to minimize the spread of* Phytophthora *pathogens. Come learn about this challenge of increasing concern and the efforts afoot to minimize the threat. Audience participants will be encouraged to share their experiences in the extended Q & A period.*

KOSTA K | *Phytophthora tentaculata*, a New Pathogen of Native Plants: The Story of a New Invasive Species Making Its Way from the Nurseries into the Environment

SUSLOW K | Preventing the Introduction of Invasive Soilborne Plant Pathogens into Restoration Planting Sites

FRANKEL S | Assembling a Response to Inadvertent *Phytophthora* Plant Pathogen Introductions in Restoration Areas: The Working Group on *Phytophthoras* in Native Plant Habitats

Thursday, May 12 Day Two: Conference

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

Room 1

Creativity in Upland Restoration
Andrew Rayburn *Chair*

GILLESPIE S | GIS Analysis Using Drones to Map Invasive Weeds in Endangered Species Habitat

PINNELL C | Native Grassland Restoration on California's Lost Coast, a Collaborative Approach

MEYER LOVELL C | Creative Strategies for Implementation of Weed Control Plans

Room 2

Montane Meadows Ralph Vigil *Chair*

HAMMERSMARK C | Hydrologic and Ecological Effects of Stream Restoration in a Montane Meadow

HASTINGS B | Challenges, Creative Collaboration, and Cost-Effective Solutions for Enhancing Fish Habitat on a Regulated River, Little Truckee River Below Stampede Dam, Nevada County, California

HUNT L | How Reconnecting a Floodplain in Indian Valley Altered Streamflow

Room 3

Mono Lake / Desert Systems
Ross Taylor *Chair*

TAYLOR R | Stream Ecosystem Flows for Geomorphic, Riparian, and Fisheries Recovery and Maintenance in Mono Basin Tributaries, CA

REIS G | The Mono Basin Operations Plan: Where the Rubber Meets the Road

HOGAN M | It Can't Be Done? Applying Outcome-based Management to the Mono Lake Rockfall Project

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

Creativity in Upland Restoration
Andrew Rayburn *Chair*

HARRIS T | Innovative Dune Restoration to Protect Private Interests, Provide Public Benefits

CLAASSEN V | Regeneration of Degraded Coast Range Soils for Perennial Plant Habitat

SMOLEN K | Squaw Valley Ski Resort: The Environmental Paradigm Shift from Enforcement to Prototype

Montane Meadows Ralph Vigil *Chair*

WALLACE E | Adaptive Channel Restoration and Pipeline Protection in Upper Truckee Marsh

WRIGHT J | Yellow Starthistle Management through Carrying Capacity and Grazing

GORNISH E | Invasive Species Cover, Soil Type and Grazing Interact to Predict Long-term Grassland Restoration Success

Riparian & Wetland Systems: Regrowing Central Valley Rivers
Mark Young *Chair*

DYBALA K | Measuring Riparian Restoration Success Using Central Valley Joint Venture Objectives

CRAWFORD C | Achieving Effective Riparian Restoration Outcomes by Weighing Cost and Benefits

HOLT J | Feathers, Fur, and Fin: Thirteen Years of Multi-Benefit Restoration

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

Creativity in Upland Restoration
Andrew Rayburn *Chair*

RAYBURN A | Seed Bank—Vegetation Relationships in Restored and Degraded Annual California Grasslands

WOLF K | Wildlife Abundance Lower in Restored Native Perennial than Annual Grasslands

KEDZIORA M | Choose Your Own Restoration Adventure

Montane Meadows Ralph Vigil *Chair*

MERRILL A | Building the Scientific Foundation for a Carbon Sequestration Protocol for Mountain Meadow Restoration

REED C | Rates and Mechanisms of Greenhouse Gas Fluxes in Unrestored Sierra Nevada Meadows

Riparian & Wetland Systems: Making Healthy Sierra Floodplains
Mark Young *Chair*

ROSS-SMITH K | Flow Regime Management for Riparian Restoration

KELSO K | Removing a 500,000 Gallon Water Tank from the Middle of a Sierra Stream

MAHACEK V | Floodplain Reconnection on the Upper Truckee River, Lake Tahoe, CA

ZANZI J | Lower Blackwood Creek Habitat Restoration Construction

Creative Collaboration for Multiple Benefits *Listed alphebetically by presenter*

Chair: Will Spangler, H. T. Harvey & Associates

Wednesday 11 May — 10:30–12:00, 1:30–3:00, and 3:30–5:00 *Room 1*

In the field of habitat restoration we almost never work alone. Like ecology itself, our work is often connected to many variables and niches, to many skills and disciplines. We not only build on knowledge accumulated over time, but we build better project outcomes when we actively work together. The Collaboration for Multiple Benefits technical session will explore how we work together across many so-called boundaries to restore landscapes through collective conservation. We will discuss collaboration across scientific disciplines, public/private partnerships, community and student involvement, agency teamwork, and new permitting approaches in order to identify opportunities to use a range of resources to meet our goals.

What Happens When Private Redevelopment Spurs Watershed-scale Restoration in Tahoe

Jason Drew

NCE, 155 Hwy 50, Suite 204, Stateline, NV 89449; **jdrew@ncenet.com**

As funding becomes more scarce and competitive across California, the restoration community is actively looking for new funding sources and creative partnerships. This is the case in the Lake Tahoe Basin where the Tahoe Regional Planning Agency (TRPA) is emphasizing public–private partnerships to achieve environmental thresholds. The work happening on the Edgewood Tahoe Golf Course is an excellent example of this partnership where significant environmental benefit is being achieved through private investment. The site is located at the bottom of the approximately 4,000-acre Edgewood Creek Watershed and home to Edgewood Creek, Golf Course Creek, and numerous wetlands and ponds. The Edgewood Creek Watershed Assessment and TRPA Environmental Improvement Program note a variety of restoration opportunities at the site including water quality, riparian habitat, stream and wetland restoration, fish passage, spawning habitat, and others. As part of the one of the most significant redevelopment projects to ever occur in the Basin, heavy emphasis was placed on restoration. Through a series of very large Threshold Improvement Projects, many acres of stream and wetland will be restored, some in response to permit conditions, and most voluntary investments in onsite resources. This presentation will highlight the importance of private investment in restoration, present the restoration projects, and discuss lessons learned from attempting such large-scale restoration on private land with private funds.

Tamalpais Lands Collaborative — One Mountain, One Vision

Sharon Farrell

Associate Vice President, Conservation Stewardship; Golden Gate National Parks Conservancy; 415.561.3065; 415.710.0557 (c); **sfarrell@parksconservancy.org**

Faced with challenges of fiscal sustainability, the California conservation community is embracing new, creative, and deliberate approaches to land protection and stewardship. One approach includes establishing strategic partnerships that extend well beyond short-term exchanges and project or transaction-based collaboration, and are instead founded in long-term, vision-based collaboration and collective impact. The recently formed Tamalpais Lands Collaborative (TLC) brings together the four agencies (National Park Service, California State Parks, Marin Municipal Water District, and Marin County Parks) and a conservation nonprofit (Golden Gate National Parks Conservancy) responsible for the management of Mt. Tamalpais — the highest peak in Marin County's coast range — to ensure the long-term health of the expansive 46,000-acre region. The TLC partner agencies have committed to deeper involvement through establishing a joint vision for the stewardship of Mt. Tam. With shared vision and plan in hand, the TLC partners have set the stage for a new, collective identity, while still differentiating their larger agency roles. This presentation examines the key steps and issues addressed during formation, including governance structure, purpose, mission and goals, partner roles, geographical focus, funding, and resource allocation. It also outlines the collective impact approach of the TLC for establishing mountain-wide conservation management and stewardship programs — including early detection, wildlife picture index, and volunteer-based programs — and restoration projects. The presentation will also highlight ongoing research about the anticipated values and benefits of this partnership, and metrics for evaluating outcomes that can be applied to broader land management collaboratives.

Collaboration for Ecosystem and Community Benefits on Markleeville Creek, CA

Sarah Green*[1] and Virginia Mahacek*[2]

[1]Executive Director; Alpine Watershed Group; **awg.sarah@gmail.com** [2]Senior Geomorphologist; Cardno Entrix; **virginia.mahacek@cardno.com**

The Markleeville Creek Floodplain Restoration Project will re-establish the form and function of the creek and floodplain at the site of the former U.S. Forest Service (USFS) Guard Station in downtown Markleeville, California. Flood walls constructed in the 1930s confine high flows and eliminate normal floodplain functions, but continue to allow damaging effects from large floods (e.g., 25-year or larger). Markleeville Creek is a tributary to the East Carson River supporting agriculture, recreation, downstream communities, and ecosystem benefits. The long history of flooding prompted the USFS to relocate their facilities in 2010. Flooding still continues to threaten the

integrity of the community's sewer system and pose a water quality risk as four unsealed sewer manholes and a lift station lie within the 25-year floodplain. Restoration planning and design over the past ten years has featured contributions from a wide range of partners and leveraged different technical, financial, and political backing as the phases continue. Watershed-scale reports and regional plans identify the importance of the project to support a variety of goals. A technical advisory committee has directed the process since 2005, setting priorities and encouraging community involvement. The final project design will not only restore a natural stream channel and floodplain and protect water quality, but also provide benefits for residents and tourists. These outcomes are of substantial long-term importance for this rural community and the Carson River watershed. Collaborative efforts to secure construction funding for the sewer system improvements, ecological reconstruction, recreation, and interpretive elements are ongoing.

Beyond Zone A: Hydraulic Models to Evaluate Multiple Restoration Objectives

Peter Kulchawik*[1] and David Shaw[2]

Balance Hydrologics, 12020 Donner Pass Rd, Ste B1, Truckee, CA 96161; 530.550.9776; [1]**pkulchawik@balancehydro.com** [2]**dshaw@balancehydro.com**

Restoration projects almost never have a single objective, so they are typically approached with a well-rounded, interdisciplinary team of professionals. Each individual comes equipped with a problem-solving toolbox based on their respective background, and in order to fully meet stakeholder and ecological objectives, team members must collectively decide what tools are best suited to address which components of the restoration design. Here, the "Village Reach" of Squaw Creek in Olympic Valley, California, is used as a backdrop to highlight how a collaborative approach can mold the restoration design, and even the project objectives. A 2D hydraulic model developed for the project is used as an example of how a single tool can be extrapolated for use by multiple disciplines, including engineers, geomorphologists, biologists, landscape architects, and permitting specialists. This general strategy of identifying overlap in what one practitioner's tool can do for others is significant to becoming more effective and efficient in designing restoration projects.

Collaborative Partnerships Create Opportunities for Restoration Using Salvaged Soil and Specimen Plants

Megan Lulow*[1], Jutta Burger[1], Milan Mitrovitch[2], Zach Principe[3], Riley Pratt[1], Matt Major[1]

[1]Irvine Ranch Conservancy, 4727 Portola Parkway, Irvine, CA 92620; 714.508.4766; **mlulow@irconservancy.org** [2]Natural Communities Coalition, 15600 Sand Canyon Avenue, Irvine, CA 92618. [3]The Nature Conservancy, 402 West Broadway, Suite 1350, San Diego, CA 92101

Open space preserves in Orange County exist within a matrix of land-use types. Managing for ecosystem health can be challenging in these landscapes due to fragmentation and edge effects, yet working partnerships can allow for opportunities that might be less feasible in more isolated restoration sites. Prompted by two planned residential developments in 2014 and 2015, conservation organizations, public landowners and managers, and a private developer orchestrated the movement of 4,000 cubic yards of top soil, 150 specimen cactus, and over 1,500 cactus pads to six degraded receiver sites. The salvaged plant community was coastal sage scrub, which includes a sub-association with cactus as a dominant structural component. Cactus scrub is critical nesting habitat for the threatened Coastal Cactus Wren, *Campylorhynchus brunneicapillus*, which require prickly pear cactus (*Opuntia littoralis*) or coastal cholla (*Cylindropuntia prolifera*) over one meter tall for nesting. Salvaged topsoil and tall cacti provide benefits of immediate nesting habitat, in additional to a native soil microbial community, a diverse native seed bank, and the potential to bury the weed seed bank at the receiver site. Initiation of approved developments are market-driven, resulting in time frames of as little as two to three months for salvage planning to completion. Success of the operation depended on established relationships among partners, efficient and frequent communication, flexibility in staff time, and funding earmarked to take advantage of such opportunities. Additional factors that facilitated completing the operation in a timely manner included pre-determined priority receiver sites and trusted contractors.

Chollas Creek Watershed Benefits: Collaborative Creek Restoration and Mosquito Abatement

Christina Schaefer*[1], Leslie Reynolds[2], Tory Walker[3], and Teresa Wikinson[4]

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The Pueblo Watershed with Chollas Creek and its tributaries features unique and sensitive habitats surrounded by dense, underprivileged, residential communities. The City of San Diego has identified numerous habitat restoration opportunities to improve conditions of the impaired creek, but lack of funding has prevented implementation. As the steward of the watershed, Groundwork San Diego is spearheading collaborate efforts at volunteer-driven habitat restoration and education projects, including a Regional

Park Designation to solicit comprehensive funding for habitat restoration and recreational opportunities. We explore the opportunities and constraints of collaborative habitat restoration efforts by way of the Lenox Drive Vector Habitat Remediation Project. This project showcases an example of multiple stakeholders collaboration to restore a portion of Chollas Creek for multiple benefits, including water quality improvements, stormwater retention, mosquito abatement, sensitive habitat enhancement, environmental clean-up, and trail construction as part the Safe Route to School Program.

Improved Permitting (and Funding) for Voluntary Restoration Projects — Know the Opportunities

Erik Schmidt

Senior Conservation Strategist; Sustainable Conservation, San Francisco, CA; 415.977.0380 x334; **eschmidt@suscon.org**

Expedited regulatory approval through "programmatic" permits and authorizations can help accelerate voluntary restoration on public and private lands in California. These broad approvals, now provided by many federal and state agencies on a statewide or regional basis, can reduce the permitting timeline for restoration proponents by several months, and cut project costs through reduced fees and staff time. For agencies, programmatic approvals reduce staff workload and help meet key environmental goals through increased and speedier restoration of habitat benefiting listed species, water quality and other resources. Restoration funders, too, can show improved grant-delivery results through more efficient permitting of their awardees' projects. With significant new restoration funding available through Proposition 1, land managers and their partners have improved opportunities to plan and design restoration projects. However, funders seek evidence that project applicants can obtain all the necessary regulatory approvals and implement their projects in a timely manner. Plans to utilize expedited permitting processes can make applications more complete and competitive. Restoration proponents seeking faster regulatory approval for environmentally beneficial projects must understand the detailed requirements and limitations of these front-loaded permits. Applicants must be willing to communicate early with regulatory agencies in a collaborative partnership, and recognize that trust is key to effectively using programmatic approvals. The first step is to know the tools that are available and how to effectively use them.

Donner Basin Assessment: Approaching Watershed Restoration Across Disciplines and Missions

Jai Singh*[1], Chris Bowles[1], Patrick Stone[2], Michele Prestowitz[3], and Lisa Wallace[3]

[1]cbec eco engineering, 2544 Industrial Blvd., West Sacramento, CA 95691; 916.231.6052; **c.bowles@cbecoeng.com** [2]H. T. Harvey & Associates. [3]Truckee River Watershed Council

In watersheds featuring complex environmental processes, extensive impacts, and diverse interests, it is essential to employ an interdisciplinary approach to achieve effective restoration results. The Donner Basin is a 29.5 square-mile sub-watershed within the Truckee River drainage located just east of the Sierra Nevada crest. As a major transportation corridor, recreation destination, water supply source, and population center, the Donner Basin experienced significant environmental degradation over the past 150 years. To assess the watershed's health and to develop a restoration strategy, a multidisciplinary project team integrated numerous fields including geomorphology, water quality, ecology, and archaeology. For example, an Erosion Hazard Analysis characterized upland sediment loading patterns due to geology, transportation development, and historic logging, while an Engineering and Land Use Pressure Index provided an understanding of development impacts to physical processes and riverine habitat. These and other assessment tools enabled us to understand the interplay of numerous factors from the basin's mountainous rim to its outlet at the Truckee River. Leveraging these findings, an opportunities assessment was conducted to identify and prioritize restoration projects and management actions. Engaging a diverse group of stakeholders throughout the project further developed opportunities in light of interests ranging from habitat restoration, conservation, and water quality, to water supply, recreation, local business, and K-12 education. By working across disciplines and missions through an iterative process, the project team developed a creative restoration strategy that will not only rehabilitate upland, lacustrine, and riverine habitat but also create outdoor classrooms, reduce flood risks, and enhance recreation.

Creek Restoration Benefits Local Ecology and School Curriculum

Geoff Smick*[1] and Tanner Harris*[2]

WRA, Inc., 2169-G East Francisco Blvd. San Rafael, CA 94901 [1]President; 415.524.7535; **smick@wra-ca.com** [2]Associate Plant Biologist; 415.524.7296; **harris@wra-ca.com**

Marin Country Day School, a K-8 school in Marin Co., California, recently completed a major overhaul of their lower school campus, including the restoration of a degraded ephemeral creek at the edge of campus. In addition to providing enhanced ecological values, various aspects of restoration were incorporated into the school curriculum. The multi-faceted team included architects, landscape designers, restoration ecologists, and engineers. Working in collaboration with school staff, the team designed a restored system with outdoor learning areas where students can interface with the creek. The restoration included removing invasive plant species, laying back incised creek banks, using bioengineered solutions to stabilize banks in critical areas, planting wetland species along the margins of the channel, and planting native riparian trees and shrubs above the top of bank to provide a structurally complex riparian community. The restoration was incorporated into the 8th grade science curriculum, providing learning opportunities such as "adopting"

native plants used in the restoration to learn about during the year. The students assisted with vegetation monitoring that was required by the agencies and assisted with maintaining the restored creek by implementing weed management and trash cleanup. After 5 years of monitoring, the restoration was deemed a success in large part due to the involvement of the school and students. The school will soon embark on Phase II of the project, which involves updating the upper campus and restoring the upper reach of the same creek.

The Restoration of an Urban Creek: Long-term Success through Collaboration

Terri Thomas*[1], Jonathan Young (Presidio Trust), Dennis Jongsmomijit, (Point Blue Conservation Science), Diana Humple (Point Blue Conservation Science), Dr. Matthew Kondolf (UC Berkeley), Doug Kern (Mendocino Land Trust), Angela Pincetich (National Park Service), Rune Storesund (Storesund Consulting), Igor Lacan (UC Berkeley), Joe McBride (UC Berkeley), Thomas Gardali (Point Blue Conservation Science)

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In 2005, the daylighting of a 150-meter reach of Tennessee Hollow creek brought together UC Berkeley, Point Reyes Bird Observatory (now Point Blue Conservation Science), The Urban Watershed Project, the Presidio Trust, the National Park Service, and Storesund Consulting to develop a channel and riparian Monitoring Plan for Thompson's Reach in the Presidio of San Francisco. Ten years later, the results of the monitoring show the success of this restoration. Native plant cover increased from 0% to 94%. The Shannon Diversity Index for all Avian Species was significantly and positively related to the proportion of shrub cover. The abundance and richness of individual focal species also increased as did the aquatic invertebrate richness. Channel monitoring showed only slight migration. Water quality trends were identified monthly. The partnerships built credibility, instilled a sense of success in the community, brought natural values to the forefront of discussion, and acted as a pilot project to gather funding for the remaining restoration projects in the Tennessee Hollow watershed. With the global increase of urban creek daylighting this project serves as a model of how collaborative efforts promote holistic restoration success.

Creativity in Upland Restoration *Listed alphebetically by presenter*

Chair: Andrew Rayburn, California Native Grasslands Association

Wednesday 11 May — 3:30–5:00 *and*
Thursday 12 May — 11:00–12:30, 2:00–3:30, and 4:00–5:30 *Room 1*

A Monumental Task: Restoring Maritime Chaparral Habitat on Fort Ord National Monument

Thor Anderson

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Restoring over 60 acres of rare central coast maritime chaparral habitat is no easy task, yet it is moving forward on Fort Ord National Monument through successful collaboration between Federal, State, and local agencies, non-profit organizations, and private contractors. Since 2010, Burleson Consulting Inc. has led a comprehensive restoration team to strategically plan and implement passive and active restoration on former Fort Ord. An initial project challenge was the propagation of thousands of special-status manzanitas that had the reputation of being difficult to cultivate. To overcome this challenge, the restoration team built a native plant nursery specializing in the propagation of 'hard-to-grow' species. Our biologists continually improve cultivation techniques and have improved the success rate for the 'hard-to-grow' manzanita cuttings from an initial 10 percent to approximately 50 percent currently. At our nursery, we have also taken a proactive approach in preventing the introduction and spread of pathogens by working closely with the California Department of Food and Agriculture and implementing their recommended BMPs. We believe these BMPs have largely contributed to our success at the nursery. One of our tactics for acquiring the large quantities of native seed is by utilizing commercial seed producers. We currently have six commercial seed production plots growing Fort Ord seed. At three of the plots, we are attempting to produce seed that has never been commercially grown and we are experiencing varying levels of success. Our presentation will reflect on past and present project challenges, lessons learned, and how we plan to proceed with this decade-long endeavor.

Successful Desert Scrub Reclamation at Boron Open Pit Mine

Timothy Burke*[1], Joseph Siefke[2], and Richard S. Carr III[3]

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The Boron open pit is a world-class borate mine located in the western Mojave Desert of California. The climate is classified as harsh, with evaporation to precipitation at nearly a 25:1 ratio. Overburden slopes at the mine consist largely of silty arkosic sandstone soils which contain varying levels of residual boron. The threat to native plant re-establishment due to soil boron toxicity is pervasive and likely unique to this mine. Mine overburden to be stripped requires sampling scrutiny prior to placement. Final slopes are contour-tilled and seeded with a native mix whose species were selected based on test plots and early slope trials and reclamation success.

Regeneration of Degraded Coast Range Soils for Perennial Plant Habitat

Vic Claassen

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Soils that lose their ability to infiltrate rainfall following loss of structure and compaction can cause increased runoff and surface erosion, flashier flows in receiving watersheds, and loss of moisture needed for late summer growth. This presentation identifies some typical outcomes that occur during soil degradation, with reference to different types of rain events and substrate conditions. Both human-caused and natural processes can result in reduced soil infiltration. Similarly, both mechanical treatment and amendment and more natural, gradual plant and root growth inputs can contribute to regeneration of a soil's ability to capture rainfall and regenerate a sustainable plant-soil community. Examples are given from a habitat improvement project in California's North Inner Coast Range.

GIS Analysis Using Drones to Map Invasive Weeds in Endangered Species Habitat

Sundaran Gillespie*[1] and Geoff Smick*[2]

WRA, Inc., 2169-G East Francisco Blvd. San Rafael, CA 94901 [1]GIS Analyst; 415.524.7274; **gillespie@wra-ca.com** [2]President; 415.524.7535; **smick@wra-ca.com**

The explosion of commercially available, unmanned aerial vehicles (UAV; i.e., 'drones') in the marketplace provides a novel tool to the ecologist. With both fixed-wing and copter-style drones large enough to carry high-resolution cameras that can produce geo-referenced, ortho-rectified mosaic imagery, new approaches to habitat mapping are available at a relatively inexpensive cost. Traditionally, conducting field surveys for invasive plant mapping over large areas requires substantial person hours at a relatively high cost. Before the advent of UAV aerial photography, high-resolution aerial photographs were only available from manned, fixed-wing aircraft at extremely high costs. For one of our wildlife conservation bank projects, we use a combination of inexpensive, high-resolution aerial imagery from drones in conjunction with limited field ground-truthing to create accurate maps of weed infestations in endangered species habitat. The aerial imagery is imported into GIS where polygons are digitized around clearly visible areas of target weed species

(i.e., artichoke thistle). The resulting polygons are categorized into various classes based on percent cover. Once the distribution and density of target weed species has been mapped, an annual treatment program is identified and implemented. Since high-resolution aerial imagery can be produced so inexpensively, it can be flown multiple times over the year to capture the appropriate subject matter (phenology, hydrology, colors, etc.). For this project, we fly the site bi-annually: once in the spring to map the plants during their vegetative growth to plan for treatment ahead of seed set, and once in the fall to gauge post-treatment efficacy.

Innovative Dune Restoration to Protect Private Interests, Provide Public Benefits

Tanner Harris*[1], Matt Richmond*[2], and Geoff Smick*[3]

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Broad Beach is a nearly 1-mile stretch of beach located in Malibu, California. Since the early 1970s, it is estimated that the beach has lost more than 600,000 cubic yards of sand. The loss of beach and dunes has put homes along the beach, including septic systems, at risk of damage from storm surges. Following installation of temporary emergency revetments, the homeowners are currently funding a more permanent solution that incorporates natural beach and dune processes into the shoreline stabilization efforts. WRA is working with a team of stakeholders, including the homeowners, the California Coastal Commission, and federal and state agencies to develop a dune restoration plan for the site as part of the stabilization efforts. The plan focuses on merging engineered solutions with natural shoreline stabilization to protect private property while restoring some level of natural function to the beach and dune system. The project represents one of the largest dune restoration efforts in California and is being treated as a regulatory pilot program by the Commission. A number of treatments will be incorporated into the design and will be monitored for effectiveness and use in adaptive management. The project not only protects private property but also provides valuable public access along the California coast. In addition, lessons learned from the restoration will support future regulatory decisions related to shoreline stabilization, an issue that will increase in importance in California with predictions of future sea level rise and increased storm severity.

Choose Your Own Restoration Adventure

Matt Kedziora[1] and Glen Kinoshita[2]

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[2]**Glen.Kinoshita@icfi.com**

Upland restoration presents a variety of planning challenges and directions, and each decision affects the next during your management period. Decisions are made considering ecological integrity, success standards, and client concerns. We highlight a series of restoration choices, their pros and cons, and how each decision could affect future restoration performance. Pre-determined results, related to pros and cons of the decision tree, will be identified. Considerations of cost drivers, climate, and restoration site prescriptions will be incorporated into an adventurous restoration storyline. A collaborative approach (creativity in collaboration!) to this presentation will mimic the children's book series "Choose Your Own Adventure." Two audience teams will decide and vote at each decision stage, allowing each team to complete the storyline. One team will be awarded sign off if they are closest to final success standards.

Creative Strategies for Implementation of Weed Control Plans

Cecilia Meyer Lovell[1], Robert Hobbs[2], Marc Doalson[3], and Linda Robb[4].

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Many large infrastructure projects under the regulatory guidance of the California Public Utilities Commission require implementation of Weed Control Plans during and post-construction. The intent of these programs is to reduce the introduction of new weed species and/or prevent an increase in existing weed populations so as to protect native habitat adjacent to the project. This is especially important for large linear projects. These programs can be conducted alongside restoration programs for temporary impacts, include the permanent impact areas or even the entire right-of-way, and range from 3 to 50 years. Over the last 5 years, we have had the opportunity to implement several of these programs over more than 250 linear miles in California and Nevada and will share observations and lessons learned for creatively implementing these programs for the highest ecological benefit. These include a range of approaches from implementing the program alongside the companion restoration program to refocusing the program into an Adaptive Weed Control Strategy (AWCS) that targets source populations (within and outside the right-of-way) of the most problematic weed species. The AWCS is a creative adaption of the required weed control program that requires extensive collaboration with agencies and landowners to utilize weed control funds for the best benefit of the entire ecosystem, not just the project area. We'll provide details of these programs, as well as thoughts on preparing plans unique

to a specific project and creatively collaborating to implement these plans to the best benefit of the surrounding habitat areas.

Native Grassland Restoration on California's Lost Coast, a Collaborative Approach

Cassie Pinnell

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California's native grasslands have been heavily impacted, and are often considered too challenging, time consuming, or expensive to restore. However, coastal prairie stands have managed to maintain a foothold along Humboldt County's Lost Coast and have been a restoration focus of a local community, non-profit, and agency partnership for over 30 years. These prairies support over 10 native grass species, but have been heavily encroached by coyote brush, followed closely by thick Douglas fir forests, and have been declining rapidly. Efforts to maintain these coastal prairies have been fueled by wildfire risk management, interest in species and habitat preservation, and goals to promote climate resiliency. We present here a collaborative approach to preserve and restore this important ecosystem, and to promote the ecological processes to maintain the extent of the Lost Coast coastal prairie. Methods to manage encroaching vegetation over time have included hand treatments, mastication, and removal with heavy equipment. Re-vegetation of native grasses has relied on hand collection of native seeds, cultivation in our local native plant nursery, broadcast and plug planting, and the creation of a native grass farm to increase local seed stock. Through a long-lasting collaboration of community volunteers, agency staff, hunting groups, landowners, local restoration practitioners, and students, we have managed to keep these grasslands from disappearing into forests. After many years of efforts, we can offer both qualitative and quantitative results and costs, as well as many lessons learned.

Seed Bank—Vegetation Relationships in Restored and Degraded Annual California Grasslands

Andrew P. Rayburn*[1], Craig Schriefer[2], Aubrianne Zamora[2], and Emilio A. Laca[2]

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Soil seed banks represent the pool of seeds of different species at a site that could potentially germinate and recruit into the above-ground community. Seed banks also serve as reservoirs of biodiversity and help maintain desirable native species. Analysis of seed banks and seed bank—vegetation relationships has direct applications for habitat restoration and management. In California's Great Central Valley, grasslands are increasingly restored to improve habitat and enhance ecosystem services. Studies of seed banks and seed bank—vegetation relationships in California grasslands are rare, and extent to which restoration efforts lead to native species recruitment into seed banks has rarely been assessed. More information is needed, especially since observations suggest there are significant challenges in retaining native grasses in the years following initial planting. We analyzed seed banks and vegetation in paired restored and degraded annual grasslands in the northern Central Valley. Our objectives were to examine seed bank composition, seed bank similarity within and between restored and unrestored fields; and seed bank similarity to standing vegetation. We found a high degree of variation in seed bank composition and seed bank-vegetation relationships, suggesting patchy distributions of species. We also found that relatively few native grasses persisted in both seed banks and vegetation in the years following restoration, likely due to competition with exotic species and management practices. We also found no native grasses in seed banks within unrestored fields, strongly suggesting that passive restoration will be ineffective on these and similarly degraded sites. Through our approach, we demonstrate the utility of seed bank analysis for optimizing restoration implementation, monitoring restoration trajectories, and guiding adaptive management.

Revegetating Rock: Restoration of Sites with Disturbed or Limited Soil

Joan Schwan*[1], Doug Loudon*[1] Matt Brown[2], and Shannon Johnson[3]

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Healthy soil is essential to the development of vegetation, but restoration practitioners are often called upon to revegetate land with disturbed or missing soil layers. Prunuske Chatham, Inc., has worked in a number of settings that required establishing native vegetation in soil-limited substrates—from quarry sites to rock spoils piles to rock revetments. We will describe our strategies for work in these environments, summarize our results, and identify lessons learned, using three examples from our work with Pacific Gas and Electric Company (PG&E). Our first example is revegetation of steep, unconsolidated rock spoils piles along the Pit River. This work began in 2009 with planning, local seed collection, and study of suitable reference sites to develop appropriate success targets. Other key project elements included using cardboard concrete forms to minimize slope disturbance during planting and provide plantings with relative stability and access to soil; use of a diverse species palette; and ongoing drip irrigation through drought conditions. Our second example is restoration of a southern Sierra mixed conifer forest at a site quarried for rock. In this project, extensive planning and effort went into careful removal and stockpiling of native soils for later replacement. Soil testing, development of appropriate target conditions, methods and oversight for soil handling, and targeted soil treatments were other strategies for ensuring that soil conditions would support native

vegetation. Our third example involved addition of river run fines and gravels to the interstices of existing rock slope protection adjacent to a river to support willow establishment.

Squaw Valley Ski Resort: The Environmental Paradigm Shift from Enforcement to Prototype

Katrina D. Smolen

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An environmental paradigm shift has transpired at Squaw Valley Resort which utilizes an adaptive management framework for the protection of water quality and in-stream habitat to contribute to watershed health. Protection, restoration, and enhancement minimize the impacts of roads and recreational use, which have developed over 150 years of cumulative anthropogenic impact. Hydro Restoration integrates an iterative design, restoration, and monitoring process, utilizing Best Management Practices, to successfully guide Squaw's Environmental Program. This multi-tier program involves the use of source protection, sediment control, and native plant vegetation to reach watershed sustainability goals. Squaw's 4,000 acres of terrain have been inventoried and are monitored annually to identify and restore erosive areas. To evaluate the success of improvement efforts, Squaw Valley has implemented substantial water quality monitoring regime. Squaw Valley Resort's Environmental Improvement Program has implemented over 50 restoration and revegetation projects in the past decade at a cost of approximately $2,000,000 — prioritized by a Facility Assessment and achieved through the Water Quality Improvement Program and Critical Water Quality Improvement Program. Dozens of new construction activities have also been achieved with minimal environmental impact and 100% compliance of water quality regulations. Hydro Restoration ensures impeccable standards are maintained through communication, collaboration, and education between staff and contractors to enable Squaw Valley Resort to apply solution-based project management and meet upper watershed restoration goals of slope sustainability, thereby reducing sediment loads to benefit watershed health. Hydro Restoration ensures strict adherence to regulatory guidelines and mitigation measures, and coordinates closely with all local, state, and federal regulatory agencies and stakeholders. Squaw Valley's efforts to improve and sustain the mountain's natural vegetation and riparian areas all contribute positively to the Squaw Creek watershed. The success of these efforts is witness in the green of the mountains, the clarity of the water, and the results of the TMDL Bioassessment surveys.

Wildlife Abundance Lower in Restored Native Perennial than Annual Grasslands

Kristina M. Wolf*[1], Matt Whalen[2], Ryan P. Bourbour[3], and Roger A. Baldwin[4]

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In California, >98% of native grasslands have been destroyed or degraded due to invasion and land-use change. Restoration is assumed to provide improved wildlife habitat, increasing wildlife abundance and diversity relative to exotic annual grasslands. We compared relative wildlife abundance at paired restored and unrestored grasslands treatments at four locations in the Central Valley using live trapping and surveys in four seasons from 2014-2015. Restored treatments were planted with native perennial grasses 12 to 24 years ago but are now invaded by exotic annual species. Unrestored treatments contained similar non-native plant species assemblages but did not have any native grasses. Rodent and snake abundance was significantly higher in unrestored treatments by 28% and 90%, respectively. The non-native *Mus musculus* was the only rodent species with significantly higher abundance in unrestored treatments, while native species' abundance was not significantly different between treatments; differences in total rodent abundance were therefore plausibly driven by exotic rodent species' abundance. Structural equation modeling indicated that rodent species responded significantly differently to physical vegetation structure, rather than to differences in plant species. Raptor surveys in three seasons showed 36% higher abundance — with more time spent foraging, greater attack rates, and higher prey capture success rates — in unrestored treatments. Greater native raptor and snake abundance in unrestored treatments are likely supported by greater abundance of non-native rodents in unrestored grasslands. Native grassland restoration may not automatically confer increased wildlife abundance, suggesting a more nuanced approach could be required for the restoration of desired biodiversity and wildlife abundance.

Fire and Post-Fire *Listed alphebetically by presenter*

Chair: Carol Presley, Carol Presley Consulting

Wednesday 11 May — 10:30–12:00 and 1:30–3:00 *Room 2*

Fire plays a critical role in the renewal and reinvigoration of landscapes. Land stewards, farmers and restoration ecologists, use fire proactively to eradicate invasive exotic plants that threaten to out-compete native species. Fire is also highly effective at providing a non-chemical means to kill microbial pathogens and combust diseased vegetation in order to reduce the spread of infection.

Fire, either in a prescribed manner as in fuel load reduction, or under wildfire conditions, yields ecosystem-wide benefits, whether or not the fire was "planned". In the last couple of years, California has experienced record numbers of wild fires in habitated areas and in designated forests. Post-fire efforts include erosion protection, slope stabilization, and creating conditions to allow pre-fire vegetation or more historic species compositions to establish. There exist mixed theories on how to implement these ends. The majority of presentations in this session are case studies of post-fire treatments.

Fire Mid-restoration Planning Process: An Extra Check on Design

Kyra Engleberg* and Nate Bello

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The 300-acre Elizabeth Lake restoration site is part of a 4,000-acre mitigation bank between the Angeles National Forest and the Mojave Desert in northern Los Angeles County. WRA conducted baseline studies in 2011 and began planning to a restore alluvial fan habitat by removing man-made impoundments. In the summer of 2013 the Powerhouse Fire burned over 30,000 acres in Los Angeles County and destroyed nearly 60 structures. This fire swept through the planned restoration site and dramatically changed the landscape, threatening to undo years of planning. Monitoring post-fire has demonstrated increases in diversity of native plant species and in the extent of native shrubs/subshrubs. Surveys found fire-follower species not previously recorded onsite such as *Acmispon glaber* (deerweed) and *Eriodictyon parryi* (poodle-dog bush), and increases in bush poppy (*Dendromecon rigida*) and Davidson buckwheat (*Eriogonum davidsonii*). However, increased numbers of invasives were also observed. The increase in bare ground following the Powerhouse Fire also presented an opportunity to observe sediment and flow characteristics of substantial flow events. Several large rain events have occurred since the Powerhouse Fire that resulted in substantial sedimentation and erosion at the impoundments that the restoration would remove. These observations validated the assessment of the hydrologic impairments and highlighted the need for the restoration. While major events such as fire require the reexamination of restoration plans and resurveying, they may not compromise the design and may actually support it. Because any robust restoration design should take into account natural disturbance like fire, fire mid-planning process may offer a validation of the activities, as in the case of Elizabeth Lake.

How Could California Benefit from the Newly Enacted "National Seed Strategy for Rehabilitation and Restoration"

David Gilpin

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In September 2015, the Bureau of Land Management and its federal agency partners introduced a "National Seed Strategy for Rehabilitation and Restoration" at a press conference in Boise, ID. The Strategy is the government's response to address the impacts of plant community disturbances by natural and man-caused events, particularly fire. The mission of the Strategy is to ensure genetically-appropriate seed for future large-scale rehabilitation and restoration projects. The four goals of the Strategy are 1) Identify seed needs and ensure genetic availability; 2) Identify research needs and improve technology for native seed production; 3) Develop tools to make timely restoration decisions; and 4) Develop strategies to improve communication. The question remains, "How could California benefit from the National Seed Strategy," and what in the strategy offers California land managers and individual landowners the best available tools to address the impacts of excessive erosion and noxious weed infestation. In the short term, few functional benefits or accomplishments are offered to California landowners. However, a long-term view offers more benefits, as time could allow for plant material (seed) availability through production grow-outs from the seed industry for a public seed bank. Federal and/or state agencies or consortiums of public and private entities would want to make funds available for seed production, acquisition, and storage as well as for research purposes. Agencies and private practitioners would specify and use seed as a primary tool to reclaim disturbed lands. Standards for genetic appropriateness would be adopted when large-scale reclamation efforts are proposed and local or regional seed is produced. The State of California and their partners should support a "Native Seed Certification Program" to help focus the California native seed industry. In order to be successful and make this Strategy a reality, the seed industry and the agency/private partners would work together to bring genetically-appropriate seed to the market place in quantities sufficient to meet the needs of multiple large-scale projects that may occur regularly.

The Importance of Fire in Grassland Restoration

Jaymee Marty

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Fire is used in California's highly invaded grasslands to control cover of invasive species, particularly certain non-native grasses. Many native species persist in these grasslands despite the high cover of exotics particularly at sites with extreme edaphic or hydrologic environments (e.g. serpentine, vernal pools). At four study sites spread across the Sacramento Valley, I assessed the effects of fire on plant community composition in heavily invaded uplands and less invaded seasonal wetlands known as vernal pools occurring within the grasslands. Across all sites, fire reduced exotic grass cover but increased exotic forb cover. However, exotic forb cover increased only in the upland habitat outside the vernal pools while exotic annual grass cover was reduced throughout the habitat. Native plant biodiversity increased with burning for at least one year post-burn across all sites and for at least three years at one of the sites. While prescribed fire can be a challenge to implement, it is one of the few grassland restoration tools that provides both the ability to treat large areas and replenish the native seedbank, preserving native biodiversity potential into the future.

Revisiting Burned Chaparral Landscape 14 Years Post Fire

Carol Presley, PE

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In October 2002, 3100 acres of predominantly chaparral vegetation were burned in the eastern slopes of the Santa Cruz Mountains west of Morgan Hill, California. Various treatments were suggested by a variety of resource agency staff, a major concern being resultant sedimentation to a receiving reservoir. This presentation discusses the rationale for treatment selection given the restrictions of private ownership, poor access, steep terrain, and most importantly, re-establishment of resident vegetation. Photographs of the burned areas and subsequent treatments tell the story best with discussion of fire progression, products and work forces used, and qualitative evaluation of the treatment strategy that was employed. Post-fire treatments must consider the existing landscape and resident vegetation in order to develop the appropriate treatments. Site-specific conditions — including proximity of residences, existing and future land-use considerations at the site — also contribute to the selection of treatments. After a significant fire, there is oftentimes a tendency to respond to erosion concerns by immediately establishing some sort of vegetation. For the ultimate renewal of chaparral landscape, this does not always present the best alternative if the long-term goal is to promote re-establishment of the pre-fire landscape.

Restoration Express—Creative, Effective, and Timely Restoration Efforts Following California's Butte Fire

Chris Swann[1], Justin Mynk[2], Jose Setka[3], and Vanessa Stevens[4]

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Timely post-fire restoration can be notoriously challenging. Recognizing the scale of the impacts of the September 2015 Butte Fire in Calaveras and Amador Counties, the need to act quickly (before the rainy season) and the potential for severe water quality impacts, EBMUD took an active role on restoration efforts in the Mokelumne River Canyon. In an intensive, 3-month all-hands-on-deck strategy, we identified critical sites in need of prompt protection, took result-based action, and adaptively managed our responses based upon real-time observations. Following industry standards, creative alternatives, and internally proofed processes, EBMUD jumpstarted the restoration efforts in November 2015, continuing direct and indirect actions through early February 2016. Our measure of success focused on site stabilization, water quality protection, and the re-establishment of native perennial plant populations on the landscape. We employed EBMUD staff, state crews, volunteers, and landowners in a multi-pronged effort. Our qualitative data coupled with fiscal details and strategic actions provides a unique view of success in post-fire restoration efforts.

Response of Vegetation after Wildfire on the Warm Springs Natural Area in Moapa, Nevada

Von K. Winkel, Ph.D.

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During July 2010, a wildfire burned 407 acres of the Warm Springs Natural Area (WSNA) in Moapa, Nevada. The WSNA is a natural area owned and operated by the Southern Nevada Water Authority and is home to 28 sensitive wildlife and macroinvertebrate species including the endangered Moapa dace (*Moapa coriacea*), the Southwestern willow flycatcher (*Empidonax trailii extimus*), Vermillion flycatcher (*Pyrocephalus rubinus*), and the Moapa naucorid (*Limnocoris moapensis*). The fire burned 112 acres of mesquite bosque, 16 acres of riparian tree corridor along the Muddy River and its tributaries, 157 acres of shrubland, nine acres of California palm (*Washingtonia filifera*) groves, 93 acres of grassland, and 20 acres of wet meadow and marshland. Following the fire, the recovery of resprouting species was rapid in contrast to non-sprouting species which was nearly non-existent. Five years following the fire, nearly every

burned Western honey mesquite (*Prosopis glandulosa* var. *torreyana*) had resprouted. The height of resprouted branches was over 80% of pre-fire tree height. Western honey mesquite trees rebounded so quickly and abundantly that several mesquite groves were thinned to decrease fuel loading. In contrast, almost no screwbean mesquite (*Prosopis pubescens*) trees had resprouted after five years. Burned velvet ash (*Fraxinus velutina*) tree resprouts were so abundant that new stems outnumbered burned stems 7:1. In contrast, few cottonwood trees (*Populus fremontii*) resprouted. Resprouting shrub species, arrowweed (*Pluchea sericea*) and water jacket (*Lycium andersonii*), reached near pre-fire growth by summer 2015.

Mono Lake / Desert Systems *Listed alphebetically by presenter*

Chair: Ross Taylor, Ross Taylor & Associates

Wednesday 11 May — 10:30–12:00 *and* Thursday 12 May — 11:00–12:30 *Room 3*

Planning, Permitting, and Restoring Endangered Species Habitat and Resiliency on a Southwest River

Zooey Diggory*[1], Glen Leverich[1], Bruce Orr[1], Tom Dudley[2], Jim Hatten[3], Kevin Hultine[4], and Matt Johnson[5]

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The upper Gila River in southeast Arizona supports a relatively robust population of endangered southwestern willow flycatcher, despite the fact that flycatchers must now nest almost exclusively in the nonnative, invasive tamarisk (*Tamarix* spp.) that now dominates the river's riparian vegetation. The tamarisk beetle (*Diorhabda elongata complex*), which was released for biocontrol of tamarisk in the early 2000s, is anticipated to arrive in the upper Gila River valley in the next few years and, as it has on other southwest rivers, result in the defoliation and mortality of most of the tamarisk and, along with it, much of the existing nesting habitat for the flycatcher. In 2012, an interdisciplinary science team began the development of a planning framework to identify high-priority areas for restoration of native nesting habitat that would be resilient to the effects of the beetle, promote natural recruitment of native riparian plants, and account for the biophysical factors that will most influence restoration success. Since that time, the highest priority areas have been permitted and implementation has begun. This presentation will provide an overview of the restoration framework and the considerations and methods used to identify restoration areas, describe the permitting process used for working within occupied habitat for an endangered species, and describe initial implementation results.

It Can't Be Done? Applying Outcome-based Management to the Mono Lake Rockfall Project

Michael Hogan

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In a very unusual and perhaps unique project, Caltrans and the Mono Lake Committee (MLC) have embarked on a multi-year, adaptively managed project near Lee Vining on Highway 395 called the Lee Vining Rockfall Project. The project has been in play for over three years — starting with small pots of soil to test amendment-plan responses, then moving to small- and medium-sized test plots on the actual project site, and from there to full-scale implementation — and yet there are still many reasons why it may not perform as intended. But unlike most other projects of this sort, which rely on applying BMPs and expert-opinion-based treatment, but little or no follow up, the Rockfall Project is not relying on prediction alone. By basing treatment on actual results with very specific success

criteria — with each step scaling up the results of the previous step — confidence is built because the probability of success is based on actual proof of treatments. As of spring 2016 the Rockfall Project is only half built — the outcome of the project is not yet known. But if initial results are any indication, this project is well on its way to meeting success criteria. Already the grasses, seeded shrubs, and forbs are emerging throughout the project and the main concern, erosion — even on the 60-degree portion of the slopes — is generally non-existent. And perhaps most importantly, Caltrans and the Mono Lake Committee have gained a degree of trust that is uncommon between two entities with seemingly different agendas. Rather than pushing and pulling on each other to move toward their specific versions of "what should be" (and spending finite resources on attorneys), they have come together to actually explore mutual goals as a team and, in the end, create a project focused clearly on outcomes and learning.

Stream Restoration Agreement Charts New Cutting-edge Path for Habitat Recovery

Geoff McQuilkin

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The Mono Basin Stream Restoration Settlement Agreement represents three years of collaborative negotiations with the Los Angeles Department of Water & Power (DWP) to improve its aqueduct infrastructure and operations in order to restore stream habitat and recreational trout fisheries destroyed by excessive water diversions. In 2010, after 12 years of Water Board-ordered study, scientists Dr. Bill Trush and Ross Taylor produced a Synthesis Report recommending a new streamflow release pattern intended to maximize the success of the decades-long stream restoration effort; however the 1930s-era infrastructure designed to maximize water exports was an obstacle. Negotiations began in 2011 as a series of facilitated meetings between the Mono Lake Committee, DWP, the California Department of Fish & Wildlife, and California Trout. After two years of fact-finding and a year of intense negotiations, the parties signed a settlement agreement in August 2013 that will implement the Synthesis Report's recommendations and set the stream restoration program on the path towards completion. Translating the Settlement Agreement into Water Board license language has taken longer than expected, but this year the parties anticipate DWP's water licenses to be

amended and Settlement components to be implemented. Most significant is the construction of a new outlet to Rush Creek from Grant Lake Reservoir that will enable the reliable delivery of new high and low stream flows. It also includes an innovative cost-sharing component to fund the outlet construction and a creative contracting-administration component to fund ecological monitoring and facilitate adaptive management.

Discoveries in the Control of Emergent Plants in Great Basin Springs and Ponds

Steve Parmenter

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Beginning 47 years ago, selected aquatic habitats began to be managed as refuges for imperiled desert fishes in the eastern Sierra and Mojave desert of southwestern California. Post-disturbance invasion by native *Typha* spp and *Schoenoplectus acutus* altered food webs, predator cover, and water depth to the detriment of fishes. In the case of Owens pupfish, refuge populations collapsed with a median persistence of 8 years. Herbicide, damming, substrate paving, and hand weeding provided costly ephemeral relief. Effective eradication of problem plants with zero recolonization has been accomplished in the past 14 years by underwater mowing, dormant season drowning, excavation or explosives, combined with replacement planting of 1-3 specific clonal species of native Cyperaceae on the shoreline. Competing species establishment was associated with reduced clonal spread and elimination of seedling recruitment in both *Typha* and *S. acutus*. Case studies of treatments with 6-14 year maintenance-free outcomes, failed attempts, and new efforts involving draw-down, fire, and/or herbicide will be described. Natural history and management observations will be joined to suggest a general hypothesis and research questions about clonal plant succession in emergent alkali wetlands.

The Mono Basin Operations Plan: Where the Rubber Meets the Road

Greg Reis

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Since the Mono Basin Synthesis Report was released in 2010, and since the Mono Basin Stream Restoration Settlement Agreement was signed in 2013, there have been many facility and operational changes that have the potential to affect Los Angeles Department of Water and Power (DWP) operations in the Mono Basin. The Mono Basin Operations Plan (MBOP) will need to incorporate and address many of these changes, and we present here a few examples of the complexities that await. Among the changes, Southern California Edison has begun hydropower-peaking upstream of DWP's facilities. Also, the historic drought has left Mono Lake and Grant Lake Reservoir very low. Additional water for Mono Lake level maintenance needs to be programmed into the Synthesis Report hydrographs, and the Mono Lake Committee (MLC) has done some initial work on this. Initial work has also been done by MLC and DWP to look at operationally realistic ramping rates compared to the ecologically-optimized rates in the 2010 Synthesis Report. New facilities are being built at Grant Lake Reservoir to bring outdated equipment up-to-date, and the MBOP will need to describe these facilities and incorporate the new capabilities they bring to sustainable water management in the Mono Basin.

Stream Ecosystem Flows for Geomorphic, Riparian, and Fisheries Recovery and Maintenance in Mono Basin Tributaries, CA

Ross N. Taylor, M.S.

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The California State Water Resources Control Board (SWRCB) must balance how water is allocated to meet the needs of citizens and natural resources. In 1941, the Los Angeles Department of Water and Power (LADWP) completed the construction of infrastructure to store and export water from the Mono Basin, on the east side of the Sierra Nevada Mountains, to the City of Los Angeles. Over the next five decades, these water exports caused significant negative ecological changes to Mono Lake and its tributary streams — primarily Rush and Lee Vining creeks. In 1998, the SWRCB established preliminary instream flows in Mono Lake tributaries to promote the recovery of Mono Lake, the stream channels, and the non-native (but naturally reproducing) trout fisheries. Two independent scientists (aka, 'Stream Scientists') were also appointed by the SWRCB to monitor the recovery of the stream channels and the fisheries, to evaluate the 1998 ordered flows, and to recommend adjustments to these preliminary flows. After amassing 12 years of monitoring data, the Stream Scientists identified specific areas of the 1998-ordered hydrographs that potentially limited the recovery of the streams and fisheries. Recommendations were then developed to better achieve desired ecological outcomes and processes and to improve the reliability of flow releases below LADWP's points of diversion. The recommended changes to the 1998 ordered flows were presented to the SWRCB in April of 2010 in the Stream Scientists' Synthesis Report. After submission of the Synthesis Report, LADWP and the major stakeholders undertook a two-year-long facilitated process to reach consensus on outstanding disagreements with the Synthesis Report recommendations. In September of 2013, LADWP and the major stakeholders signed terms of settlement which included the streamflows recommended in the Synthesis Report. This presentation highlights the strategies and data-based analyses used by the Stream Scientists to develop their recommended stream ecosystem flows (SEFs). This presentation also describes how watershed-specific differences and existing infrastructure within Rush and Lee Vining creeks influenced flow recommendations.

Montane Meadows *Listed alphebetically by presenter*

Chair: Ralph Vigil, Habitat Restoration Sciences, Inc.

Thursday 12 May — 11:00–12:30, 2:00–3:30, and 4:00–5:30 *Room 2*

Invasive Species Cover, Soil Type and Grazing Interact to Predict Long-term Grassland Restoration Success

Elise S. Gornish

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Understanding of the factors responsible for driving reestablishment of degraded grassland plant communities is largely derived from short-term studies. In order to develop an understanding of the factors responsible for longer-term restoration outcomes in California annual grasslands, in 2015 I surveyed 12 fields in Davis, CA, that were seeded with native species mixtures starting in 2004. Using field surveys, I investigated how invasive plant richness and cover, native plant richness and cover, aboveground biomass, grazing, soil type, and restoration species identity might provide utility for explaining patterns of restoration success. I found a negative relationship between invasive cover and restoration cover, which was attributed to the slow establishment of seeded species and subsequent dominance by weeds. The relationship between invasive cover and restoration cover was modified by grazing, likely due to a change in the dominance of exotic forbs, which have a more similar growing season to restoration species, and therefore compete more strongly for late season moisture. Finally, I found that soil type was responsible for differences in the identity and abundance of invasive plants, subsequently affecting restoration cover. This work highlights the value of focusing resources on reducing invasive species cover, limiting grazing to periods of adequate moisture, and considering soil type for successful long-term restoration in California annual grasslands. Moreover, observations of long-term restoration outcomes can provide insight into the way mechanisms driving restoration outcomes might differ through time.

Hydrologic and Ecological Effects of Stream Restoration in a Montane Meadow

Chris Hammersmark

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Stream restoration activities throughout California are numerous; however, the hydrologic and vegetative responses of these systems are poorly understood and rarely documented. To assess the hydrologic and vegetative responses to "pond and plug" stream restoration in a montane meadow system, a hydrologic model was developed and coupled to a suite of vegetation species distribution models. This approach was applied to a meadow and stream restoration project on Bear Creek, a tributary of the Fall River in the northeastern California. First, a complete hydrologic model was developed and used to simulate hydrologic conditions in the meadow under pre- and post-restoration conditions. Subsequently, vegetation data were combined with simulated water-table depths to develop habitat-suitability models for several species. Habitat suitability was predicted as a function of water-table depth and range during the growing-season. Results from the hydrologic model document three general hydrologic responses to the restoration actions: (1) increased groundwater levels and volume of subsurface storage; (2) increased frequency/duration of floodplain inundation and decreased magnitude of flood peaks and (3) decreased annual runoff and duration of baseflow in the restored reach. Results from the vegetation modeling indicate an increase in the spatial distribution of suitable habitat for mesic vegetation and a concomitant decrease in the spatial distribution of suitable habitat for xeric vegetation. The methods utilized in this study should be used to improve the setting of objectives and performance measures in restoration projects in similar environments, in addition to providing a quantitative, science-based approach to guide riparian restoration efforts.

Challenges, Creative Collaboration, and Cost-Effective Solutions for Enhancing Fish Habitat on a Regulated River, Little Truckee River below Stampede Dam, Nevada County, California

Brian Hastings*[1], Dave Shaw[1], Dave Lass (Trout Unlimited), Loren Roach and Mark Girard (Habitat Restoration Sciences, Deborah Urich (Tahoe National Forest), and Beth Christman (Truckee River Watershed Council)

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The Little Truckee River is one of the most prized recreational fly-fishing locations in the country, yet wild trout populations are limited to a small reach of the river, below Stampede Dam. Balance Hydrologics worked with staff from Tahoe National Forest (USFS), California Department of Fish and Game (CDFG), Trout Unlimited, Truckee River Watershed Council, and volunteers to evaluate options and complete a scientific analysis in support of conceptual designs, permitting, and implementation of a project to improve habitat for multiple life-stages of wild trout. Balance staff worked with volunteers to collect field data to support design concepts and facilitate project implementation. CDFG supplemented the hydrologic data through habitat typing and quantitative surveys of fish species and abundance to help prioritize areas for enhancement and quantify baseline conditions. The pooled data from diverse stakeholders were then evaluated and synthesized into conceptual enhancement plans. Key habitat enhancement features included introduction and strategic placement of roughly 100 large rootwads and over 50 boulders. Willow replanting supplemented the instream and bank

habitat components and were carried out by volunteers. Advanced conceptual plans were completed in 2011 and the project was implemented in the fall of 2015. This talk explores the challenges of instream habitat enhancements below a dam and describes the contributions from a diverse team and volunteers that contributed to a cost-effective project which resulted in fish habitat improvements, and recreational and local economic benefits.

How Reconnecting a Floodplain in Indian Valley Altered Streamflow

Julie Fair[1], Maxwell Odland[1], Austen Lorenz[2], Bonnie Ricord[1], and Luke Hunt*[1]

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The deeply eroded channel through Indian Valley (Alpine County) was filled in 2012 using the plug-and-pond technique to reconnect the channel to the historic floodplain. After restoration, the previously intermittent stream has flowed continuously, despite California's historic drought. Stream gauges above and below the meadow show that the meadow reduces high spring flows and increases low summer flows. Gauges also show incredibly intense thunderstorms corroborated by time-lapse photos and rapid rates of sedimentation. We will present flow and groundwater data, evaluate the Replenish model that Coca Cola prepared when funding this project and discuss how Indian Valley restoration fits expectations within the California Water Action Plan.

Building the Scientific Foundation for a Carbon Sequestration Protocol for Mountain Meadow Restoration

Amy Merrill*[1], Mark Drew[2], Stephen Hart[2], Ben Sullivan[4], Cody Reed[4], Nate Lawrence[1], Jim Wilcox[5], Dave Weixelman[6], Abby Dziegiel[2], Levi Keszey[2], Leslie Mink[5], and Gia Martin[5]

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Healthy mountain meadows provide many ecological benefits. Do they also sequester Carbon, resulting in a net reduction in GHG emissions? We present the first year of findings from a project with the sequential goals of measuring carbon sequestration in the field and then developing a meadow carbon protocol for the hydrologic restoration of degraded mountain meadows. Our team, the Sierra Meadow Restoration Research Partnership (SMRRP), includes ten partner institutions. We are employing a modified before-after, control-impact (BACI) design using seven impact (to be restored), seven control (to remain degraded), and four reference ('ideal' condition) meadows. The meadows range in location from the Upper Feather River to the Kern River Basins in the California Sierra Nevada. At all meadows, we use a common framework and set of field, laboratory, and data analysis protocols to populate a database on net soil C sequestration, including changes in soil carbon, NPP, and CO_2, N_2O and CH_4 fluxes on the carbon-equivalent budget. We describe our research approach and present data on CO_2, N_2O, and CH_4 fluxes from the first three seasons of field measurements. In addition, we present preliminary data on soil C storage (g/m^2), aboveground plant biomass inputs (g/m^2), biomass C:N ratios, and other ancillary measurements such as soil moisture and soil temperature. Furthermore, we describe our plans to use this growing body of data to build an empirical model of meadow C sequestration as part of a basis for a Sierra meadow carbon protocol for California.

Rates and Mechanisms of Greenhouse Gas Fluxes in Unrestored Sierra Nevada Meadows

Cody C. Reed*[1], Stephen C. Hart[2], Amy E. Merrill[3], Mark Drew[4], and Benjamin W. Sullivan[5]

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High-elevation riparian meadows are hydrologically controlled, highly productive ecosystems characterized by shallow water tables and hydric soils. In these ecosystems, anaerobic soils slow decomposition rates and create conditions that promote carbon sequestration, resulting in large soil carbon stocks. The stability of this carbon, however, is impacted by management practices. Sierra Nevada montane meadows are often focal points of human activity, placing them at risk for channel incision, loss of hydrologic function and increased soil carbon loss via erosion or enhanced decomposition. However, few data are available regarding fluxes of greenhouse gas (GHG) from unrestored Sierra Nevada meadows and the ability of restoration activities to increase carbon sequestration. To better understand the rates and mechanisms that control GHG dynamics in degraded Sierra Nevada meadows, we sampled soil GHG fluxes and physical and biological characteristics in 14 meadows with emphasis on 3 impacted meadows. Greenhouse gas fluxes and rates were measured in situ using a static chamber method. We also measured depth to groundwater, soil carbon content, bulk density, belowground biomass, and aboveground biomass. Our results suggest that degraded meadows may be significant sources of carbon dioxide and net sinks for methane and nitrous oxide. However, fluxes varied substantially among sites and seasons. Our results suggest that, if restoration can successfully restore the hydrology of meadow ecosystems, there is an opportunity to reduce GHG emissions from these ecosystems and increase carbon sequestration.

Adaptive Channel Restoration and Pipeline Protection in Upper Truckee Marsh

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During the record snowmelt year of 2011, a portion of Trout Creek in the Upper Truckee Marsh completely filled with sand and gravel, causing the stream to avulse to the north approximately 70 feet. The avulsion resulted in the main flow being located over two sewer pipelines located along the edge of the marsh on property owned by the California Tahoe Conservancy. The inundation prevented normal maintenance by the South Tahoe Public Utility District, increasing the risk of a sewer overflow to the meadow. Erosion and channel development processes threatened the integrity of the sewer lines, manholes, and the pump station. After considering more structural alternatives, the District adopted an adaptive management approach using bio-technical methods to encourage re-direction of flows while protecting marsh resources. In consultation with the landowner and regulatory and resource agencies, a five-year adaptive management plan was developed. Two years of implementation actions are complete. The measures included removal of an abandoned road fill, revegetation with salvaged sod, construction of pilot channels in historical channel locations, placement of coir logs and sod berms, and creation of meadow hummocks to raise the elevation of the pipeline easement and increase hydraulic roughness using pre-planted coir mats, willow stakes, and shrubs. Adaptive management of bio-technical features and post-construction monitoring will occur for up to five years to ensure that the project meets its objectives. The project has substantially reduced risk to the pipelines and has successfully established stabilizing marsh vegetation in the avulsion area.

Yellow Starthistle Management through Carrying Capacity and Grazing

Jamie Wright*[1], Barbara O. Bomfim[2], and Lucas C R Silva[3]

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The yellow starthistle, *Centaurea solstitialis*, is an invasive herb in the Sierra Nevada forests that has the ability to outcompete native plants and degrade their habitat. Such invasive plants can deplete soil moisture thus further making the area less inhabitable for other vegetation. In spite of its high ecological importance, little is known about growth rates of such species in its ecological niche within the Sierra Nevada forests. Such data can provide valuable inferences about the species carrying capacity. If the yellow starthistle is not growing exponentially, it could be inferred that the species is nearing or at its carrying capacity. Eradication of the yellow starthistle at its carrying capacity could be an efficient effort at removing the plant since the species reproduction rates are low. Once it has been determined that the yellow starthistle is at its carrying capacity, grazing could be an effective removal method. Goats could be an optimal grazer since they are able to consume yellow starthistles before and after the plant's spikes are developed. Eradication of yellow starthistle at its carrying capacity should be coupled with other management practices to ensure a successful permanent removal. Once most or all yellow starthistle individuals are removed, native California Sierra Nevada perennials with deep root systems should be planted. The early establishment of native perennials could lower the chances of surviving yellow starthistle outcompeting the native species.

Preventing the Spread of Plant Pathogens *Listed alphebetically by presenter*

Chair: Carol Presley, Carol Presley Consulting

Thursday 12 May — 8:30–10:30 *Room 2*

Over the past several years, numerous species of the pathogen *Phytophthora* (pronounced Fie-TOF-ther-uh) have been detected in California native plant nurseries and restoration sites. A species that had never been found in the US, *Phytophthora tentaculata*, occurred in several California native plant nurseries and was outplanted in restoration areas on sticky monkey flower (*Diplacus aurantiacus*), toyon (*Heteromeles arbutifolia*), coffeeberry (*Frangula californica*), mugwort (*Artemesia douglasiana*) and other native species produced as nursery stock. Preliminary follow-up investigations have identified more than 20 *Phytophthora* species in northern and southern CA native plant nurseries and restoration sites. Several land owners have spent over $5 million to remove potentially infested plants from restoration areas, collaborating with scientists to develop and test new methods to eradicate these pathogens from contaminated soil. *Phytophthoras* are notorious plant pathogens, including the species that cause sudden oak death (*Phytophthora ramorum*), the Irish potato famine (*P. infestans*), and numerous diseases of agricultural, horticultural and forest plants. Inadvertently planting *Phytophthora*-infected nursery stock into native environs has the potential to introduce these pathogens into sensitive habitats. With the broad range of plants susceptible to *Phytophthora*, the pathogens can destroy the ecological values that restoration is trying to enhance. Efforts are underway to prevent pathogen introduction and spread by implementing Best Management Practices for native plant nurseries and restoration projects. Additionally, the Working Group for *Phytophthoras* in Native Plant Habitats is bringing all aspects of the problem together to coordinate a comprehensive, unified program of management, monitoring, research, education and policy to minimize the spread of *Phytophthora* pathogens. We need your ideas and observations about how to protect wildlands from these unintentional pathogen introductions into high-value habitats.

Assembling a Response to Inadvertent *Phytophthora* Plant Pathogen Introductions in Restoration Areas: The Working Group on *Phytophthoras* in Native Plant Habitats

Susan J. Frankel*[1], Janice Alexander[2], Jessica Appel[3], Diana Benner[4], Elizabeth Bernhardt[5], Cheryl Blomquist[6], Tyler Bourret[7], Matteo Garbelotto[8], Janell M. Hillman[9], Mia Ingolia[3], Kathy Kosta[6], Greg Lyman[3], Heather Mehl[7], Ellen Natesan[3], David M. Rizzo[7], Suzanne Rooney-Latham[6], Alisa Shor[10], Laura Lee Sims[8], Karen Suslow[11], and Ted Swiecki[5]

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Restoration projects serve as an inadvertent pathway for the introduction of invasive *Phytophthora* pathogens: preliminary surveys are detecting multiple *Phytophthora* species from restoration sites, purchased plants, and in native plant nurseries. The pathogens recovered pose a threat to native California flora; for example, *Phytophthora tentaculata*, new to the USA, is known to be present in seven California counties, on approximately 10 species of common California native plants, including sticky monkey flower (*Diplacus aurantiacus = Mimulus aurantiacus*), several Artemisia species, toyon (*Heteromeles arbutifolia*), coffeeberry (*Frangula californica*), and others. The "Working Group on *Phytophthoras* in Native Plant Habitats" is bringing together industry, scientists, regulators, native plant professionals, land managers, and others to prevent further introductions and spread by developing treatments, best management practices, and other changes to restoration practices. In this session, we will review 2014-2016 detections, pathogen distribution, threats, and progress on treatments for native plant *Phytophthoras* in California. A following discussion session will call on the audience for questions and ideas of how to protect wildlands from these unintentional pathogen introductions into high-value habitats.

Phytophthora tentaculata, a New Pathogen of Native Plants: The Story of a New Invasive Species Making its Way from the Nurseries into the Environment

Dr. Suzanne Rooney-Latham[1], Kathleen Kosta*[1], Karen Suslow[1], and Kristina Weber[1]

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In 2012, *Phytophthora tentaculata*, a pathogen known to cause root and crown rot of nursery plants in Europe and China, was detected for the first time in North America on declining sticky monkey flower plants (*Diplacus aurantiacus*) in a Monterey County native plant nursery. In 2014, the pathogen was again found, this time in toyon (*Heteromeles arbutifolia*) and *Diplacus* that had been planted at a restoration site in northern California. These plants were produced in a nursery in Placer County, where coffeeberry plants (*Frangula californica*) were also found to be infected. In response to these detections, the California Department of Food and Agriculture (CDFA) began trace-back activities to determine the distribution within the nursery and restoration systems. To date, *P. tentaculata* has been detected at nine nurseries in seven counties throughout California, and in four restoration areas in three counties. Awareness of the situation spread rapidly through the restoration and native plant nursery industries prompting widespread testing of nursery stock and outplanted materials. More than a thousand samples that have been collected from nurseries and wildlands were tested at the CDFA Plant Pest Diagnostic Laboratory by several diagnostic methods including DNA sequence analysis. In addition to *P. tentaculata*, more than 21 other species of *Phytophthora* were detected from the roots of symptomatic plants of many species of native plants. To date, *P. tentaculata* has not been detected in non-restored, wildland areas. In response, native plant nurseries are changing operations and implementing best management practices to insure clean stock production.

Preventing the Introduction of Invasive Soilborne Plant Pathogens into Restoration Planting Sites

Karen Suslow*[1] and Kathy Kosta[2]

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Successful, sustainable restoration projects are the foundation of SERCAL. How do we educate the next generation of restoration practitioners to fully understand the repercussions of outplanting native plants infected with invasive plant pathogens into riparian areas and jeopardizing the integrity of the restoration environment? Root-rotting plant pathogens such as *Phytophthoras* exist worldwide. In 2012, a new plant pathogen, *P. tentaculata*, was discovered for the first time in North America in a CA watershed outplanting of native plants. In 2009, USDA Plant Epidemiology and Risk Analysis Laboratory published a list ranking *P. tentaculata* #5 risk threat of the 29 exotic species of *Phytophthora* not established in the contiguous United States. The list of prioritized *Phytophthora* species was generated using multiple criteria including knowledge of host range, geographic distribution, potential economic and environmental impacts, and potential pathways of plants imported into the United States. Within a short period of time, the pathogen has now been found in nine native plant nurseries in seven CA counties in northern and southern CA and in four habitat restoration sites. Over the past decade, the ornamental nursery industry, in conjunction with researchers and state and Federal regulators, have created a Best Management Practices document for growers which is being implemented in multiple states nationwide as part of a Systems Approach for managing pests and pathogens in the horticultural supply chain. Learn how and why many native plant nurseries are implementing a similar program to protect their plants and safeguard the native environment.

Riparian & Wetlands *Listed alphebetically by presenter*

Chair: Mark Young, Westervelt Ecological Services

Wednesday 11 May — 1:30–3:00 and 3:30–5:00 *and*
Thursday 12 May — 2:00–3:30 and 4:00–5:30 *Room 3*

Inter-connected riparian and wetland systems make up vibrant aquatic habitats throughout California. Critical losses of these habitats have had a devastating effect on both flora and fauna; all shaped by land-use decisions. Over the last four-plus decades, environmental awareness and regulatory support have challenged society to halt this destruction and restore functioning ecosystems. The Riparian and Wetlands session is divided into four themes, with the talks providing representative examples of these restoration efforts. These themes are: a) Water Quality and Restoration, b) Restoring Bay Wetlands, c) Re-Growing Central Valley Rivers, and d) Making Healthy Sierra Floodplains.

Achieving Effective Riparian Restoration Outcomes by Weighing Costs and Benefits

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Over the past year and a half, Sustainable Conservation has developed a framework to weigh the costs and benefits of riparian restoration along the Lower Mokelumne River, in order to help local stakeholders target outreach and funding for future riparian restoration projects to most effectively meet the goals in their watershed plan. We assessed the remaining area that could be restored to riparian habitat along the river, and conducted a cost-benefit analysis to help inform outreach and funding for future restoration work. The goal for the product is to provide decision-support information that is spatially explicit and informs stakeholders where targeted outreach to landowners along the river and funding allocations could achieve the biggest bang for the buck in terms of environmental outcomes for the investment in project planning, permitting, and implementation. We are interested in sharing the framework for our assessment with the SERCAL audience, in the hope that other conservation practitioners will be able to build on it for their own work to increase the effectiveness of limited outreach capacity and funding for riparian restoration in California.

Measuring Riparian Restoration Success using Central Valley Joint Venture Objectives

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Riparian restoration projects provide multiple benefits to the fish, wildlife, and people that depend on them. Thus, capturing the full value of these restoration projects may require multiple metrics of success. We present a simple way to measure the benefit of individual riparian restoration projects to riparian birds using the recently revised Central Valley Joint Venture population, density, and habitat objectives. These objectives are intended to achieve a long-term goal of riparian ecosystems that are capable of supporting robust and resilient wildlife populations, benefitting people and wildlife of the Central Valley and beyond. To illustrate how these objectives can be applied, we discuss two Central Valley riparian restoration projects — the 2,100-acre Dos Rios Ranch restoration project, one of the largest riparian restoration projects in the region, and the 300-acre Lower Cosumnes River restoration experiment, which is designed to compare the effectiveness of multiple restoration practices in providing habitat for riparian birds. We used the Central Valley Joint Venture objectives to estimate the potential value of each project in terms of how many additional breeding riparian landbirds the project could deliver, to estimate the contribution of each project toward achieving the habitat objectives, and to set the criteria by which the outcomes of the experiment will be assessed. Ongoing bird population surveys will allow us to measure the actual outcomes of each project and ultimately to demonstrate project success even as these systems are impacted by a changing climate.

Integrating Water Quality Improvement into Coastal Restoration

Steve Gruber

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Big Canyon is a 1,300-acre coastal watershed in Newport Beach, California, that drains to Upper Newport Bay, an important coastal ecological preserve. Big Canyon Creek, which drains the watershed, is a perennial urban stream that is impaired due to elevated levels of selenium. As a result, a total maximum daily load (TMDL) has been established for the creek to protect the stream's beneficial uses. Big Canyon Creek also suffers from anthropogenic alterations that have negatively impacted stream hydrology, habitat, and water quality, as well as riparian vegetation and wildlife habitat. The Big Canyon Habitat Restoration and Water Quality Improvement Project is a multiple benefit, collaborative program designed to address these issues by integrating stream and riparian restoration with water quality improvement wetlands, a comprehensive water conservation strategy, and enhanced recreational opportunities. The restoration components consist of 5 acres of restored riparian habitat and invasive species removal, a re-graded flood plain to provide stream connectivity, and stream channel restoration to reduce erosion and enhance in-stream habitat. The water quality

improvement wetlands have been integrated into the restoration design. They consist of subterranean treatment cells specifically designed to reduce selenium concentrations to levels low enough to meet the regulatory requirements of the TMDL. They will also remove a suite of stormwater pollutants common to urbanized watersheds (metals, nutrients, and indicator bacteria). The project has been funded through a collaborative effort involving grants from multiple agencies, matching funds from the City, and a volunteer workforce from several local environmental groups.

Feathers, Fur, and Fins: Thirteen Years of Multi-benefit Restoration

Jeff Holt*, Heyo Tjarks, Trevor Meadows, Helen Swagerty, and Michael Rogner

River Partners, 121 West Main, Suite H, Turlock, CA 95382

Over the last thirteen years, River Partners has restored over 3,000 acres of riparian habitat along the San Joaquin River at the confluence of its largest tributary, the Tuolumne River. The majority of this work occurred on the San Joaquin River National Wildlife Refuge but more recently has taken shape on the adjacent Dos Rios Ranch. The Refuge was established in 1987 in an effort to save the Aleutian cackling goose, which at the time was a federally listed species. However, over the past thirteen years, restoration efforts have focused on habitat for multiple threatened and endangered species including the least Bell's vireo, riparian brush rabbit, and most recently, salmon. In addition to wildlife habitat, our restoration design also incorporates components to promote natural river processes (e.g. sediment deposition and scour), improve local flood safety, and enhance groundwater recharge. Through ecological design and adaptive management, the restoration has been resilient to both fire and floods and has maintained valuable wildlife habitat throughout the four years of historic drought. We present here thirteen years of lessons learned through the analysis of vegetation and wildlife monitoring data, hydraulic modeling, and adaptive management techniques used to design and manage a multi-benefit riparian restoration project.

Removing a 500,000 Gallon Water Tank from the Middle of a Sierra Stream

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In the 1950s, a 500,000-gallon water tank was constructed in the middle of Griff Creek in the Lake Tahoe Basin. As a result, the creek was constrained to a narrow portion of the already small valley floor. As residential development encroached on the creek in the 1960s, it further impacted the creek and its riparian corridor. Bank instability, channel incision, and conifer encroachment were evident throughout the reach. The North Tahoe Public Utility District recognized the value in removing the dilapidated tank for public safety, water system efficiency, and the ability to improve riparian conditions along Griff Creek. The tank, pump station, and associated aboveground infrastructure were removed in the fall of 2014 along with an approximately 200'-long berm constructed on the left bank of the creek. The site was then recontoured to restore natural grades and allow hydrologic connection between the creek and its

historic floodplain. One of the unique aspects of the project was the need to perform a benefit-impact analysis to determine if instream improvements were to be included. The result showed the impact outweighed the benefit and therefore the project focused on bank and floodplain improvements. Another unique aspect of the project was the ability to use only onsite soils from the floodplain excavation to fill the large cut slopes from the original tank construction. This presentation will highlight the lessons learned from integrating restoration into an infrastructure project.

The Role of Local Adaptation in Heavy Metal Tolerance and Phytoextraction Capacity

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A century of gold mining in the Sierra Nevada foothills has resulted in a legacy of abandoned mine waste containing heavy metals. Environmental and human health risks of these contaminants are especially high in riparian areas where heavy metals may enter waterways and have far-reaching impacts due to connectivity to the Delta and the Pacific Ocean. The abandoned Providence Mine in Nevada City, CA, borders Deer Creek, a major tributary to the Yuba River, and contains elevated levels of cadmium, lead, and arsenic. One viable strategy for abandoned mine sites in riparian areas such as Providence Mine is phytoremediation, the use of green plants to cleanup environmental contaminants. Willows (*Salix* spp.) have demonstrated capacity to tolerate and extract high concentrations of cadmium, among other contaminants. In this study, we investigated the potential role of local adaptation in heavy metal extraction capacity and tolerance in the California-native Arroyo willow (*S. lasiolepis*) to test the hypothesis that trees growing in contaminated soils are better candidate source trees for mine site re-vegetation. We used a simple factorial experiment to examine differences in growth, mortality, root length, and heavy metal extraction capacity between cuttings from trees growing in mine waste versus trees growing in non-contaminated soil. Results will inform future restoration and re-vegetation efforts of historic mining sites, and demonstrate the importance of considering proper source population site and genetic effects in developing remediation strategies.

Floodplain Reconnection on the Upper Truckee River, Lake Tahoe, California

Virginia Mahacek*[1] and Michael Rudd, PE[2]

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Two of Cardno's river and floodplain restoration projects along the Upper Truckee River used varied approaches to address the geomorphic and ecological consequences of historic disturbance throughout the watershed and at the project sites to achieve goals while considering ongoing land uses, infrastructure constraints, and uncertainty about future restoration actions on adjoining reaches. The California Tahoe Conservancy's Lower West Side project reconnected over 12 acres of floodplain wetlands in the Upper Truckee Marsh. It restored an area that had been buried in several feet of fill for over 30 years, improving ecological function and water quality while being flexible to fit future river restoration options. Implementation was phased between 2000 and 2003 and protected lake water quality. Adaptive management and qualitative and quantitative post-project monitoring illustrate the varied benefits. The site is being integrated into the recently selected 'preferred' design for the adjoining river and marsh restoration. The City of South Lake Tahoe's Upper Truckee Middle Reach project re-established 18 acres of active floodplain. It excavated broad areas of fill along the airport and constructed over 3,000 feet of sinuous channel to replace the channelized and rip-rap section. Construction spanned 2008 to 2011 to allow vegetation to stabilize the new channel and floodplain surfaces prior to activation. Monitoring is characterizing post-project conditions, tracking performance and effectiveness, and informing adaptive management actions. Both projects received TRPA Best-in-Basin awards. We will discuss objectives and desired outcomes, design approach and constraints, implementation techniques, monitoring methods and results, adaptive management actions, and lessons learned.

Tides not Casinos: Restoring 1,000 Acres of Tidal Wetlands at Sears Point

Julian Meisler

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In 2005, Sonoma Land Trust completed the acquisition of 2,327 acres along the rural northern shoreline of San Pablo Bay — land that had been slated for construction of a Las Vegas-style casino The next ten years of planning, permitting, and fundraising paid off in fall 2015 with the breach of an historic levee and the return of the tides. We present some of the innovative project design features and discuss the pros and cons for small organizations taking on large and expensive projects and the vital need for collaboration in such pursuits.

20 years of Collaborative Conservation after Curtailment of In-channel Mining on Lower Cache Creek

Andrew Rayburn*[1], Mark Tompkins[2], Paul Frank[2], Elisa Sabatini[3], Heidi Tschudin[4], Keith Hannon[5], Nancy Ullrey[5], Randy Sater[6], Hillary White[7], and Casey Liebler[3]

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Lower Cache Creek in Yolo County was historically mined for gravel, constrained by transportation infrastructure, and bounded by agriculture, leading to environmental degradation. In 1996, in-channel mining was curtailed and the innovative Cache Creek Area Plan was implemented to adaptively manage creek resources. Since then, the County has partnered with public and private stakeholders to implement the multifaceted CCAP, the 10-year update of which is underway. We focus on changes in biological resources over the 20-year period. Since 1996, several sites have been revegetated or restored, and additional sites are being assessed. For example, over the next 20 years, mining companies will restore and dedicate 1,500+ acres to public ownership that will be integrated into the lower Cache Creek Parkway to support public use and conservation. Vegetation mapping and classification has also occurred, most recently in 2016 using UAV aerial photography. These data are being compared to baseline and intermediate datasets to assess changes in critical riparian habitat that is home to numerous special-status wildlife species. A comprehensive elderberry (*Sambucus nigra* ssp. *caerulea*) survey has also been conducted to serve as a permitting baseline. Finally, a long-term collaborative invasive species treatment program has successfully targeted tamarisk (*Tamarix* sp.), arundo (*Arundo donax*), Ravenna grass (*Saccharum ravennae*), and other species. This program is now being scoped for expansion into the upper watershed to target source populations. All of these programs have been integrated with geomorphic and hydraulic monitoring, modeling, and analysis, setting the stage for creative, collaborative conservation to continue on lower Cache Creek.

Flow Regime Management for Riparian Restoration

Katie Ross-Smith, PhD

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Riparian forests represent a small fraction of lands in California watersheds, yet support a disproportionately high diversity and richness of biota. Riparian forests are also critical to the maintenance and restoration of aquatic systems. Riparian vegetation provides food for aquatic biota; instream habitat, shade, water quality protection; and affects floodplain processes. California riparian plants are adapted to the dynamic and episodic, yet seasonally probable, hydrology conditions, including infrequent extreme precipitation events and multiple years with low precipitation. Water management for hydropower, flood protection, and/or urban and agricultural uses frequently alters the natural flow regime and can degrade riparian forests. In this presentation, the natural flow regime elements that can be restored by flow management and the potential benefits of each to riparian function and structure will be discussed. Several factors, including which element(s) of the flow regime is altered, watershed characteristics, channel morphology, and plant species and lifestages, can differ among projects such that a "one-size-fits-all" approach to riparian flow enhancement and protection is not appropriate. Examples from several FERC relicensing projects on the western slope Sierra Nevada with recently modified flow regimes to address specific riparian issues provide a range of cases. The information provided by inventory and monitoring techniques (i.e., mapping, rapid assessments, plot/transect surveys, tree cores) and modeling to inform science-based flow regime recommendations is discussed. Last, perspectives will be given on successfully communicating technical guidance to managers and stakeholders for development and evaluation of project-specific riparian flows.

Predicting Functions of Restored Tidal Wetland Habitats

Ramona Swenson*[1], Gerrit Platenkamp[1], and Matt Gause[2]

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Wetland restoration at sites where wetlands are already present requires permits under the Clean Water Act. An assessment of the functions and services provided by the impacted and proposed restored wetland habitats may then be required. Available tools for functional assessment of wetlands in California have limited utility in predicting wetland functions, especially on an appropriate spatial or temporal scale. In the San Francisco Bay-Delta, the California Rapid Assessment Method (CRAM), the method recommended by the U.S. Army Corps of Engineers (Corps), can be used for predicting a limited set of wetland functions, but this method does not explicitly consider functional capacity (e.g., maintaining fish and wildlife) or other ecosystem and landscape functions likely to be performed and of greatest public benefit. The Corps' hydrogeomorphic (HGM) approach provides additional useful functional relationships. We applied a hybrid approach for a planned tidal restoration site in Suisun Marsh owned by Westervelt Ecological Services and the State and Federal Water Contractors Water Agencies. We used CRAM to represent the predicted hydro-period, hydrologic connectivity, topographic complexity, and structural patch richness. In addition, we used HGM variables to represent sediment deposition, nutrient and organic carbon exchange, plant community and prey pool maintenance, and utilization by fish and wildlife. An important additional (adverse) function, the potential to produce and export methyl mercury, was not represented by either method and was added to the assessment. We propose a

comprehensive method to evaluate the range of potential functional change following restoration that combines elements of CRAM and HGM.

Lower Blackwood Creek Habitat Restoration Construction.

John Zanzi*[1], Mark Girard[2], and Loren K. Roach, P.E.[2]

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Restoration along 1,200 linear feet of Lower Blackwood Creek in the Lake Tahoe Basin represented the final piece of a comprehensive interagency restoration of one of California's premier watersheds. A century of disturbance degraded the creek, a critical spawning area for rainbow trout and historically a habitat for Lahontan Cutthroat Trout. Annual creek flows have caused heavy bank erosion and vegetation loss, and coupled with previous in-channel gravel mining increased sediment delivery to Lake Tahoe, contribute more fine sediment per unit of area than any other watershed in the Basin. The restoration is a project of California Tahoe Conservancy, contracted through the State of California Department of General Services. Designed by Northwest Hydraulic Consultants, construction was conducted by Habitat Restoration Sciences (a Dudek company). Key restoration components included stabilizing banks, establishing vegetation, and creating fish habitat. Bank erosion was reduced by realigning segments of the channel and incorporating instream woody material with revegetation to redirect channel flows. Native plant species were installed to establish shaded riverine aquatic habitat, stabilize banks, regulate water temperatures, and provide long-term nutrients. Stream flow rates were modified by creating riffles with faster flow rates over rock bottoms in shallow areas and deeper pools of calmer water to restore fish habitat. Adaptive management was conducted during the construction efforts as the site conditions had changed from those expected. The majority of the project was completed in one construction season including successful channel rewatering, meeting strict water quality standards, and returning in-stream flow into the Lake

Comparative Spatial Analysis for SF Bay Restoration Monitoring

Chris Zumwalt*[1] and George Salvaggio[2]

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With the advent of new ground- and aerial-based mapping technologies, traditional spatial data collection is rapidly evolving. Ground-based LIDAR and Unmanned Aerial Vehicle (UAV, i.e., drone)-based aerial imagery and topographic data collection methodologies are two novel options that, with their high accuracy and high-volume of data capture over a short time period, are valuable options for ecologists to increase efficiency and accuracy over traditional methods. The success of tidal habitat restoration projects, such as Yosemite Slough in San Francisco, is measured by numerous criteria, including tidal vegetation growth for species such as pickleweed. Traditionally, annual reports measuring growth of these species rely on visual "percent coverage" estimate surveys conducted by field technicians. While these estimates were acceptable for monitoring purposes, WRA believed that more accurate measurements could be made using emerging spatial technologies and put them to the test in order to determine which approach yielded the best results. WRA GIS staff compared traditional field data collection using hand-held Trimble GPS units to spatial data derived from high-resolution photos captured via UAV and ground-based side-scanning LIDAR. Analysis approaches included hand digitization, proximity analysis, point aggregate analysis, and remote sensing. Results indicated that traditional hand-held GPS data collection resulted in fewer but larger polygons that were less accurate and that remote sensing on the UAV imagery combined with ground truthing aerial signatures produced the most accurate results and was most efficient. This hybrid approach allowed WRA to produce higher quality measurements of vegetation growth and informed methodology for future projects.

Poster Session & Student Poster Competition *Listed alphebetically by presenter*

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

Reception: Wednesday 11 May — 5:00–7:00 *Lakeview Suites*

Coastal Dune Mining Site Revegetation and Stabilization Methods

Kayti Christianson*[1], Thor Anderson[1], and Leslie Allen[2]

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Burleson Consulting Inc. has recently teamed with ICF International to continue revegetation of sand mining activities in Marina, California. Beginning in 1990, two separate areas of the Lapis Sand Plant, referred to as the South and North Pit, have been the focus of revegetation of coastal dune habitat. Our project objective is to continue these efforts with the goal of 25% native vegetation cover with six native species present in compliance with the Surface Mining and Reclamation Act of 1975. Since 2002, the South Pit has needed little revegetation assistance aside from maintenance of invasive iceplant (*Carpobrotus edulis*). However, due to a historic access road and mining impact, the North Pit has been subject to high wind exposure causing challenges for the reestablishment of native vegetation. Burleson developed a strategy to stabilize dunes by assessing wind erosional features during multiple site visits, reviewing past erosion control efforts, comparing to Google Earth imagery, and monitoring vegetation in 2015. Our stabilization and revegetation efforts include placement of erosion control fabric, reconstruction of historic sand berms, installation of strategic wind breaks, dispersal of native seed, and planting of native vegetation. Our poster illustrates the current methods, successes, challenges, and future plans.

Lee Vining Rockfall Safety Project Provides Unique Restoration Opportunity

Lisa Cutting

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The California Department of Transportation (Caltrans) Lee Vining Rockfall Safety Project began May 2015 and construction is scheduled to be completed in Fall 2016. The project will improve motorist safety by reducing rockfall incidents along a one-mile stretch of Highway 395 adjacent to Mono Lake. Six slopes were identified as problematic and prone to having rocks fall onto the highway. The Mono Lake Committee (MLC) immediately saw this project as an opportunity to not only secure the slopes for safety, but to incorporate long-term revegetation to restore and stabilize the slopes naturally and to heal the visual scars left by the 1930s road cuts. Due to steep slopes and unique ancient lakebed soils, a standard revegetation approach was not likely to succeed. MLC worked closely with Caltrans to tailor the project to meet the rockfall safety criteria and offer the best solution for revegetating the slopes. The revegetation component has two key elements: 1) a five-year comprehensive evaluation period including specific adaptive management flexibility should the vegetation recovery not proceed as planned and 2) the Lee Vining Test Plot project was completed prior to breaking ground on the Rockfall Safety project, and has been instrumental in informing specifics related to soil amendments and plant species composition. In the past, MLC and Caltrans have had seemingly at-odds priorities for highway projects in the Mono Basin, but this is an example of a creative and cooperative solution that is working to achieve multiple benefits.

Community-supported Steelhead Recovery Efforts in Santa Barbara and Ventura Counties

Mauricio Gomez*[1] and Erin Brown[2]

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Recovery efforts of the federally endangered steelhead trout (*Onchorhynchus mykiss*) in Santa Barbara and Ventura Counties face many challenges. Some of the challenges they encounter include barriers to migration, lack of streamflow/drought conditions and landowner support. Over the past eight years, we have helped improve conditions for steelhead by securing landowner support in multiple watersheds, removing multiple barriers to migration and opening up miles of stream habitat. These efforts have been supported by our partnerships with diverse stakeholders including agricultural landowners, public agencies, local non-profit organizations and interested community members. These partnerships have allowed our efforts to continue making an impact on steelhead recovery in the region.

Accelerate Your Restoration Project Using Programmatic Permits!

Katie Haldeman*, Erik Schmidt,* and Erika Lovejoy*

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Expedited regulatory approval through "programmatic" permits and authorizations can help accelerate restoration on public and private lands in California. These broad approvals, now provided by many federal and state agencies on a statewide or regional basis, can reduce the permitting timeline for restoration proponents by several months or more, and cut project costs through reduced fees and staff time. For agencies, programmatic approvals reduce staff workload and help meet key environmental goals through increased and speedier restoration of habitat for listed species, water quality and other beneficial uses. Restoration funders, too, can show improved grant-delivery results through more efficient permitting of their awardees. However, restoration proponents seeking faster regulatory approval for environmentally beneficial projects must understand the detailed requirements and limitations of these front-loaded permits. Applicants must be willing to communicate early with regulatory agencies in a collaborative partnership.

Laguna Canyon Road: Impacts of a Changing Climate on Wetland and Riparian Creation

Anisha Malik

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The widening and realignment of Laguna Canyon Road in Orange County, California, brought about mitigation for creating additional wetland and riparian systems within the existing Laguna Coast Wilderness Park. With multiple habitats to be restored and created, including alkali marsh, freshwater marsh, willow scrub, mulefat scrub, and coastal sage scrub, came the opportunity to design the site to improve hydrology and reconnect two lake systems historically linked that separated and degraded over time. With an intricate grading and planting plan in place, the only variable deterrent to the successful development of the site has been changing climate patterns. The site has endured significant stress since its implementation seven years ago, including increased inundation during its first few years of establishment to the opposite side of the spectrum in its later years, trying to sustain during drought conditions. Because of these factors, the mitigation sites have not met certain performance standards distinguished at the beginning of the project. The question arises, with the continuation of the drought in California and the infrequent rain events, how creation and restoration of habitats will progress with a lack of consistent hydrology. The approach of these projects will need to adapt, and the collaboration between multiple sectors is key in order to restore the various ecosystems within the Arid West.

Livestock Grazing for Landscape Diversity in California Vernal Pools

Julia Michaels

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California vernal pools are seasonal wetlands that are disappearing at an alarming rate to development. The remaining pools are located on private rangeland or on easements, where grazing is used as a tool to combat the encroachment of exotic grasses. This points to a potential win-win solution for ranchers and restoration. However, no studies have looked at the effects of grazing on between-pool (beta) diversity, which is the most prevalent form of diversity in these systems. Local disturbances and selective grazing in some upland ecosystems have been shown to enhance diversity at local sites, while homogenizing diversity between these sites. To address this question, I have compared species assemblages in vernal pools that have been grazed continuously and in pools that have been fenced off from livestock at a site in Sacramento County for over 30 years. I paired 15 grazed and 15 ungrazed pools, and sampled richness, cover and abundance. I am currently using PermANOVA and PermDISP statistical software to compare beta diversity between the grazed and ungrazed pools.

Eradicating Weeds in Sierra Meadows for Climate Change Resilience.

Elizabeth Brusati, Doug Johnson, and Dana Morawitz*

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Sierra Nevada meadows are important for wildlife, water storage, and carbon sequestration. These functions will become even more critical as California's climate changes. In 2014-15, Cal-IPC worked with Sierra Nevada organizations to eradicate invasive plants in and around Sierra meadows. Species included Scotch thistle, Canada thistle, spotted knapweed, rush skeletonweed, perennial pepperweed, and

yellow starthistle. Sites included Bear Valley (PG&E, treatment by the Placer County Agriculture Dept.), the Truckee River (treatment by private contractor through TRWC); Smithneck State Wildlife Area (treatment by the California Conservation Corps); the Tahoe Basin and Hope Valley (treatment by the El Dorado/Alpine Counties Dept. of Agriculture). Eighty-seven populations of 11 invasive plant species were removed, with eventual eradication from these sites as the goal. New populations were also located. For each site, weed locations were uploaded to Calflora, work was documented with photos, and a long-term eradication workplan will be put in place. We also developed two reports with actions that land managers can take to improve climate resilience in montane meadows.

Effects of Temperature on Soil Erosion Rates in the Lake Tahoe Basin

Kimberly Oyervides

BS Candidate; Environmental Sciences, Sierra Nevada College

Increasing temperatures are a global concern. In the Sierra Nevada, rising temperatures have the potential to affect a range of physical, chemical and biological processes that rely on predictable freezing and warming cycles. Soils are the largest carbon sink, foster nutrient cycling, store water for vegetation and provide structural support. This study focuses on erosion rates of Incline Village Watershed and the potential effects increased temperature may have on moisture holding capacity and erosion rates. Five different soils types with in the Incline Village Watershed were selected based on accessibility and relative proportion of the total watershed. At each location, six soil core samples (three replicates and three controls) were randomly sampled and brought back to the lab at Sierra Nevada Campus. Once in lab, samples for each soil type were run through a series of wet and dry oscillation treatments to assess changes in holding capacity. Although results showed no significant difference in holding capacity (one-way anova, p-value 0.33) across and within all soil types within the temperature ranges of 80°F, 90°F, and 100°F, a noticeable difference occurred at the 100°F treatment. Additionally, erosion rate factors (using the Universal Soil Erosion Equation (A=KR(LS)) using the new holding capacity values did not show significant differences for all temperature and soil types except for noticeably higher rates at the 100°F treatment. As climate change impacts become increasingly prevalent, potential changes in soil holding capacity and increases in erosion rates could cause severe degradation to hillsides and waterways.

Battling Plant Pathogens: The Hidden Threat to Native Nurseries and Our Retaliation

Phillip Reyes*[1], Nick Jew[2], Kayti Christianson[3], and Thor Anderson[4]

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Recently an alarm has sounded at California native plant nurseries that a new plant pathogen, *Phytophthora tentaculata*, has been detected. *Phytophthora* species present a pertinent and vicious danger to a variety of California native plants and ecosystems. If restoration nurseries are not managed responsibly, they could do more harm than good by serving as a vector for introducing plant pathogens to restoration sites. In light of this threat, native plant nurseries are reassessing and implementing new BMPs as to minimize the impact of harmful pathogens. Working closely with the California Department of Food and Agriculture (CDFA) and Monterey County Agricultural Commission, Burleson's native plant nursery has taken a proactive approach in preventing the introduction and spread of plant pathogens. This has largely been credited to implementing recommended BMPs at our nursery and diligently observing and modifying them as we identify weaknesses. Our display highlights the nursery BMPs we have implemented including sanitation practices, soil transportation and storage, proximity of plants to the ground and to one another, as well as quarantine and treatment of questionable plants. We are encouraging other native plant growers to share their experiences and insights on the matter and to start conversations about how to combat pathogens within the nursery community. Through collaborative efforts, our goal is to develop an improved protocol to effectively limit the presence of *Phytophthora* and other plant pathogens.

Fuels Treatment Effectiveness Project in Woods Creek, Lake Tahoe Basin

Logan Rooney

Interdisciplinary Studies: Outdoor Adventure Leadership and Environmental Studies; Sierra Nevada College

Since 1995, The North Lake Tahoe Fire Protection District has managed wildfire risk for the 1,700 acres of land surrounding Crystal Bay and Incline Village Communities. The 2016 Fuels Treatment Effectiveness Project served the North Lake Tahoe Fire Protection District and their ongoing fire protection action plan in Incline Village including enhanced documentation of past and future prescribed burns in Wood Creek. This map of Wood Creek serves to provide better record of current initiative of fuels treatment of East Wood creek as well as organize existing records of fuels treatment of previous prescribed burns of West Wood creek. This project mapped wildfire fuels hazards in Wood Creek in one of many locations within the planning areas (Incline Village, NV land sub-divisions) of North Lake Tahoe Fire Protection District and the Fuels Management division with the intention of facilitating a larger discussion of managing fuel hazards and protecting communities from wildfire risks.

Breuner Marsh, Resilient Restoration Design in the Face of Sea Level Rise

George Salvaggio[1], Geoff Smick*[2], and Chris Zumwalt*[3]

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The East Bay Regional Park District's Breuner Marsh project restores 40 acres of tidal and seasonal wetlands in Richmond, California. The project also enhances habitat for endangered and threatened species while improving public access. Breuner Marsh is one of the first restoration projects in the San Francisco Bay Area that anticipates and accommodates rising sea levels due to climate change. Using rigorous data and spatial modeling, the design permits tidal marsh to migrate incrementally to higher elevations over the next 50 to 100 years. The analysis also helped to identify the location of the 1.5-mile segment of the Bay Trail to protect park facilities following sea level rise. Preservation of Breuner Marsh is the culmination of planning led by the District following decades of community-led activism. Since the 1950s, residents of this historically underserved community lobbied to keep Breuner Marsh as public open space and saved the site from multiple development proposals. A key part of the planning process, public workshops were held to confirm goals, priorities, and bolster public support. Surface models and three-dimensional renderings were created for the community meetings. These illustrations played a significant role in conflict resolution and consensus building. The team also worked in concert with regulatory agencies to integrate public access without adversely affecting endangered species. The cooperative effort resulted in meeting project goals including balancing ecological sustainability while benefiting the local community with access to expanded open space. The habitat restoration was constructed in 2014 while the public access components anticipated in 2016/17.

Riparian Habitat Restoration on Rock Stabilized Levee Repair Sites

George Strnad, RLA, RA*[1] and Chris Hargreaves[2]

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After Hurricane Katrina's devastation of New Orleans in 2005, California's levee system in the Sacramento-San Joaquin River Delta was closely scrutinized by DWR for potential weaknesses. The key obstacle that prevented an immediate engineered repair of many eroded levees was the presence of valuable natural resources. Because of the high cost of mitigation, land acquisition, and habitat creation, it was determined that repaired levee sites would be ecologically restored in place and in kind with similar habitats. This created an enormous challenge for the ecologists — a viable, riparian ecosystem sustained by a high water table had to be to be re-created to accommodate phraetophytic vegetation on top of massive piles of large crushed rock. In response to this challenge, AECOM designers developed an innovative soil-filled rock slope protection technique that guaranteed survival of riparian plants on heavily armored levee banks by providing capillary fringe via loamy soil fill. URS ecologists also eliminated a non-permeable geotextile from the design and replaced it with a well-graded, gravel filter to prevent piping of the erodible substrate (sugar sand), while maintaining an elevated water table. Restoration plans were developed for 15 Delta levee repair sites on the banks of Sacramento and San Joaquin Rivers, and on Steamboat, Sutter, and Cache Sloughs. AECOM worked closely with DWR experts and resource agencies to meet the demanding SAM riparian restoration criteria. The key ecological goal to fully restore the sites was deemed successful by the regulatory and permitting agencies two years after the planting was completed.

Managing Coyote Brush to Protect Sensitive Plant Habitats

Don Thomas

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The Peninsula Watershed of the San Francisco Public Utilities Commission (SFPUC) encompasses a variety of sensitive plant habitats. These include serpentine grassland, valley grassland, basking habitat of the San Francisco garter snake and serpentine seep habitat of fountain thistle (*Cirsium fontinale* var. *fontinale*). In addition to fountain thistle, other federally protected plants in the Watershed include *Eriophyllum latilobum*, *Pentachaeta bellidiflora* and *Hesperolinon congestum*. With the end of grazing and with fire suppression, it has been observed that there has been an extensive spread of coyote brush (*Baccharis pilularis*) within the grassland–scrub matrix in the Watershed and elsewhere on the San Francisco Peninsula. Coyote brush is encroaching into serpentine seep and grassland habitat of fountain thistle and is converting grassland into coyote brush monocultures. When coyote brush is removed, with the root system left in place, it resprouts vigorously. SFPUC has investigated both chemical and non-chemical methods of controlling resprouting. This study reports the results of a test of the efficacy of different herbicide treatments in preventing the resprouting of coyote brush. Three different methods of application were tested: foliar spray, cut-stump and basal bark. Also a number of different herbicides were evaluated including glyphosate, imazapyr, aminopyralid and triclopyr. It was found that all of the herbicides suppressed resprouting in cut-stump applications. Foliar sprays of glyphosate and triclopyr were effective in killing the foliage, but some resprouting was observed after triclopyr treatment. Basal bark application of triclopyr was effective at preventing resprouting of smaller plants but not of larger plants.

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